




# BMJ Open Exposure to risk and experiences of river flooding for people with disability and carers in rural Australia: a cross-sectional survey

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## ABSTRACT

**Objectives** In this paper, we explore the exposure to risk and experiences of people with disability and carers during a flooding event and the subsequent mental health impacts.

**Design** A cross-sectional survey between September and November 2017. Binary logistic regression models were used to investigate associations between the mental health of people with disability and carers and their exposure to the flood. Inductive content analysis was used to analyse qualitative data.

**Setting** Flood-affected communities in the rural area of Northern Rivers, New South Wales, Australia, 6 months after river flooding in 2017.

**Participants** People over 16 years and a resident in the Northern Rivers at the time of the flood were invited to participate. Using a purposive, snowballing sampling technique participants were drawn from a wide range of socioeconomic backgrounds and had experienced different degrees of flood exposure.

**Results** Of 2252 respondents, there were 164 people with disability and 91 carers. Both groups had increased odds of having their home flooded (people with a disability: OR 2.41 95% CI 1.71 to 3.39; carers: OR 1.76 95% CI 1.10 to 2.84). On evacuation, respondents reported inaccessible, conflicting and confusing information regarding flood warnings. Essential services such as healthcare and social services were disrupted (people with a disability: OR 3.98 95% CI 2.82 to 5.60; carers 2.17 95% CI 1.33 to 3.54) and access to safe and mould free housing post flood event was limited. After taking sociodemographic factors into account, respondents with a disability and carers had greater odds of probable post-traumatic stress disorder compared with other respondents (people with a disability: 3.32 95% CI 2.22 to 4.96; carers: 1.87 95% CI 1.10 to 3.19).

**Conclusion** Our findings show the profound impact and systemic neglect experienced by people with disability and carers during and after the 2017 flood event in the Northern Rivers. As people with disability will take longer to recover, they will require longer-term tailored supports and purposeful inclusion in flood preparedness and recovery efforts.

## INTRODUCTION

The severity and frequency of fluvial (river) floods are likely to increase as a result of a warming climate, intensified hydrological

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This study addresses an important gap in the literature on reporting how people living with disability and carers exposure to risk and experience of disasters such as fluvial floods in Australia.
- ⇒ As people with disability and carers may be difficult to reach, a study strength was the use of purposive sampling, utilising a snowball technique recruiting respondents via personal and local organisational networks.
- ⇒ Our sampling approach, though necessary to meet the aims of this study, constrains our ability to generalise our findings to the broader population.
- ⇒ Though brief versions of validated screening tools were used to assess psychological outcomes, they are not clinically diagnostic—our data, therefore, indicate ‘probable’ diagnoses.

cycles and land development.<sup>1–4</sup> As climate change progresses, attention to the public health consequences of extreme weather events is urgently needed.<sup>5–7</sup> Weather-related disasters, including flooding, have been linked to increased prevalence of mental health disorders such as post-traumatic stress disorder (PTSD), anxiety and depression.<sup>5–18</sup> However, a systematic review by Fernandez *et al* concluded that there is limited mixed-methods research about the mental health impacts of fluvial flooding.<sup>10</sup>

Socially vulnerable populations are disproportionately impacted by flood events including home inundation, evacuation and displacement.<sup>9 19–22</sup> Viewed from a social vulnerability perspective, flood events intersect with social, cultural, economic and other factors (eg, age, gender, poverty and disability) to shape people’s exposure to risk and their ability to prepare for, respond to and recover from extreme events.<sup>23 24</sup> Research grounded in this perspective posits that unequal disaster-related consequences

are experienced by different populations because of pre-existing disparities in the socioeconomic system. Individuals with disability and their carers are often among these populations as their circumstances render them vulnerable.<sup>25</sup>

There is an increasing body of literature on disability and disaster, mostly reporting North American research<sup>26 27</sup> with little Australian research on the topic.<sup>28 29</sup> Research shows that individuals with disability experience higher risk of death,<sup>25 30</sup> disruption to support networks,<sup>31</sup> injury and loss of property during floods,<sup>32</sup> increased challenges while evacuating<sup>27 33 34</sup> and sheltering.<sup>35</sup> These people also take longer to recover, requiring more intensive case management support postdisaster.<sup>36–38</sup> For example, in their examination of reports from disaster case workers, Stough *et al* found that while people with disability had the same postrecovery needs as others, they required far greater support in obtaining access to the services they needed, such as housing, medical services and transportation.<sup>38 39</sup> In comparison to research on people living with disability, the empirical research on how carers are impacted by weather related events is sparse,<sup>40 41</sup> and virtually non-existent regarding impact of fluvial flooding events.

