Strategies to enhance resilience post-natural disaster: a qualitative study of experiences with Australian floods and fires

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ABSTRACT

Background Disasters have a significant impact on mental health that may be mitigated by promoting resilience. This study explores the lay perspective on public health interventions that have the potential to facilitate resilience of adults who experience a natural disaster.

Methods Semi-structured interviews were conducted 6 months post-disaster between June 2011 and January 2012 with 19 people who experienced the 2010/11 Victorian floods. Twenty lay witness statements from people who presented to the 2009 Victorian Bushfires Royal Commission were also selected for analysis. Transcripts were analysed using an interpretive and comparative content analysis to develop an understanding of disaster resilience interventions in an ecological framework.

Results The participants identified resilience focused interventions such as information that help individuals manage emotions and make effective decisions and plans, or enable access to resources; face-to-face communication strategies such as public events that restore or create new social connections; rebuilding of community capacity through coordination of volunteers and donations and policies that manage disaster risk.

Conclusions Disaster recovery interventions designed within an ecological model can promote a comprehensive integrated systems approach to support resilience in affected populations.

Keywords fire, flood, interventions, natural disaster, qualitative research, resilience

Introduction

The state of Victoria, Australia has a long history of floods and fires. In January 2009, Victoria experienced a decade of drought and a severe heatwave. This was the precursor to 316 fires resulting in the death of 173 people, and innumerable people devastated by loss in February 2009.1 Seventeen months later, Victoria experienced heavy rain in September 2010 resulting in at least 200 Victorians evacuating due to rising river water.2 Heavy rainfall (up to 300 mm) fell over the next 4 months across two-thirds of the state during January 2011.2 This led to flooding of over 100 towns,2 and one recorded death.3

Disasters such as these result in significant public health problems that include serious psychological harm in the exposed population.4,5 The public health implications are likely to become more significant as climate change leads to more natural disasters.6 The challenge for public health policy and practice is to minimize the number of individuals affected and optimize outcomes for the population. This study explored the usefulness of resilience as a salutogenic approach
to respond to natural disasters and mitigate adverse mental health outcomes.

The Hyogo Framework for Action 2005–2015, the International Strategy for Disaster Reduction7 and the Australian National Strategy for Disaster Resilience8 promote resilience-based policy to achieve better outcomes to natural disasters. Policy translation to practice requires an understanding of the concept of resilience to be integrated into effective strategies. To date, the literature has focused on describing resilience and how to measure it. Very little work has been done to establish whether strategies to promote resilience achieve the desired outcomes. While the term ‘resilience’ is used within policy and strategy documents, it remains a contested term used in a range of disciplines. Human resilience research has developed an understanding of risk and protective factors for individual, or community resilience, but a socio-ecological view of resilience suggests strategies implemented in a population approach should address multiple system levels.

Bronfenbrenner’s human ecological development theory has been used in resilience research to analyse the human experience, including the multiple dimensions of the social world.9 Previous research using Bronfenbrenner’s theory has investigated different populations such as older people10 and children11,12 to describe resilience in a typology of nested systems of child/adult, family, community and society. Bronfenbrenner’s theory has also been used to explain the experiences of people in a disaster13,14 and categorized measurable factors of community resilience.13

The experience of people post-disaster can supplement scientific knowledge. This fundamental public health principle15 supports a qualitative approach to use lay knowledge to transfer information to the scientific community and consequently policy and practice.16 The aim of this study was to explore, from the lay perspective, the nature of interventions which aid resilience in people who have experienced a disaster in the Australian context.

