Witness Statement

Statement of:  **Professor Lisa Frances Gibbs**

Occupation:  Professor of Public Health

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Level 5, 207 Bouverie Street, Carlton 3053

Date:  22 May 2020

I, Lisa Frances Gibbs, Professor of Public Health, say as follows:

**Key qualifications, professional experience and academic research**

1. I have a PhD in Public Health and an Honours Degree in Psychology, further details:
   
   (a) Doctor of Philosophy, Public Health, Deakin University 2003
   
   (b) Bachelor of Science (Honours), Psychology, The University of Melbourne, 1987
   
   (c) High Performance Leadership Intensive Course at Said Business College, Oxford University, 2016

2. I am a Professor of Public Health at the University of Melbourne. My role there is Director of the Child and Community Wellbeing Unit in the Centre for Health Equity, Melbourne School of Population and Global Health which includes three streams of public health research into 1) trauma and resilience; 2) migration and social cohesion; and 3) changing lifestyles and healthy futures. I am also Academic Lead of the Community Resilience and Public Health Unit in the Centre for Disaster Management and Public Safety at the University of Melbourne. I have been leading public health research for the past 15 years, focused on: 1) disaster recovery and community resilience, and 2) child public health research. These two fields intersect through my research on child disaster resilience. One of my key strengths is close partnerships with government and service providers resulting in direct translation of research into policy and practice. In my academic career I have published 125 peer reviewed academic publications including 35 specifically focused on the mental health and wellbeing impacts of natural disasters. I am the lead investigator on the Beyond Bushfires study which has investigated the mental health and wellbeing impacts of the Black Saturday bushfires up to 10 years afterwards. I am
also the lead investigator on studies of the long term academic impacts of the Black Saturday bushfires on school students, as well as a range of other disaster resilience studies.

3 This Witness Statement is primarily based on research studies I am leading with teams of academic collaborators and cross-sectoral partner agencies. Specific details on the major studies are as follows:

(a) The Beyond Bushfires: Community Resilience and Recovery study was developed with the support of University of Melbourne seed funding in 2009 in the wake of the Victorian Black Saturday bushfires and then fully funded through an ARC Linkage Grant (LP100200164; 2009-2015) to examine the social and community factors that influenced mental health and wellbeing outcomes 3-5 years following the 2009 Black Saturday bushfires. It was a longitudinal mixed methods study of 25 communities and over 1,000 participants comparing outcomes across high, medium and low/no bushfire impact communities. The Beyond Bushfires Final Report was published in 2016 as an overview of findings for non-academic audiences (1)(Annexure A). There have been 24 academic publications to date of Beyond Bushfires findings and methods. Many of these are referenced in this Witness Statement.

(i)  **Beyond Bushfires research team and investigators** (current and previous):

Professor Lisa Gibbs\(^1\), Professor Richard Bryant\(^2\), Professor Louise Harms\(^3\), Professor David Forbes\(^4\), Dr Karen Block\(^1\), Dr H Colin Gallagher\(^5\), Greg Ireton\(^1\), John Richardson\(^1,6\), Professor Philippa Pattison\(^7\), Professor Colin MacDougall\(^8\), Professor Dean Lusher\(^5\), Elyse Baker\(^1\), Connie Kellett\(^3\), Alana Pirrone\(^1\), Robyn Molyneaux\(^1\), Lauren Kosta\(^3\), Kate Brady\(^1,6\), Marian Lok\(^2\), Gisela Van Kessel\(^8\), Professor Elizabeth Waters\(^1\).

1. Melbourne School of Population and Global Health, University of Melbourne
2. University of New South Wales
3. Department of Social Work, University of Melbourne
4. Phoenix Australia: Centre for Posttraumatic Mental Health
5. Centre for Transformative Innovation, Swinburne University of Technology
6. Australian Red Cross
7. University of Sydney
8. Southgate Institute, Flinders University

(ii)  **Beyond Bushfires study partners**: Victorian Department of Health, Australian Red Cross, Australian Rotary Health, Australian Government Department of Human Services (Centrelink), Phoenix Australia: Centre for Posttraumatic Mental Health, Central Hume Primary Care Partnership, Bendigo Loddon Primary Care Partnership, North East Primary Care Partnership, Outer East Primary Care Partnership, Central West Gippsland Primary Care Partnership, Lower Hume Primary Care Partnership
(b) The 10 Years Beyond Bushfires study was commissioned and co-funded by Emergency Management Victoria, Victorian Department of Health and Human Services and Australian Red Cross to enable us to go back to the original Beyond Bushfires cohort and investigate their social connectedness and mental health and wellbeing 10 years after the Black Saturday bushfires. Of the 966 participants invited to complete the 10 Years Beyond Bushfires survey, a total of 525 participants provided consent and completed the survey. The findings are in different stages of preparation/review and have not been published yet.

(i) **10 years Beyond Bushfires research team and investigators:**

Professor Lisa Gibbs¹, Professor Richard Bryant², Dr H Colin Gallagher³, Professor David Forbes⁴, Professor Louise Harms⁵, Dr Karen Block¹, Robyn Molyneaux R¹, Greg Ireton¹, Professor Colin MacDougall⁶, Alana Pirrone¹, Dr Connie Kellett⁵, Hannah Morrice¹.

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(ii) **10 Years Beyond Bushfires study partners:** Emergency Management Victoria, Department of Health and Human Services, Australian Red Cross, Social Research Centre

(c) ReCap: The Bushfire Natural Hazards CRC funded a disaster recovery project in response to requests from their end-user organisations. The project was focussed on the combined community capitals underlying disaster resilience and recovery – i.e. social, natural, built, political, financial, cultural and human. This study did not proceed as intended because the original lead universities had staffing changes and so it was offered to me to lead in partnership with a team at Massey University under the leadership of Professor David Johnston. The project was renamed ReCap (Recovery Capitals) and is now focussed on developing practical resources for use by the end-user organisations to guide recovery work.

(i) **The ReCap research team:** Professor Lisa Gibbs, Phoebe Quinn and Alana Pirrone from University of Melbourne in partnership with Professor David Johnston, Dr Denise Blake and Emily Campbell from Massey University.

Additional academic contributors include Professor Daniel Aldrich (Northeastern University, USA), Dr Melissa Parsons (University of New England, Australia), Professor Mehmet Ulubasoglu & Farah Beaini (Deakin University, Australia), Professor Louise Harms, University of Melbourne, Dr Hugh Colin Gallagher, Swinburne University and Professor Colin MacDougall, Flinders University. **The ReCap project has drawn upon relevant data and findings from the Beyond Bushfires study and related research conducted by the University of Melbourne,**
Australia; on Resilient Wellington and related research conducted by Massey University, New Zealand; and other relevant disaster recovery research.

(ii) **ReCap study partners:** The ReCap resources are being co-developed with stakeholder partners including Australian Red Cross – Lead end-user, New Zealand Red Cross, Wellington Region Emergency Management Office (WREMO), Fire and Emergency New Zealand, Emergency Management Australia, Australian Department of Home Affairs, The Leadbeater Group, Resilient Melbourne, Social Recovery Reference Group, Regional Arts Victoria, Department of Primary Industries and Regions SA, Emergency Management Victoria, Country Fire Authority, State Emergency Service Victoria, Creative Recovery Network

(d) The Strengthening School Communities study examined the impacts of the Black Saturday bushfires on student academic progress. It also reviewed the changed demands and stressors affecting teachers in the aftermath of a disaster which can be difficult to address in a system focussed on student needs. It was funded initially by the Teachers Health Foundation. In response to the academic findings, the Victorian Department of Education and Training funded the Understanding of the long term academic impacts on children of bushfires study. (Other current related studies not listed here)

(i) **Research team and investigators** (current and previous):

Professor Lisa Gibbs¹, Jane Nursey², Dr Sean Cowlishaw², Greg Ireton¹, Professor Louise Harms³, Dr Lauren Kosta², Dr H. Colin Gallagher⁴, Professor Richard Bryant⁵, Dr Karen Block¹, Robyn Molyneaux¹, Phoebe Quinn¹, Katitza Marinkovic¹, Lauren Carpenter¹, Nathan Alkemade² (previous), Professor David Forbes².

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5. University of New South Wales

(ii) **Children and Disasters Advisory Group:** Our various research studies relating to children, families and school communities (including some not listed in this Witness Statement) benefit from the expert advice and contributions of our cross-sectoral Children and Disasters Advisory Group:

- **Australian Red Cross:** Kate Brady (on maternity leave); Melissa Morgan; John Richardson
- **Phoenix Australia:** Jane Nursey, Sean Cowlishaw
- **Department of Health & Human Services:** Fiona Li; Tanja Surwald
- **Teachers Health Foundation:** Penny Jones, Joseph Phung
- **Emergency Management Victoria:** Jane Watson
(e) There are a range of other related research studies, program evaluations, PhD studies and knowledge translation projects which have not been described. In some cases, these smaller projects have been mentioned briefly in the Witness statement.

Immediate and short term health impacts of natural disasters on mental health and wellbeing

My research expertise is focussed on the medium to longer term impacts of disasters on mental health and wellbeing rather than the immediate and short term impacts, which I report on in the next section. I recommend these three published reviews conducted by others for consideration by the Commission:

a. Beaglehole and colleagues recently published a meta-analysis of 27 studies reporting on post disaster mental health outcomes 1 – 48 months after disaster exposure (2). They reported that:

“Increased rates of psychological distress and psychiatric disorders follow natural disasters. High levels of heterogeneity between studies suggest that disaster variables and post disaster response have the potential to mitigate adverse effects” (p716)

b. Associate Professor Eva Alisic’s meta-analysis of 40 studies measuring short-term predictors and long-term posttraumatic stress symptoms in children (3) showed that;
“The most notable predictors of long-term posttraumatic stress in children were symptoms of acute and short-term posttraumatic stress, depression, anxiety, and parental posttraumatic stress.” (p142)

c. Lori Peek also provided an overview of the literature relating to child vulnerabilities and resilience in disasters (4) and reported that:

“Children are psychologically vulnerable and may develop post-traumatic stress disorder or related symptoms; are physically vulnerable to death, injury, illness, and abuse; and often experience disruptions or delays in their educational progress as a result of disasters. Children have special needs and may require different forms of physical, social, mental, and emotional support than adults. However, children also have the capacity to contribute to disaster preparedness, response, and recovery activities. In order to promote children’s resilience to disasters, we must improve their access to resources, empower them by encouraging their participation, offer support, and ensure equitable treatment.” (p1)

I also provide below some relevant (but not comprehensive) insights from our research below.

Separation from loved ones: Evidence explored within a previous literature review (5), found a gap in the literature published between 2002 and 2013 relating to the short- or long-term psychosocial consequences of separation from family during the threat period. Subsequently, our Beyond Bushfires research showed that people who were separated from their loved ones during the Black Saturday bushfires and did not know if they were safe, suffered more distress and were at risk of poorer mental health outcomes 3 years after the bushfires (6). Some key points from this analysis include:

(a) Over 50 percent of the 964 study participants were separated from loved ones during the bushfires and reported that this caused them high levels of stress. Some would have actively decided to separate as part of their bushfire response plans but for others it was unplanned. Given high levels of online and phone contact in current society, expectations of the immediacy of communication are likely to exacerbate the stress of separation for family members.

(b) A high number of people (45% of those who reported separation) were separated from family members for more than 12 hours without contact, some up to two days or more.

(c) On average, those who were separated were older than non-separated individuals. When controlling for age, separated individuals reported more chronic health conditions.

In addition, multigroup structural equation modelling of the Beyond Bushfires data examined anxious versus avoidant relationship attachment styles, separation from loved ones during the bushfires and mental health outcomes 3 years later. It showed different patterns based on attachment styles indicating that “attachment anxiety amplifies a negative reaction to separation;
meanwhile, for avoidant individuals, separation in times of danger may facilitate defensive cognitive processes.”(7)(p1)

8 School impacts: School staff are often first responders and frontline workers during and immediately after a natural disaster. It is one of the most challenging crises they are likely to face (8). However, there is limited evidence about how they manage these responsibilities in addition to their usual roles and on top of their own experiences of the traumatic event (9-12). School-based research conducted following the Boston bombing showed that school strategies to support students and teachers varied considerably, even in the same region and in response to the same event (10).

9 Our Strengthening School Communities study included qualitative interviews in 2016-2017 to understand the experiences of school staff in the short term following the Black Saturday bushfires in Australia and their professional development needs (13). In-depth interviews were conducted with ten stakeholders from the Victorian education system whose professional roles related to disaster preparedness and trauma support, or staff in other roles who had personal experiences of disaster and trauma exposure. This study highlighted the major demands placed on schools and teachers in the aftermath of a natural disaster. This included:

(a) Students’ distress, changed classroom behaviours and reduced capacity to learn
(b) Teachers’ own distress from personal and various exposure to trauma
(c) Increases in family support needs
(d) Reduced time and opportunities to exercise self-care due to prioritising student support needs

10 This was a small, preliminary study that was consistent with the existing limited evidence and highlighted the need for further research about how best to support school staff following large scale trauma events impacting on school communities.

11 I don’t have expertise in relation to the mental health impacts of disasters for first responders. Research conducted by Professor Richard Bryant and colleagues may be of help when considering interventions to support resilience to stress (14). It reports on a review of available evidence for pre-incident training for First responders:

“We found no evidence of the effectiveness of pre-employment screening or psychoeducation offered as a standalone package, and little evidence for interventions aimed to improve wellbeing and resilience to stress - although current trials of empirically-driven interventions for first responders are underway and show promise in preventing stress-related psychopathology. Operational and line manager training showed the most promise but need to be evaluated in high quality trials with sufficient follow-up to draw conclusions about their preventative benefits.” (p1)
Long term impacts of natural disasters on mental health and wellbeing

12 Mental health & wellbeing: Traditionally, the post disaster international literature has focussed on individual mental health in the first two years following exposure to a natural disaster (15, 16). In the past decade this has shifted to greater recognition of wellbeing more broadly and of the important influence of social factors. The Beyond Bushfires study found that people showed remarkable resilience following the Black Saturday bushfires with the proportion of people who did not meet the threshold of serious mental health disorders (based on self report) increasing from 77.8% to 81.8% from 3 to 5 years afterwards. The remainder however in high and medium impacted areas, did have significant ongoing mental health problems compared to their peers in low/no impact areas. The findings 5 years after the bushfires (Annexure B) showed that:

“Overall, the rates of people suffering probable PTSD, MDE or severe distress (problem alcohol use excluded because of its high prevalence in all communities) were 21.9% in high-affected, 10.3% in medium-affected and 5.6% in low-affected regions; those living in high-affected regions were more likely to have any disorder than those in other regions (OR: 3.18, 95% CI: [1.89, 5.33], p = 0.001).” (17)p546.

13 The 10 years Beyond Bushfires study findings about mental health impacts showed patterns that were consistent with the 5 year findings but it is noted that these findings are unpublished and currently undergoing peer review.

14 It should be noted that this does not include the many people who had sub-clinical signs of trauma that impacted on their wellbeing. Severe psychological distress was predicted by fear for one’s life in the bushfires, death of someone close in the bushfires, and ongoing difficulties such as change of income, change of accommodation and relationship breakdown (17). The focus for grief support in service delivery is often only for those who have lost immediate family members, but it is far more complex (18). The loss of friends, community members, colleagues, pets, homes and the environment were all felt intensely by those affected by disaster. The good news is that prolonged grief in this context was rare.

15 Children: As part of the Beyond Bushfires study, we conducted in-depth interviews with 35 community members ranging from 4 years to 66 years. The insights from children, teenagers, parents and grandparents revealed that children and teenagers’ sense of safety and stability was undermined by the disaster experience in many ways that emerged in the following months and years (19).

16 Our small scale qualitative evaluation of the CFA Survive and Thrive program in Anglesea indicated that bushfire education can help to promote a sense of safety as children learn how to recognise signs of risk in their environment and how to respond if that occurs, and also how to recognise when they are not in danger (20). Children and youth are not passive victims and are capable of contributing meaningfully to disaster preparedness, response and recovery (4, 21).

17 In the Strengthening School Communities study we conducted a quantitative analysis of Victorian Department of Education and Training major datasets and showed that students from bushfire
affected schools were more likely to show academic delays indicating neuropsychological impacts from disaster-related trauma and family, school and community-level disruptions (22, 23)(Annexure C). The cohort of children who began attending government primary schools in rural Victoria in 2008 were tracked through their schooling years. The academic progress of students who were attending high and medium disaster-affected primary schools were compared with their peers at schools with low/no affect (n = 24,642). The results showed that in reading and numeracy, the expected gains from students’ Year 3 to Year 5 scores were reduced in schools with higher levels of bushfire impact (23).

In the Understanding the long term academic impacts of bushfires on children study we found that the earlier delays in academic progress seemed to have sustained impact on academic outcomes, with students from high impact schools showing lower scores than their peers across all subjects from Year 5 to Year 9 – i.e. up to 8 years post bushfires. It is important to note that these findings are still undergoing peer review and have not been published yet.

There are conflicting findings in the international literature about disaster impacts on student academic outcomes. This shows the need for studies of long term outcomes, assessment of different aspects of the learning experience, consideration of whether or not the mass trauma events are followed by ongoing home, school and community level disruptions, and measures introduced to mitigate those effects.

**Impact of key life stressors and events identified in Beyond Bushfires study**

Major life stressors: As noted previously, the Beyond Bushfires study showed ongoing difficulties such as change of income, change of accommodation and relationship breakdown contribute to poorer mental health outcomes 3 to 5 years after the bushfires (17, 24). This shows that it is not just the disaster event itself that is influencing mental health and wellbeing outcomes, the recovery experience is also an important factor, indicating there are opportunities to mitigate the medium to long term mental health outcomes. While anger is an understandable reaction to the ongoing stress and disruptions post disaster, sustained intense anger and outbursts three years after the event were found to be an independent indicator of mental health risk (25).

Rebuilding and relocation: The majority of the literature on people living somewhere else after a natural disaster relates to forced displacement rather than making decisions about whether to remain living in an affected community or relocating elsewhere. There have been studies emerging over the past decade, many from Hurricane Katrina which is a combination of these experiences, e.g. people from New Orleans having to move to another city in the immediate aftermath and then being faced with the decision about whether to move back in the following years (26-29). Most people (70%) commenced rebuilding their home within 2 years after the fires. Most of those people who did rebuild felt the timing was about right (78%) (unpublished findings from 10 years Beyond Bushfires). However, having to navigate systems and services that are often poorly coordinated can be highly stressful. People’s decisions about whether to stay in their community or leave led to different experiences but similar levels of wellbeing 3 years afterwards (30). People who feared for their lives during the bushfires or lost property were more likely to choose to leave their community and begin a new life elsewhere. The disaster experience
continued to affect their wellbeing, but they benefited from being removed from the ongoing disruptions and challenges in the bushfire-affected community. Those who stayed were more likely to experience depression if close friends and neighbours had moved away (31) and the ongoing community-wide recovery process was often exhausting, but having a connection to the community helped support their wellbeing, as did the shared processing of the trauma of the bushfires (30). Understanding these differences in experiences for those who stay and those who leave can help to inform decision making and also service delivery targeted to needs. Decisions about relocation may be further complicated for Aboriginal people whose rights, interest and connection to Country remain specific to the disaster-affected area (32).

22 Changes in natural environment: There is a substantial body of literature that demonstrates the positive influence of the natural environment on health and wellbeing generally but less focus in the disaster literature which tends to describe the natural environment as a factor in social and/or economic recovery (33-35). A recent paper makes a powerful link between connection to Country for Aboriginal Australians and the pain experienced from damage to the local landscape from the summer season of bushfires (32). This highlights a major gap in the literature and recovery materials about Aboriginal experiences and knowledge relating to disaster recovery, as distinct from insights in relation to land and fire management.

23 In the Beyond Bushfires study we conducted a mixed methods analysis of the influence of people's connection the natural environment. Participants reported a strong sense of grief at the devastation to the natural environment around their home and community. However, a sense of attachment to the natural environment was still protective for mental health and wellbeing over time. People with a weak attachment to the environment (n= 102, 19% of the participants) reported on average higher psychological distress (K6), higher rates of fire-related symptoms of PTSD, and symptoms of major depression 5 years after the Black Saturday bushfires. They also had significantly lower levels of resilience, lower post-traumatic growth scores, and reported lower life satisfaction, and lower anticipated life satisfaction for the following year (36).

24 Social ties: As noted previously, people who were separated from their loved ones during the fires and did not know if they were safe were found in the Beyond Bushfires study to be at risk of poorer mental health outcomes 3 years afterwards (6). This was particularly prevalent in people with an attachment style characterised as anxious (7). The extent to which couples were influenced by their partner’s mental health during recovery was also influenced by the attachment style in their relationship (37), specifically “Male partners’ attachment avoidance was associated with depression and PTSD in both partners. By contrast, a female partner’s attachment avoidance was associated with greater depression and PTSD in herself, but fewer PTSD symptoms in a male partner” (p192).

25 The connection between mental health and people’s social networks was complex (38), “Depression risk was higher for participants who reported fewer social connections, were connected to other depressed people, or were connected to people who had left their community. PTSD risk was higher if fewer people reported being connected with the participant, if those who felt close to the participant had higher levels of property loss, or if the participant was linked to
others who were themselves not interconnected. Interestingly, being connected to other people who in turn were reciprocally close to each other was associated with a lower risk of PTSD.” (p277).

26 Being part of a community group was found to be protective of mental health 3-5 years afterwards (39) (Annexure D). The benefits of being part of a group increased with more group involvement – up to a point. There is a tendency for a few people to do the heavy-lifting in coordinating activities for many groups and these people will need support to protect their mental health. In communities where many people belonged to groups, the benefits extended beyond the group members to others living in the community – a sign of a resilient community. These “community-level health benefits come when most people participate to some extent, suggesting that the distribution of involvement across the community is important” (p167).

27 Violence: There is limited but growing evidence of gender-specific patterns of vulnerability to violence following natural disasters (40-42), including a qualitative study conducted in the wake of the Black Saturday bushfires (43) (Annexure E). Analyses of the Beyond Bushfires data showed that women were 7 times more likely to experience violence in communities severely impacted by the Black Saturday bushfires compared to low impact communities, with rates of 1.0, 0 and 7.4% in low, medium and high bushfire-affected areas, respectively (44). For women, experience of violence was also linked with income loss and poor mental health, and more severe post-traumatic stress disorder and depression symptoms.

Key systems and services that support recovery from natural disasters from a mental health and wellbeing perspective

28 Community-based recovery programs and public messaging can draw on Hobfoll et al's 5 essential elements to guide psychosocial interventions in the short term (hours to months) after a disaster. Although published in 2007, they are still a useful guide for recovery systems and service (45). They were developed by an international network of experts in disaster and mass violence in the absence of strong evidence and are well-supported by the evidence of risk and protective factors that have emerged in the years since it was published. The five elements are to promote a sense of 1) safety; 2) calm; 3) hope; 4) self and community efficacy and 5) connectedness.

29 Our ReCap project aims to support wellbeing after disasters by providing evidence-based guidance for those involved in disaster recovery. ReCap emphasises the interacting elements of recovery, using a framework of ‘community capitals’ – natural, social, financial, cultural, political, built and human. The first recovery resources will be released in June 2020 and are designed primarily for recovery workers but will also be useful for senior managers and as a resource for community leaders.

30 Disaster preparedness programs make an important contribution to both physical safety and mental wellbeing in a disaster context. The evidence for the impact of school based disaster education programs has progressed markedly over the past 15 years (46). However, there has been very little evidence on the outcomes of preparedness programs following a disaster.
experience for either school or adult focused programs (46, 47). We were commissioned by the Country Fire Authority to conduct a review of the Community Fireguard Program in the months following Black Saturday. We found that it supported social connectedness and practical and psychological preparedness when it was delivered as intended (48). We also examined the costs and benefits of the program (49) and demonstrated that:

“Totalled over ten years, the cost per Fireguard Group for the program is $10,884, with a range of $2697–$19,071, and in the event of a major bushfire the predicted savings from reduced property loss is $732,747 and from reduced fatality $1.4 million. Even if the risk of major bushfire event in a region were one in 100 years, the estimated cost savings in a 100-year period is $217,116 per group. The value of the psychosocial impacts was not calculated, as quantitative data were not available.” (p375).