We investigated the experiences and mental health impacts of river flooding on people with disability and carers, in an Australian rural location at 6 months postflooding. Specifically, we will answer the following research questions: (1) What were the associations between different flooding exposures and mental health impacts at 6 months after a major flooding event and (2) What was the likelihood and experience of being flooded, evacuated, displaced and having disrupted access to food, healthcare and social services? In doing so, we will enable identification of opportunities to mitigate risk and inform strategies to strengthen preparedness efforts, along with response and recovery to future flooding.

## METHODS

### Study setting

The Northern Rivers region of New South Wales, Australia, is a flood-prone rural area that experienced more than 30 flood disaster declarations between 2004 and 2014.<sup>19</sup> In 2017, ex-Tropical Cyclone Debbie brought record-breaking rainfall to the region that caused widespread flooding in local business districts and residential areas on a scale not seen in more than 40 years.<sup>42</sup> The Northern Rivers takes in areas with relatively high levels of social vulnerability.<sup>21 43</sup> There is a higher proportion of people with disability (24.8%) and carers (13.8%)<sup>44</sup> compared with the Australian average of 17.7% and 10.8%, respectively.<sup>43</sup> On average 6.5% of the Northern Rivers population required assistance with core activities compared with the Australian average of 5.1%.<sup>44</sup> Rolfe *et al* demonstrated that 82% of people living in the 2017 flooded areas in the town of Lismore (a major service centre in the Northern Rivers) were in the socioeconomically lowest quintile.<sup>21</sup>

### Study design

This study draws on data from a cross-sectional survey undertaken between September and November 2017, 6 months after river floods in the Northern Rivers region, which included an exploration of the experiences and mental health outcomes of people with disability and their carers who experienced this flooding event.

A detailed description of the study design has been published elsewhere.<sup>45</sup> Design and reporting of our study was guided by the Strengthening the Reporting of Observational Studies in Epidemiology Statement<sup>46</sup> and the Standards for Reporting Qualitative Research.<sup>47</sup>

### Patient and public involvement

This study benefited from being grounded in a community–academic partnership, which was key to its research design, implementation and dissemination/translation, particularly in facilitating recruitment and supporting respondents' participation. Further detail on this partnership can be found in the study protocol.<sup>45</sup>

### Data collection

Community members who were 16 years and older and resident in the Northern Rivers at the time of the flood event were invited to participate regardless of whether or not they felt affected by it. We aimed to recruit participants from a broad cross-section of the community, with a wide range of socioeconomic backgrounds, and who had experienced different degrees of flood exposure. We used a purposive snowballing sampling technique, where community advisory groups and other community networks, service providers and local government staff assisted in promoting the survey and offered support and encouragement for people to complete it.<sup>45</sup> Given the known differential impact of flooding on socially vulnerable groups this approach was particularly important to ensure engagement of hard-to-reach, socioeconomically vulnerable populations groups such as Aboriginal and Torres Strait Islander people, people with disability and carers. The sampling strategy was therefore not intended to provide a representative sample of the broad Northern Rivers population, but rather to ensure participation by 'hard to reach' groups in the population.

To maximise participation in the survey a number of techniques were implemented including: leaflet drops and door-to-door data collection in a sample of random neighbourhoods in the most affected areas; social and local media campaigns; and a prize draw. The survey was available in online and printed formats.

The study cohorts were identified from two sociodemographic survey questions:

1. An income support question: 'At the time of the flood, were you receiving any income support from the government?' Respondents who reported receiving the Australian Government disability support pension or a carer's allowance were included. To be eligible for the disability support pension, an individual needed to be assessed as having a permanent physical, intellectual or

psychiatric condition restricting their ability to work.<sup>48</sup> To be eligible for a carer's allowance the recipient had to be assessed as engaged in the constant care of someone with a severe disability or illness or who was frail aged.<sup>49</sup> Both support payments depended on the individual's level of income and assets (for carer support, this included both the carer and the receiver of care).

2. A multiple-choice question describing current circumstances if not in paid employment—for example, looking for paid work, in full-time education, looking after family/children—that included 'Unable to work due to long-term sickness or disability'. Respondents who selected this response option were added to the people with disability cohort, as it covered those who may not be eligible for the disability support pension.