**Methods**

**Theoretical framework**

Bronfenbrenner’s model describes the ecological environment as ‘a set of nested structures, each inside the next, like a set of Russian dolls’ (Fig. 1) (p. 3).17 There are five levels that direct an analysis of the effect of the environment on the person.17 The innermost level is the microsystem and consists of the immediate setting, where the person engages in activities either independently or with others. The microsystem is nested within the next level known as the mesosystem, which contains the multiple settings in which the individual participates. The third level, the exosystem, considers distal settings where the individual does not participate, but where events occur that affect the individual. The macrosystem refers to overarching patterns of ideology or social organization that affect the individual.17 The final level the chronosystem incorporates the dimension of time into the analysis.9

**Participants and recruitment**

The study sample included 19 people who experienced flooding in the 2010/11 season and 20 people who provided witness statements to the 2009 Victorian Bushfires Royal Commission. Royal Commissions are the highest form of inquiry on matters of public importance in Australia. Two data sets were sought to triangulate sources and add credibility to the findings. Interviews were conducted as there were no existing documents available for people exposed to the floods. The bushfire witness statements were chosen because they allowed existing data to be used, rather than imposing a burden on people through asking them to retell their stories. Although the two sources of data were provided for different purposes, both sets were rich detailed accounts of disaster experience and enabled an in-depth analysis.

Communities that had experienced flooding were identified through media reports and a sample (4) selected to ensure diversity of perspectives based on exposure to the flooding, previous flooding experience and socioeconomic factors (e.g. income, education) previously identified as associated with community resilience (Table 1).5,21 The six communities represented by the Royal Commission witness experienced severe bushfire conditions. The Index of Economic resources for the 10 communities (4 flood communities and 6 bushfire communities) ranged from a low level (2) to a moderate level (9) and were slightly higher for the fire affected communities.18 Geographic diversity scores (Accessibility/Remoteness Index of Australia—a continuous measure 0–15 of road distance to the nearest centre22) ranged from 0.4 (accessible) to 2.8 (moderately accessible) and was lower for the fire sample.

Initial recruitment of people who experienced flooding occurred through advertisements placed in local newspapers and flood recovery newsletters. Further snowballing ensured the sample broadly represented socio-demographic factors associated with individual resilience such as age, sex, education, ethnicity and employment status (Table 2).5 The bushfire witness statements were selected on the basis of being information rich in relation to interventions supporting resilience and diversity on socio-demographic factors (Table 2).

**Data collection**

The flood interviews were conducted between July 2011 and January 2012 (6–12 months post-floods). The bushfire
witnesses provided their statements to the Victorian Bushfires Royal Commission 6–12 months post-disaster. This period is considered to be within a resilience timeframe (as opposed to a recovery timeline). The first interviews were held with Flood Recovery Officers as key informants to gather contextual information. Each person was interviewed once for approximately an hour, and the interviews were recorded and transcribed with consent. Memo notes recorded initial interview impressions and decisions during analysis. Each participant was offered the opportunity to review their transcript and one key informant removed some personal reflections. The semi-structured interviews used open-ended questions to explore the informant’s life history and place their disaster experience into context. Probing questions were used to delve into the details of the experience and understand the impact. Clarifying questions were asked to encourage the informant to reflect on the meaning of the experience.

Ethics approval for the interviews and the use of transcripts was gained from the Flinders University and Southern Area Health Service Social and Behavioural Research Ethics Committee on the 9th of May 2011.

Data analysis

The transcripts were imported into NVivo 8 (QSR International PTY Ltd. Australia) to manage the data. The content analysis procedure was guided by Hsieh and Shannon. Each member of the team contributed to the initial coding and discussions were held to explore similarities and differences, challenge assumptions and develop labels for the emerging codes until consensus was reached. The Bronfenbrenner framework was used to organize the data into a series of concept maps. Credibility of the findings was further supported by the triangulation of researchers, prolonged engagement with iterative reading of the transcripts and considering negative cases. Finally,
<table>
<thead>
<tr>
<th>Exposure factor</th>
<th>Flood sample</th>
<th>Fire sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Community A</td>
<td>Community B</td>
</tr>
<tr>
<td>Index of economic resources(^18)</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Remote geographic location(^19)</td>
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<td>0.8</td>
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<tr>
<td>Flood history(^20)</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Property loss(^1)</td>
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\(^a\)Interview data.
the transcripts were reread by author G.v.K. to verify the final structure with the original data.