Similarly, as noted previously, we conducted a very small in-depth review of the Country Fire Authority Survive and Thrive program in Anglesea, an immersive and ongoing bushfire education school program operated in a partnership between the local CFA station and the primary school (initially established in Anglesea and subsequently extended to Strathewen and St Andrews) (20). Coincidentally, bushfires affected the surf coast (Wye River and Separation Creek in particular) in the 2015/16 summer following our review and so it was possible to go back to the school early in the 2016 year to interview the students about their experiences in coping with the threat of nearby fires and the need to be alert and ready to respond using their new knowledge and skills from the program. Our findings showed that:

“Children demonstrated knowledge and skills gained in monitoring environmental risks and bushfire behavior, as well as a more nuanced understanding of the different civic roles of adults and children in responding to a bushfire in different contexts. Faced with the reality of a nearby bushfire during the summer holidays, children demonstrated their capacity for critical thinking and application of their knowledge to support appropriate action” (p86).

Further research is needed to confirm these findings.

In our Beyond Bushfires analysis of separation from loved ones during the bushfires (6), we found that most people were able to make contact with their family in the first few hours after being separated, in person or via phone (some people reported multiple methods of re-establishing contact), but as time passed, other methods started gaining importance, including (but not limited to) the reunification service provided by the Australian Red Cross. The Red Cross reunification service was updated based on these findings and other post-disaster reviews including the Victorian Bushfires Royal Commission to establish the “Register. Find. Reunite.” service which combines online and manual systems (to operate in circumstances where there is loss of power and communications).

Our findings showing the post-bushfire impacts on student academic progress and outcomes demonstrate the need for school resilience programs focused on social, emotional, learning and
vocational support for children and teenagers. The challenge is in determining which programs will make a meaningful difference. As noted in our 2019 publication (23),

“There are studies that indicate that positive school environments can, over time, mitigate the disaster-related impacts on academic performance (50-54). This has not been specifically evaluated in disaster contexts; however, a meta-analysis of the impact of social and emotional learning programs in schools generally, demonstrated improved academic performance across all year levels (55).” (p1403)

35 We conducted a review of the Emotional Literacy through Visual Arts (ELVA) approach (https://www.daxcentre.org/education/education-primary/) in disaster risk and affected schools in 2017-2018. The study design and limited scope of the evaluation did not allow us to assess effectiveness but the multiple methods did provide some important indicators of feasibility, acceptability and impact that showed that the ELVA approach is promising in primary and preschool settings in disaster contexts and should be considered for a larger trial over an extended period of time (56).

36 As noted in a separate literature review of approaches to support students post-disaster (57), teachers “need access to evidence-informed programs to guide their approaches, and to professional learning designed to advance their skills in providing such programs.” (p2) While there are some existing evidence informed programs and resources, further prospective research is required to build evidence about what student support programs work (and don’t work) for who, when, in what family, social and school circumstances, and at what financial cost because the academic impacts that we have demonstrated from the Black Saturday bushfires did not occur in a vacuum. There were many support programs operating in those schools and communities. To prevent future harm and lost potential we need to determine which ones will make a meaningful difference.

37 The All Right? health promoting social marketing campaign was developed in the early aftermath of the Christchurch earthquakes in New Zealand. It provides a successful model for promoting everyday activities and strategies to support wellbeing and has operated for almost 10 years post-earthquakes. Marketing research showed positive results but it has not undergone a rigorous evaluation. The Canterbury Wellbeing Index was established following the earthquakes as a population wellbeing monitoring tool to inform government and agency decision making about recovery services.

Mental health and wellbeing impacts of the 2019/2020 bushfires on affected communities and persons

38 We have not commenced detailed research examining the mental health and wellbeing impacts of the 2019/2020 bushfires. However, we did conduct a sub-sample analysis of people affected by the bushfires in a recent COVID-19 survey (58). This was a partnership study between the Melbourne School of Population and Global Health, University of Melbourne and the Doherty Institute for Infection and Immunity, The Royal Melbourne Hospital and University of Melbourne
by the following research team: Dr Freya M. Shearer, Professor Lisa Gibbs, Associate Professor Eva Alisic, Katitza Marinkovic Chavez, Niamh Meagher, Phoebe Quinn, Lauren Carpenter, Professor Colin MacDougall, and Dr David J. Price. Data was collected from 3-6 April 2020. A second wave of data was collected in May and the results will be released shortly. Here are some extracts from the first report – noting that this is a preliminary analysis and has not undergone peer review:

(a) “Relatively small numbers of respondents were affected by the bushfires (severely 4.1%, n=41; a fair amount 6.3%, n=63; slightly 18.5%, n=184). Further sampling is therefore required to confirm any trends. Nonetheless, there are early indications of potentially important links between bushfire affectedness and experiences of COVID-19. Bushfire affectedness appears to be linked with: being affected by other disasters that summer; experiencing difficulties when self-isolating; and experiencing events including assault or violence and changes to accommodation as a result of COVID-19 and measures to prevent its spread.” (p1-2)

(b) “Those affected by the bushfires of the 2019/2020 summer were much more likely to be affected by other disasters that summer.” (p11)

(c) “A high proportion of the Aboriginal and Torres Strait Islander respondents (53.2%, n=47) were affected by the bushfires severely or a fair amount, compared to 8.3% amongst non-Indigenous respondents. This pattern persists across metropolitan, provincial and rural locations. As Aboriginal and Torres Strait Islanders reported better self-rated physical health than non-Indigenous respondents, poor health does not appear to explain this link.” (p11)

(d) “Those who had been affected by the bushfires severely or a fair amount were also more likely to report significant life events experienced due to COVID-19 and measures to prevent its spread, compared to those not affected or slightly affected by the bushfires. Concerningly, this included higher proportions experiencing assault or violence (17.3% vs 1.2%); change of physical health other than COVID-19 diagnosis (26.0% vs 8.2%); change in mental health (38.5% vs 22.8%); and change of accommodation (24.0% vs 3.5%). The likelihood of these events was generally even higher amongst respondents who had been required to self-isolate, but the link with bushfire affectedness also appears amongst those not required to self-isolate.” (p11-12)

(e) “Amongst respondents who had been required to self-isolate, those who had been affected by the bushfires severely or a fair amount (n=47) were more likely to report more difficulties during self isolation. This included mental health effects (66.0%) and difficulty accessing clear instructions about self-isolation (55.3%).” (p12)

(f) At the time of this survey, there were some early indications of greater optimism regarding Australia’s future and ability to cope with disasters amongst the severely bushfire affected respondents. This may reflect positive impressions of society and community that can arise in the immediate aftermath of disasters. However, further sampling is required to confirm these trends.” (p12)

These findings provide early insights into the complexities of recovery from multiple hazard events occurring in quick succession.
Experience in, and involvement with, the response to, and recovery from, the 2019/2020 bushfire season

I have not been directly involved in the bushfire response and recovery efforts, except as an expert advisor as outlined below. The advice that was sought and the recommendations given were consistent with the topics covered in this Witness Statements. I also noted in my advice that the experience of disasters over the 2019/20 summer season in Australia was unique for a number of reasons:

(a) Firstly, the sheer scale of the fire impact across the Australian landscape meant it had a national profile.

(b) Secondly, there were different types of impact on the population from this event – a) a place-based impact on residents of bushfire affected communities; b) tourist exposure before going back to the safety of their homes and communities; and c) people affected by dense bushfire smoke across the country for extended periods.

(c) Thirdly, this summer involved cascading hazard events – droughts morphed into bushfires, dust storms, giant hailstorms, gale force winds, floods, and the coronavirus. The importance of social connectedness to bushfire recovery was severely undermined by the physical distancing requirements of the pandemic.

(d) Finally, the natural disasters were not perceived by the public as rare events, as previous disasters have been. They were portrayed as a terrifying harbinger of change, reflecting increasing public eco-anxiety. The influence of this on mental health impacts and recovery remains to be seen.

Expert advice: My expert advice was sought by Australian Department of Education, Training and Employment, COAG Education Council, Bushfire Recovery Victoria, Victorian Department of Education and Training (including information for briefing papers for Minister Merlino), VicHealth, Royal Commission into Victoria’s Mental Health System, Victorian Department of Health and Human Services, Australian Red Cross, Inspector General for Emergency Management Office, Rob Heferen, Deputy Secretary for Higher Education, Commonwealth Department of Education, Australian Institute for Disaster Resilience, NSW Department of Education and Training, Rural Solutions South Australia -Department of Primary Industries and Regions, Arts Centre Melbourne, Landcare, Firefoaxes, and requests from community members and recovery workers (NB additional planned briefings were postponed due to COVID-19)

Webinar presentations and podcast interviews: I was invited to contribute to webinars and podcasts being hosted by Australian Department of Education, Training and Employment for senior Education officials across Australia, Independent Education Union of Australia, NSW Teachers Health Foundation, First Person Consulting, Australian Red Cross, University of Melbourne
Advisory groups: Invited to join Expert Advisory Groups by Australian Red Cross, Victorian Department of Education and Training, Paul Ramsay Foundation, Strategic Think Tank Human and Social Recovery, and University of Melbourne

Philanthropic: Provided evidence and advice to support decision making by the Paul Ramsay Foundation, UNICEF and Variety

Academic: Invited to collaborate on major bushfire recovery studies by leading mental health, public health and social network experts; invited by National Workforce Centre for Child Mental Health to contribute to joint Senate and Royal Commission submissions; also invited to collaborate on major COVID-19 studies by leading public health experts.


Media requests: Jan 2020 - French newspaper (mental health impacts), Sydney radio (caring for children), Age article (losing a house), Washington Post (public health impacts), SBS News (long term mental health), SMH & Age article (mental health impacts), Early Childhood Resource Hub (early years settings), ABC Radio Gippsland (community resilience), Australian Teacher Magazine (school communities), Canberra Times (supporting children), ABC 7.30 Report (long term impacts), French publication Ecologie (disasters and climate change), RACGP news (resilience and recovery). Feb 2020 - The Medical Republic (ecoanxiety), Nature Index (researcher mental health), Independent Education Union newsletter (school staff), ABC documentary (resilience).

I am not in a position to comment in any detail on what worked well and did not work well with the response to and recovery from the 2019/20 bushfire season because I was not involved in any assessment of service delivery. The only thing that was clearly apparent was that many of the planned discussions and recovery initiatives were postponed or cancelled because of the pandemic restrictions.

Whether recommendations of the Beyond Bushfires Final Report have been implemented in the response to, and recovery from, the 2019/2020 bushfire season

In addition to the requests for advice and presentations described above, I have been advised our Beyond Bushfires research findings and our research on the impacts on students and school communities have been used in the following ways for recovery from the current season:

(a) Christine Morgan, CEO National Mental Health Commission, National Suicide Prevention Adviser to the Prime Minister cited Beyond Bushfires research in a press conference at Australian Parliament House 12 Jan 2020

(b) A summary of our research was prepared by Victorian Department of Health and Human Services’ staff to inform policy and funding decision making in February/March 2020
(c) The March 2020 report from the Chair of Bushfire Recovery Victoria to the Premier cited Beyond Bushfires research.

In relation to specific recommendations for government and service providers from the 2016 Beyond Bushfires Final Report:

(a) Government mental health and wellbeing planning – disaster impacts were not included in the final 10 year mental health plan

(b) Government disaster planning for schools – the Department did not maintain the working group but the Children and Disasters Advisory Group was established by the University of Melbourne with regular exchanges of expert advice between the University, the Advisory Group and the Victorian Department of Education and Training

(c) Something for parents – I am not aware of whether there is a guide to local governments about post disaster support to parents. However, there have been many resources developed by agencies across Australia to support parents and families affected by emergency events including a guide we co-developed with Australian Red Cross to help families to choose the most relevant resources for them1. The Victorian Department of Education and Training have been providing information for parents in the wake of the 2019/20 bushfires online and through webinars in line with pandemic restrictions. I am not in a position to comment on what has been released by other Education Departments.

(d) Communications register – as far as I am aware this has not been established and has been included in my recommendations below

(e) Five year recovery plan and psychosocial services – implemented in part and varying across jurisdictions. I am not in a position to fully assess implementation and it is still early stages in the recovery process from the 2019/20 season.

(f) Involvement of local government and community – I am not in a position to assess if this has been implemented.

(g) Local emergency management plans - I am not in a position to assess if this has been implemented.

(h) Online information - Emergency Management Victoria’s systems for providing timely and clear emergency messages online and through the VicEmergency App showed a marked improvement in the 2019/2020 season. While there will no doubt be further improvements planned, the clarity in the messaging in the VicEmergency App this summer was commendable. I am not in a position to comment on the balance achieved by government department and recovery support agencies between online information and in person or phone service delivery

1 https://www.redcross.org.au/get-help/emergencies/resources-about-disasters/resources-for-parents#recover
(i) Screening for risk – Phoenix Australia do provide training to trauma and recovery service providers

(j) Community groups/community leaders/parks and recreation facilities - I am not in a position to assess if these remaining Beyond Bushfires Final Report recommendations have been implemented.

51 Prior to this season, we were informed that the Beyond Bushfires and related research contributed within Australia to:

(a) State Government emergency management planning in Victoria, Queensland, South Australia, New South Wales and Western Australia

(b) Victorian Department of Education and Training additional programs for schools and Black Saturday 10th Anniversary initiatives

(c) Australian Red Cross disaster recovery policies and programs

(d) National Disaster Mitigation Framework

(e) Phoenix Australia: Centre for Posttraumatic Mental Health programs and resources

(f) Emergency Management Victoria Strategic Action Plan and Resilient Recovery Framework

(g) Inspector-General for Emergency Management’s reform of Victoria’s Emergency Management sector

(h) NSW flood recovery and Blue Mountains bushfire recovery

(i) Victorian Wye River Recovery and Renewal Plan

(j) Were distributed by Municipal Association Victoria through local government networks

(k) Informed the National Principles for Disaster Recovery which were recently revised and updated by Australian and New Zealand government departments in partnership with recovery support agencies and Australian communities impacted by major disasters.

(l) Informed Psychosocial Committee advice for the Victorian Department of Health and Human Services. This is the Committee which provides expert advice about policy and allocation of services to protect mental health and wellbeing in the event of major emergency events in Victoria

(m) Cited in Victorian Council of Social Services (VCOSS) government policy advice relating to disaster recovery

52 The international impacts of the Beyond Bushfires research have not been not listed here because of the national focus of the Royal Commission.
Improvements that should be made to the provision of recovery support and services for mental health and wellbeing to affected communities and persons

The following recommendations have been prepared for this Witness statement from previous recommendations arising from the Beyond Bushfires research, in consultation with the 10 years Beyond Bushfires research investigators and study partners:

(a) Establish a **5 year framework** for recovery from major disasters to account for extended mental health impacts.

(b) Provide advisory and support services within bushfire affected communities that focus on **reducing the impact of major life stressors** (e.g. financial advice, guide to building regulations, relationship counselling, job retraining)

(c) Establish a **Communication register** for people who relocate from disaster affected communities and others who are not community members but are highly impacted (e.g. family members of those who died; holidaymakers trapped in fires). This will support communication of relevant resources, services and research in the following years.

(d) **Extend trauma support services** to those highly impacted but not living in affected communities – with information disseminated through the proposed communication register (see above).

(e) **Be flexible in timing of support services** to allow people to recover at their own pace.

(f) **Monitor patterns of community group membership** as a useful indicator of individual wellbeing and a healthy and resilient community.

(g) **Invest in local community groups’** facilities, equipment and activities to enable continued operation post disaster to promote individual and community resilience.

(h) **Support community group leaders** to ensure their mental health and wellbeing is not compromised by their efforts to maintain group activities

(i) Recognise the important role of **creative activities** in people’s lives

(j) Include **restoration of the natural environment** in recovery planning to address mental health and wellbeing as well as aesthetic, cultural, spiritual, economic and recreational aspects of recovery

(k) **Involve local government and community committees** in decision making and service delivery to ensure local relevance and continuity beyond the immediate recovery period.

(l) **Local emergency management plans** need to include input from all sectors of the community, including children and young people, and account for psychosocial impacts in addition to physical safety and asset protection.

(m) Increase provision of **family violence prevention** strategies and support services in high impact communities
(n) **Promote links to major research studies** conducted in Australia, such as the Beyond Bushfires website (beyondbushfires.org.au) to enable individuals, local communities, services and government to use the non-academic reports and briefing notes to support evidence informed decisions.

(o) **Continue NAPLAN** as an important longitudinal research and academic monitoring tool.

(p) **Provide funding for school-based bushfire education programs** that teach children and teenagers how to live in bushfire risk environments and involve them in local bushfire preparedness and recovery initiatives.

54 I would suggest that further work is needed to:

(a) Understand Aboriginal natural disaster recovery experiences and learn from **Aboriginal knowledge systems** about trauma and healing

(b) Build evidence about **diversity and equity** in recovery; recovery from exposure to **multiple cascading hazard events**; and the influence of **climate change anxieties** on recovery experiences.

55 Child and school-specific recommendations: The University of Melbourne research studies – Strengthening School Communities and Understanding of the long term academic impacts on children of bushfires showed extended bushfire impacts on student learning progress and academic achievements. This highlights the need for strategic and staged post-disaster recovery planning for affected school communities. The following recommendations have been prepared for this Witness statement in consultation with the research investigators and the Children and Disasters Advisory Group, from previous recommendations arising from the studies:

(a) Have a program for **staff briefing and training** in trauma informed practice (before students return and at key recovery intervals) to support staff wellbeing and their capacity to meet the needs of students.

(b) Provide **parents** with information and consultation sessions at different stages post disaster, with childcare provided to make it possible for all parents to attend, some resource options:

(i) a new guide\(^2\) to resources for children and families to help people to navigate through the many resources released following the bushfires

(ii) a new guide\(^3\) to parenting after disasters

(iii) updated Red Cross resource\(^4\) for children and parents after crisis


\(^3\) [https://www.redcross.org.au/getmedia/7cc1c0-a6d9-41a1-a8e0-4b2663be74/Crisis-Parents-Booklet.pdf.aspx](https://www.redcross.org.au/getmedia/7cc1c0-a6d9-41a1-a8e0-4b2663be74/Crisis-Parents-Booklet.pdf.aspx)

(c) Ensure disaster affected schools have access to a **trauma psychologist** (and/or other relevant health professional) with disaster experience and/or training including ongoing mentoring as well as appropriate strategies and services for the referral of high risk students.

(d) Introduce a parent/care-giver report of student health, development, wellbeing, trauma exposure and family circumstances at **transition to secondary school** (similar to the School Entrant Health Questionnaire before primary school) as a guide to individual, school and regional support needs.

(e) Implement **school and community-based trauma support programs** for students showing sub-clinical signs of trauma that are resourced by trained and mentored trauma and disaster personnel.

(f) Support all school communities to extend their **social and emotional resilience strategies** and curriculum to promote staff and student wellbeing (55) and support mental health (59) as part of disaster preparedness and for at least 6 years following a major disaster event.

(g) Provide additional **learning support** for disaster affected students at all year levels:

(i) Focusing on reading and numeracy in primary school

(ii) All academic domains in secondary school

(h) Support access to **vocational education and training** (VET) for secondary students in the years following disaster exposure to provide the best opportunities for students to thrive in the workplace (60)

(i) Ensure schools have access to **family violence practitioners** and guidance on referral options.

(j) Appoint **additional teaching and support staff** and/or volunteers (potentially seconded or invited out of retirement) to educational settings as needed in the years following the disaster event to help meet the extra administrative, social, emotional and learning demands.

(k) Adjust **departmental administrative requirements** and **timelines** for disaster affected educational settings to acknowledge the additional demands on staff and students.

(l) Conduct **new research** to increase understanding of the impacts of the pandemic on school communities generally and on the bushfire affected schools in particular, focussing on school engagement/attendance, academic achievements, and staff and student mental health and wellbeing.

Conduct **research and evaluation** of post disaster student support strategies to build evidence about what works (and doesn’t work) for who, when, in what family and social circumstances, and at what financial cost.
Additional school-related considerations developed by the Children & Disasters Advisory Group

The provision of psychosocial and mental health support to school communities to assist with preparedness, response and recovery in natural disasters and community trauma is impeded from best practice by the lack of a workforce that has adequate numbers and competency in the field of disaster mental health, children and young people, teaching and learning and developmental psychology. The need to have a holistic understanding of the child within their system is vital when working with this cohort.

(a) It is suggested that an evidence based training program focussed on child/youth/school context is developed and that all wellbeing and mental health practitioners that intend to provide psychosocial and mental health support be accredited in this training program.

Bushfires often impact rural and remote communities where health workforce capacity and capability is diminished:

(a) It is recommended that equitable access to specialist child/youth/school practitioners be achieved by considering options such as financial incentives to provide continuing service to such areas

(b) That deployment of such professionals work to achieve a continuum of care, where professionals are tenured for a minimum period

(c) That Telehealth options are enabled and supported in rural and remote communities with access to required tele-communications to assist with access to specialist care and knowledge

Signed by Lisa Frances Gibbs on 22/05/2020

Signature of witness
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60. Polidano C, Ryan C. What Happens to Students with Low Reading Proficiency at 15? Evidence from Australia. Melbourne, Australia: University of Melbourne Faculty of Business and Economics; 2016.
Annexure A to the Statement of Professor Lisa Gibbs, 22 May 2020

Suggested citation:


Study partners on the Australian Research Council Linkage Grant:
- Victorian Department of Health
- Australian Red Cross
- Australian Rotary Health
- Australian Government Department of Human Services (Centrelink)
- Phoenix Australia: Centre for Posttraumatic Mental Health
- Central Hume Primary Care Partnership
- Bendigo Loddon Primary Care Partnership
- North East Primary Care Partnership
- Outer East Primary Care Partnership
- Central West Gippsland Primary Care Partnership
- Lower Hume Primary Care Partnership

Additional support:
- University of Melbourne
- University of New South Wales
- Swinburne University
- Flinders University
- University of Sydney
- Jack Brockhoff Foundation

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INTRODUCTION

The Beyond Bushfires: Community Resilience and Recovery study was conducted to examine the impacts of the Black Saturday and related bushfires of February 2009 on community members’ physical and mental health and wellbeing. The research also aimed to build understanding of the interplay between individual, social and community-level recovery. The six year study involving over 1,000 participants across Victoria was conducted by The University of Melbourne in partnership with community members and a range of community, academic, government, emergency, and health agencies [1].

The results showed individual and community capacity to recover from a disaster experience and subsequent disruptions, and to adapt to changed lives and environments. There was progressive recovery at community level over time but there was also evidence of delayed impacts on individual mental health and extended impacts at five years post-bushfires. The results highlighted the influence of close friends and family, social networks and community groups, and natural environment on resilience and recovery. There are clear opportunities to use these findings to inform individual decision making, community-level strategies to strengthen resilience, and targeting and timing of recovery services.

The research findings are being shared through a range of outlets including website, facebook, twitter, academic journals, scientific conferences industry and community seminars to ensure that the learnings from this event can help those who were directly impacted and also help others to prepare for future disaster events. We have worked in close partnership with key government, emergency and community agencies to use the research findings to improve planning, response and recovery services – and we continue to seek funding to support this ongoing work.

This report presents an overview of the findings and key recommendations. Links to detailed academic papers arising from the study can be found on the Beyond Bushfires website – www.beyondbushfires.org.au
RESEARCH TEAM

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Southgate Institute for Health, Equity and Society, Flinders University

The late Professor Elizabeth Waters, previous Principal Investigator, is acknowledged for her leadership role in establishing this study. The investigators gratefully acknowledge the generosity of the research participants in sharing their time and experiences, and the support from community organisations and local governments.
The study was funded by initial seed funding from The University of Melbourne and an Australian Research Council (ARC) Linkage Grant (LP100200164) including financial and in-kind contributions from ARC Linkage partners: Victorian Department of Health, Australian Red Cross, Australian Rotary Health, Australian Government Department of Human Services (Centrelink), Phoenix Australia Centre for Posttraumatic Mental Health, and six Primary Care Partnerships: Central Hume, Bendigo Loddon, North East, Outer East, Central West Gippsland, Lower Hume. Additional salary support for Lisa Gibbs and Elizabeth Waters from The Jack Brockhoff Foundation is also acknowledged, as is investigator support from the University of New South Wales, Swinburne University, Flinders University, and University of Sydney. The Social Research Company was commissioned to conduct recruitment and quantitative data collection.
WHY DID WE CONDUCT THE STUDY?