### Sample

A total of 2530 people responded to the survey, 278 (11%) of whom were excluded from data analyses because of missing carer or disability status data, leaving a final sample of 2252. A sensitivity analysis was conducted that showed minimal differences in the patterns of results between flood exposure and mental health outcomes for the full dataset and the dataset with missing socio-demographic records removed.<sup>9</sup> Seven per cent of respondents (n=164) identified as having a 'long-term sickness or disability' and 5% (n=117) were carers. There were 26 respondents who were both a carer and a person with disability. For this analysis, we ensured two mutually exclusive groups were identified, we therefore removed these 26 respondents from the 'carers' group (n=91) and retained them in the 'disability' group (n=164). This was a pragmatic decision based on people with disability being our primary group of interest.

### Quantitative data

Sociodemographic data included age, sex, relationship status, employment status, type of income support payments received, and educational qualifications. The flood exposure measures included self-reported damage to the following sites: suburb; non-liveable areas of their home (eg, garden shed, garage); liveable areas of their home (eg, bedrooms); income-producing property (business/farm) and/or the home of a significant other.

Mental health status was assessed using brief versions of validated screening tools as they provide an efficient approach to identifying people at high risk of a mental health disorder. First, self-report measures for postflood distress included a single ongoing distress item from the Brief Weather Disaster Trauma Exposure and Impact Screen ('Are you still currently distressed about what happened during the flood?').<sup>50</sup> The measure was field-tested and used as part of the Queensland Government's annual Self-Reported Health Status survey after severe flooding in the summer of 2010–2011.<sup>50</sup> The yes/no 'still currently distressed' item from this measure was used in our analysis to allow for assessment of ongoing stress and anxiety related specifically to the flood event (as distinct

### Box 1 Free-text opportunities in cross-sectional survey drawn on for this analysis

- ⇒ Q1—Is there anything on your mind that you want to say right up-front about the flood?
- ⇒ Q6b—(Did you have to evacuate your home?) If yes, is there anything more you want to say about this?
- ⇒ Q15g—(In your view, are any of the following organisations to blame for anyone's distress after the flood?) Is there anything more you want to say about this?
- ⇒ Q16a—(Were you in the Northern Rivers when the heavy rain fell in June 2017 (about 3 months after the March/April flood?) If Yes: Did this affect you in any way? If so, how?
- ⇒ Q45—(Thinking back, have the severe rain and flood resulted in you being able to make any positive changes in your life?) If yes: could you give an example of your positive changes?
- ⇒ Q58—Is there anything else you want to add about your experience of the March/April flood or what things are like for you now?

from other possible causes of anxiety), and for comparability to other similar studies in which it has been used.<sup>50</sup>

The Post Traumatic Stress Disorder Checklist (PCL-6)<sup>51</sup> included a brief clinical screening tool (cut-point for probable diagnosis  $\geq 14$ ) that was introduced as a list of 'complaints' that 'people sometimes have' after severe rain and flooding. The PCL-6 has adequate diagnostic performance in primary care settings including for minority populations (sensitivity 80%–92%; specificity of 72%–76%).<sup>52 53</sup>

### Qualitative data

In the survey, there were six key opportunities for free text responses that explored respondents' experience of the flood event and perceptions of how they were impacted by it. These opportunities are described in [box 1](#).

Free-text responses were provided in at least one of the eight opportunities by 153/164 (93%) respondents with disability and 80/91 (88%) carers. Responses to each free-text opportunity in the survey ranged from a short sentence to several paragraphs.

### Analysis

Unadjusted binary logistic regression models were used to calculate the odds of experiencing flood exposure (damage to non-liveable areas, liveable areas and evacuation and length of displacement) for respondents with a disability and carers relative to other respondents. For binary logistic regressions comparing mental health outcomes (still distressed and probable PTSD) between our key interest groups and other respondents, we adjusted models to take into account all measured socio-demographic characteristics (age, gender, education level and employment status) as well as flood exposure (cumulative exposure index for individuals by summing the number of self-reported damage sites: suburb; non-liveable areas of their home (eg, garden shed, garage); liveable areas of their home (eg, bedrooms); income-producing properties such as businesses or farms; and

home of a significant other).<sup>45</sup> Respondents who did not complete a health outcome measure were excluded from analysis for that indicator only. Stata V.15 software<sup>54</sup> was used for analysis with the significance level set at  $p < 0.05$ .