Results

The characteristics of all participants were collated and compared with the population of Victoria to assist the sampling process (Table 1). The 2009 Victoria Bushfires Royal Commission transcripts included a description of a number of characteristics as the witness introduced themselves, but this information was not provided by all witnesses. From the data available it can be seen that a greater number of older people than the state population average and more women (61.5%) than men (38.5%) contributed to the findings. The sample was educated to a higher level than the average Victorian but the full-time employment rate was less than the state average.

Quotations from the interviews transcripts are provided in Table 3 as evidence of the results.

Rebuilding as the central outcome for resilience

A common theme of Getting on with rebuilding as the central outcome sought from interventions emerged from the data. Getting on with rebuilding occurred at all levels of Bronfenbrenner’s nested systems. Within the home (microsystem), outcomes included reconstructing the house as a place of safety and a haven, or re-establishing a sense of place, which contributed to rebuilding personal identity. People strived to restore social networks (mesosystem) through processes, such as assisting

Table 2 Participant characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Flooded interviewees (n = 19)</th>
<th>%</th>
<th>Fire witness (n = 20)</th>
<th>%</th>
<th>Population of Victoria (2006), %</th>
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<td></td>
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<tr>
<td>25–44</td>
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<td>23.5</td>
<td>2</td>
<td>10.1</td>
<td>28.8</td>
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<tr>
<td>45–64</td>
<td>8</td>
<td>47.1</td>
<td>5</td>
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<td>23.5</td>
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<td>13.6</td>
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<td>11.8</td>
<td>8</td>
<td>40.0</td>
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<tr>
<td>Gender</td>
<td></td>
<td></td>
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<tr>
<td>Male</td>
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<td>42.1</td>
<td>7</td>
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<td>8</td>
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<td>2</td>
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<tr>
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<td>15.8</td>
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<td>20.0</td>
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</table>

*Incomplete data available for fire sample.

*Could indicate >1, e.g. volunteer and working.
Table 3 Interview and transcript quotations

**Microsystem interventions**

- If we get good news [to a funding proposal], we will at least have a chance to start rebuilding our lives. (fire witness 24—male)
- The second time a lot of psychological support which I didn’t think was necessary until the later part when I realised that the only people who really need to listen or want to listen or want to help are the flood recovery people, no one else has any idea or gives a shit. (flood informant 6—female)

**Mesosystem interventions**

- I learnt that the essential element of sustainable recovery is to find and engage with the strengths and networks that existed in a community before the disaster. Every community has something that works for them and that they value. It is worth taking the time to identify and connect with those networks and to build on the pre-existing strengths wherever possible. (fire witness 20—female)
- …the lady from the Flood Recovery office in [town] has been covering council money the cost of people turning up for a cuppa on, once a fortnight. Just so you can sit down, relax a bit, talk a bit with people about whatever and also she will pass on any information about floods that she has at the time. (flood informant 7—female)

**Exosystem interventions**

- Sandbags were not overly available and there is somewhat a bit of anger about that. There are stories of sandbags being available but locked in a shed, shire shed and so on. So there was a fair bit of, there is some accusation of incompetency with regards to the prevention of this, and why were we flooded and why weren’t we given more warning and so on and I think that adds to the trauma, part of the anger I suppose. (flood informant 3—male)
- [name] and I have also been involved in the [area] Development Group, which has worked with companies like [company] on establishing semi-permanent accommodation in [town] so that residents can return there and rebuild the local community. (fire witness 34—female)

**Macrosystem interventions**

- If the Government took out appropriate insurance, this would send a positive message to the rest of the community about responsible risk management. It would also alleviate a major cause of community anger after fire events. (fire witness 27—female)
- One of the people down the road, [name] didn’t get flooded but they gave her money and that was what I am saying they handed it out willy-nilly and they gave her flood recovery money. She came up here and said here you have my share because you deserve it more. (flood informant 18—male)