The February 2009 Victorian bushfires led to tragic loss of life and far-reaching damage to the Victorian landscape and rural communities. One hundred and nine communities self-identified as being impacted by the bushfires. There were 173 fatalities, 3,500 buildings (2,133 houses) damaged or destroyed, and major disruptions in the everyday lives of those living in the affected communities. Although a lot of research had already been done about the short term mental health impacts of natural disasters, much less was known about how individual recovery was affected by social and community level changes over time [1]. The University of Melbourne and partner organisations held discussions with the networks of health service providers in affected areas (the Primary Care Partnerships) and it was agreed that increased understanding of these issues would support recovery and future preparedness.

HOW DID WE CONDUCT THE STUDY?

From the beginning, we approached this study as a partnership. We believed that was the only way to ensure the research utilised the range of expertise (community, service provider, academic and government) needed to capture the complexity of the post disaster environment and to achieve results that would generate meaningful outcomes. We invited a range of communities with different profiles to participate in the study [1]. They varied in level of bushfire impact (from no direct impact to high levels of impact), size of community, distance from Melbourne, and the average income and education of residents. This helped us when we were analysing the results to recognise what was arising from the bushfire impact and what may reflect the influence of other factors. We visited key community groups in each location to discuss the study and tried to keep in contact throughout. This helped us to recognise similarities and differences between communities, and the things we learnt and the feedback we received influenced decision making at each stage of the study.

There were also a number of linked PhD research studies conducted to further our understanding of bushfire resilience and recovery.
WHO PARTICIPATED?

We circulated a survey from December 2011 to January 2013 to people living in the selected communities and those who had relocated, and 1,056 people participated either by phone interview or online. At the end of the survey, 966 agreed to be recontacted, resulting in 736 completing the survey again in 2014. We also conducted 35 indepth interviews with people aged from 4-66 years in 2013 and 2014. In our interviews, we asked people to show us what was important to them in their communities and walked with them around their homes, properties, local parklands and towns as they shared their stories [2].

Participants in the main study did not differ between high, medium and low impact communities in terms of sex, age, country of birth, or employment status.

The vast majority of the respondents were glad they had completed the survey even among the small proportion who felt distressed while they were doing it.

**Survey participants**

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<tr>
<th></th>
<th>Baseline n=1056</th>
<th>Follow up n=736</th>
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<tr>
<td><strong>Gender</strong></td>
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<td>61% Female</td>
<td>39% Male</td>
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<td>61% Female</td>
<td>39% Male</td>
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<tr>
<td><strong>Age</strong></td>
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<tr>
<td>18</td>
<td>87</td>
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<td>AVG: 56</td>
<td>AVG: 58</td>
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<tr>
<td>21</td>
<td>89</td>
<td></td>
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<tr>
<td><strong>Resided in bushfire affected area in 2009</strong></td>
<td>77%</td>
<td>81%</td>
</tr>
<tr>
<td>N= 811</td>
<td>N= 597</td>
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<tr>
<td><strong>Identified as Aboriginal or Torres Strait Islander</strong></td>
<td>0.7%</td>
<td>0.5%</td>
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<td>0.2%</td>
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Three to four years after the bushfires, participant responses indicated that the majority of people were resilient following the disaster experience and its aftermath. However, a significant minority were reporting symptoms which indicated mental health problems that were beyond levels likely to be manageable and may require professional support [3]. This is approximately twice the level you would expect in a population not affected by disaster.

Severe psychological distress was predicted by fear for one’s life in the bushfires and death of someone close in the bushfires.

Two years later, i.e. five years after the fires, rates of mental health problems had significantly reduced to 21.9% in high-impact communities but were still higher than national levels [4]. While many people showed signs of improved mental health over time, there were others with delayed onset of mental health problems such as posttraumatic stress disorder.
It was not just the fire event itself that affected people. Experiencing major life stressors after the bushfires (i.e. change of income, change in accommodation or change in personal relationships) impacted on ongoing mental health [3].

It became clear that there were varied approaches to recovery that co-existed because the ultimate aim among people and groups was different. Depending on how the impact of the bushfire event and aftermath was experienced, some people aimed to reclaim their lives and others needed to reinvent their lives [5].

**MAJOR LIFE STRESSORS**

**BEREAVEMENT**

Our study mostly included people who had experienced loss through death of friends and community members in the fires, rather than direct family members. We found that the loss arising from the death of friends and community members was predictive of poor mental health outcomes, demonstrating the community-level impact of loss [6].

“I went to four funerals in that week and there were two I didn’t get to go to because I was at others… And none of those first four were for one person”
**POSTTRAUMATIC GROWTH**

Posttraumatic growth refers to people’s positive experiences after traumatic events – appreciation of life, new possibilities, personal strength, relating to others and spiritual change. We found women were more likely to report these changes. People from medium-high affected communities and those experiencing more posttraumatic stress, were also more likely to be reporting posttraumatic growth.

**ANGER**

Our research showed that anger can be both a motivator and a barrier to recovery, and tends to be influenced by the social context and service provider response [7].

“Well sometimes you need it to get out of bed. I mean if you’re sitting on that sort of precipice and *blank depression* on one side and *feisty anger* on the other, it might be that you need to tip over into anger to prevent yourself from going the other way… I think that it had a really important place initially”

However, regularly experiencing intense, explosive anger three to four years after the fires was shown to be associated with poorer mental health outcomes. This held true even after the influence of major life stressors after the fires was taken into account [8].

**PHYSICAL HEALTH**

Self-assessed general health appeared to be lower (poorer) than that of the general population, however, factors such as socioeconomic status and rural residence are not controlled for and these may well influence the scores, particularly since there was no difference between high, medium and low bushfire impact communities. There was no significant change in self-assessed health between time 1 and time 2.

It was difficult to determine the impact of bushfire experiences on particular physical health conditions because anomalies in responses suggested the data was not accurate. For example there were many people who responded ‘yes’ at time 1 to the question “have you ever been told by a doctor that you have any of the following health conditions?” and then responded ‘no’ at time 2 to the same question. After adjusting for this, the rate of ‘new’ incidences of cancer, respiratory, circulatory, and muscular conditions that were reported at time 2 were no different between medium-high impact communities and low impact communities.
Increased bushfire exposure and impact was associated at time 1 with decreased subjective wellbeing but increased sense of community. Over time there were shifts in the different factors contributing to the measure of subjective wellbeing. Specifically, there were: improvements in mental health; no change in self-rated physical health; and reduced life satisfaction. Overall, there was increased subjective wellbeing over time but decreased sense of community. This may reflect a ‘return to normal’ levels of community engagement or it could indicate negative experiences of community engagement over time in a post disaster environment.

**WELLBEING & LIFE SATISFACTION**

Separation from close loved ones, during and immediately after the fires, was a risk factor for subsequent mental health problems, particularly for people who tend to feel anxious about their relationships [9, 10].

**SEPARATION**

Involvement in community groups was protective. As an individual’s number of group memberships increased, their mental health improved but there was a curvilinear relationship between group membership and concurrent mental health (PTSD and depression) so that at a certain point membership to additional groups became detrimental to mental health. This was particularly true for men at time 1 and applied to both men and women at time 2.

Living with someone else was protective, but the risks of living alone appeared to be offset by group involvement. This was particularly true for those who were retired.

This suggests that a healthy community is characterised by having many groups with high levels of participation spread across the community, so that the majority of people participate in several groups.

**COMMUNITY**
The reality of the disaster and its aftermath formed the ongoing backdrop of children’s daily lives. Children from a very young age through to older youth experienced anxieties and upheavals at home, in school, in sport, in friendship groups and in the community [11].

“She had so much trouble going back to school. She couldn’t think, concentrate at all. Everything seemed irrelevant that she was doing and they tried so hard. They were very helpful but she had a lot of trouble with just fitting in with the kids that she knew before there. They weren’t understanding her and she just felt that all their problems were very trivial.” (Parent)

This prompted families to make adjustments to help to restore the children’s sense of safety and stability [11]. Children were involved in the decision making. Typically, they either sought familiarity in the community context or conversely a move away from disaster affected environments.

“Well there’s lots of new and nice people and it’s not as much, well I don’t know, it’s not black, it’s more better and nice.” (Child)

Grandparents, school staff and community members provided important additional support to the family efforts to provide a stable environment for children.
There were many examples of family members responding differently to the experience of the bushfires and the aftermath. This meant that measures to support one family member’s needs sometimes conflicted with other family member’s needs - e.g. the decision about whether to relocate out of the disaster-affected area or stay connected to their community.

Attachment insecurities within couples were linked to their individual mental health outcomes. For example, self isolation and avoidance in relationships by one partner (particularly men) was likely to be associated with poor mental health for both partners [13].

Parents spoke of parenting situations they never expected to face. Finding ways to manage the trauma reactions experienced by their children often required new understandings, skills or strategies. Valued aspects of parenting, like patience and tolerance or having the answers in difficult times, were compromised by demands of rebuilding and recovery that were competing for their time and energy as well as parents’ own trauma responses. While changes to parenting were often accompanied by feelings of loss, sadness, and at times helplessness, there were also positives in the opportunities to model recovery and resilience for their children [14, 15].

One of the strongest predictors of outcomes was social ties. Being connected with many people was generally protective but it also meant a higher likelihood of losing someone close in the bushfires.

We had a closer look at social ties to understand how it related to individual outcomes [16].
MOVING AFTER A BUSHFIRE

There was a lot of anxious speculation in communities about whether it is a good idea or not to relocate after the disaster. We found that the wellbeing of those who stayed in the community and those who chose to relocate was similar but they had different experiences [17].

STAYED
Those who stayed felt a strong sense of connection which was associated with higher levels of wellbeing

MOVE AWAY
Those who were most affected by the bushfires were more likely to move to a new community

DEPRESSION risk was higher for those who stayed and were connected to people who had left their community

MAJOR LIFE STRESSORS
The impact of subsequent financial and relationship difficulties was often lessened, for those who moved away.

SERVICE SUPPORT

Family members were seen to be the main source of support, over and above any formal support services.

The emergency response overall was reported as the second most helpful source of support, followed by friends and the community.

Many men and women were allocated a case manager, and most found this helpful.

All of these supports were identified as being sources of difficulty at times too.

Communication and caring were identified as two critical factors in disaster recovery [18]:
• Clear and regular communication was essential for making informed decisions
• A caring manner in the delivery of services and support was repeatedly reported as a positive influence on recovery.
Self-reported attachment to the natural environment appeared to be a constant trait and to have a protective effect in terms of life satisfaction, mental health outcomes, resilience, posttraumatic growth and community attachment.

People found the online environment helpful for peer-to-peer interactions, ‘insider information,’ insights into coping and managing of psychosocial consequences related to the disaster, and to further their overall understanding of disaster recovery. They were less likely to use the online environment to access formal support services [19].
RECOMMENDATIONS

ADVICE FOR INDIVIDUALS AND FAMILIES

Consider mental health planning – When planning for bushfire emergencies, be mindful that your decision will impact on both your physical and mental health. Exposure to a bushfire for you and your family can increase risk of mental health problems.

Plan ahead for how to find each other – Separation from family members during a disaster is highly stressful. This stress can have a lasting impact, even when everything turns out (relatively) okay. Have a plan about where or how you will reconnect, especially if communication and road systems are affected. The Australian Red Cross provides the Register Find Reunite service.

Be kind to yourself and others – It can take more than five years for some people to recover from a disaster experience and its aftermath, particularly in high impact communities.

Be open to the possibility of positives – Positive outcomes can come from a disaster experience, even for those who have had the most severe losses. This is referred to as posttraumatic growth.

We are all different – People can respond differently to the same experience and have different recovery needs, including within families.

Remember the children – Even very young children can be affected by the disaster and what is happening around them for years afterwards. Ensure children and young people of all ages feel safe and stable, and involve them in recovery decisions and activities in age appropriate ways.

Adaptive parenting – You may find parenting changes as you accommodate your own and your child’s reactions to the disaster trauma and subsequent disruptions. Remember other parents have felt this way too, sometimes it’s about doing the best you can in tough situations.

Community groups can make a difference – Being involved in community groups leads to better mental health outcomes. However, share the load: Don’t leave it to just a few people to make sure these local groups keep going. Local groups need leaders and members to survive, and those who do “too much” might become overburdened.

Relocating can help for some – The decision to stay living in a disaster affected community or to move somewhere else is offset by two contrasting forces in peoples’ lives: connection to the community, and post-disaster disruption. Those who decide to stay are likely to feel more connected to their community. For those who decide to move away from the disaster affected community, the impacts of post-disaster disruptions to income, accommodation and relationships are likely to be lessened.

Changes in the natural environment can influence recovery – Many people find watching the bush regrow and recover helpful for their own wellbeing.

Go online – Many people find online connections a helpful way to gather information and share experiences.
Government mental health and wellbeing planning – Department of Health and Human Services (DHHS) include consideration of disaster impacts in the broader mental health and wellbeing support service planning, including the 10 year Mental Health Plan.

Government disaster planning for schools – Department of Education and Training maintain the current working group of senior staff and key academics to ensure emerging evidence in relation to the impact of disasters on children, staff and schools is incorporated into government emergency planning and resilience building activities and resources for schools.

Something for parents – Municipal Association of Victoria, in collaboration with the Department of Health and Human Services and Emergency Management Victoria, provide a guide to local government on how to provide additional post-disaster support to parents through existing services such as immunisation sessions, maternal and child health, and mobile libraries. Providing childcare will enable parents to participate in recovery activities as well as taking time for their own wellbeing. Department of Education and Training provide evidence-informed, timely services and support to parents through schools and early childhood settings.

Communication register – A communication register be established of people who relocate from disaster affected communities and others who are not community members but are highly impacted (e.g. family members of those who died). Australian Red Cross to consider the potential for this to be coordinated through the Register Find Reunite Service.

Five year recovery plan – Emergency Management Victoria include psychosocial recovery up to five years post-disaster in the Relief and Recovery Reform Strategy. Consultation with the DHHS Emergency Management Psychosocial Reference Group is recommended in development of this aspect of the Reform Strategy. Mental health risk screening and referral to individual, social and community level support services should be available within affected communities for managing trauma and for anger management, as well as providing specific services to reduce the impact of major life stressors (e.g. loss of income, change in accommodation and relationships). Support in managing trauma should be extended to those not living in affected communities – with information disseminated through the proposed communication register (see above).

Involvement of local government and community – Government disaster recovery taskforces engage with Municipal Association of Victoria on the best way to recognise and involve local government and community in decision making and service delivery to ensure continuity beyond the immediate recovery period.

Local emergency management plans – Local governments engage different sectors of the community in emergency planning and recovery processes, including children and young people, and account for psychosocial impacts in addition to physical safety and asset protection.

Online information – Emergency Management Victoria provide timely information about emergency management and services online and through social media throughout response and recovery periods to support community members in making informed decisions. Government departments and agencies involved in providing recovery support services also provide online information but continue to deliver services by phone and in person.
Screening for risk – Phoenix Australia: Centre for Posttraumatic Mental Health provide training to trauma and recovery service providers in recognising and addressing key risk factors for poor mental health outcomes including living in a high impact community, fear of dying at the time of the disaster, loss of someone close (including friends and community members), separation from family members at the time of the disaster, experiencing major life stressors after the disaster, intense anger, and living alone.

Invest in community groups – Department of Health and Human Services, Emergency Management Victoria, Municipal Association of Victoria and local government continue to recognise and support community groups as critical influences on social connection and individual and community level recovery, and to promote inclusion and facilitate wide participation.

Recognise community leaders – Local government continue to recognise community leaders as an important resource to guide local action and communication, and this connection be recognised and supported by state and national agencies including Emergency Management Victoria, Department of Health and Human Services, Australian Red Cross and Municipal Association of Victoria in any locally based preparedness, response or recovery initiatives.

Parks and recreation facilities – Local governments and Parks Victoria prioritise restoration of community parks and recreation facilities as an important post-disaster support to mental health and wellbeing.
REFERENCES


7. Kellett C, PhD Study: Anger, and anger support, for individuals and communities affected by the 2009 Black Saturday bushfires, in Department of Social Work. In Progress, University of Melbourne, in progress.


APPENDIX 1: BEYOND BUSHFIRES PUBLICATIONS
TO DATE


APPENDIX 2: RELATED CONFERENCE AND SEMINAR PRESENTATIONS TO DATE

2016


2015


2013


APPENDIX 2: RELATED CONFERENCE AND SEMINAR PRESENTATIONS TO DATE CONT.

2012
42. Gibbs L. Beyond Bushfires: Community Resilience and Recovery. NDMRI seminar series, August 2012, Melbourne.

2011
APPENDIX 3: RELATED PHD STUDIES


For further information:

Beyond Bushfires website: www.beyondbushfires.org.au

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Annexure B to the Statement of Professor Lisa Gibbs, 22 May 2020

Longitudinal study of changing psychological outcomes following the Victorian Black Saturday bushfires

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Abstract

Objectives: To map the changing prevalence and predictors of psychological outcomes in affected communities 5 years following the Black Saturday bushfires in Victoria.

Method: Follow-up assessment of longitudinal cohort study in high, medium and non-affected communities in Victoria, Australia. Participants included 1017 respondents (Wave 1) interviewed via telephone and web-based survey between December 2011 and January 2013, and 735 (76.1%) eligible participants were retested between July and November 2014 (Wave 2). The survey included measures of fire-related and subsequent stressful events, probable posttraumatic stress disorder, major depressive episode, alcohol use and severe distress.

Results: There were reduced rates of fire-related posttraumatic stress disorder (8.7% vs 12.1%), general posttraumatic stress disorder (14.7% vs 18.2%), major depressive episode (9.0% vs 10.9%) and serious mental illness (5.4% vs 7.8%). Rates of resilience increased over time (81.8% vs 77.1%), and problem alcohol use remained high across Wave 1 (22.1%) and Wave 2 (21.4%). The most robust predictor of later development of fire-related posttraumatic stress disorder (odds ratio: 2.11; 95% confidence interval: [1.22, 3.65]), general posttraumatic stress disorder (odds ratio: 3.15; 95% confidence interval: [1.98, 5.02]), major depressive episode (odds ratio: 2.86; 95% confidence interval: [1.74, 4.70]), serious mental illness (odds ratio: 2.67; 95% confidence interval: [0.57, 1.72]) or diminished resilience (odds ratio: 2.01; 95% confidence interval: [1.32, 3.05]) was extent of recent life stressors.

Conclusion: Although rates of mental health problems diminished over time, they remained higher than national levels. Findings suggest that policy-makers need to recognize that the mental health consequences of disasters can persist for many years after the event and need to allocate resources towards those who are most at risk as a result of substantive losses and ongoing life stressors.

Keywords

Posttraumatic stress disorder, disaster, bushfires, resilience, Black Saturday

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There is overwhelming evidence of the adverse mental health consequences of both man-made and natural disasters (Norris et al., 2002a, 2002b). Most research has focused on posttraumatic stress disorder (PTSD), with rates of approximately 10–20% being reported in the initial year following the disaster (North, 2007; North et al., 2008). Depression is also commonly reported after disasters, with approximately 14% of survivors reporting major depression (Norris et al., 2002a, North et al., 2012). Finally, there is also much evidence that excessive use of substances is common following disasters (Boscarino et al., 2006; Vlahov et al., 2002). These trends need to be balanced with the recognition that all large studies of disaster survivors converge on the observation that most people are resilient and do not develop psychiatric disorders (Norris et al., 2009).

Current evidence is limited by several factors. First, most studies lack comparator populations which are important to determine the relative impact of the disaster on the affected population. Second, few studies have tracked the long-term sequelae of major disasters, with most research focusing on the initial year or 2 years after the event. The longest follow-up to date was conducted after the Buffalo Creek dam disaster, which studied a sample of litigants over time; this study found that PTSD decreased from 44% at 2 years to 28% at 14 years (Grace et al., 1993). Another study of survivors of the Oklahoma Bombing found that the rate of PTSD decreased from 41% at 6 months to 26% at 7 years (North et al., 2011); this latter study found no cases of delayed onset of PTSD in which people developed the disorder if they did not present with it at the 2-year assessment.

Australia has a long tradition of dealing with natural disasters, and numerous studies have longitudinally investigated the mental health effects of bushfires and earthquakes. One study that tracked the mental health of people exposed to the Newcastle earthquake throughout the initial 2 years of the disaster found that 18% of those most exposed to the quake had probable PTSD at 2 years (Carr et al., 1997). A 20-year follow-up of children affected by a major bushfire found that although disaster-affected children had higher rates of adult psychopathology, this was not directly a result of the childhood disaster exposure (McFarlane and Van Hooff, 2009). In a rare design, a New Zealand study capitalized on a cohort study of people living in the Canterbury region, 57% of whom were exposed to the 2010–2011 earthquakes. This design allowed mental health effects of the disaster to be disentangled from other potential confounding factors; this research reported that the disaster could account for 10.8–13.3% of overall rates of mental health conditions in this cohort (Fergusson et al., 2014).

There is a need for further study of long-term effects of disasters because this initial evidence suggests that people can suffer the adverse psychological effects for prolonged periods after the disaster occurs.

In February 2009, Australia experienced one of its worst disasters when severe bushfires affected most of the state of Victoria in what is known as the ‘Black Saturday’ fires. This disaster caused widespread damage, including 173 fatalities, 3500 buildings being damaged or destroyed, and massive adverse impact on community infrastructures (The 2009 Victorian Bushfires Royal Commission Final Report Summary, 2009). To study the long-term effects of the disaster, we undertook a major multi-method longitudinal study to map the mental health sequelae of the fires (Beyond Bushfires: Community, Resilience and Recovery Study (Gibbs et al., 2013). In an earlier report that identified the mental health status of survivors 3–4 years after the fires, we found that people in highly affected regions had higher rates of probable disaster-related PTSD (15.6%), probable depression (12.9%), severe distress (12.8%) and heavy alcohol use (24.7%) relative to those from less affected regions and also higher than Australian normative data (Bryant et al., 2014). The goal of this report is to outline the status of the mental health of respondents 5 years after the disaster and to map the course and predictors of mental health over time.

**Method**

**Participants**

This Wave 1 data collection occurred between April 2012 and January 2013 (approximately 3–4 years after the fires) and recruited adults aged at least 18 years of age living in 25 communities in 10 locations in Victoria; the sites were selected because they were variably affected by the Black Saturday fires, ranging from a high level of impact in terms of lives lost and property destroyed through to communities with minimal impact. Affectedness was defined as high-impact (operationalized as many houses lost plus fatalities; N=630), medium-impact (operationalized as ranging from a small number of fatalities through to communities with no fatalities but significant amount of property damage; N=182), and low-impact (operationalized as no evidence of burning; N=205). The 2006 census data indicated a total adult population of 7693 in the selected communities, including 702 adults in the two pilot communities. The Victorian Electoral Commission (VEC) provided contact details of both current residents and those who relocated since the fires (N=7467 adults), and a letter was sent to them inviting them to participate in the study with a reply-paid envelope; this step was taken to comply with ethical requirements pertaining to respondents’ privacy. Additional community awareness activities, mailbox drops, area-based phone calls, news media and social media activities were also conducted to increase awareness of the study and methods for registration. In terms of people who were eligible to participate this study, 16% of available people eventually participated and completed the survey. The sample...
who participated in this study were older, had a higher proportion of females and were more educated than the general community according to census data for these regions. At the completion of the Wave 1 survey, 966 participants agreed to be contacted for the Wave 2 survey. The Wave 2 data collection was conducted between July and November 2014 (5 years after the fires). In terms of retention, 736 (76.1%) eligible participants took part in Wave 2. Of these, 29 had not been living in the study communities at the time of the fires and were excluded from the final analyses. The final sample for the analyses below is based on a sample of \( n = 707 \) individuals who took part in both surveys and who lived in a selected community on the day of the bushfires.

