Human behaviour during natural hazard emergency evacuations

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Background

When considering land use planning approvals, consideration of human behaviour when planning emergency evacuations and the suitability of evacuation as a treatment option is critical. In what follows we make some key observations relating to how people behave in response to evacuation warnings in response to, or in anticipation of, hazardous circumstances.

Evacuation rates vary and not everyone leaves

Reviews and research conducted after major evacuations have identified that evacuation rates are highly variable (Baker 1991) with assessments differing even for the same event. The table below summarises evacuation rates that have been achieved in particular disaster events.

<table>
<thead>
<tr>
<th>Context</th>
<th>Evacuation rate</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood, Grafton, NSW Australia 2001</td>
<td>18%</td>
<td>(Pfister 2002)</td>
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<tr>
<td>Flood, Maitland, NSW Australia 2007</td>
<td>76%</td>
<td>(Gissing, Molino et al. 2008)</td>
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<tr>
<td>Flood, Grafton, NSW, Australia, 2009</td>
<td>24%</td>
<td>(Molino Stewart 2009)</td>
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<tr>
<td>Hurricane Katrina, US, 2005</td>
<td>48%</td>
<td>(Stephens, Hamedani et al. 2009)</td>
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<tr>
<td>Hurricane Katrina, US, 2005</td>
<td>80-90%</td>
<td>(Jonkman, Maaskant et al. 2009)</td>
</tr>
<tr>
<td>Hurricane Kita, US, 2005</td>
<td>55%</td>
<td>(Stein, Dueñas 2010)</td>
</tr>
<tr>
<td>Hurricane Ike, US, 2008</td>
<td>77%</td>
<td>(Morss and Hayden 2010)</td>
</tr>
<tr>
<td>Tsunami, Natori City, Japan, 2011</td>
<td>82%</td>
<td>(Murakami, Takimoto et al. 2012)</td>
</tr>
<tr>
<td>Hurricane Irene, US, 2011</td>
<td>27%</td>
<td>(Wallace, Poole et al. 2014)</td>
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</tbody>
</table>

Studies have also been shown that there is a proportion of the population who do not intend to evacuate when advised to do so. For example research carried out in the US in the context of wildfires indicates that 11% of residents in California intend to stay on their property during an evacuation (McCaffrey and Winter 2010). In Australia when interviewing residents that had evacuated during the Maitland 2007 flood, only 52% said they would evacuate in any future flood (Gissing, Molino et al. 2008).

1 Evacuation rate refers to the % of the community at risk that evacuated from the affected area during an actual disaster.
Intentions however, do not always translate into observed behaviour with Whittaker and Handmer (2010) concluding that there were significant disparities between expressed intentions and actual responses to bushfire risk. In their review of Victorian bushfire research relating to community behaviour on Code Red days they noted that 50-60% of residents expected to leave on Code Red days. However, a study following the declaration of a Code Red day found that very few residents had acted on their original intention, with some two-thirds of affected residents choosing to remain at home.

The timing that people leave varies

The timing which people choose to leave following a warning to evacuate is also extremely variable (Sorensen 1991):

- In their study post the 2011 Japanese tsunami, Murakami, Takimoto et al. (2012) found that 37% commenced evacuation during or directly following the earthquake, 31% evacuated sometime afterwards, 14% did so when the danger became obvious, while 18% did not evacuate at all.
- In the case of Australian bushfires, McLennan, Paton et al. (2015) found very few people choose to leave before there is evidence of an actual fire. The 2009 Victorian Black Saturday Fires provided some concern with the observation that a significant number of people intended to stay and see what the bushfires were like before deciding whether to leave their property (Whittaker, McLennan et al. 2009, Whittaker, Haynes et al. 2013).
- Petrolia and Bhattacharjee (2010) assessed the intentions of people to evacuate in respect of hurricanes in the US. 34% of those sampled indicated they would evacuate, 28% would wait before deciding, 30% would not evacuate and 8% didn’t know what they would do.

The reasons why people do evacuate

The main reason for people evacuating is the perception that the anticipated hazard is a significant threat (Baker 1991). Research after hurricane evacuations has demonstrated that the stronger the storm and the closer its proximity, the greater the chance that people will evacuate (Smith and McCarty 2009). People are more likely to evacuate when they understand that a warning applies to them (Baker 1991, Huang, Lindell et al. 2012); the more personalised the form of delivery the greater the response (Baker 1991, Huang, Lindell et al. 2012). In general, research supports that mandatory evacuations may be more effective than voluntary evacuations, although they can result in community anger and social turmoil (Bobrowsky 2013).

The reasons why people don’t evacuate

The main reason people don’t evacuate is they do not perceive the threat of the anticipated hazard to be sufficient enough to act (Baker 1991, Gissing, Molino et al. 2008, Smith and McCarty 2009). Other reasons for not evacuating include:

- Desire to protect their property from the hazard (Baker 1991, Gissing, Molino et al. 2008)
- Need to fulfil obligations to employers (Baker 1991, Smith and McCarty 2009)
- Concern about looters (Baker 1991)
- Inconvenience and effort incurred in having to evacuate (Baker 1991)
Evacuation is not without risk

Risks of evacuation must always be considered. For example early evacuation provides people with time to reach safety, but may also allow for the hazard to change its direction or behaviour, making an evacuation unnecessary, or worst still, leading evacuees into more dangerous locations or situations (Haynes, Coates et al. 2009). Such dangers are well illustrated by the experience of Hurricane Rita, in September 2005, when more than 2.5 million people were evacuated, resulting in heavy traffic during a period of high temperatures; the majority of deaths (90 lives) occurred as a consequence of the evacuation (Zachria and Patel 2006).

Discussion

Based upon existing international experience two key concerns emerge for emergency managers and urban planners. The first, when warned to evacuate only a portion of the community will do so. Combatting this tendency will require a greater focus on risk communication in order to maximise evacuation rates, and the deployment of back up strategies such as rescue.

The second consideration is that even when people chose to evacuate they may evacuate too late, possibly resulting in their inability to leave a hazardous area safely.

Assumptions made in evacuation modelling need to reflect all possible evacuation behaviours and scenarios. The total of these mechanisms will provide a better estimate of the overall consequences of an event.

Caution must be exercised in drawing general conclusions from the few research studies on evacuation as results are hazard specific and mostly based upon experiences overseas, much of it drawn from US hurricane experiences. Only a few studies have documented Australian evacuation behaviour and more research is needed to understand specific differences that maybe present between different hazards and different countries.

References