**Chronosystem**

- …we had a [volunteer] come along about 4 or 5 weeks ago and she said I have been sent by the shire to see if you need anything. I said it is nice of you to come but it just seems too late like when, it seems now there are people coming from everywhere that there are things set up for counselling, there donated blankets and furniture, but you can’t wait 6, 7, 8, months for—you need it then. (flood informant 2—female)
- We spent five months just hanging around. Because of the delay, some of the business people who were initially interested in being involved in the project gave up on [town] and set themselves up somewhere else. I have also observed that the morale of the remaining business community has been dented by the delay and the constant disappointments it has caused. (fire witness 25—male)

neighbours, which rebuilt connections and helped make new friends. Rebuilding community resilience (exosystem) relied on capacity building and fulfilling societal expectations of disaster hazard management and reconstruction of the damage to the environment (macrosystem). The dimension of time was inferred by getting on with people describing their ability to respond as occurring at different stages in the recovery process. Early access to external resources appeared to assist with reconstruction of damaged property.

**Microsystem interventions**

Rebuilding personal identity occurred when individuals were supported in the reconstruction of the damage to their home and lives. This occurred when they received information that either helped them to manage their emotions and consequently make effective decisions and plans, or enabled access to material and instrumental resources to support planning for their future.

Psychoeducation was provided by presentations from an experienced psychologist or via websites. The key informants commonly made positive references to the value of the psychoeducation sessions but acknowledged that attendance was not high, and this matched the low reported use by the participants. However, the people who attended a psychoeducation session reported making a number of decisions based on their new knowledge. Participants indicated a preference for psychoeducation provided in face-to-face sessions compared with websites, which were reported as unhelpful.

**Mesosystem interventions**

Social networks were restored by interventions that encouraged personal communication and linked individuals to others in their mesosystem. There was a pattern of preferring face-to-face communication as this restored social connections and helped to create new connections. Making new friends increased community involvement and social sharing. New interpersonal relations were developed at recovery centres between people seeking refuge, and staff and volunteers. Recovery centres arranged social events that created...
emotional support. Post-disaster public meetings were reported to be an effective means for supporting networks. Evacuated participants consistently described how being evacuated weakened their connections, which motivated early return to their communities.

**Exosystem interventions**

Participants’ resilience relied on the rebuilding of community capacity through activities that optimized the effectiveness of information distribution, material help and emotional support. Recovery centre staff facilitated access to the numerous sources of assistance. They supported an individual’s ability to negotiate through numerous aid providers to access the assistance they were eligible for. Recovery officers used a community development model to rebuild social and physical community structures. Relief agencies such as the Australian Red Cross and the Salvation Army coordinated help from the wider community in the form of volunteers and donations. This practical assistance also increased the capacity of communities to identify and support vulnerable and isolated individuals.

Participants attributed local government preparation and planning systems (e.g. making sandbags available, managing road side fuel load and road access) as external events that influenced their capacity to protect their home. The formation of new governance groups contributed to capacity building as they sought to influence the control of the allocation of resources and decisions affecting the future of the community.

The media (e.g. Internet, TV, radio) played an important role in communication between the disaster area and the community to enable access to volunteers and donations of resources. However, participants’ expectations about access to up-to-date information during the event from the media were not met.

** Macrosystem interventions**

The flood and bushfire participants highlighted the respective influence of waterway infrastructure and bushfire hazards policies and practices on their ability to rebuild. The establishment of the 2009 Victorian Bushfires Royal Commission appeared to convey a sense of care that was important for resilience. The actions of the governments in providing grant support was recognized as helpful, while the insurance system was experienced with mixed results. Suggestions included a flood warden system or a central disaster website contributed to by the public.

**Chronosystem interventions**

It was important to many of the participants that interventions were provided promptly. While grateful for all the support received, many participants had concerns about how long it took for grants and recovery centres to become established. Many of the participants recognized a significant degree of diversity in terms of when people were ready to access interventions, and suggesting the need for flexibility.