**Measures**

**PTSD.** Probable PTSD was assessed using an abbreviated version of the Posttraumatic Stress Disorder Checklist (PCL-S) (Bliese et al., 2008), which comprises four items each scored on a 5-point severity scale that indexes key symptoms of PTSD anchored to the previous 4 weeks. Adopting a cut of 7 on the PTSD Screen achieves an efficient estimation of PTSD diagnosis relative to the full version of the PCL-S (Bliese et al., 2008). PTSD was assessed in two ways: (a) regarding responses that were specific to the Black Saturday fires and (b) in response to traumatic events generally. To disentangle general PTSD from fire-related PTSD, we followed each question about a PTSD symptom with a question of whether this symptom was related to their reactions to the fires. For example, after asking about intrusive memories, participants were asked, ‘Were these reactions about the fires?’

**Depression.** Probable Major Depressive Episode (MDE) was assessed using the Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001). Probable occurrence of MDE was assessed if five of the nine symptoms had been present for most days in the previous 2 weeks.

**Psychological distress.** Generic psychological distress was assessed using the K6, which measures anxiety-mood problems in previous 30 days (Kessler et al., 2003). Classification of no distress has used K6 scores of 0–7, 8–12 as mild-moderate distress, and 13–24 as probable severe distress (Kessler et al., 2008). We defined psychological resilience as K6 scores of 0–7, reflecting people who reported no or minimal psychological problems. Additionally, the K6 asks how often in the past 30 days did the person see a health professional about problems reported on the K6.

**Alcohol use.** Heavy drinking was assessed using the Consumption Scale of the Alcohol Use Disorder Identification Test–Consumption (AUDIT-C) (Bush et al., 1998), a 3-item self-report measure that indexes heavy drinking. The AUDIT-C employs the initial three questions of the AUDIT, which indexes amount of alcohol consumption. We adopted recommended cut-offs of six standard drinks for males and five for females as the most effective detection of heavy drinking; these cut-offs have sound sensitivity (males: 0.82; females: 0.84) and specificity (males: 0.79; females: 0.88) (Aalto et al., 2009) with heavy/binge drinking as defined by the Timeline Followback structured interview for alcohol consumption (Sobell and Sobell, 1995).

**Recent traumatic events.** To assess traumatic events that had occurred since the fires, participants were asked to indicate whether they had been exposed to any of the following potentially traumatic events: (a) natural disaster, (b) serious accident and (c) serious assault/violence. They were also asked whether they had experienced major life stressors in the form of disruptions to their (a) income, (b) accommodation or (c) personal relationships.

**Procedure**

The study was approved by the University of Melbourne Human Research Ethics Committee. Following considerable engagement in the affected communities, the survey was conducted by a combination of telephone and web-based formats. Following an introduction to the study and obtaining informed consent, the interviewer initially asked about socio-demographic factors, events that occurred on the day of the Black Saturday fires and traumatic events that may have occurred since the fires. The Wave 2 survey followed the same format, with questions about traumatic and stressful events focusing on the time period since the last survey. Relevant to the current analyses, the survey sequentially administered the PCL-S, PHQ, K6 and AUDIT-C.

**Statistical analyses**

All data are based on the participants retained at Wave 2. Prevalence rates were calculated based on recommended cut-offs for probable PTSD, MDE, heavy drinking and serious mental illness (SMI). To determine the patterns in which people altered their status over time, separate logistic regressions were conducted to predict changes in case cut-offs of general PTSD, fire-related PTSD, depression, SMI and heavy drinking. In each regression, sex, age at the time of the Black Saturday fires and highest level of education were entered at Step 1. Factors that reflected the severity of fire exposure were entered at Step 2, including...
whether the respondent had feared for their own life, whether someone close to the respondent had died in the fires and the extent of property loss. Finally, at Step 3, major life stressors experienced since the Wave 1 survey were entered to index the additional effects of subsequent adversity on psychological outcomes. Separate regressions were conducted to predict (a) delayed development of disorder (comparing participants without the disorder at Wave 1 who either did or did not have the disorder at Wave 2) and remission of disorder (comparing participants with the disorder at Wave 1 who either did or did not have the disorder at Wave 2).

**Results**

**Participant characteristics**

Table 1 presents the participant characteristics of those retained and not retained at the Wave 2 assessment. Participants who were retained at Wave 2 did not differ from those who did not participate in terms of age, gender or whether they had experienced bereavement in the fires. Relative to those who were lost at follow-up, participants at Wave 2 were more likely to have tertiary education (38.9% vs 27.6%; odds ratio [OR]: 1.67; 95% confidence interval [CI]: [1.25, 2.21], \(p=0.000\), and fewer participants from low-impact communities (52.7%) were retained than those from medium- and high-impact communities (73.6%) (OR: 2.50; 95% CI: [1.83, 3.43], \(p=0.000\)). All subsequent analyses focus on those who were retained at Wave 2.

**Prevalence of psychological outcomes**

Table 2 presents the frequencies of reported probable PTSD, MDE, heavy drinking and SMI at Wave 2, according to the level of exposure to the fires. In terms of PTSD linked to the Black Saturday fires, more participants in the high-affected communities reported probable PTSD (10.9%) than those from the medium-affected (5.6%) and low-affected (1.9%) communities (OR: 3.04, 95% CI: [1.47, 6.29], \(p=0.003\)). A similar pattern was observed regarding general PTSD from any traumatic event, with more participants in the high-affected communities reporting probable PTSD (18.7%) than medium-affected (8.7%) and low-affected (4.6%) communities (OR: 3.14, 95% CI: [1.79, 5.48], \(p=0.001\)). A similar pattern was observed regarding general PTSD from any traumatic event, with more participants in the high-affected communities reporting probable PTSD (18.7%) than medium-affected (8.7%) and low-affected (4.6%) communities (OR: 3.14, 95% CI: [1.79, 5.48], \(p=0.001\)). Similarly, participants in the high-affected communities were more likely to report MDE (10.9%) than participants in the medium-affected (5.6%) and low-affected (2.8%) communities (OR: 3.04, 95% CI: [1.47, 6.29], \(p=0.003\)). A similar pattern was observed regarding general PTSD from any traumatic event, with more participants in the high-affected communities reporting probable PTSD (18.7%) than medium-affected (8.7%) and low-affected (4.6%) communities (OR: 3.14, 95% CI: [1.79, 5.48], \(p=0.001\)).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Retained at Wave 2 (N=735)</th>
<th>Not retained at Wave 2 (N=321)</th>
<th>Difference testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (Male)</td>
<td>283 (38.5)</td>
<td>133 (41.8)</td>
<td>(\chi^2(1) = 0.80)</td>
</tr>
<tr>
<td>Age</td>
<td>53.5 (12.8)</td>
<td>51.3 (14.3)</td>
<td>(t(550.8) = 2.16^*)</td>
</tr>
<tr>
<td>Australian-born</td>
<td>613 (83.4)</td>
<td>271 (84.7)</td>
<td>(\chi^2(1) = 0.60)</td>
</tr>
<tr>
<td>Tertiary education</td>
<td>285 (38.8)</td>
<td>89 (27.7)</td>
<td>(\chi^2(1) = 11.93^{***})</td>
</tr>
<tr>
<td>2009 community affectedness level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>470 (63.9)</td>
<td>160 (29.8)</td>
<td>(\chi^2(1) = 33.79^{***})</td>
</tr>
<tr>
<td>Medium</td>
<td>127 (17.3)</td>
<td>54 (16.8)</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>109 (14.8)</td>
<td>96 (29.9)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>29 (3.9)</td>
<td>11 (3.4)</td>
<td></td>
</tr>
<tr>
<td>Lost someone in fires</td>
<td>217 (29.8)</td>
<td>85 (26.6)</td>
<td>(\chi^2(1) = 1.11)</td>
</tr>
<tr>
<td>Extent of property loss</td>
<td>4.8 (4.0)</td>
<td>3.3 (3.9)</td>
<td>(t(1051) = 2.42^{***})</td>
</tr>
<tr>
<td>Fear for life in fires</td>
<td>358 (49.9)</td>
<td>141 (44.3)</td>
<td>(\chi^2(1) = 2.76)</td>
</tr>
<tr>
<td>Temporary housing after fires</td>
<td>241 (33.1)</td>
<td>86 (27.0)</td>
<td>(\chi^2(1) = 3.73)</td>
</tr>
</tbody>
</table>

SD: standard deviation.
Age refers to age at the time of Black Saturday fires.

\(^*\) \(p < 0.05\), \(^{**}\) \(p < 0.01\), \(^{***}\) \(p < 0.001\).
(OR: 1.40, 95% CI: [0.94, 2.09], \(p=0.19\)). Overall, the rates of people suffering probable PTSD, MDE or severe distress (problem alcohol use excluded because of its high prevalence in all communities) were 21.9% in high-affected, 10.3% in medium-affected and 5.6% in low-affected regions; those living in high-affected regions were more likely to have any disorder than those in other regions (OR: 3.18, 95% CI: [1.89, 5.33], \(p=0.001\)).

### Comorbidity

Considering the documented evidence of comorbidity between PTSD and depression and alcohol abuse (Kessler et al., 1994), the rates of comorbidity between these conditions were calculated. Relative to those without the probable diagnosis, there was stronger comorbidity of those with general PTSD (34.9% vs 14.4%; OR: 24.13; 95% CI: [13.33, 43.70], \(p=0.001\)) and fire-related PTSD (36.5% vs 15.7%; OR: 13.30; 95% CI: [7.34, 24.12], \(p=0.001\)) with probable depression. Similarly, relative to those without the probable diagnosis, there was stronger comorbidity of those with general PTSD (29.4% vs 20.3%; OR: 1.633; 95% CI: [1.03, 2.57], \(p=0.04\)) and fire-related PTSD (34.9% vs 20.4%; OR: 2.09; 95% CI: 1.20, 3.63, \(p=0.009\)) with probable severe alcohol use.

### Rates of resilience

Consistent with prevailing definitions of resilience as the absence of persistent psychological distress (as distinct from the absence of mental disorder) (Bonanno et al., 2004), we operationalized resilience as scores of 0–6 on the K6 (Kessler et al., 2008). Fewer participants from the high-affected communities reported resilience (76.8%) than in the medium-affected (90.6%) and low-affected (92.6%) communities (OR: 0.46, 95% CI: [0.32, 0.65], \(p<0.001\)).

### Changes in psychological status

Table 3 reports the changing prevalence rates of psychological outcomes across the two waves of data collection. Overall, the rates of mental health problems decreased over time. A lower rate of probable fire-related PTSD was observed at Wave 2 (8.7%) compared to Wave 1 (12.1%), with an exact McNemar’s test indicating that this difference was statistically significant (\(\chi^2=9.19, p=0.002\)). Similarly, lower rates were observed at Wave 2 for general PTSD (18.2% vs 14.7%; \(\chi^2=5.38, p=0.020\)) and severe distress (7.8% vs 5.4%; \(\chi^2=5.59, p=0.017\)). Consistent with this pattern, the rates of resilience increased over time (77.1 vs 81.8%; \(\chi^2=6.51, p=0.011\)). However, the difference in MDE (11.2% vs 8.8%) was not significantly lower at Wave 2 (\(\chi^2=3.71, p=0.054\)). Likewise, rates of problem alcohol use remained high across Wave 1 (22.1%) and Wave 2 (21.4%) (\(\chi^2=0.05, p=0.826\)).

Table 3 indicates that there were considerable shifts in each domain over time. Approximately half of participants who displayed PTSD, MDE or severe distress at Wave 1 did not retain this status at Wave 2. In contrast, a smaller but significant proportion of participants who did not report the condition at Wave 1 did report it at Wave 2; specifically, 7.3% of participants who did not report any disorder at Wave 1 reported a disorder at Wave 2.

### Predictors of changing psychological outcomes

In terms of changing mental health status across time, Table 4 presents the adjusted ORs for PTSD, MDE, heavy drinking and psychological distress for those who did not meet the cut-offs at Wave 1 but did meet them at Wave 2. The late onset of both fire-related PTSD and general PTSD was predicted by the extent of property loss in the fires and major life stressors since the fires. Late-onset MDE was predicted by major life stressors. Late-onset heavy drinking

---

**Table 2. Prevalence of mental health conditions across communities.**

<table>
<thead>
<tr>
<th></th>
<th>High affected (N = 630)</th>
<th>Medium affected (N = 182)</th>
<th>Low affected (N = 205)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTSD (Fires)</td>
<td>51 (10.9)</td>
<td>7 (5.6)</td>
<td>2 (1.8)</td>
</tr>
<tr>
<td>PTSD (General)</td>
<td>88 (18.7)</td>
<td>11 (8.7)</td>
<td>5 (4.5)</td>
</tr>
<tr>
<td>Depression</td>
<td>51 (10.9)</td>
<td>6 (4.7)</td>
<td>5 (4.5)</td>
</tr>
<tr>
<td>Severe distress</td>
<td>29 (6.2)</td>
<td>6 (4.7)</td>
<td>3 (2.8)</td>
</tr>
<tr>
<td>Heavy drinking</td>
<td>109 (23.2)</td>
<td>23 (18.4)</td>
<td>19 (17.6)</td>
</tr>
<tr>
<td>Resilient</td>
<td>361 (76.8)</td>
<td>115 (90.6)</td>
<td>108 (92.7)</td>
</tr>
</tbody>
</table>

PTSD (Fires): posttraumatic stress disorder linked to the Black Saturday; PTSD (General): posttraumatic stress disorder linked to any traumatic event.

Psychological Distress measured by K6: None (0–6), Mild (7–12) and Severe (13–24).
was predicted by younger age. Late-onset severe distress was predicted by the extent of property loss in the fires and recent life stressors. Delayed resilience was predicted by lower education level (less than tertiary education).

Table 4 also presents the adjusted ORs for PTSD, MDE, heavy drinking and psychological distress for those who met the cut-offs at Wave 1 but did not meet them at Wave 2. Recovery from fire-related PTSD was seen in those who had had higher property loss, higher levels of fear for life and higher rates of bereavement resulting from the fires. Similarly, recovery from general PTSD, MDE and severe distress was also seen in those who had had higher levels of fear for life and higher rates of bereavement. Those whose drinking rates fell tended to be younger individuals. Diminished resilience was predicted by younger age and recent life stressors.

### Discussion

The rates of probable PTSD, depression and severe distress observed 5 years following the disasters suggest that the rates of psychological distress remained high. For example, the rate of probable PTSD was markedly higher than the nationally reported rate of 4.4% rate in the Australian 2007 National Survey of Mental Health and Wellbeing (McEvoy et al., 2011), although this comparison needs to be made tentatively because these studies used very different sampling strategies and assessment tools. The elevated rates of psychiatric disorder accord with previous reports of persisting mental distress in people directly affected by severe disaster (Grace et al., 1993; North et al., 2011). The comorbidity between PTSD and both depression and alcohol use is also consistent with much evidence of the strong overlap between these conditions (Afzali et al., 2017; Kessler et al., 1994).

The observation that rates of probable disorder fluctuated over time is consistent with evidence that posttraumatic mental health follows a dynamic and fluctuating course over time (Bryant et al., 2013). The observation that a significant proportion of people apparently had better mental health over time accords with considerable evidence that many people eventually adapt over time following trauma (Galea et al., 2003; Van Griensven et al., 2006). Conversely, the trend that many people displayed probable disorder at follow-up without reporting this level of distress at the initial assessment is consistent with reports of worsening or delayed expression of symptoms as time elapses after trauma (Bonanno et al., 2008; Bryant et al., 2015; Norris et al., 2009). This finding needs to be understood in the context of this wave of data collection occurring at least 1 year after the initial wave (at least 5 years after the fires). These timeframes underscore how the effects of disasters, and their aftermath, can impact people in different ways years after the event.

Across analyses, it was apparent that ongoing life stressors were a major factor in determining the ongoing mental health of survivors of the fires. Recent stressors contributed to worsening PTSD, depression and distress, as well as diminishing psychological resilience. Previous studies have highlighted that ongoing stressors following a traumatic event significantly impact subsequent mental health (Andrews et al., 2007; Bryant et al., 2013). Disasters are often marked by widespread societal and economic adversity, which can pervasively undermine the capacity to recover from the traumatic event. The impact of ongoing stressors has been previously noted in an Australian context in the aftermath of the Newcastle earthquake, where it was noted that disruptions occurring in the period following the disaster predicted posttraumatic psychopathology 2 years after the quake (Lewin et al., 1998). More recently, in the
Table 4. Effects of socio-demographic, fire-exposure and post-fire stressors on changing psychological outcomes.

<table>
<thead>
<tr>
<th></th>
<th>Fire PTSD</th>
<th>General PTSD</th>
<th>Depression</th>
<th>Severe distress</th>
<th>Heavy drinking</th>
<th>Resilient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR [95% CI]</td>
<td>OR [95% CI]</td>
<td>OR [95% CI]</td>
<td>OR [95% CI]</td>
<td>OR [95% CI]</td>
<td>OR [95% CI]</td>
</tr>
<tr>
<td><strong>Shifting from Absent at Wave 1 to Present at Wave 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (Male)</td>
<td>1.15 [0.47, 2.95]</td>
<td>0.90 [0.44, 1.81]</td>
<td>1.33 [0.57, 3.08]</td>
<td>1.07 [0.34, 3.39]</td>
<td>1.23 [0.61, 2.51]</td>
<td>1.19 [0.70, 2.01]</td>
</tr>
<tr>
<td>Age (years)</td>
<td>1.00 [0.97, 1.04]</td>
<td>1.00 [0.98, 1.03]</td>
<td>1.02 [0.97, 1.05]</td>
<td>1.02 [0.97, 1.07]</td>
<td>0.96*** [0.93, 0.98]</td>
<td>1.00 [0.98, 1.02]</td>
</tr>
<tr>
<td>Education level</td>
<td>0.77 [0.29, 2.02]</td>
<td>0.96 [0.49, 1.91]</td>
<td>0.74 [0.30, 1.80]</td>
<td>1.27 [0.41, 3.38]</td>
<td>1.14 [0.58, 2.27]</td>
<td>0.52* [0.29, 0.94]</td>
</tr>
<tr>
<td>Property loss</td>
<td>1.31*** [1.11, 1.54]</td>
<td>1.10* [1.00, 1.20]</td>
<td>1.06 [0.95, 1.19]</td>
<td>1.10 [0.95, 1.28]</td>
<td>1.05 [0.97, 1.15]</td>
<td>0.98 [0.92, 1.05]</td>
</tr>
<tr>
<td>Fear for life in fire</td>
<td>1.63 [0.59, 4.46]</td>
<td>1.27 [0.63, 2.57]</td>
<td>2.45 [0.96, 6.23]</td>
<td>2.10 [0.61, 7.21]</td>
<td>1.49 [0.72, 3.06]</td>
<td>1.70 [0.97, 2.97]</td>
</tr>
<tr>
<td>Bereaved in fire</td>
<td>1.11 [0.44, 2.76]</td>
<td>1.07 [0.50, 2.28]</td>
<td>0.59 [0.24, 1.49]</td>
<td>0.41 [0.11, 1.54]</td>
<td>1.10 [0.53, 2.26]</td>
<td>1.08 [0.61, 1.90]</td>
</tr>
<tr>
<td>Major life stressor</td>
<td>2.11*** [1.22, 3.65]</td>
<td>3.15*** [1.98, 5.02]</td>
<td>2.86*** [1.74, 4.70]</td>
<td>2.67*** [0.57, 1.72]</td>
<td>1.04 [0.64, 1.71]</td>
<td>1.21 [0.82, 1.78]</td>
</tr>
</tbody>
</table>

|                  | OR [95% CI] | OR [95% CI] | OR [95% CI] | OR [95% CI] | OR [95% CI] |
| **Shifting from Present at Wave 1 to Absent at Wave 2** | | | | | | |
| Sex (Male)       | 0.86 [0.44, 1.69] | 0.79 [0.45, 1.39] | 1.11 [0.57, 2.16] | 0.88 [0.39, 1.98] | 1.12 [0.58, 2.19] | 0.64 [0.31, 1.36] |
| Age (years)      | 0.98 [0.96, 1.01] | 0.98 [0.96, 1.00] | 0.99 [0.97, 1.02] | 0.99 [0.96, 1.03] | 0.97* [0.95, 1.00] | 0.97* [0.94, 0.99] |
| Education level  | 0.80 [0.41, 1.53] | 0.58 [0.33, 1.02] | 0.86 [0.44, 1.67] | 0.52 [0.22, 1.21] | 0.68 [0.34, 1.35] | 0.63 [0.31, 1.29] |
| Property loss    | 1.17*** [1.07, 1.29] | 1.06 [0.98, 1.13] | 1.05 [0.97, 1.15] | 0.93 [0.91, 1.11] | 1.05 [0.96, 1.14] | 1.06 [0.97, 1.16] |
| Fear for life in fire | 2.69*** [1.28, 5.65] | 1.87* [1.06, 3.33] | 2.54* [1.20, 5.39] | 5.31*** [1.78, 15.81] | 1.21 [0.61, 2.37] | 0.95 [0.47, 1.91] |
| Bereaved in fire | 2.67*** [1.42, 5.02] | 1.77* [1.04, 3.04] | 2.94*** [1.52, 5.67] | 2.89*** [1.33, 6.25] | 1.64 [0.85, 3.19] | 0.95 [0.46, 1.94] |
| Major life stressor | 0.89 [0.55, 1.44] | 0.91 [0.60, 1.37] | 1.16 [0.72, 1.85] | 1.28 [0.74, 2.20] | 1.10 [0.69, 1.77] | 2.0*** [1.32, 3.05] |

PTSD: posttraumatic stress disorder; OR: odds ratio; CI: confidence interval.

***p < 0.001; **p < 0.01; *p < 0.05.
wake of Hurricane Katrina, it was noted that the increased rates of mental distress and suicidal risk may be attributed to the ongoing stressors in New Orleans, including inadequate housing, poor infrastructure in the worst-affected regions and the downturn in economic options (Kessler et al., 2008). Importantly, numerous studies have noted ongoing stressors contribute to worsening of mental health after disaster (Pietrzak et al., 2013) and that the relative impact of these stressors can increase as time elapses (Cerda et al., 2013). It is also worth noting that rural and regional districts of Australia can suffer a range of ongoing adversities, which can adversely impact mental health. The finding that participants across the differently affected communities experienced general PTSD and depression underscores the vulnerability of rural and regional areas of Australia to psychological difficulties.

Some of the most salient effects of the disaster, including bereavement, fear and property loss, were associated with recovery from PTSD, depression and psychological distress over time. It is possible that for individuals affected by these events, as more time elapses after the disaster, the direct adverse effects of these factors on mental health reduce. However, as noted above, life stressors – many of which may be triggered by the ongoing social and economic disruption of the bushfires – remain as a central burden on mental health of the disaster survivors.

The notion that worsening mental health was influenced by environmental stressors accords with the finding that delayed expression of PTSD was also predicted by the extent of property loss in the fires. The extent to which people suffered property damage may have resulted in ongoing and delayed difficulties in resuming prior levels of occupational or domestic functioning, which subsequently compounded their stress reactions. It is also possible that extent of property loss during the fires contributes ongoing financial stressors, arising from legal proceedings, rebuilding costs and loss of income. Prior studies of postdisaster adaptation have noted that as time elapses after the disaster, mental health is adversely affected by financial losses (Cerda et al., 2013; Galea et al., 2008). The extent of property loss in the fires may contribute to financial strain, which then impacts ongoing PTSD and depression.

It is important to note that most participants reported being resilient across time, underscoring overwhelming evidence that most people are able to cope with adversity (Bonanno and Diminich, 2013; Pietrzak et al., 2014). People who were not resilient at Wave 1 but demonstrated resilience at Wave 2 were less likely to have suffered bereavement during the fires or extensive property loss. This pattern suggests that people are more likely to adjust to the disaster as time elapses when they have suffered less exposure to events that are likely to have long-lasting effects. In other words, bereavement and severe property loss may impede resilience because they potentially continue to have an adverse impact on the survivor’s capacity to function on a daily basis.