To code and analyse the qualitative data systematically and comprehensively, we used inductive content analysis<sup>55</sup> using the software QSR NVivo V.9<sup>56</sup> to facilitate the organisation and coding of data. Guided by Elo and Kyngäs<sup>55</sup> the following steps were undertaken to ensure rigour: (1) JB and JL (two experienced qualitative researchers) immersed themselves in the data and independently read and re-read the data to get a sense of the whole, that is, to gain a general understanding of respondents' free text comments; (2) JB inductively open coded the data, writing notes and headings that described the content; (3) drawing on the notes and headings, JB developed a set of 'meaning units' (or categories); (4) through a process of comparison and rereading of data JB grouped similar categories that were perceived to belong together and developed a broader set of categories; (5) JL used the same procedure and inductively coded approximately 70% of the data independently; (6) two reviewers (JB and JL) then conferred in person to deliberate on the interpretation, resolve disagreements through discussion and identify patterns; (7) JB then applied the agreed set of categories across the whole dataset. The process was iterative and involved several reflection sessions between JB and JL discussing similarities and differences between accounts to ensure different perspectives were included.

Based on their experience as original members of the flood study team and as experts in the field, all authors checked the results to ensure they were consistent with their perceptions and understanding. Only minor adjustments were required to achieve good concordance between authors in the categorisation, analysis and interpretation of the data. To ensure that the voices of this often overlooked group were heard, we have provided a series of exemplar quotes to support the categories.

## RESULTS

### Respondent characteristics

Of the 164 respondents in the 'disability' group, 64% were female and 70% were aged 45–64 years. Of the 91 respondents in the 'carers' group, 80% were female and 53% aged 45–64 years (table 1). An apparent social gradient from respondents with disability to carers to 'others' is suggested by the proportions of each group with a university degree or in employment. Respondents with a disability were significantly less likely to be employed compared with other respondents (43% vs 88%, respectively) and were more likely to have lower educational qualifications.

### Increased flood exposure

Respondents with disability and carers had around twice the odds of their internal living areas of their homes flooded compared with other respondents (people with a disability: OR 2.41 95% CI 1.71 to 3.39; carer: OR 1.76 95% CI 1.10 to 2.84) (table 2).

As housing in flood-prone areas is generally cheaper to buy and to rent, respondents raised concerns that people with the least resources, including those with disability and carers were at times living in accommodation that placed them at particular risk of flooding.

Some of my friends lived in places in the centre of Lismore CBD that perhaps should never have been rented due to the vulnerability of their buildings in floods. These type of rooms/places were really vulnerable in the flood, it would have been impossible to get possessions to safety quickly enough. And people who rent these type of places have the least resources (mental, emotional, physical (cars etc.), financial) to cope with this type of event quickly. (Person with disability, No. 243)

### Likelihood and experience of evacuation

Respondents with disability had over twice the odds of having to evacuate compared with other respondents

**Table 1** Sociodemographic profile of survey respondents with disability, carers and others (respondents who were neither)

|                   |   | People with disability<br>(n=164) | Carers (n=91) | Others (n=1997) |
|-------------------|---|-----------------------------------|---------------|-----------------|
|                   |   | n (%)                             | n (%)         | n (%)           |
| Age group         | 16–24                                       | 5 (3.1) ***                       | 5 (5.6)       | 102 (5.2)       |
|                   | 25–44                                       | 31 (19.1)                         | 22 (24.4)     | 486 (24.7)      |
|                   | 45–64                                       | 113 (69.8)                        | 48 (53.3)     | 999 (50.7)      |
|                   | 65+   | 13 (8.0)                          | 15 (16.7)     | 385 (19.5)      |
| Gender            | Women                                       | 103 (64.4)                        | 72 (80)       | 1357 (68.9)     |
|                   | Men   | 57 (35.6)                         | 18 (20)       | 614 (31.2)      |
| Education level   | University degree                           | 37 (23) ***                       | 36 (40)       | 904 (45.7)      |
|                   | Other                                       | 124 (77)                          | 54 (60)       | 1076 (54.3)     |
| Employment status | Paid employment (part or full time)/retired | 69 (42.6) ***                     | 64 (71.1) *** | 1741 (88.2)     |
|                   | Not employed                                | 93 (57.4)                         | 26 (28.9)     | 234 (11.9)      |

Chi-squared analyses: the proportion of respondents with a disability/carers is significantly different than the proportion in other respondents (\*\*P<0.0001).