**Discussion**

**The main findings of this study**

This study demonstrated that people who experience a natural disaster sought interventions from multiple system levels over time to support an outcome of rebuilding in its broadest sense.

**What is already known on this topic**

The importance of reconstructing damaged housing, obtaining food and shelter and other survival strategies have been already observed as important microsystem interventions for individual resilience. Psychoeducation has some limited evidence but its reach is affected by low attendance. Successful communication is integral to social networks in the mesosystem but the success of information from technology in a disaster has been shown to be limited by access. Even where access to information technology is high, it can be reduced by destruction of home contents, poor or no internet or mobile connection and loss of power.

Social networks have been supported through activities that encourage engagement with others in the community such as meetings and rituals. Public meetings can be effective in supporting communities to connect, grieve and celebrate as required. Evacuees are particularly vulnerable to disrupted networks, but have more positive emotions when kept in their community groups. Creating new friends at a recovery centre has been found to contribute to resilience.

The role of volunteer and donations has been recognized and assistance from the wider local, national and international communities in the exosystem influences resilience.

**What this study adds**

This study provides insight into the resources that people value as supporting resilience after flood and fire in Australia. Consequently, this study provides service providers with a number of strategies at multiple system levels that are perceived to support resilience by those who have experienced a natural disaster.
Communication interventions rebuild connections and provide vital information. The participants relied on face-to-face contact, contrasting with other studies on multi-media. The participants did not use newsletters, leaflets and posters as reported elsewhere.\textsuperscript{32,42,43} The role of social media is gaining increasing attention, so future research should consider its roles in information dissemination and supporting resilience through emotional support. Given the risk disasters pose to communication technologies, and the possible risks about misinformation,\textsuperscript{44} multiple strategies that include systems that are less vulnerable to disaster damage are required.

Planning should incorporate strategies to manage the transition and emotional consequences of removing people from their home, or denying them access to their home when implementing roadblocks. Strategies that maintain social networks between evacuees and people remaining in the local community and broader macrosystem are important. Media and leadership training should incorporate communication skills for managing community emotions such as anger. Disaster planning needs to include contingencies to support those service providers and leaders suffering loss themselves.

The recovery centres modelled a community development approach to disaster recovery and rebuilding community capacity that enabled access to support from the broader community and government. Pre-planning the resourcing and establishment of recovery centres may enable a faster response.

Limitations of this study
The sample was biased towards older people. This is not surprising given previous research has established that older people may be more resilient and so may be more likely to agree to participate in research or present at a Royal Commission. It may be that younger people chose other forums to share their experiences with the wider community. Consequently, it cannot be claimed that this research reflects their experiences or needs. No participant in either sample identified themselves as being an Aboriginal or Torres Strait Islander and the representation of people born overseas is below the state percentage (although consistent with representation in rural communities). This suggests that the role of culture could not be adequately observed in this sample. Data collection was limited to a single point in time and so does not account for the possible change in perceptions of the participants throughout the disaster experience. The experience of participating in the flood interviews as semi-structured with one interviewer was different from the unstructured public witness process. However, the issues raised in both sets of transcripts were surprisingly similar, and both groups conveyed a similar purpose of sharing their experience might contribute positively to future disaster management. Finally, relying on bushfire witness statements meant it was not possible to explore, clarify or confirm emerging issues.

Conclusion
This study was an exploratory qualitative analysis giving voice to lay knowledge regarding the nature of interventions which aid resilience in people who have experienced a disaster in the Australian context. The findings have been synthesized within a model of ecological disaster resilience to describe a key outcome of getting on with rebuilding for the participants who experienced a bushfire or flood. The model facilitates the translation of scientific and lay understanding of resilience to provide direction for disaster management services aiming to address the consequences of psychological harm.

Authors’ contributions
G.v.k. carried out the interviews and drafted the manuscript. Each author participated in the design of the study, the analysis of the data and preparing the manuscript. All authors have read, revised and approved the final version.

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