We qualify this conclusion by recognizing that the sample at this assessment represents a minority of those affected by the fires, and hence there remain questions over the generalizability of the findings. The recruitment of only 16% of people in the affected regions tempers our conclusions and precludes definitive statements about the incidence of psychopathological conditions after the fires. The finding that participants in this study were older, more likely to be female and more educated than others in the community highlights the need for caution in generalizing these results to the broader community. We also note that the survey methodology did not use structured clinical interviews, the measures of stressful life events were not psychometrically validated measures, it is inherently difficult to disentangle PTSD related to fires from PTSD related to other events and there is a possibility that the observed rates of probable disorder may be inflated (North, 2014). In this sense, it is possible that our reported rates may be detecting subsyndromal levels of disorders (North and Pfeiferbaum, 2002). This possibility is underscored by the absence of validation of the probable diagnosis cut-offs for this population, and scoring below the cut-offs may still incorporate a range of subsyndromal symptomatology that can pose risk for ongoing difficulties. Nonetheless, there is strong evidence that subsyndromal levels of disorders following traumatic events lead to comparable levels of impairment and distress as diagnostic levels, and hence the reported rates nonetheless represent a significant health issue (Pietrzak et al., 2012; Stein et al., 1997).

These findings have implications for disaster policymakers. It is apparent that the mental health effects of large-scale disasters can persist for years after the event, and resources need to be devoted to addressing these needs. It appears that those most at risk of persistent or delayed mental health problems are those who are exposed to the more severe trauma exposure during the disaster, as well as those who suffer adverse life events in the aftermath of the event. Strategies that can minimize stressful events for those affected by disaster in the years after the initial event may carry widespread benefits in alleviating the mental health burden of survivors. The findings also suggest that monitoring of disaster survivors who are exposed to ongoing stressors (e.g., financial strain, insurance difficulties and rebuilding pressures) is warranted because these people are the ones who are most likely to experience deteriorating mental health years after the disaster, and so resources may need to be targeted towards these individuals or communities.

**Acknowledgements**

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References


Annexure C to the Statement of Professor Lisa Gibbs, 22 May 2020

Delayed Disaster Impacts on Academic Performance of Primary School Children

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Social disruption caused by natural disasters often interrupts educational opportunities for children. However, little is known about children’s learning in the following years. This study examined change in academic scores for children variably exposed to a major bushfire in Australia. Comparisons were made between children attending high, medium, and low disaster-affected primary schools 2–4 years after the disaster (n = 24,642; 9–12 years). The results showed that in reading and numeracy expected gains from Year 3 to Year 5 scores were reduced in schools with higher levels of bushfire impact. The findings highlight the extended period of academic impact and identify important opportunities for intervention in the education system to enable children to achieve their academic potential.

Natural disasters arise from many different types of hazards and cause widespread destruction, and often death and injury. The size and severity of the event often undermines the capacity of systems and services to respond, resulting in significant loss of infrastructure and facilities. The subsequent ongoing stressors and social disruption add to the trauma of the original event and can reduce mental health and well-being for years afterward (Bonanno, Brewin, Kaniasty, & La Greca, 2010; Bryant et al., 2014; Bryant et al., 2017). In addition to the direct threats of the disaster experienced by adults, children can experience specific challenges associated with different stages of physical, mental, emotional, cognitive, and social stages of development (Anderson, 2005; Bonanno et al., 2010; Peek, 2008).

One of the potential disruptions for children after disasters involves access to schools because school facilities may be destroyed, teachers are not available, or children are relocated (Casserly, 2006;...
integration skills and rapid automatized naming (involving rapid retrieval of the names of sequential visually presented items) along with higher executive functions become important skills that can differentially impact the acquisition of literacy skills (Moll et al., 2014; Ozernov-Palchik et al., 2016). Similarly, continued achievement in mathematics is dependent upon the development of broader executive functions (Cragg & Gilmore, 2014).

The available evidence indicates that early interruptions to the development of these cognitive skills can have adverse impacts on academic performance at primary, secondary, and university levels (Di Pietro, 2015; Pane, McCaffrey, Kalra, & Zhou, 2008; Peek & Richardson, 2010; Pérez-Pereira, Tinajero, Rodríguez, Peralbo, & Sabucedo, 2012; Scott, Lapré, Marsee, & Weems, 2014). In the disaster context such interruptions may arise from the development of a trauma-related mental health disorder, such as PTSD, or be due to ongoing stressors such as having to relocate to another school in another location as a result of the disaster (McFarlane, Policansky, & Irwin, 1987; Pane et al., 2008; Sacerdote, 2008; Scott et al., 2014). Age-based differences emerged in a study with primary and secondary school children 1 year after an oil spill disaster affecting coastal towns in Spain, suggesting stage of development may be a factor in determining subsequent impacts on academic performance (Pérez-Pereira et al., 2012). Conversely, no significant difference was found for completion of secondary school certificates between disaster-affected and nondisaster-affected students 2 years after the Canterbury, New Zealand earthquakes (Beaglehole, Bell, Frampton, & Moor, 2017), or in academic outcomes for primary school children in the Netherlands up to 3 years after a major firework disaster (Smilde-van den Doel, Smit, & Wolleswinkel-van den Bosch, 2006). The authors in the Netherlands study speculated these positive outcomes may have been due to various school-based intervention programs for affected children. This is supported by other studies that indicate that positive school environments can, over time, mitigate the disaster-related impacts on academic performance (Barrett, Ausbrooks, & Martinez-Cosio, 2012; Pane et al., 2008; Peek & Richardson, 2010; Reich & Wadsworth, 2008; Sacerdote, 2008). This has not been specifically evaluated in disaster contexts; however, a meta-analysis of the impact of social and emotional learning programs in schools generally, demonstrated improved academic performance across all year levels (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011). The trajectory for potential disaster impacts on academic achievement over time is unknown because...
the majority of the current evidence base only extends to 3 years postdisaster, although a 20 year follow-up of children affected by a disaster did demonstrate that those who were bushfire affected were less likely than the comparison group to extend their education and careers (McFarlane & Van Hooff, 2009). Further examination of this issue is of paramount importance because of the potential for short-term impacts on academic performance to affect perceptions of capability, aspirations, and long-term educational and employment pathways.

This article reports on a study of academic scores for primary school children in Victoria, Australia up to 4 years after a major bushfire event in February 2009, commonly referred to as the Black Saturday bushfires (another term for “bushfire” is “wildfire”). The aim was to identify whether:

1. students in schools with high and medium bushfire impact showed reduced progression in their academic scores from Year 3 to Year 5 compared to their peers in schools with low or no impact, and;
2. if there were differences in impact for different school subjects.

**Black Saturday Bushfires**

The 2009 fires in rural Victoria began in January after a decade-long drought. The fire conditions became extreme, beginning in the east of the state and continuing to burn for several weeks. On Saturday 7, February temperatures climbed to 47°C (117°F), winds gusted at over 100 km/h (60 mph), and multiple new fires ignited across the rural and regional parts of the state. The fires burned 400,000 hectares of landscape, completely destroyed two townships and significantly damaged others resulting in widespread destruction and the loss of 173 lives including 35 children and young people. Sixteen children and young people were orphaned, and many more were injured and traumatized by their experiences (Victorian Bushfires Royal Commission, 2009). One hundred and nine communities self-identified as being affected by bushfires. Over 2,000 homes were destroyed, three schools and at least three preschools were completely destroyed in the fires with staff and students housed in temporary accommodation for up to 2 years. Over 70 schools and childcare settings in high impact areas were highly affected through building and student exposure, as were other community resources such as sporting facilities and playgrounds, resulting in family, school, and community level disruption for years after the event.

**Methods**

**Participants**

This study utilized two major data sets held by the Victorian Department of Education and Training: (a) Enrollment in the first year at a Victorian primary school is accompanied by a parent completed School Entrant Health Questionnaire (SEHQ), which collects health, well-being, development, and demographic information about the student; (b) Standardized National Assessment Program—Literacy and Numeracy (NAPLAN) academic assessments are conducted in Grades 3 and 5 in primary school and Years 7 and 9 in secondary school. The students included in this study were 33,690 students who in 2008 were enrolled in first year at a Victorian government primary school and completed their standardized NAPLAN academic assessments in 2011 (Grade 3) and 2013 (Grade 5). Students were excluded if they changed schools between Grade 3 and Grade 5. Students’ NAPLAN results were matched with their SEHQ data. After this matching process the final sample available for the analyses was \( n = 24,642 \) students (female = 11,982; male = 12,660).

**Measures**

**Bushfire Affectedness**

Schools included in this study were located in areas that receive fire protection from the Country Fire Authority (CFA) rather than the Metropolitan Fire Brigade. This classification was used as a proxy indicator to identify schools located in peri-urban, rural, regional, and remote communities to minimize confounding factors that would arise from comparison with urban schools. The included schools were then classified into three levels of bushfire affectedness (0—low, 1—moderate, 2—high). Classification followed a complicated geospatial procedure using the Victorian Bushfire Reconstruction and Recovery Authority data. There were 78 primary schools (\( n = 1,285 \)) in localities defined as a “high” bushfire affectedness region based on loss of lives and properties. There were an additional 50 schools (\( n = 832 \)) that were defined as being in a “moderate” affected region because they were located in a catchment zone adjacent to a high impact locality. The remaining 1,073 schools (\( n = 22,525 \)) were defined as being in a “low” affected region because very limited...
or no damage occurred and there was no loss of lives. They were all classified as “low” rather than “no” impact because even the areas that did not have fire come through were at risk on the day of the fires, their local CFA services were all involved in fire response, and many of the communities were affected by subsequent road closures and service disruptions. This classification procedure was designed by the University of Melbourne Centre for Disaster Management and Public Safety.

**National Assessment Program—Literacy and Numeracy**

The NAPLAN tests are run annually in Australian primary schools for students in Grade 3 and Grade 5. They are designed to assess four education domains of reading, writing, numeracy, and language conventions. The language conventions are further subdivided into spelling and grammar.

**School Entrant Health Questionnaire**

*Household language.* Is the primary household language English? (0—no, 1—yes).

*Aboriginal or Torres Strait Islander.* Is the student an Aboriginal or Torres Strait Islander (ATSI)? (0—no, 1—yes).

*Lives with both parents.* Does the student live with both parents? (0—no, 1—yes).

*Parents Evaluation of Developmental Status.* The Parents Evaluation of Developmental Status pathway is based on parent responses to questions about the child covering eight domains; (a) expressive language and articulation; (b) receptive language; (c) fine motor skills; (d) gross motor skills; (e) behavior; (f) social-emotional; (g) self-help; (h) school. Parents report whether they have concerns in these domains (yes or no). Children are rated for risk, from 1 to 4, with higher scores indicating lower risk, based on the number of items which are scored as “yes.”

*Mother’s education/father’s education.* The mother’s and father’s education was a self-report question whereby the parent’s highest level of school education was selected as either: “Year 9 or Equivalent or below”; “Year 10 or Equivalent”; “Year 11 or Equivalent”; or, “Year 12 or Equivalent.”

**Statistical Analyses**

When data intrinsically have a hierarchical or clustered structure then multilevel models (MLM) are specifically designed for these types of analyses (Hox, 1998). As is the case in most educational research the data in this study are nested at the individual (Level 1) and within schools (Level 2), which supports the use of MLM analyses. Regardless of whether the primary variables of interest are at the individual or school level, failure to account for the clustering effects can lead to incorrect conclusions due to inaccurate calculations of standard errors and confidence intervals (Maas & Hox, 2004). We ran our analysis using Mplus version 7.4 (Muthén & Muthén, 2013) with the robust maximum likelihood estimator. Our analysis is a specific type of MLM—random slope analysis. Furthermore, we include the test of whether the random slopes are predicted by the level of bushfire affectedness (i.e., low, moderate or high level of affectedness). Our analysis will control for school clustering effects when defining the slope of change at the individual level, predicting Year 5 NAPLAN domain scores based on corresponding Year 3 NAPLAN domain scores.

In our study, we are primarily focused on whether the level of bushfire affectedness predicts a difference in academic performance at the school level. Therefore, at the higher level of the model we will include bushfire affectedness as a predictor of the slope. If this affectedness level significantly predicts the slope, then the rate of change between Year 3 NAPLAN domain scores and Year 5 NAPLAN domain scores is different between the schools within the three affectedness levels. To account for the influence of demographic factors, we have included “Lives with both parents,” “Home language English,” “ATSI status,” “Mother’s level of education,” “Father’s level of education,” “Gender,” and “Pediatric Health” as controlling variables for the Year 3 and Year 5 NAPLAN scores. The analysis will account for these demographic influences prior to defining the slope between Year 5 and Year 3 NAPLAN scores.

In simple terms, our analysis will define a slope that represents the relationship between Year 3 NAPLAN scores predicting Year 5 NAPLAN scores. The scores at both year levels are controlled for by relevant demographic variables to minimize noise. As the data are clustered we run this analysis using the recommended MLM approach. Finally, at the school level we investigate the impact of bushfires on the slopes, which were defined at the individual level. This will investigate whether the 2009 Black Saturday bushfires are influencing the natural relationship between Year 3 and Year 5 NAPLAN scores. These analyses have been run five times separately for each of the NAPLAN domains: (a) reading, (b)
writing, (c) spelling, (d) numeracy, and (e) grammar. We ran the multilevel analyses with list wise deletion for missing data enabled, as per the Mplus default settings.

**Results**

**Descriptive Statistics**

Demographic details are provided in Table 1. Dependant samples T-tests found that both overall and for each affectedness region separately, NAPLAN domain scores in Grade 5 were significantly higher compared with domain scores in Grade 3 (all \( p < .001 \)). Chi-square tests were conducted to compare categorical variables across affectedness regions and found the proportion of students who lived with both parents was significantly lower (\( p = .004 \)) in the high impact region (84.4%) compared with the medium impact (88.9%) and the low impact (87.4%) regions. Additionally, the proportion of mothers who had a minimum level of education being Year 12 or equivalent was significantly lower \( (p < .001) \) in the high impact (51.8%) and medium impact (56.0%) regions compared with the low impact region (64.4%). Similarly, the proportion of fathers who had a minimum level of education being Year 12 or equivalent was significantly lower \( (p < .001) \) in the high impact (40.2%) and medium impact (42.4%) regions compared with the low impact region (56.2%). There were no other differences in the demographic variables.

**Multilevel Results**

The full details of the separate multilevel analyses for each of the five NAPLAN domains can be seen in Table 2. In Level 1 we see across all five NAPLAN domains 29 of 35 controlling variables were significant for Year 3 scores, and there were 28 of 35 that were significant for Year 5 scores, although there were some differences in which variables were significant at each year level.

At Level 2 we find the predictive relationship between Year 3 and Year 5 NAPLAN scores is unaffected by level of bushfire impact for the writing, spelling, and grammar domains. Conversely, the predictive relationship between Year 3 and Year 5 NAPLAN scores is affected by level of bushfire impact for the reading and numeracy domains. In both sets of analysis there was a significant negative relationship at Level 2 between the slope and affected level, therefore as affected level increases the slope decreases, or the slope becomes flatter between Year 3 NAPLAN and Year 5 NAPLAN. That is, we find a flattened developmental trajectory between Year 3 and Year 5 NAPLAN scores (reading and numeracy) for those individuals in schools that have been more affected by the bushfires.

To investigate the differences in the slopes for the reading and numeracy domains across the levels of bushfire affectedness, subpopulation analyses were run in Mplus using the Complex data command to control for clustering effects when calculating standard errors in the model. The differences in the slopes across bushfire affectedness regions can be seen in Figure 1. This figure shows the comparative standardized beta weights for Year 5 NAPLAN domain scores being predicted by Year

<table>
<thead>
<tr>
<th>Measure</th>
<th>( M ) (SD)/proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(^a)</td>
<td>9.97 (0.42)</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>48.60%</td>
</tr>
<tr>
<td>ATSI (% yes)</td>
<td>1.60%</td>
</tr>
<tr>
<td>Home language English (% yes)</td>
<td>88.80%</td>
</tr>
<tr>
<td>Lives with both parents (% yes)</td>
<td>87.30%</td>
</tr>
<tr>
<td>Mother education (mode)</td>
<td>Year 12 + (63.5%)</td>
</tr>
<tr>
<td>Father education (mode)</td>
<td>Year 12 + (55.0%)</td>
</tr>
<tr>
<td>PEDS</td>
<td></td>
</tr>
<tr>
<td>High risk</td>
<td>6.80%</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>16.60%</td>
</tr>
<tr>
<td>Low risk</td>
<td>8.20%</td>
</tr>
<tr>
<td>None</td>
<td>68.40%</td>
</tr>
<tr>
<td>Region impact</td>
<td></td>
</tr>
<tr>
<td>Low (( n ))</td>
<td>22,525 (91.4%)</td>
</tr>
<tr>
<td>Medium (( n ))</td>
<td>832 (3.4%)</td>
</tr>
<tr>
<td>High (( n ))</td>
<td>1,285 (5.2%)</td>
</tr>
<tr>
<td>NAPLAN(^b) Grade 3 (2011)</td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>435.17 (88.35)</td>
</tr>
<tr>
<td>Writing</td>
<td>424.04 (60.86)</td>
</tr>
<tr>
<td>Spelling</td>
<td>416.58 (74.96)</td>
</tr>
<tr>
<td>Numeracy</td>
<td>417.52 (74.17)</td>
</tr>
<tr>
<td>Grammar</td>
<td>436.96 (93.24)</td>
</tr>
<tr>
<td>NAPLAN Grade 5 (2013)</td>
<td></td>
</tr>
<tr>
<td>Reading</td>
<td>511.31 (65.47)</td>
</tr>
<tr>
<td>Writing</td>
<td>489.59 (60.78)</td>
</tr>
<tr>
<td>Spelling</td>
<td>498.02 (68.38)</td>
</tr>
<tr>
<td>Numeracy</td>
<td>496.81 (73.25)</td>
</tr>
<tr>
<td>Grammar</td>
<td>507.83 (71.21)</td>
</tr>
</tbody>
</table>

Note. ATSI = Aboriginal or Torres Strait Islander; PEDS = Parents Evaluation of Developmental Status; NAPLAN = National Assessment Program—Literacy and Numeracy.

\(^a\)Age at February 1, 2013 (Grade 3). The data were captured in whole years and did not include months. \(^b\)The range of possible scores in each domain for each year level is 0–1,000 (Australian Curriculum Assessment and Reporting Authority, 2013).
Despite the scores for numeracy plateau between levels of bushfire affectedness, there is a pattern of reduction in the slope values over time for the “low” region to find a significant result.

### Discussion

This study analyzed primary students’ academic performance from 2 to 4 years after the Black Saturday bushfires, adjusting for demographic factors collected 1 year before the bushfires. The analyses examined the level of improvement in academic scores from Year 3 to Year 5 across regions of impact (i.e., were the changes in academic scores over time the same for low-, moderate-, and high-affected regions). The results showed that in reading and numeracy the expected gains in academic scores from Year 3 to Year 5 were reduced with higher levels of bushfire impact. There were no significant trends in academic scores for the writing, spelling, and grammar domains of the academic assessment, and no gender differences in any of the scores.

This finding demonstrates the potential impact of disaster exposure on academic performance. The differential impact on subject performance was consistent with another study of student academic performance after a fire at a discotheque party in Sweden in which 63 young people were killed and 213 physically injured (Broberg, Dyregrov, & Lilled, 2005). The authors attributed this to the different levels of concentration required: “The most negative influence on schoolwork was reported for subjects demanding high concentration (e.g., mathematics,
physics, and grammar) whereas subjects like religion, psychology, and arts were reported to have become easier, more interesting or more important (pp. 1282–1283). This may reflect a shift in student priorities and social and emotional responses to subject content following their loss and trauma experiences. Another explanation is that difficulties with certain subjects are mediated through the disruption of neuro-maturational processes that underlie the development of cognitive, social, and emotional building blocks necessary for academic achievement (De Bellis & Zisk, 2014; Gabowitz et al., 2008; McCrory et al., 2010).

Different types of cognitive deficits related to working memory, speed of processing, visual-verbal integration skills, rapid automatized naming, and higher executive functioning may have greater importance for particular types of learning. However, given that these same cognitive skills are known to be impacted by early trauma experiences and the development of PTSD, it is possible to hypothesize that the deficits in reading and numeracy demonstrated by the children in this study may be cognitively mediated (either directly or indirectly though the development of PTSD), as was reported in the Broberg et al. (2005) study. This is supported by evidence that lower socioeconomic status and proximity to disaster impact zone have been independently associated with higher risk for delayed development of these core neuropsychological skills (Welsh et al., 2010) as well as development of PTSD (Terasaka, Tachibana, Okuyama, & Igarashi, 2015).

Studies of children’s postdisaster recovery trajectories have shown different groupings, reflecting individual variation in response to a given experience. Some children show resistance to disaster impacts, others show progressive recovery, and others show ongoing or delayed impacts (Kronenberg et al., 2010; La Greca et al., 2013; Saigh, Mroueh, & Bremner, 1997; Scott et al., 2014; Shannon, Lonigan, Finch, & Taylor, 1994). There are also likely to be different contributing factors to poor academic performance including persistent symptoms of PTSD and aggression (Scott et al., 2014), impacting on school satisfaction (Sims, Boasso, Burch, Naser, & Overstreet, 2015) and test anxiety (Weems et al., 2013) School staff are often acutely aware of the initial impacts of an emergency event on students’ academic performance (Dyregrov, Dyregrov, Endsjo, & Idsoe, 2015). However, over time, parents and schools may not recognize that delayed impacts arise from the disaster experience, and therefore children may not be offered appropriate support programs (Gibbs et al., 2015; Grelland Rokholt, Schultz, & Langballe, 2016; Smilde-van den Doel et al., 2006).

The impact on reading results in this study may also have arisen due to reduced supported reading at home. Our previous work has shown that the bushfires and subsequent life stressors markedly
affected the mental health of parents up to 5 years later (Bryant et al., 2017), which could create a family environment that could hinder children’s abilities to study and learn. We also note that parents in the high-affected region had lower education levels, and it is possible that this factor may have contributed to the poorer performance of children in these communities. No other studies of children’s postdisaster academic performance have identified subject differences in impacts. However, a study of prenatal exposure to disaster has shown a similar association with lower third grade results in reading and maths (Fuller, 2014). It was not possible in this study to assess individual exposure to the disaster from the available data, including psychological or family factors that may moderate academic performance. Instead, attendance at schools in disaster impacted areas was used as a proxy for disaster exposure. At primary school level, the vast majority of students would be attending schools close to their home, as compared to secondary school for which many students travel longer distances.

It is also possible that academic performance was impaired because of substantial damage to infrastructure and social disruption in schools, which directly limited the accessibility of teaching facilities for children. Focusing on school-level impacts is helpful in highlighting the demands on school staff and resources (Alisic, Bus, Dulack, Pennings, & Splinter, 2012; Casserly, 2006), and the importance of a planned comprehensive program of postdisaster support for children. It has been suggested that school-level programs and high standards of academic achievement at students’ new schools may mitigate the disruption and academic decline experienced by relocation (Barrett et al., 2012; Pane et al., 2008; Peek & Richardson, 2010). However, this is mostly based on research arising from Hurricane Katrina where the children moved away from schools that have been described as among the most poorly performing schools in the USA to schools with higher academic standards and expectations of students (Casserly, 2006; Peek & Richardson, 2010; Reich & Wadsworth, 2008). A combination of sensitive support from teachers, targeted academic support, and encouragement to engage in extracurricular activities have been indicated but not yet proven as factors likely to enable students to adjust to the school changes and thus to realize their academic potential (Barrett et al., 2012; Grelland Røkholt et al., 2016; Pane et al., 2008; Smilde-van den Doel et al., 2006). This provision of a positive supportive environment has been recognized more broadly as an important element in child and youth resilience (Durlak et al., 2011; Ungar, 2011), and mental health promotion (Weare & Nind, 2011). Further research would be helpful to identify the content and dose of school-level interventions most likely to support positive post-disaster outcomes. Additional examination of regional differences would also provide insights into the influence on student resilience of wider factors such as levels of available resources, local recovery processes, and social connectedness.