**Table 2** ORs of flood exposure and mental health outcomes for respondents with a disability and respondents who are carers compared with other respondents

| Respondent category                     | Person with a disability<br>(n=164) |                              | Carer<br>(n=91) |                              | Others<br>(n=1997) |
|---|-------------------------------------|------------------------------|-----------------|------------------------------|--------------------|
|   | n(%)                                | OR† (95% CI)<br>(Ref=others) | n (%)           | OR† (95% CI)<br>(Ref=others) | n (%)              |
| <b>Flood exposure</b>                   |                                     |                              |                 |                              |                    |
| Non-liveable area flooded (yard/garden) | 59 (37.6)                           | 1.93 (1.39 to 2.69)***       | 390 (20.0)      | 1.92 (1.24 to 2.97)**        | 390 (20.0)         |
| Liveable area of home flooded           | 101 (62.4)                          | 2.41 (1.71 to 3.39)***       | 911 (46.1)      | 1.76 (1.10 to 2.84)*         | 911 (46.1)         |
| Home evacuation                         | 47 (29.4)                           | 2.46 (1.71 to 3.54)***       | 285 (14.5)      | 1.38 (0.80 to 2.37)          | 285 (14.5)         |
| Displaced <6 months                     | 31 (18.3)                           | 0.58 (0.30 to 1.10)          | 199 (10.0)      | 0.74 (0.25 to 2.21)          | 199 (10.0)         |
| Displaced ≥6 months                     | 18 (11.4)                           | 3.78 (2.18 to 6.55)***       | 63 (3.2)        | 1.78 (0.70 to 4.54)          | 63 (3.2)           |
| Long time for help to arrive            | 28 (17.3)                           | 3.25 (2.08 to 5.09)***       | 119 (6)         | 2.14 (1.11 to 4.13)*         | 119 (6)            |
| Disrupted access to health/social care  | 62 (38.3)                           | 3.98 (2.82 to 5.60)***       | 266 (13.5)      | 2.17 (1.33 to 3.54)**        | 266 (13.5)         |
| Disrupted access to food                | 53 (32.7)                           | 2.06 (1.45 to 2.91)***       | 377 (19.1)      | 1.60 (0.99 to 2.57)          | 377 (19.1)         |
| <b>Mental health outcomes</b>           |                                     | aOR‡ (95% CI)                |                 | aOR‡ (95% CI)                |                    |
| Still distressed                        | 67 (40.9)                           | 1.76 (1.18 to 2.63)**        | 250 (12.8)      | 0.84 (0.49 to 1.44)          | 250 (12.8)         |
| Probable PTSD                           | 65 (40.1)                           | 3.32 (2.22 to 4.96)***       | 419 (21.3)      | 1.87 (1.10 to 3.19)*         | 419 (21.3)         |

\*P<0.05; \*\*p<0.01; \*\*\*p<0.001.  
 †Unadjusted OR.  
 ‡aOR for other sociodemographic variables (age, gender, education level and employment status) and severity of flood exposure.  
 aOR, adjusted OR; PTSD, post-traumatic stress disorder.

(OR 2.46 95% CI 1.71 to 3.54) (table 2) due to their increased flood exposure. In the qualitative data there were numerous reports of people evacuating late (or not at all). When people with disability wait too long it causes challenges because there are inadequate resources in the emergency sector to evacuate everyone. Respondents reported taking longer to evacuate due to a lack of transport and the extra time needed to pack and move additional equipment, as well as sensory challenges and the disruptions to their routine.

... when we did evacuate it was late because we were worried about our children ... one who is autistic and is easily stressed when routines are disrupted. (Carer, No. 13)

There were also commonly reported challenges with information related to evacuation orders and flood warning systems, as well as poorly timed, conflicting or incorrect warnings regarding flood water levels and the possible need for evacuation. Respondents identified that at times they did not understand the messages they were given and so struggled to make effective decisions, for example:

Didn't know what evacuation meant for example, what to take, would I have to stay there, where to go... Had no idea what river levels meant, for example, Tweed River is 4.3m. (Person with disability, No. 154)

It was reported that deaf people were given oral directions that were not accompanied by sign language, and some reported not being able to hear the warning sirens. These communication barriers affected how

quickly people became aware of the extent of the flooding, the need to evacuate, access to emergency information during the flood event and their ability to seek assistance.

I got no warning but TV said evacuation for [the] CBD, and when I rang SES for information I could not get through. I needed clarification for my family and I have 3 special needs kids and I needed help to evacuate ... I said I need help! I was told no help for me as I was under order to evacuate hours before but no one rang, no one knocked on my door! [My house] was completely destroyed. Knocked off the pylons, condemned [to] a horrific night of hell getting the kids out by myself. (Carer, No. 67)

A number of carers described the importance of sensitive communication by emergency services tasked with providing evacuation orders. The quote below reflects a number of responses to the order to evacuate well in advance, and the challenge in responding to this order for people with additional support needs.