In the data sets utilized for this study, it was not possible to track students who moved to different schools during their primary school years. This means that the final sample only included students who attended the same school in Prep, Grade 3, and Grade 5. It is possible that some students temporarily relocated and then returned between the study measures. However, children who permanently relocated were not included in the sample because of the difficulties in linking the data. This is a limitation of the study. Families who relocated following the Black Saturday bushfires were most likely to have been significantly affected in terms of property loss (Gibbs et al., 2016). Other postdisaster studies have also shown that children who relocated to new areas and schools were most at risk initially of poor academic outcomes (Pane et al., 2008; Peek & Richardson, 2010; Sacerdote, 2008). Therefore, the results in this study may represent an underestimation of the disaster impacts on academic achievement. In fact, high mobility in school years is generally considered a risk factor for academic achievement (Obradovic et al., 2009) particularly if it occurs for “negative” reasons, but the effect may be a proxy for a range of other high-risk factors such as low income, marginalized social groups, and non-nuclear families (Pane et al., 2008). As previously noted, in a postdisaster context, it appears that the initial negative consequences of shifting to a new school in a new area may be offset by a positive school culture (Barrett et al., 2012; Peek & Richardson, 2010).

Conclusion

This study contributes new findings about delayed impacts on academic achievements for children living in postdisaster communities. It extends the existing evidence base by examining the period up to 4 years after the event and identifies a subject-specific depression in academic achievements over time for reading and numeracy that clearly differentiates between different levels of bushfire affectedness at the school
level. Given the apparent delayed impact, previous findings in the literature of no impact within a 3-year period of the disaster event should be reviewed. Although it is positive to find no difference in those early years after the event, the risk is that subsequent impacts on academic performance are overlooked and, without targeted interventions, children’s future academic trajectories, and life opportunities may be compromised. There is emerging evidence that the early neurodevelopmental impacts of trauma may only be observed at later stages of development when key abilities are due to emerge, for example, the development of executive skills through adolescence. Without early intervention, these adverse developmental trajectories have the potential to impact educational and functional outcomes many years down the track. It is promising that the wider evidence base indicates there are opportunities to mitigate negative impacts on child academic achievement through positive multilevel school strategies. This provides direction for research, policy, and school-level planning and response to disaster events. This study may also be used to guide future research studies into the developmental factors likely to be underlying the delayed impacts on academic achievement specifically relating to reading and numeracy.

References


Disaster Impacts on Child Academic Performance 1411


Reich, J. A., & Wadsworth, M. (2008). Out of the floodwaters, but not yet on dry ground: Experiences of displacement and adjustment in adolescents and their parents following Hurricane Katrina. *Children, Youth...


Annexure D to the Statement of Professor Lisa Gibbs, 22 May 2020

The effect of group involvement on post-disaster mental health: A longitudinal multilevel analysis

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Depression
PTSD
Natural disasters
Social capital
Social networks

ABSTRACT

Involvement in voluntary associations is a key form of social capital and plays an especially important role following disaster as a venue for coordination and decision-making for the wider community. Yet, relatively little attention has been paid to how group involvement affects mental health, at either the individual or community level. The aim of this study was to assess the impact of involvement in voluntary associations on mental health among residents of bushfire-affected communities. A longitudinal sample of 642 individuals affected by the 2009 Victorian bushfires in south-eastern Australia were surveyed in 2012 and 2014 (3- and 5-years post-disaster). A further subsample (n = 552) of residents residing continuously within 22 bushfire-affected communities were examined for community-level effects using multilevel regression methods. After adjusting for demographics, disaster exposure, and network variables, group involvement at time 1 bore a curvilinear relationship with PTSD at both time points: moderate involvement was most beneficial, with no participation, or high amounts, yielding poorer outcomes. High amounts of group involvement was likewise linked to a greater risk of major depression. Furthermore, communities with higher median levels of group involvement reported lower levels of PTSD symptoms and major depression two years later. With respect to group involvement, more is not always better. For individuals, moderation – if possible – is key. Meanwhile, community-level health benefits come when most people participate to some extent, suggesting that the distribution of involvement across the community is important.

A well-established empirical finding is that social support and other psychosocial resources play a key role in reducing the impact of disaster exposure, buffering individuals from various post-disaster stressors, and speeding recovery (Brewin et al., 2000; Liu et al., 2014; Norris et al., 2002; Ozer et al., 2003). Yet, much remains unknown about the complex interplay between affected individuals and the community as a whole, and how this shapes mental health (Kawachi et al., 2008). One way to track and analyze this relationship is through involvement in voluntary organizations (e.g., religious groups, civic organizations, sports clubs, etc.). Voluntary groups offer a social platform for civic participation, engagement, recreation, and for creating and maintaining the shared expectation that help will be there when it is needed. In the wake of a disaster, these groups take on added importance, allowing residents to participate more directly in recovery-related planning and collective decision-making, and to maintain a sense of normality and support during a period of profound disruption (Aldrich, 2011; Nakagawa and Shaw, 2004). Group involvement is therefore a concept that bridges levels of analysis. To the individual, group involvement is an investment of time and effort, a choice, a social identity, and a potential source of social support. For the community, voluntary groups are a key aspect of the social infrastructure, scaffolding collective norms of mutual support (or lack thereof), and enabling residents to organize...
and respond as a whole. Both levels of influence have the potential to shape mental health recovery after a disaster. Consequently, multilevel methods are essential for investigating the simultaneous influences of individual and community-level social capital on mental health.

In this study, we investigate the impact of involvement in voluntary groups on post-disaster mental health, examining its effect on PTSD and depression symptoms in the years following a major bushfire disaster. In February 2009, amid record-breaking heatwave and drought, the worst bushfire disaster in recorded Australian history affected large areas across the state of Victoria, resulting in 173 lives directly lost, thousands of physical injuries, and devastating property damage. In this study, we examine not only how one's own group involvement affects individual-level mental health outcomes in the years following the disaster, but also the possible benefit that may come from living in a community with high levels of group involvement, more generally. This study adds to the small body of multilevel research examining the impact of social capital on post-disaster mental health at both the individual- and community-levels (Lowe et al., 2015; Wind and Komproe, 2012), and one the very few to also use longitudinal data (Matsuyama et al., 2016).

1. Voluntary associations, social capital, and mental health

Involvement in voluntary groups has long been regarded as a key element of social capital, an umbrella concept referring to various tangible and symbolic resources imbued in social relationships, the benefits of which accrue to the individual who holds them, and/or to the community that they bind together (Burt, 2000; Coleman, 1988; Kawachi et al., 2008; Lin, 2002; Putnam, 2000). Public health researchers have generally favoured a holistic conceptualisation in which social capital is seen as a collective property of groups, defined by high levels of civic engagement, norms of reciprocity and participation, and generalized social trust within a community (Moore et al., 2005; Putnam, 2000). This approach therefore emphasizes shared prosocial cognitions (i.e., how people think and feel) as core components of social capital (Ehsan and De Silva, 2015). Alternatively, a social network approach generally defines social capital in terms of various privileged positions and useful configurations within a network, and the access to resources that those positions confer (Burt, 2000; Coleman, 1988; Kwon and Adler, 2014). A network approach thus emphasizes a careful analysis of structural elements, defining social capital primarily in terms of what people actually do. In distinction from a communitarian approach, a network approach treats people's communal feelings and expectations as potential consequences of structural social capital, rather than components thereof. However, despite the potential of social networks as a concept that spans levels of analysis, network research has, in practice, treated social capital as a property of the individual, rather than of social systems (Kwon and Adler, 2014).

Debates about the precise nature of social capital notwithstanding, various forms of social capital have been widely linked to mental health and wellbeing (De Silva et al., 2005; Ehsan and De Silva, 2015). Nevertheless, despite the well-founded expectation that organized group life plays a crucial role in the healthy functioning of individuals and communities, empirical evidence is limited in at least two key respects. First, despite repeated findings for how social capital’s protective effects for mental health (De Silva et al., 2005; Ehsan and De Silva, 2015), group involvement in particular has received mixed results. While some studies have found the number of group memberships to coincide with psychological wellbeing (Cruwys et al., 2013; Jetten et al., 2015; Lam et al., 2018; Rietschlin, 1998; Sani et al., 2014), others have found no such relationship (Baum et al., 2000; De Silva et al., 2006; Veenstra, 2005), or even inverse relationships (De Silva et al., 2006; Mitchell and LaGory, 2002).

One possibility for these mixed results could be that the impact of group involvement on mental health is not linear, but curvilinear. Some researchers have noted the diminishing benefit that may result from higher and higher numbers of group memberships. Putnam (2000 (2000) points to the “declining marginal productivity” that comes with increasing levels of social interaction, noting that the most benefit derived from organized social interaction is found in going from no interaction to some (p. 333–4). Rietschlin (1998) finds an equivalent result, looking more specifically at membership in voluntary associations. However, increasing levels of group involvement may not simply provide less and less benefit, but past a certain point, may start to be detrimental to health and wellbeing. Supporting this idea, satisfaction and positive mood have been found to be lower for both small and large networks of personal relationships, compared to medium-sized ones (Silverstein et al., 1996; Stokes, 1983). In terms of group involvement and group activities, a handful of studies have found U-shaped curvilinear relationships between group involvement and mental health issues, including both senior citizens’ involvement in volunteer activities (Onyx and Warburton, 2003), and adolescents’ involvement in extracurricular activities (Randall and Bohnert, 2012).

By contrast, other studies stress the particular benefit of having multiple group identities (Haslam et al., 2008; Iyer et al., 2009; Jetten et al., 2009; Lam et al., 2018), including social support, self-esteem, and a sense of continuity during times of change (Haslam et al., 2008; Iyer et al., 2009; Jetten et al., 2009; Lam et al., 2018). Overall, this body of research focuses primarily on group-related cognitive processes – and less so on the structural circumstances that underpin these psychological mechanisms. Given that the current study focuses most closely on the structural nature of voluntary group involvement, rather than any accompanying socio-cognitive processes, we proceed with a hypothesis that moderate amounts of actual involvement will provide the most benefit to mental health, with under- and overinvolvement associated with poorer outcomes:

Hypothesis 1. For individuals, the relationship between group involvement and post-disaster mental health issues will be curvilinear (U-shaped), with medium levels of group involvement at baseline leading to lower PTSD (Hypothesis 1a) and lower depression (Hypothesis 1b) at Time 2.

A second important limitation within the social capital and mental health literature is an incomplete empirical picture of how patterns of community-level social participation affect mental health. While research has suggested that communities high in cognitive forms of social capital (e.g., prosocial norms, trust) have better mental health outcomes, there is relatively little research looking specifically at structural forms of social participation (De Silva et al., 2005; Ehsan and De Silva, 2015; Matsuyama et al., 2016), with group involvement receiving even less attention. This is an important difference from post-disaster social research more generally, in which social capital and voluntary associations have been widely examined with respect to the broader recovery process. High levels of social and civic participation within an affected community are generally seen as contributing to collective resilience processes (Aldrich, 2011; Norris et al., 2008), including the mobilization of informal and formal resources needed in the wake of a disaster (Aida et al., 2013; Aldrich, 2011; Matsuyama et al., 2016; Nakagawa and Shaw, 2004; Wind and Komproe, 2012). Given the shared nature of the problems facing a disaster-stricken community, the benefits of social capital should extend beyond those who participate directly in its creation, boosting the functioning of the community as a whole. Such communities should be further able to successfully place demands on government, and dissuade its residents from moving away (Aldrich, 2011). Living in a community with a high level of civic engagement should therefore carry an additional mental health benefit, above and beyond the benefit that may come from one's own direct involvement.

Hypothesis 2. Communities with higher rates of involvement in voluntary associations at baseline will lead to lower levels of mental health issues at Time 2, both in terms of PTSD (hypothesis 2a) and...
depression (hypothesis 2b).

2. Data and method

2.1. Participants and procedure

Two subsamples of participants were drawn from a larger sample of past and current residents (N = 736) of 25 bushfire-affected communities in rural and regional Victoria, surveyed at two time points as part of a longitudinal study of individual and community responses to the disaster (Gibbs et al., 2013). Survey data at time 1 were collected with informed consent from May 2012 through January 2013 (3–4 years post-disaster) by telephone interview or by web-based questionnaire, and readministered in the same way two years later (July to November 2014). At time 1, participants were asked questions about disaster exposure. At both time points, participants were asked about life events and circumstances, mental and physical health, wellbeing, social functioning, and network connections. Of the original sample (N = 1056), 736 participated in both rounds. Residents were drawn from three types of communities: highly-affected communities, characterized by numerous fatalities and extreme physical destruction; medium-affected communities, characterized by sporadic fatalities and extensive property damage; and a set of comparison communities, characterized by bushfire risk, but only sporadic property damage. According to 2011 census figures, the overall population for these communities was approximately 6111 adults (Australian Bureau of Statistics, 2011b). Rurality indices indicate that the participating communities are accessible to moderately accessible (see appendix A in supplementary materials).

For the individual-level analysis, a subsample of participants (n = 642; ≈10.5% of adult population) were selected on the basis of having lived in the same affected community at the time of the bushfire and at both data collection timepoints (n = 29 were excluded because they did not reside in the community at the time of the bushfires. The remaining exclusions (n = 65) were due to missing data for predictor and/or outcome variables. Excluded participants led to excluding 3 communities.). In comparison to census figures for these communities, this study sample of continuous residents was composed disproportionately of female respondents (n = 391 (61.1%), χ² = 25.98, p < .001), and was disproportionately older (M = 53.83, SD = 12.62, χ² = 762.35, p < .001) (see Table 1). For the multi-level analysis, a further subsample of participants (n = 552; ≈9.1% of adult population) were selected on the basis of having resided continuously in the same community throughout the disaster and both data collection periods. The average cluster size was 25.1 individuals (SD = 21.6), with a range 98 to 1. The study was approved by the University of Melbourne Human Research Ethics Committee.

2.2. Measures

2.2.1. Group involvement

Individuals were asked to name the groups in which they were currently involved, with group involvement calculated as the sum total of group memberships. Individuals could name up to 10 groups, providing a group name. No definition was given as to what constituted “current” involvement. In this study, only data from Time 1 is considered. Using this count data, average and median levels of group involvement were computed for each community in the study. Using field notes, informants, and internet searches, research team also used group names to categorize groups into eight broad categories, including bushfire support groups. The resulting categorization scheme is presented in Table 2, with rates of participation in each. Estimated duration (years, months, days) of personal involvement with each group was also asked, but did not factor into this analysis.

Table 1

<table>
<thead>
<tr>
<th>Individual-level descriptive statistics.</th>
<th>M (SD) n (%)</th>
<th>Paired comparison (T1 vs T2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (Female)</td>
<td>391 (61.1%)</td>
<td>χ² = 31.51***a</td>
</tr>
<tr>
<td>Age</td>
<td>53.83 (12.62)</td>
<td></td>
</tr>
<tr>
<td>Post-secondary education</td>
<td>386 (60.1%)</td>
<td></td>
</tr>
<tr>
<td>Interpersonal network ties (T1)</td>
<td>2.65 (2.59)</td>
<td></td>
</tr>
<tr>
<td>Disaster-related bereavement</td>
<td>191 (29.8%)</td>
<td></td>
</tr>
<tr>
<td>Property loss</td>
<td>4.86 (3.97)</td>
<td></td>
</tr>
<tr>
<td>Additional disaster or fire experience (T2)</td>
<td>220 (34.3%)</td>
<td></td>
</tr>
<tr>
<td>Financial deprivation (T2 only)</td>
<td>59 (1.30)</td>
<td>Z = 5.82***</td>
</tr>
<tr>
<td>PTSD symptoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: 3.21 (3.60)</td>
<td>T2: 2.70 (3.31)</td>
<td></td>
</tr>
<tr>
<td>χ² = 54.81***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: 116 (18.1%)</td>
<td>T2: 91 (14.2%)</td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: 4.86 (5.66)</td>
<td>T2: 4.13 (5.27)</td>
<td></td>
</tr>
<tr>
<td>χ² = 4.16***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: 69 (10.7%)</td>
<td>T2: 52 (8.1%)</td>
<td></td>
</tr>
<tr>
<td>Probable major depression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: χ² = 4.06*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income loss</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-T1: 285 (44.5%)</td>
<td>Pre-T2: 178 (27.8%)</td>
<td></td>
</tr>
<tr>
<td>Other traumatic events</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: 0.27 (0.50)</td>
<td>T2: 0.26 (0.52)</td>
<td></td>
</tr>
<tr>
<td>χ² = 24.08***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Religious organizations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-T1: 87 (13.6%)</td>
<td>Pre-T2: 35 (5.5%)</td>
<td></td>
</tr>
<tr>
<td>χ² = 18.15***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: 0.49 (0.41)</td>
<td>T2: 0.50 (0.39)</td>
<td></td>
</tr>
<tr>
<td>Retired</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: 214 (33.4%)</td>
<td>T2: 248 (38.8%)</td>
<td></td>
</tr>
<tr>
<td>χ² = 1.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: 486 (75.9%)</td>
<td>T2: 476 (74.4%)</td>
<td></td>
</tr>
<tr>
<td>χ² = 4.32*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living alone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1: 99 (15.4%)</td>
<td>T2: 111 (17.3%)</td>
<td></td>
</tr>
<tr>
<td>χ² = 4.32*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a Comparison statistic refers to female versus male.

Table 2

Descriptive statistics for Group involvement.

<table>
<thead>
<tr>
<th>Average number of involvements</th>
<th>Individuals with at least one involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group category</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Sport groups and clubs</td>
<td>.18 (.52)</td>
</tr>
<tr>
<td>Youth, children, and school groups</td>
<td>.07 (.29)</td>
</tr>
<tr>
<td>Community/interest groups</td>
<td>.44 (.81)</td>
</tr>
<tr>
<td>Religious organizations</td>
<td>.09 (.34)</td>
</tr>
<tr>
<td>Environmental and outdoor groups</td>
<td>.10 (.34)</td>
</tr>
<tr>
<td>Fire preparedness groups</td>
<td>.13 (.35)</td>
</tr>
<tr>
<td>Support groups and services</td>
<td>.05 (.26)</td>
</tr>
<tr>
<td>Miscellaneous or unnamed</td>
<td>.08 (.34)</td>
</tr>
<tr>
<td>Overall</td>
<td>1.14 (1.44)</td>
</tr>
</tbody>
</table>

2.2.2. Disaster exposure

Interpersonal loss was measured via a self-report question regarding the death of loved ones, and relation to the deceased. Extent of individual property loss was measured by a self-report 11-point scale of overall property loss (0 = nothing, 10 = everything).
2.2.3. PTSD symptoms
A 4-item version of the Posttraumatic Stress Disorder Checklist Screen (PCL-C) was used to assess PTSD symptoms (Bliese et al., 2008). Items pertaining to re-experiencing, avoidance, emotional arousal, and difficulties concentrating over the previous four weeks were measured on a 4-point Likert-type scale ($\alpha_{t1} = 0.82$, $\alpha_{t2} = 0.85$). A total sum score was used for the analyses, yielding a potential range of 0–16. Probable PTSD was calculated using a cutoff score of 7 (Bliese et al., 2008).

2.2.4. Depression
Depressive symptoms were assessed by means of the Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001), consisting of nine items pertaining to symptoms experienced over the prior two weeks, scored on a 4-point Likert-type scale. ($\alpha_{t1} = 0.86$, $\alpha_{t2} = 0.88$). A total sum score was used for the analyses, yielding a potential range of 0–27. Major depression classified as having five or more qualifying symptoms, including anhedonia (Kroenke and Spitzer, 2002).

2.2.5. Interpersonal network ties
The size of one’s personal social support network was included to control for sources of direct, person-to-person social support that may coincide with group involvement. This was measured by asking participants for the identifications of people to whom one felt personally close, and summing the result (Bryant et al., 2017).

2.2.6. Employment and financial stress
Employment status was assessed (full-time = 1, part-time = 0.5, unemployed/home duties = 0), with retirement included as an additional dummy variable. Income loss in the previous two years was indexed by a single dichotomous item self-report question. At time 2 only, financial deprivation was assessed via a series of questions related to cash flow problems and limited financial resources (Travers and Robertson, 1995). Due to a coding error, only seven of the nine items from the original scale were included ($\alpha = 0.80$).

2.2.7. Major life events
Experiential factors included other traumatic events (accident or injury, assault, violence, or threat of violence) and other disaster exposures (fire and/or other natural disasters). Relationship change was measured as a discrepancy in domestic partnership status between the two data collection timepoints, and/or a self-report of a change in relationship status as a major life event in the intervening time period. Community relocation was determined by examination of residents’ reported through direct questions about relocation and by comparing individuals’ town of residence at each data collection time point.

2.2.8. Sociodemographic factors
Sex, age, and education level were included as individual-level control variables. Household composition factors included marriage/cohabitation and living alone.

2.2.9. Community-level resources
The Index of Economic Resources Relative Socio-economic Advantage and Disadvantage (IRSAD) – taken from 2011 census data – was used as a general community-level measure for relative socio-economic advantage and disadvantage for people and households within each community (Australian Bureau of Statistics, 2011a).

2.3. Statistical analysis
The analysis strategy was two-fold. First, we conducted an individual-level longitudinal regression analysis, looking at depressive and PTSD symptoms across time for the first subsample as a whole ($n = 642$). This approach allowed for the analysis of the impact of group involvement on mental health conditions over time, while adjusting for a wide array of individual-level sociodemographic, sociostructural, social network, and experiential factors. Second, to further examine community-level influences, a series of multilevel regression analyses at time 2 were conducted on the subsample of continuous residents ($n = 552$). To achieve model identification, simpler models with fewer predictors were necessary, given the small number of communities ($n = 22$). Therefore, the multilevel model was specified to predict a single mental health outcome at time 2, incorporating a subset of predictors from the individual-level model. For each model, a curvilinear effect was tested by including group involvement as a main effect (linear term), along with a squared (quadratic) term. To mitigate multicollinearity, the linear term was centred around the grand mean or the grand median, depending on whether the median or mean term was used at level 2. The quadratic term was the square of the centred linear term. All analyses were conducted using Mplus version 7.02 (Muthén & Muthén, 1998–2011). Robust Maximum Likelihood (MLR) estimation was used, given the lack of a normal distribution for outcome variables (Chou et al., 1991). This equated to multilevel logistic regression when used with the dichotomous cutoff variables for PTSD and depression.

3. Results
Hypothesis 1 stated that group involvement at baseline would show a curvilinear (U-shaped) relationship with both PTSD (hypothesis 1a) and depression (hypothesis 1b) at Time 2. In support of hypothesis 1a, individual-level group involvement bore a significant curvilinear relationship with PTSD at time 1 ($\beta_{x1} = -0.17$, $\beta_{x2} = 0.02$) and at time 2 ($\beta_{x2} = -0.12$, $\beta_{x2} = 0.02$), even when controlling for a range of related sociodemographic and network variables (Table 3, Model A). Meanwhile, group involvement bore no significant relationship with depression symptoms: only a marginal curvilinear relationship was observed between T1 group involvement and T1 depression, with no such relationship for T2 depression. Hypothesis 1b is therefore not supported.

To further examine the longitudinal association between mental health outcomes (T2) and group involvement (T1) at both the individual-level and the community-level, a series of multi-level regression analyses were conducted (Tables 4 and 5). For the individual-level portion of the models, statistically significant predictors from the prior individual-level analysis were retained. For the community-level portion of the model, the relationship between group involvement and community-level PTSD was examined while adjusting for community-level bushfire exposure, along with indices of area socioeconomic status.

As seen in Table 4 (Model B-E), a curvilinear association between group involvement (T1) and PTSD (T2) was again found at the level of the individual. This curvilinear pattern result was also found for probable cases of PTSD (Models F and G), indicating that moderate amounts of group involvement lead to both fewer cases of clinically significant PTSD, as well as posttraumatic stress symptoms generally. F-tests confirmed that the addition of the quadratic term significantly improved model fit both for PTSD symptoms (Model D), $\Delta R^2 = 0.008$, $F_{1,537} = 9.42$, $p = .002$, and for probable PTSD, $\Delta R^2 = 0.020$, $F_{1,537} = 23.05$, $p < .001$.