... some representatives of the emergency services would not listen to people who have lived through many floods. To expect infirm, aged or carers of disabled to move to other premises is silly. As an aged person with rather dicey balance, and having a disabled son equally as awkward, to demand they evacuate is difficult to achieve. Large, and larger, pillows, blankets, 5 medications, an aged cat—and where and when and how and what happens then? (Carer, No. 177)

### Likelihood and experience of displacement

Respondents with disability had almost four times the odds of being displaced for more than 6 months than others (OR 3.78 95% CI 2.18 to 6.55). As people with disability were more likely than others to have their homes flooded, and to be evacuated and displaced, there was a reported increased need for alternative housing for both the short and the long term, and for assistance to access such housing. As a result, housing vulnerabilities were evident. Respondents identified a lack of affordable accommodation for displaced people with disability and carers, which resulted in some living in unsafe accommodation (eg, mould, no cooking facilities and structural damage), relocating to other areas (with the subsequent loss of their support networks) or even becoming homeless.

When so many houses are flood damaged, a lot of people are displaced from lower cost housing, which leads to a lack of affordable accommodation. With many more people looking for accommodation, high levels of financial stress were reported:

Where the flood did affect me was the housing crisis born of a shortage of rental properties. I was given notice to move from my rental property just before the flood. It was extremely tough to find anything affordable on the pension (& with pets) in the months after. I am currently in temporary accommodation till March, then who knows? (Person with disability, No. 168)

### Accessing help at the time of the flood and support for recovery

Respondents with disability and carers were more likely to report that the help they needed took a long time to arrive in comparison to other respondents (people with disability: OR 3.25 95% CI 2.08 to 5.09; carer: OR 2.14 95% CI 1.11 to 4.13)

There were many reports of respondents feeling they had been left to fend for themselves and experiencing frustration with getting assistance in the form of financial disaster relief measures, help with cleaning up and accessing services.

The lack of help for the homeless and vulnerable. The anxiety and stress that occurred and the amount of people left homeless and still trying to find a home 5 months later. Services that were desperately needed but were very hard to find. (Person with disability, No. 1)

There was a reported perception that recovery supports were not available or accessible to people with disability in ways that they could use to take action, to keep safe and to recover. In one instance for example, a respondent had to relocate to another area so missed accessing crucial information about recovery assistance and grants as the information was sent to their impacted home. A number of respondents reported difficulty navigating the paperwork to enable access to recovery support.

### Losing connection to support networks and access to essential services

Respondents with disability were more likely to report disrupted access to essential services, such as health, social care (OR 3.98 95% CI 2.82 to 5.60) and food (OR 2.06 95% CI 1.45 to 2.91), in comparison to other respondents (table 2). In free-text responses, respondents reported barriers to accessing essential services that included disrupted banking facilities, road blockages and damage due to flooding, closed businesses, reduced opportunities for community participation and, importantly, disruption to support networks.

Disrupted support networks further hampered access to essential services and often resulted in social isolation, with reports of paid support staff being affected by flooding themselves and then not being able to support their clients. It was reported that further disruption occurred when some paid support staff had to move away from the area because they could not secure affordable accommodation after the flood event.

... one of my son's Carers (he has severe autism and needs one on one attention at all times) was flooded out of her home and her car was destroyed. ...She is going to be leaving the area, as a result of losing her home, and while this obviously most affects her, it greatly affects us, and particularly my son, as she has been one of his carers since he was an infant. We will greatly miss her as a friend, but even more importantly, as a very important part of our family system and for our son. (Carer, No. 12)

Social connectivity was identified as a supportive factor for respondents with disability in terms of their mental health and of being able to access assistance. Some respondents reported that people with disability who were viewed by community and emergency workers to be well connected to the community, or 'visible and well known', received wider community support in accessing essentials such as food.

### Mental health impacts

After taking sociodemographic factors into account, carers and respondents with a disability had twice and three times the odds of probable PTSD compared with other respondents respectively (table 2). Respondents with a disability were also more likely to report still being distressed about the flood in comparison to other respondents (OR 1.76 95% CI 1.18 to 2.63) (table 2).

Analyses of the qualitative data illustrated how the flood event also compounded existing physical and mental health issues, which led to profound and long-lasting impacts.