The specific role of bushfire- and mental health support groups, which were especially active in the aftermath of the bushfires, were also tested to determine whether the positive effect of high levels of group participation on PTSD was the result of help-seeking for mental health issues (Table 4, Model E). Here, splitting the linear (non-squared) group involvement effect into separate support-group and non-support-group effects resulted in two negative but non-significant linear effects. Nevertheless, the quadratic (squared) term remained significant ($\beta_{x2} = 0.03$). The curvilinear association therefore does not appear not to be a result of a high level of help-seeking for post-disaster mental health issues.
The aim of the current study was to investigate the impact of involvement in voluntary associations on mental health over time, in the years following a major bushfire disaster. This was investigated at both the level of the individual and that of the community, adjusting for a range of experiential and sociostructural variables. Group involvement was associated with PTSD symptoms, both at the individual level and the community level, and both cross-sectionally, and longitudinally. At the individual level, the curvilinear relationship between group involvement and PTSD symptoms at both time 1 and at time 2 suggests that an optimum level of involvement in groups has a beneficial effect on individual recovery from trauma. However, past a certain level, group involvement’s benefit diminishes and begins having a detrimental effect on PTSD.

There are several possible explanations for this curvilinear relationship. Given that our findings suggest a more specific effect for PTSD symptoms, compared to depression (see below), this could suggest that moderate levels of group involvement may facilitate opportunities for adaptive trauma processing. Yet, past a certain level, the sheer time and effort needed to maintain high levels of involvement within a highly disrupted social and physical environment may overtax one’s coping resources, exacerbating PTSD symptoms and probable major depression. High group involvement may involve engaging with multiple factions within a community, who may each hold a different set of expectations. Especially within a recovery setting, such underlying tensions may arise, potentially increasing one’s exposure to displays of competition, opposition, and conflict, resulting in exposure to negativity and burnout. A second possibility is that having many opportunities for group participation may present a “paradox of choice” (Markus and Schwartz, 2010), in which having some level of choice is beneficial for one’s wellbeing, but having too much choice is detrimental. Individuals with many group memberships may have to choose from among many options, ultimately forgoing some in favor of others, leading to a decrease in wellbeing. A related possibility is that, in having too many group involvements, a person does not have the time available to become embedded in any one group in particular, and, as a result is less able to gain adequate social support overall.

The multilevel analysis reveals that the influence of group involvement on mental health is not confined to the individual; simply residing in a community in which a majority of people participate at least one or two groups has added benefit (for both PTSD symptoms, and major depression). Both individuals and communities fare better when group memberships are widely and evenly shared among a large portion of the community residents, rather than concentrated in a relatively small number of highly involved people. Put another way, when most community members have a few group involvements (but not too many), it is beneficial for both themselves, and to the wider community.

The fact that it is median group involvement (and not average group involvement) that best predicts PTSD and major depression outcomes likely bears a direct relationship to the curvilinear association at the individual level. That is, community-level mental health improves through rising rates of group involvement, but only if inequality (variance) in group involvement remains relatively low. If group involvement is concentrated in the hands of a few (high variance), the community-level protective effect is nil, or perhaps even negative. Given the sensitivity of the statistical average to outliers (i.e., highly involved), the median is a more appropriate single measure of broad-based, equitable group involvement across a community. Future research with a larger sample size at level 2 would benefit from testing the average level of group involvement alongside a measure of variance (e.g., coefficient of variation, Gini index).

As shown, depression displayed a different pattern than PTSD. At the individual level, a marginal curvilinear relationship between group involvement and depression symptoms at baseline did not reach

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**Table 3** Individual effects. Depression and PTSD symptoms over time (n = 640).

<table>
<thead>
<tr>
<th>Model A</th>
<th>Depression</th>
<th>PTSD symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time 1</td>
<td>Time 2</td>
</tr>
<tr>
<td></td>
<td>B (S.E.)</td>
<td></td>
</tr>
<tr>
<td>Mental health at Time 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>-.15 (.08)</td>
<td>.01 (.06)</td>
</tr>
<tr>
<td>PTSD symptoms</td>
<td>-.13 (.05)**</td>
<td>.00 (.04)</td>
</tr>
<tr>
<td>Sociodemographics b</td>
<td>-.07 (.08)</td>
<td>.03 (.06)</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full/part-time (T1)</td>
<td>.08 (.12)</td>
<td>-.35 (.10)**</td>
</tr>
<tr>
<td>Full/part-time (T2)</td>
<td>.16 (.13)</td>
<td>.01 (.13)</td>
</tr>
<tr>
<td>Retired (T1)</td>
<td>.19 (.12)</td>
<td>.08 (.12)</td>
</tr>
<tr>
<td>Retired (T2)</td>
<td>-.13 (.11)</td>
<td>.10 (.10)</td>
</tr>
<tr>
<td>Household composition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/domestic</td>
<td>.05 (.13)</td>
<td>.35 (.15)**</td>
</tr>
<tr>
<td>partner (T1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/domestic</td>
<td>-.21 (.14)</td>
<td>.44 (.16)**</td>
</tr>
<tr>
<td>partner (T2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lives alone (T1)</td>
<td>.33 (.16)*</td>
<td>.29 (.15)</td>
</tr>
<tr>
<td>Lives alone (T2)</td>
<td>.25 (.13)</td>
<td>.11 (.13)</td>
</tr>
<tr>
<td>2009 Bushfire Exposure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property loss</td>
<td>.13 (.04)**</td>
<td>.03 (.03)</td>
</tr>
<tr>
<td>Interpersonal loss</td>
<td>.40 (.09)**</td>
<td>-.01 (.07)</td>
</tr>
<tr>
<td>Major life events</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income loss (T1)</td>
<td>.41 (.08)**</td>
<td>.50 (.07)**</td>
</tr>
<tr>
<td>Income loss (T2)</td>
<td>.21 (.08)**</td>
<td>-.24 (.07)**</td>
</tr>
<tr>
<td>Traumatic events (T1)</td>
<td>-.17 (.07)*</td>
<td>.23 (.07)**</td>
</tr>
<tr>
<td>Traumatic events (T2)</td>
<td>.13 (.08)</td>
<td>.18 (.07)**</td>
</tr>
<tr>
<td>Leaving community</td>
<td>-.01 (.12)</td>
<td>-.01 (.11)</td>
</tr>
<tr>
<td>Leaving community (pre-T1)</td>
<td>.06 (.10)</td>
<td>-.01 (.10)</td>
</tr>
<tr>
<td>Leaving community (pre-T2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Network variables (Time 1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Close social ties</td>
<td>-.01 (.01)</td>
<td>-.02 (.01)*</td>
</tr>
<tr>
<td>Group memberships</td>
<td>-.20 (.07)**</td>
<td>-.04 (.05)</td>
</tr>
<tr>
<td>Group memberships (squared)</td>
<td>.03 (.01)</td>
<td>.02 (.01)</td>
</tr>
</tbody>
</table>

***p ≤ .001; **p ≤ .01; *p < .05, #p < .10; b Measured at Time 1; PTSD symptoms and depression, property loss, and age, are standardized on both x and y axes. All others (binary, ordinal, and count) are standardized for y-variable only. CFI = .997; NNFI = .998; RMSEA = .018. **Hypothesis 2 considered whether communities with a higher levels of group involvement (average and median) at Time 1 had fewer mental health issues at Time 2. For PTSD, the median level of group involvement in a community positively predicted its subsequent levels of PTSD symptoms (Table 5, Model D), but not probable cases (Model G). For depression, the inverse was found: both the median and the average level of group involvement in a community predicted fewer probable cases of major depression (Table 5, Models M and N), but not depressive symptoms (Models H – I). Hypothesis 2a and 2b are thus both partially supported: higher levels of group involvement in a community predicts fewer mental health issues.

To offer a more precise analysis of the point at which increasing group involvement starts to become over-involvement, a sensitivity analysis was conducted (see Appendix B in supplementary materials). On an individual-level, people fare better with increasing group involvement, up to two groups, while those with three or more involvements fare progressively worse. The same pattern extends to the community level as well: communities with higher proportions of residents having one or two group involvements display lessened PTSD. However, as the proportion of highly-involved residents (3 or more involvements) grows, the mental health of the community as a whole declines.

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4. Discussion
statistical significance, with no relationship found at time 2. Instead, depression symptoms were negatively associated with close inter-personal ties, which supports the repeated finding for the ameliorative effect of direct interpersonal support. In terms of group involvement, only for major depression was a significant relationship found specifically for over-involvement. At the community level, places with higher levels of group involvement had lower rates of subsequent major depression, property loss, age, financial stress, and SES (IRSAD) are standardized on both x and y axes. All others (binary, ordinal, and count) are standardized for y-variable only. ICC for the null model for the continuous measure is .032.

Other results indicate the important influence of domestic relationships, with those in intimate partnerships (at Time 1) experiencing poorer mental health generally, presumably due to the added responsibilities and negative social influence that can flow across these important relationships in the wake of disaster (Gallagher et al., 2017). Nevertheless, a subsequent change in relationship status predicts continued poor mental health, reaffirming the toll that divorce and relationship loss can have on the individual (Afifi et al., 2006). Furthermore, unexpectedly, higher individual-level education predicted more subsequent PTSD symptoms (Table 5, Models B-E), in contrast to conclusive evidence to the contrary (Brewin et al., 2000; Norris et al., 2002; Ozer et al., 2003). One speculative explanation is that, in this setting, a higher level of education could be confounded with recent relocation to the area, in line with the trending regional migration of more affluent city-dwellers to environmentally attractive but historically less-educated “tree change” communities (Smailes et al., 2014), such as those in our sample. Despite the relative educational advantage of recent migrants, their short tenure within the community may act as a personal vulnerability factor in the face of disaster, perhaps through less social integration with the local community.

4.1. Clinical and practical significance

The most important practical finding in this study remains that some group involvement leads to lessened PTSD following a disaster. While our results indicate a curvilinear, U-shaped relationship between PTSD and involvement in voluntary associations, the finding that nearly half of the sample (44.7%) had no such involvements suggests that the most gain in wellbeing might come from supporting participation by those with little to no current involvement. Nevertheless, the finding of a curvilinear association between PTSD and group involvement resembles prior findings regarding the diminishing returns of more and more social interaction (Putnam, 2000; Rietschlin, 1998), and adds an important qualification to more recent suggestions that more is always better when it comes to group memberships (Iyer et al., 2009). While

Table 4

<table>
<thead>
<tr>
<th>Individual-level factors (Level 1)</th>
<th>PTSD symptoms</th>
<th>Probable PTSD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model B</td>
<td>Model C</td>
</tr>
<tr>
<td>Intercept/threshold</td>
<td>.43 (1.10)</td>
<td>.32 (1.56)</td>
</tr>
<tr>
<td><strong>Mental health (Time 1)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSD symptoms</td>
<td>.44 (0.5)**</td>
<td>.45 (0.5)**</td>
</tr>
<tr>
<td>Depression symptoms</td>
<td>.20 (0.7)**</td>
<td>.20 (0.7)**</td>
</tr>
<tr>
<td>Sociodemographic variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex (Male)</td>
<td>-.06 (.06)</td>
<td>-.05 (.05)</td>
</tr>
<tr>
<td>Age</td>
<td>.04 (.04)</td>
<td>.04 (.03)</td>
</tr>
<tr>
<td>Education (Postsecondary)</td>
<td>.03 (0.01)*</td>
<td>.03 (0.01)*</td>
</tr>
<tr>
<td>Employment level (Time 1)</td>
<td>-.23 (1.0)*</td>
<td>-.25 (1.0)**</td>
</tr>
<tr>
<td>Retired (Time 1)</td>
<td>-.24 (1.0)*</td>
<td>-.29 (1.0)**</td>
</tr>
<tr>
<td>Married or domestic partnership</td>
<td>.36 (1.2)**</td>
<td>.33 (1.3)**</td>
</tr>
<tr>
<td>Relationship status change (since T1)</td>
<td>.47 (1.1)**</td>
<td>.51 (1.1)**</td>
</tr>
<tr>
<td>Lives alone (T1)</td>
<td>.29 (1.2)*</td>
<td>.27 (1.3)*</td>
</tr>
<tr>
<td>Disaster exposure and life stressors</td>
<td>.08 (0.03)**</td>
<td>.09 (0.03)**</td>
</tr>
<tr>
<td>Property loss in 2009 bushfires (T1)</td>
<td>.07 (0.04)</td>
<td>.07 (0.04)</td>
</tr>
<tr>
<td>Financial stress (reported at T2)</td>
<td>.16 (.06)**</td>
<td>.20 (.05)**</td>
</tr>
<tr>
<td>Additional disaster/fire exposure (since T1)</td>
<td>.13 (0.04)**</td>
<td>.14 (0.04)**</td>
</tr>
<tr>
<td>Traumatic events (since T1, reported at T2)</td>
<td>.16 (.06)**</td>
<td>.20 (.05)**</td>
</tr>
<tr>
<td><strong>Associational life (Time 1)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group memberships</td>
<td>-.01 (0.03)</td>
<td>-.04 (0.02)*</td>
</tr>
<tr>
<td>Group memberships, squared</td>
<td>.01 (0.03)</td>
<td>.03 (0.01)**</td>
</tr>
<tr>
<td>Bushfire/mental health support groups</td>
<td>.08 (0.03)**</td>
<td>.09 (0.03)**</td>
</tr>
<tr>
<td><strong>Community-level factors (Level 2)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTSD symptoms</td>
<td>.83 (.14)**</td>
<td>.81 (1.3)**</td>
</tr>
<tr>
<td>Bushfire impact (Low, Medium, High)</td>
<td>.35 (.24)</td>
<td>.3 (.37)</td>
</tr>
<tr>
<td>Socio-economic Status (IRSAD)</td>
<td>-.24 (1.1)**</td>
<td>-.23 (1.3)**</td>
</tr>
<tr>
<td>Average group membership (Time 1)</td>
<td>.15 (.45)</td>
<td>-.14 (.47)</td>
</tr>
<tr>
<td>Median group membership (Time 1)</td>
<td>.50 (.24)*</td>
<td>-.46 (.24)*</td>
</tr>
<tr>
<td>Model fit</td>
<td>–2 log likelihood</td>
<td>–2467.15</td>
</tr>
<tr>
<td>Akaike (AIC)</td>
<td>4978.30</td>
<td>4974.91</td>
</tr>
<tr>
<td>Bayesian (BIC)</td>
<td>5073.20</td>
<td>5069.81</td>
</tr>
<tr>
<td>ICC estimates</td>
<td>.032</td>
<td>.032</td>
</tr>
</tbody>
</table>

**p ≤ .001; *p ≤ .01; †p ≤ .05; ‡p ≤ .10; ‡‡ centred within context; † For models E, F and H, group involvement variables (Level 1 and 2) are centred on 1 (sample median); ‡ For model F, general group membership variables pertain to non-support groups. All other variables are grand mean-centred, unless otherwise specified; PTSD (both levels) and depression symptoms, property loss, age, financial stress, and SES (IRSAD) are standardized on both x and y axes. All others (binary, ordinal, and count) are standardized for y-variable only. ICC for the null model for the continuous measure is .032.**
self-identification and other psychological processes enabled by group involvement might be increasingly beneficial in an additive sense, the practical realities and costs of having one's time and energy spread too thinly may also come into play, counteracting the socio-cognitive benefits of increasing group involvement. This should especially be the case in situations where social participation could risk depriving less-involved individuals of an important source of social support. 

Moreover, these findings suggest that widening participation would be beneficial not only to the mental health of involved individuals, but also to the community as a whole, lending support to the view of social capital as both an individual and an ecological asset. However, our findings suggest an important dilemma when it comes to supporting mental health at the individual- and community-levels simultaneously: human groups do not exist independently of the individuals who participate in them and lead them. For a smaller number of highly involved individuals in our sample, who are presumably leaders and influential members of the community, their high levels of group commitment apparently imposed a burden on their own personal mental health. Therefore, for these highly connected individuals, reducing their (over) commitment may be beneficial for them, individually. Yet, at the same time, if these individuals were to pull back their involvement for the sake of their own mental health, this could be to the detriment of the groups from which they withdraw, and in turn, the wider community. Without their participation (and perhaps leadership), these groups could decline in functioning, or outright cease to exist. In turn, this could risk depriving less-involved individuals of an important source of social participation and normality in an otherwise tumultuous social environment. Furthermore, given the important role of community groups as a forum for discussion and decision-making (Aldrich, 2011; Nakagawa and Shaw, 2004), any decline in voluntary group activity could hinder the community’s recovery and reconstruction, overall.

Future research would benefit from measuring the full range of residents’ specific group memberships as a way to index personal mental health and social capital. Possible community-level interventions may come in the form of efforts to preserve and enhance the voluntary group composition of changing communities. In the wake of disaster, this might include tracking the functioning of local groups over time, emergency support to keep them up and running, and targeted support for formal and informal community leaders. During normal times, interventions might include local leadership training, involvement in planning forums for disaster resilience, and supports for groups aimed at less-involved individuals.

### 4.2. Strengths and limitations

A key strength of this study is its longitudinal and multilevel design, allowing us to test that group membership at baseline was a causal antecedent to PTSD at time 2. Moreover, other social network and social support factors were extensively controlled for, allowing us to make specific assertions regarding the influence of group involvement.
However, several limitations remain. First, while recruitment methods were intensive and extensive, the saturation-focused recruitment strategy introduced some non-probability, with our final sample being disproportionately older and more female than the population of the bushfire-affected areas. This potentially limits the generalizability of the results. Second, the communities assessed were relatively few, and rural; we therefore cannot assert that these findings extend to urban areas, where voluntary group membership and civic participation may take on different forms and patterns. Third, the way in which group membership was measured emphasized the number of groups one was involved in, but did not take into account the frequency of participation in each group. Future research should consider not only the number of structural linkages, but also their relative intensity, when considering different profiles of group involvement. Fourth, disaster exposure was assessed retrospectively at baseline, and thus we cannot rule out that recollections were biased by concurrent mental health issues at time 1. Fifth, measurement of mental health symptoms relied on self-reports, rather than clinical interviews.

5. Conclusion

Despite the well-founded expectation that organized group life plays a crucial role in the healthy functioning of individuals and communities, surprisingly little empirical evidence exists in support. In response, the findings from this study support the basic but important premise that involvement in voluntary groups is beneficial, not only for the individuals who are themselves involved, but for the community as a whole. These findings therefore highlight group involvement as a sociostructural phenomenon – differentiated from cognitive forms of social capital – that impacts subsequent mental health at both the individual and community levels. At the same time, however, these findings also suggest that simple linear relationships do not adequately capture this general relationship. More is not necessarily better when it comes to social connections. Both under-and over-involvement can be detrimental to mental health. Moreover, the distribution of group involvement across the community as a whole should be of primary concern when attempting to characterize its resilience, with attention paid to whether most residents in a community are engaged with as-sociational life, at least to some extent, rather than simply considering average rates of participation.

Financial support

This research was supported through an Australian Research Council Linkage Grant (LP100200164), along with the contributions of these partner organisations: Outer East Health and Community Support Alliance, Bendigo Loddon Primary Care Partnership, Lower Hume Primary Care Partnership, Central West Gippsland Primary Care Partnership, Banyule Nillumbik Primary Care Alliance, Central Hume Primary Care Partnership, Australian Red Cross, Australian Rotary Health, Victorian Department of Health, Centrelink.

Acknowledgements

The authors gratefully acknowledge the contributions of research participants, and the support of community organisations and local governments. The authors would like to acknowledge the Beyond Bushfires investigator team for their contribution to this paper (particularly Lou Harms and Greg Ireten), along with Alex Stivala for technical assistance. We would also like to acknowledge the contributions of the late Elizabeth Waters.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2018.11.006.

References


Interpersonal violence and mental health outcomes following disaster

Robyn Molyneaux, Lisa Gibbs, Richard A. Bryant, Cathy Humphreys, Kelsey Hegarty, Connie Kellett, H. Colin Gallagher, Karen Block, Louise Harms, John F. Richardson, Nathan Alkemade and David Forbes

Background
Disasters pose a documented risk to mental health, with a range of peri- and post-disaster factors (both pre-existing and disaster-precipitated) linked to adverse outcomes. Among these, increasing empirical attention is being paid to the relation between disasters and violence.

Aims
This study examined self-reported experiences of assault or violence victimisation among communities affected by high, medium, and low disaster severity following the 2009 bushfires in Victoria, Australia. The association between violence, mental health outcomes and alcohol misuse was also investigated.

Method
Participants were 1016 adults from high-, medium- and low-affected communities, 3–4 years after an Australian bushfire disaster. Rates of reported violence were compared by areas of bushfire-affectedness. Logistic regression models were applied separately to men and women to assess the experience of violence in predicting general and fire-related post-traumatic stress disorder, depression and alcohol misuse.

Results
Reports of experiencing violence were significantly higher among high bushfire-affected compared with low bushfire-affected regions. Analyses indicated the significant relationship between disaster-affectedness and violence was observed for women only, with rates of 1.0, 0 and 7.4% in low, medium and high bushfire-affected areas, respectively. Among women living in high bushfire-affected areas, negative change to income was associated with an increased likelihood of experiencing violence (odds ratio, 4.68). For women, post-disaster violence was associated with more severe post-traumatic stress disorder and depression symptoms.

Conclusions
Women residing within high bushfire-affected communities experienced the highest levels of violence. These post-disaster experiences of violence are associated with post-disaster changes to income and with post-traumatic stress disorder and depression symptoms among women. These findings have critical implications for the assessment of, and interventions for, women experiencing or at risk of violence post-disaster.

Declaration of interest
None.

Keywords
Post-traumatic stress disorder; trauma; violence.

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Whether primarily natural or human-made, disasters pose a well-documented risk to mental health, with increased rates of depression, post-traumatic stress disorder (PTSD) and related conditions among those in affected areas. Research has also thoroughly examined the pre-, peri- and post-disaster risk factors that contribute to the prevalence of mental health issues, with a range of life stressors (both pre-existing and disaster-precipitated) linked to adverse outcomes. One particular focus in existing literature is interpersonal violence following disasters (a broad term to cover all types of violence committed by one person against another). This is often classified at the subcategorical level, such as gender-based violence (violence against someone based on socially ascribed gender roles), community violence (violence between unrelated individuals, who may be known or unknown to each other) or family violence (violence largely between family members and intimate partners), an aspect of which is intimate partner violence (IPV; violence directed against an intimate partner or ex-partner). There is growing empirical evidence of gender-specific patterns of vulnerability to violence following natural disasters. Longitudinal research indicates that experiences of IPV before a disaster increase the likelihood of IPV following a disaster event, and this may be exacerbated by heightened stress post-disaster and damage to the physical and social infrastructures that provide domestic violence response and support. Although previous research has found support both for and against post-disaster increases in IPV, certain peri-disaster experiences (such as property damage, job loss and financial hardship) have been linked to increased IPV risk. This is a significant mental health issue, as post-disaster IPV is associated with PTSD and depression. One gap within previous literature is that there has been little consideration of the pattern of interpersonal violence across communities variably affected by disaster. In the absence of pre-disaster data on incidence of violence, such comparative data on impact severity could indicate the extent of influence of the disaster experience, and identify those individuals and communities that may be at increased risk of certain post-disaster experiences and poorer mental health.

In February 2009, widespread bushfires in Victoria, Australia resulted in 173 fatalities and the damage or destruction of 3500 buildings. Known as the ‘Black Saturday’ bushfires, they remain one of Australia’s worst disasters on record and produced long-term repercussions for the functioning and well-being of affected communities. This paper aimed to fill a gap in the current research by identifying those at the most risk of interpersonal violence in the post-disaster setting, factors that relate to experiences of post-disaster violence and how these experiences of violence may affect individuals’ health and well-being. First, this paper compared rates of violence across communities that experienced low, medium and high bushfire-affectedness following these widespread bushfires (for 1, 2, 3, 4 years after an Australian bushfire disaster). Rates of reported violence were compared by areas of bushfire-affectedness. Logistic regression models were applied separately to men and women to assess the experience of violence in predicting general and fire-related post-traumatic stress disorder, depression and alcohol misuse.

Results
Reports of experiencing violence were significantly higher among high bushfire-affected compared with low bushfire-affected regions. Analyses indicated the significant relationship between disaster-affectedness and violence was observed for women only, with rates of 1.0, 0 and 7.4% in low, medium and high bushfire-affected areas, respectively. Among women living in high bushfire-affected areas, negative change to income was associated with an increased likelihood of experiencing violence (odds ratio, 4.68). For women, post-disaster violence was associated with more severe post-traumatic stress disorder and depression symptoms.

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the total sample, and by gender). Second, the paper examined the relationship between the occurrence of violence and other negative experiences that occurred following the fires among those individuals reporting the highest levels of violence. Finally, this paper investigated the gender-specific relationship between interpersonal violence and well-being and mental health (linked to violence and/or disaster exposure), with particular respect to post-disaster depression, PTSD and heavy drinking.

Method

Participants

The sample comprised 1016 residents (aged ≥18 years) from 25 communities across 10 Victorian rural and regional locations. The data were gathered in 2012–2013 as part of the Beyond Bushfires: Community Resilience and Recovery study, in which 25 communities in 10 locations were selected to represent diversity in terms of Community Resilience and Recovery study, in which 25 communities in 10 locations were selected to represent diversity in terms of

Community-level impact

Communities were categorised according to community-level exposure. For the purpose of this analysis, the community groupings were adjusted to provide clear cut-offs based on numbers of fatalities, resulting in three distinct groups. These groups were defined as high bushfire-affectedness (operationalised as four or more fatalities, and high numbers of houses lost; \( n = 675\)) medium bushfire-affectedness (significant amount of property damage, with the most severe end of the medium grouping including one or two fatalities; \( n = 136\)) and low bushfire-affectedness (no evidence of direct burning; however, communities may have been on fire alert during the bushfires and affected by road closures and involvement of local firefighters in the regional response; \( n = 205\)). This categorisation system utilised housing damage figures provided by the Victorian Government Rapid Impact Assessment process and fatalities by community as advised by the Victorian Coroner. Our approach is consistent with the use of fatalities and residential housing loss as community-level impact indicators by the Victorian Bushfire Reconstruction and Recovery Authority.

Bushfire exposure

Three items were used to assess individual-level bushfire exposure: whether a respondent feared for their life (yes/no), whether the respondent experienced loss of a loved one (yes/no) and extent of property loss owing to the fires (on a scale from 0 (nothing) to 10 (everything)).

Experience of assault or violence

Participants were asked whether, since February 2009 (the 2009 bushfires), they had personally experienced assault or violence (yes/no).

PTSD

Probable PTSD was assessed with the Posttraumatic Stress Disorder Checklist–Civilian Version (PCL). This four-item version of the PCL comprises four items each scored on a five-point Likert scale that index key symptoms of PTSD over the previous 4 weeks (Cronbach’s alpha = 0.82). The PCL was altered to ask whether the symptom being endorsed was in response to reminders of the Black Saturday fires (PCL Fire-related), or in response to reminders of traumatic events generally (PCL General). Total scores for each participant were then generated for both Fire-related and General post-traumatic stress symptoms.

Depression

Probable major depression was assessed using the Patient Health Questionnaire (PHQ-9). Presence of depression was coded if five of the nine symptoms had been present for most days in the previous 2 weeks (Cronbach’s alpha = 0.86).

Alcohol use

Alcohol use was assessed with the three-item self-report Consumption Scale of the Alcohol Use Disorder Identification Test (AUDIT-C, an abbreviated version of the AUDIT), assessing how often the respondent drinks, how many drinks are consumed in a day and how often they have six or more drinks in a single occasion, which measures the amount of alcohol consumption but not adverse effects of alcohol use (Cronbach’s alpha = 0.81). Items are summed to produce a score of 0–12 (0 reflects no alcohol use).

Major life stressors

Participants were asked to indicate whether they had experienced major life stressors in the form of disruptions to their income, employment status, occupation, accommodation or personal relationships since the bushfires, and whether these had resulted in a negative outcome.

Procedure

The study was approved by the University of Melbourne Human Research Ethics Committee (HESC ID: 1034829.4). Data collection was piloted in late 2011, then conducted between April 2012 and January 2013. The full study protocol, including a participatory approach and strategies to ensure post-trauma sensitivity, are described elsewhere. Surveys were either self-completed via an online questionnaire or administered via computer-assisted telephone interview (CATI), depending on participant preference. The survey commenced with a range of sociodemographic questions, followed by the PHQ-9, AUDIT-C, PCL and questions about bushfire exposure and subsequent traumatic or stressful life events.

The Beyond Bushfires: Community, Resilience and Recovery study initially sought to recruit approximately equal numbers from low, medium and high bushfire-affected communities. However, population estimates for these communities indicated a larger population across the high bushfire-affected communities (compared with the medium and low bushfire-affected communities), and this was further enhanced by the higher response rates within those communities. As such, the final sample had an over-representation of individuals from high bushfire-affected communities. Based on the total adult population for each of these regions, the
participation rates were approximately 9.5% for low, 9% for medium and 19.2% for high bushfire-affected communities (based on population estimates of 2153, 1532 and 3508, respectively\(^3\)). Communities were selected with a view to equivalence across regions in Socio-Economic Indexes for Areas, community size and remoteness (i.e. distance from Melbourne, Victoria’s state capital and most populous city). When compared with census data from the participating communities,\(^3\) the study sample was found to have a significant overrepresentation of women ($\chi^2 (1) = 51.36, P < 0.001$) and was older than the population data suggests for residents in these regions ($\chi^2 (7) = 741.86, P < 0.001$). This pattern of differences was also observed for each region separately, with samples in the low, medium and high bushfire-affected communities demonstrating an overrepresentation of women and older residents compared with population estimates. Two key mental health measures (the PHQ-9 and PCL-4, detailed below) were assessed for measurement invariance between the two interview modes (CATI and online), controlling for age and gender, and found to be completely scalar invariant, with no mean difference between the two groups. This indicates that the two modes of survey completion produced consistent results.

### Statistical analyses

Analyses were conducted with SPSS version 24 for Windows. The first stage of analysis compared gendered rates of violence within communities that experienced low, medium and high bushfire-affectedness. $\chi^2$ analyses were used to investigate the relationship between region bushfire-affectedness, gender and experiences of violence.

The second stage of analysis examined the relationship between the occurrence of violence and other negative experiences that occurred following the fires among those individuals at high risk of experiencing violence, based on the analysis of gendered rates of violence across communities. A binomial logistic regression was conducted to examine the risk of major life stressors (negative change in income, employment, occupation, accommodation and relationship) in the prediction of experiences of violence, based on the analysis of gendered rates of violence across communities. A binomial logistic regression was conducted to examine the risk of major life stressors (negative change in income, employment, occupation, accommodation and relationship) in the prediction of experiences of violence, based on the analysis of gendered rates of violence across communities.

The analysis included 967 participants\(^a\) with a mean age of 56.5 (s.d. = 13.30, range, 18.3–87.7). The majority of participants were female ($n = 585, 60.5\%$). Participants were not found to differ between the three levels of affectedness in terms of gender, country of birth or employment status. However, participants in low bushfire-affected regions were on average slightly older than those of high bushfire-affected regions (although the effect size was small; Hedges’ $g = 0.21, F(244.72) = 0.07, P = 0.02$), and fewer participants in the low bushfire-affected communities had tertiary education than those in the medium and high bushfire-affected communities (24.4% in the low bushfire-affected group, 46.9% in the medium bushfire-affected group and 35.6% in the high bushfire-affected group; $\chi^2 (2, N = 967) = 16.10, P < 0.001$).

Since the 2009 bushfires, 5.3% of participants in the study reported experiencing assault or violence. Rates of participant reports of violence, and other life stressors experienced since the bushfires separated by region are provided in Table 1. A significant relationship was observed between region and experience of violence ($\chi^2 (2, N = 962) = 10.68, P = 0.005$). An inspection of the adjusted standardised residuals found an overrepresentation of individuals who experienced violence in the high bushfire-affected regions.

Although no significant differences were found in the reports of violence between males and females within each region or across the complete sample, differences emerged across regions. When rates of violence across regions were examined separately by gender, no significant differences in the proportions of reported violence across the three regions was found for males. However, among female participants there was a significant difference across regions ($\chi^2 (2, N = 581) = 11.67, P = 0.003$), with inspection of the adjusted standardised residuals indicating an overrepresentation of women who experienced violence in the high bushfire-affected region. As seen in Table 1, rates of women experiencing violence since the time of the fires were 1.0, 0 and 7.4% in low, medium and high bushfire-affected areas, respectively.

### Results

#### Predictors of violence against women in high bushfire-affected regions

Analyses then explored a series of predictors of experiencing violence among women residing in the high bushfire-affected areas ($n = 406$; model results are presented in Table 2). $\chi^2$ analyses were used to assess significant relations between violence and major life stressors. Proposed control variables (education level and relationship status) were not significantly related to experiences of violence, nor were changes in occupation (with a negative outcome), as some these variables were not included in the logistic regression model.

Change in employment (with a negative outcome; $\chi^2 (1, N = 403) = 7.15, P = 0.007$), change in accommodation (with a negative outcome; $\chi^2 (1, N = 403) = 9.06, P = 0.003$) and change in income (with a negative outcome; $\chi^2 (1, N = 402) = 15.97, P < 0.001$) were

---

\(\chi^2\): Chi-squared statistic. The symbol \(\chi^2\) is used to denote the chi-squared test statistic, which is a measure of how well a given model fits the observed data. It is calculated by comparing the observed frequencies with the expected frequencies under the null hypothesis.

\(P\): Probability value. This is the probability of observing the test statistic under the null hypothesis. A small P-value (typically less than 0.05) indicates that the observed data is unlikely to have occurred by chance, suggesting that the null hypothesis should be rejected.

\(a\): As this is a large-scale study, data collection was spread over a number of months. A trend was observed toward participants from low bushfire-affected communities completing the survey earlier. Further analysis (weighted for the different group sizes) indicated that this effect size was small. Upon investigation, the two pilot communities who completed the survey at an earlier time point were producing this trend, and when removed from the sample no differences were observed between timing of survey completion and community impact. As a result, this subset of participants ($n = 49$) are excluded from the initial analysis. Importantly, this produces no change in the significance of findings. Additionally, no relationship was found between the number of days between bushfires and survey completion, and reports of violence.
Molyneaux et al

Participant reports of assault or violence, and major life stressors according to severity of impact on region

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Independent variables</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assault or violence</td>
<td>16.4 (6.0%)</td>
<td>30.2 (6.7%)</td>
<td>6.2 (6.1%)</td>
<td>9.5 (6.1%)</td>
<td>26.4 (6.7%)</td>
</tr>
<tr>
<td>Negative change in accommodation</td>
<td>2.0 (3.8%)</td>
<td>0.0 (0.8%)</td>
<td>1.0 (1.0%)</td>
<td>0.0 (0.8%)</td>
<td>2.0 (3.8%)</td>
</tr>
<tr>
<td>Negative change in income</td>
<td>17.0 (4.2%)</td>
<td>2.0 (1.0%)</td>
<td>2.0 (1.0%)</td>
<td>2.0 (1.0%)</td>
<td>17.0 (4.2%)</td>
</tr>
<tr>
<td>Negative change in relationship</td>
<td>12.7 (4.2%)</td>
<td>1.0 (2.0%)</td>
<td>0.0 (0.0%)</td>
<td>0.0 (0.0%)</td>
<td>12.7 (4.2%)</td>
</tr>
<tr>
<td>Negative change in employment</td>
<td>1.2 (4.5%)</td>
<td>3.0 (4.2%)</td>
<td>3.0 (4.2%)</td>
<td>3.0 (4.2%)</td>
<td>1.2 (4.5%)</td>
</tr>
<tr>
<td>Negative change in occupation</td>
<td>3.4 (4.0%)</td>
<td>1.2 (2.0%)</td>
<td>1.2 (2.0%)</td>
<td>1.2 (2.0%)</td>
<td>3.4 (4.0%)</td>
</tr>
</tbody>
</table>

This analysis excludes 47 pilot participants as their data was collected at an earlier time point.

* In the Total column indicates a significant difference (P < 0.05) in rates across region for men and women combined.
** In the gender-specific column indicates a significant difference (P < 0.05) in rates across region for the gender specified.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Assault or violence</th>
<th>Odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.98 (0.95-1.01)</td>
<td></td>
</tr>
<tr>
<td>Negative change in accommodation</td>
<td>2.03 (0.92-4.49)</td>
<td></td>
</tr>
<tr>
<td>Negative change in income</td>
<td>4.68* (1.62-13.54)</td>
<td></td>
</tr>
<tr>
<td>Negative change in employment</td>
<td>1.20 (0.92-2.75)</td>
<td></td>
</tr>
</tbody>
</table>

* P < 0.004.

all found to be significantly related to reports of violence, and have endorsement rates within the sample of 31.5, 23.9 and 48.1%, respectively. Participants’ age was also found to be significantly related to experiences of violence and was therefore included as a controlling variable. Change in relationship (with a negative outcome; χ² (1, N = 398) = 9.30, P = 0.002) was found to be significantly related to experiences of violence among women in high bushfire-affected communities, showing an overrepresentation of women reporting a negative change in relationship and an experience of violence. However, the expected and actual count in some cells was very low, as was overall endorsement (12.7%), and as a result the decision was made to exclude this variable from the logistic regression.

The model significantly predicted reports of violence (χ² (4) = 23.09, P < 0.001), and found that experiencing a negative change in income since the fires predicted 4.68 times higher odds of violence among women residing in high bushfire-affected regions (Table 2). Other life stressors were not found to be associated with experiences of violence among this subgroup.

Mental health and heavy drinking across all regions

Regression weights for the variables in the fire-related and general PTSD, depression and heavy drinking models are presented in Table 3. All variables were assessed for excessive multicollinearity and Variance Inflation Factor (VIF) score ranges were 1.02-1.15 (for both male and female models), which is low and permits simultaneous inclusion in a regression equation. All models were statistically significant.

When accounting for clustering at the community level on standard errors, experiences of violence were found to predict increased depression symptoms and more severe PTSD symptoms among women but not men. As anticipated, fire exposure variables (loss of a loved one, property loss and fear for life) each uniquely contributed to increased fire-related PTSD symptoms among both men and women. Interestingly, after accounting for the predictive value of these variables, experiencing violence since the fires significantly predicted increased fire-related PTSD symptoms among women, but not among men. When community clustering was accounted for, experiences of violence were not found to predict drinking behaviours among men or women.

Table 2

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Assault or violence</th>
<th>Odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.98 (0.95-1.01)</td>
<td></td>
</tr>
<tr>
<td>Negative change in accommodation</td>
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<td></td>
</tr>
<tr>
<td>Negative change in income</td>
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<td></td>
</tr>
<tr>
<td>Negative change in employment</td>
<td>1.20 (0.92-2.75)</td>
<td></td>
</tr>
</tbody>
</table>

* P < 0.004.

Discussion

This study provides the first evidence of the overrepresentation of individuals reporting post-disaster experiences of violence in high disaster-affected communities compared with communities with lower levels of disaster-affectedness. Closer examination of this association reveals that the relationship between severity of impact and experiences of violence appears to be confined to women, with 7.4% of women in high bushfire-affected areas reporting experiencing violence in the 3–4 years following the bushfires,
Table 3: Linear regression predicting severity of mental health symptoms for men and women, accounting for clustering at the community level

<table>
<thead>
<tr>
<th></th>
<th>PTSD fire-related</th>
<th>General Major depression</th>
<th>Heavy drinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTSD fire-related</td>
<td>22.5%***</td>
<td>14.5%**</td>
<td>6.7%*</td>
</tr>
<tr>
<td>General</td>
<td>31.8%**</td>
<td>22.0%**</td>
<td>8.0%**</td>
</tr>
<tr>
<td>Major depression</td>
<td>11.6% (0.10, 0.15)</td>
<td>8.2% (0.08, 0.09)</td>
<td>3.8% (0.03, 0.04)</td>
</tr>
<tr>
<td>Heavy drinking</td>
<td>14.7% (0.12, 0.15)</td>
<td>8.2% (0.08, 0.09)</td>
<td>3.8% (0.03, 0.04)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>β (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.01 (0.01 to 0.02)</td>
</tr>
<tr>
<td>Disasters-related property</td>
<td>-0.01 (-0.03 to 0.01)</td>
</tr>
<tr>
<td>Disaster-related loss</td>
<td>0.08 (0.04 to 0.12)</td>
</tr>
<tr>
<td>Disaster-related fear for losses</td>
<td>0.14 (0.15, 0.16)</td>
</tr>
<tr>
<td>Cumulative major life stressors</td>
<td>0.23 (0.20, 0.26)</td>
</tr>
</tbody>
</table>

* Significant at p < 0.05
** Significant at p < 0.01
*** Significant at p < 0.001

Interpersonal violence after disaster

Consistent with existing literature, a relationship was observed between experiences of violence and poor mental health. Experiences of violence since the bushfires were associated with increased symptoms of PTSD and depression among women 3–4 years after the disaster, even when controlling for the predictive validity of potentially traumatic fire-related experiences and other life stressors. These results reflect those reported elsewhere for women in the post-disaster context (both men and women, and women specifically) and in literature on the relationship between post-disaster life stressors and mental health. Among men, experiences of violence were not found to be associated with PTSD or depression; this did not reflect existing research on the observed association between experiences of violence and PTSD (for both men and women, and men specifically) and depression. It should also be considered that given the cross-sectional nature of this data, those experiencing poor mental health may be at increased risk of experiencing violence. Further longitudinal research would be required to clarify the direction of this relationship.

The unique profiles of association between experiences of violence and mental health outcomes for men and women could be the product of gender-specific experiences of violence. As reflected in the existing literature, gender-based forms of violence (such as sexual violence and IPV) increase in the acute and longer-term aftermath of a natural disaster. A range of factors may contribute to this, such as pre-disaster experiences of violence, specific peri-disaster and post-disaster experiences and stressors, relationship adjustment and non-physical forms of intimate partner abuse (verbal and psychological). The findings from this study identify reductions in income as the most salient stressor with respect to this risk.

The findings of this study have implications for the assessment of risk and prevention of disaster-related violence, especially among women. In particular, this research indicates that women should be considered for preventative and post-disaster support and interventions regarding violence within communities at risk of, or recently experiencing, bushfires. That the strongest predictor of women’s experience of violence in the high bushfire-affected area was a negative change in income suggests that subsequent financial stress ought to be identified as a risk factor in post-disaster violence. However, it should be acknowledged that because of the cross-sectional nature of this data, it is not possible to identify the exact causal relationship between income and experiences of assault; it is also plausible that both violence and mental health may be influenced by underlying socioeconomic deprivation in the post-disaster setting and that experiences of violence may cause women to leave relationships, in turn negatively affecting the women’s income. In addition, the context of data from previous research that links pre-disaster and post-disaster victimisation, these findings highlight the need raise awareness and to monitor and support those members of the community already at risk of IPV. This is especially important considering the gender-specific burden of violence on...
mental health, which has pressing implications for women’s ability to recover from disaster experiences in the longer term. In conclusion, this study examined prevalence of violence across regions with varying levels of disaster impact. It highlighted important gender distinctions in both the experience of violence, and the association between violence and mental health post-disaster. The findings showed an increased post-disaster risk of violence for women residing in high bushfire-affected regions compared with lesser affected areas. Negative changes to income (a core feature of the social disruption that follows a major disaster) was identified as a particularly important indicator of risk and may provide a target for intervention. Furthermore, reports of violence among women increased the severity of mental health symptoms, suggesting that post-disaster experiences of violence may impair women’s ability to recover from disasters. These findings have critical implications for future research and for the assessment of, and interventions for, women experiencing or at risk of violence in the post-disaster context.

Limitations

The authors acknowledge several limitations to this study. First, to permit comparison between variably affected communities, a system of categorisation of community exposure was formulated at the community level, based on severity of bushfire damage to property and fatalities. This measure did not incorporate individual exposure variables (although these were measured separately, and included in analysis of the third research question). With regards to response rates within these community groupings, it is acknowledged that response rates were lower for low bushfire-affected communities (approximately 9.5% for low bushfire-affected, 11.8% for medium bushfire-affected and 18% for high bushfire-affected communities), and this results in an overrepresentation of individuals from more highly bushfire-affected communities within the study sample. Although all efforts were made to ensure equivalence across regions in Socio-Economic Indexes for Areas, community size and remoteness when recruiting from communities, it is possible that these response rates may bias the sample. When compared with census data from the participating communities (Australian Bureau of Statistics, 2011 community profiles), the study sample as a whole was found to have a significant overrepresentation of women and was older than the population data suggests for residents in these regions. This pattern was also reflected across the low, medium, and high bushfire-affected communities separately. As limited data were collected relating to individual sociodemographic factors, it was not possible to compare these in detail across community impact groups within the data-set, and as such it must be acknowledged that the results of this study may reflect a more general relationship between violence and socioeconomic deprivation. Additionally, although overall sample size for this study was large, because of the overrepresentation of women and participants from high bushfire-affected communities and rates of violence reported, some groups within the analysis were small. This limitation restricted the analysis and number of independent variables that could be investigated, and so further research should investigate these relationships within a larger sample.

Second, the measure used in this study to assess violence was general in nature and did not ask participants to provide any detail on the type of violence they experienced, its repetition or frequency, who perpetrated it or whether experiences of violence were present before the bushfires. As such, it is not possible to conclude whether the violence they experienced was perpetrated by someone known to them (such as a partner, constituting IPV), the gendered nature of this relationship or someone unknown to the respondent. Depending upon the individual respondent’s interpretation of the question and their personal experience, it is possible that this broad measure of violence may have led to underreporting of violence (or less probable, but possible overreporting). Future research should seek to investigate this relationship among specific forms of violence more closely, as it may shed light on the gender-specific vulnerabilities to violence in the post-disaster setting (in line with other literature). In line with this, research should also consider the role of family violence and violence against children. Additionally, it should be acknowledged that PTSD was assessed using a short form four-item version of the PCL, although this has been shown to have good diagnostic efficiency in the literature. Third, as previously noted, the data used in this study were cross-sectional, therefore causality cannot be inferred between reported experiences of post-disaster violence and the development of the assessed mental health conditions and heavy drinking. This also applies to the relationship between negative changes to income and experiences of violence. Finally, it is acknowledged that the data used within this paper represents individuals who are clustered within communities. Although there are many ways in which to analyse such data, one of which was used in this paper, future research would be well placed in examining such relationships between community-level disaster impact and experiences of violence through more involved hierarchical or multilevel forms of modelling, to best represent this inherent structure. Although acknowledged as a limitation of this current study, it is believed that the findings presented here provide important insight into violence post-disaster that has not been reported previously. It is hoped that further research will further investigate the incidence and nature of violence in the post-disaster setting.

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Author contributions
R.M. contributed to conception and design of paper, conducted analysis and interpretation of data, initial and subsequent drafts of paper, along with revision of article and final approval of the version to be submitted for publication. L.G. contributed to discussions about the conception and design of the paper and the variables for inclusion in the analysis, reviewed and critiqued the draft paper providing constructive suggestions about terminology and interpretation of findings, and provided final approval of the version to be submitted for publication. K.H. contributed to discussions about the conception and design of the paper, extensive critical revision of drafts and final approval of version to be submitted for publication. C.H. contributed to discussion of data and paper conception, interpretation of results, critical revision and addition of content to article, and final approval of version to be submitted for publication. K.H. contributed to discussion of results and aid in interpretation, critical revision of article and final approval of version to be submitted. C.K. contributed to conception and design of the study as well as analysis, responses to prior reviewer requests and comments, revision of drafts and final approval of the version to be submitted. K.B. contributed to conception and design of the paper, contributed to drafting and approval of final version for submission. K.H. contributed to discussions about the conception and design of the paper, reviewed and critiqued the draft paper providing constructive suggestions about the framing and interpretation of findings, and provided final approval of the version to be submitted for publication. L.G. contributed to conception and design of the paper, reviewed and critiqued the draft, and provided final approval of the version to be submitted for publication. N.A. was involved in design and analysis and interpretation of the data, revision of the article and approval of the final version to be submitted for publication. D.F. made substantial contribution to conception and design of the paper, analysis plan, interpretation of data, drafting and revising the article, and final approval of the version to be published.

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