I miss my daily chats at the now closed newsagency. We lost 3 newsagents as they have not reopened. My whole support network was turned upside down. My PTSD condition worsened during and after the flood. (Person with disability, No. 34)

Mental health symptoms linked to the floods (table 2) further impeded access to services:

The shock of the flood made it difficult to get out of the house to pursue assistance or get informed. (Person with disability, No. 249)

## DISCUSSION

Our study found that people with disability and carers were more severely affected by the flood event, as they were more likely to have the living areas of their homes inundated and to experience far greater disrupted access to essential services such as flood recovery efforts, healthcare, social services and food in comparison to others. In addition, respondents with a disability were more likely to be evacuated and experience lengthy displacement. As a result, respondents had more need for alternative short-term and long-term housing. Furthermore, with longer term displacement (which is particularly deleterious to mental health),<sup>9</sup> respondents were significantly more likely to report that, 6 months after the flood event, they were still distressed and experiencing probable PTSD.

Our findings are also in keeping with those of previous studies describing barriers to evacuation,<sup>57 58</sup> which include inaccessible, conflicting and confusing information, and poorly timed or incorrect warnings regarding flood-water levels and the possible need for evacuation. Thus, it is vital that government and emergency services address these barriers to evacuation through better and more targeted early warnings, and working in partnership with the community, trusted leaders and groups to communicate those warnings and improve the response to them. By making this information available and accessible in ways that people with disability can take action to keep safe, the expectations on emergency services that cannot currently be met will be mitigated.

Access to safe, mould-free and affordable housing was a significant issue highlighted in our study. Similarly, Stough *et al*<sup>38</sup> and Fox *et al*<sup>59</sup> identified that post disaster, people with disability experienced difficulties in obtaining housing that is accessible in both the short and long term. Recovery barriers included a perceived lack of, or conflicting, information, and difficulty navigating the paperwork required to apply for assistance. Following a disaster, people with disability must navigate two complex and often inaccessible bureaucracies: the emergency response and recovery arrangements and disability services. Stough *et al* state 'that a salient difference in the disaster experience of individuals with disabilities is the considerable and unique complications that they confront in accessing disability-related services and resources after a disaster.'<sup>38</sup> As many people had to relocate, accessing information became even more of a challenge. Disability support staff and services themselves were compromised and disrupted by the flood event which further exacerbated problems with prompt access to recovery and support services.

Mental health concerns were cited as a barrier to recovery, as they specifically impacted on people's ability to navigate the systems needed to aid recovery. These findings are consistent with current research highlighting that people with disability will take longer to recover from weather-related disasters, and require longer term tailored supports during that period.<sup>8 36 39</sup> The finding that people with disability and carers were more likely to have probable PTSD 6 months after the flood event highlights the need to raise awareness among all social and healthcare professionals of the longer-term psychological impact of traumatic events.<sup>60</sup>

People with disability and carers are disproportionately impacted by floods and there have been calls for more disability-inclusive responses to weather-related events.<sup>40 57 61</sup> The need for greater investment in preparedness is amplified in areas where disasters are likely to occur again and where the most socially marginalised populations reside. For example, as the occurrence and severity of floods in the Northern Rivers region will likely increase due to climate change, those who are most socio-economically disadvantaged will be more affected as they live in flood-prone areas.<sup>21</sup> Thus, emergency management approaches need to take into consideration the profile of communities in high flood risk areas, and develop plans that target more effective risk communication, preparedness planning, disaster warnings and support to access recovery services.

Our findings clearly support recommendations for an increasing focus on disaster prevention and preparedness.<sup>62 63</sup> The vulnerability of people with disability and carers is further increased because they have not been included in community-level disaster preparedness.<sup>37 57 64 65</sup> Person-centred preparedness conversations, for example, would help people with disability to be involved in planning how they will respond in an emergency situation. To this end, Australian researchers, in partnership with stakeholders from the disability, community and emergency services sectors, have co-designed a Person-Centred Emergency Preparedness (P-CEP) model<sup>57 64 66</sup> to support more effective and systemic responses.<sup>67</sup> This strengths-based model has a suite of tools available to assist people with disability, carers and service providers to develop emergency preparedness plans through self-assessment, targeted actions and advocacy relevant to their support needs they in an emergency, and to support individuals to take ownership of these plans.<sup>57 64 66</sup> P-CEP emphasises the roles of multiple stakeholders in reducing disaster risk, rather than restricting actions to those of government and emergency services to protect people with disability and carers.<sup>67</sup>

In this context of the importance of preparedness to mediate the impact on people with disability it is of concern that little attention has been given to the scarcity of disability data,<sup>68–70</sup> which is a crucial underlying factor that precludes movement towards inclusion and, ultimately, addressing inequities.<sup>38 69 71</sup> Stough *et al*<sup>38</sup> identified that most jurisdictions have only a very limited idea

of how many people with disability live or work in flood-prone areas. Without these data, the impact of events such as floods on people with disability remains difficult to address and perpetuates their exclusion.<sup>69 71</sup>

Improving outcomes for people with disability and carers post flooding cannot be achieved without also challenging the inequities they experience in all aspects of life. Although their vulnerability is often attributed to personal cognitive or physical abilities, many respondents in our study focused on the social and structural factors that precluded inclusion as being problematic in the evacuation and recovery process—such as lack of transport, difficulty navigating postrecovery systems, poor access to alternative housing, etc—rather than on their own characteristics. This is in line with social vulnerability theorists who conceptualise vulnerability as the result of pre-existing barriers and exclusionary social practices, rather than as an attribute of the person.<sup>23</sup> Similarly, although we do not deny the significance of floods as trigger events, we do emphasise the various ways in which social systems operate to make people vulnerable to the risks posed by extreme weather-related events such as floods.

Carers play a vital role in providing support for people with disability, and yet their experiences during and after flood events, and the impacts on them, has received very limited attention.<sup>40</sup> Given the disproportionate impacts that carers experience from flood events, it is important that they are identified as a key interest group. This finding is consistent with Pickering *et al* who in a recent scoping review highlighted the need for more research and purposeful inclusion of carers in disaster preparation and recovery.<sup>40</sup> What is clear from our study is that both groups—people with disability and carers—require targeted strategies that will address their specific needs before, during and following an emergency, such as a flood, including supporting their preparedness. There is, therefore, a particular need for further research into the impacts on, and experiences of, carers during such events.

### Strengths and limitations

This study addresses an important gap in the literature on reporting how people living with disability and carers experience disasters such as fluvial floods in Australia. Our identification of respondents with disability and carers was restricted to those who indicated they could not work due to long-term disability or illness (including via receipt of the disability support pension) and those eligible for a government carer's allowance, respectively. We recognise that there are varying types of disability, and we may have excluded other respondents with impairments that do not necessarily limit their employability but could interfere with their capacity to prepare and respond adequately in an emergency situation (eg, those with sight/hearing loss, mobility issues). Similarly, we may have excluded other carers who were not eligible to receive the government allowance. As receipt of a disability support pension is income and assets dependant, the inclusion of

the demographic question 'unable to work due to long-term sickness or disability' enabled us to capture people ineligible for the government disability allowance due to income and asset restrictions and people. This question was unpiloted and did not include follow-up questions addressing the nature of impairment or functional limitations experienced by respondents, this information would have been helpful in further understanding the flood impact on people with different types of disability or support needs.

Our sampling approach was not intended to estimate population prevalence for measures related to exposure or outcome. Self-selection bias may have resulted in those who had been affected by the flood event participating in the survey. Furthermore, the survey relied on self-reported data that may affect the accuracy of the information.

While we lacked a mental health baseline prior to the flood, we included two measures specifically related to the flood and we adjusted for socio-demographic factors known to predict mental health. The literature points to people with disability<sup>72</sup> and carers<sup>73 74</sup> as having elevated rates of mental health disorders compared with the general population. To address this, we used validated screening tools and analysis techniques that allowed for an assessment of ongoing stress and anxiety related specifically to the flood event (as distinct from anxiety arising from other causes). Brief mental health disorder screening tools have useful applications and are widely used by clinicians and researchers as they provide an efficient method to query symptom areas requiring further assessment or research.<sup>75</sup> They are, however, not a substitute for full diagnostic criteria.<sup>76</sup> Therefore, this study must be viewed in the light that we used brief screening tools as opposed to a full clinical assessment.

A particular strength of our study was the community-academic partnership, in which we used local community and organisational networks to document experiences of socioeconomically marginalised respondents that included people with disability and carers.<sup>45</sup> Despite these efforts, the relatively small number of respondents with disability and carers reduced statistical power and may have meant some important associations were not shown to be statistically significant. Though the survey was available in several formats and efforts were made by organisation who were part of our community-academic partnership to assist people to complete the survey, the survey may still have been inaccessible for some people.

### CONCLUSION

The 2017 flood event in the Northern Rivers highlighted the profound impacts and systemic neglect experienced by people with disability and their carers during and after the flooding in the region. We found people with disability and carers are more likely than others to be affected and displaced, their needs are more immediate and urgent than most, and their mental health is more likely to be compromised. As people with disability will take longer to



recover, they will require longer term tailored supports. Our research provides compelling evidence that more needs to be done to ensure their purposeful inclusion of people with disability and carers in both flood preparedness and recovery efforts.

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