Mapping the vulnerability of older persons to disasters

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Older people sit at the centre of a unique constellation of factors that combine to increase their vulnerability to the negative effects of catastrophic events. The aim of this paper is to explore some of the factors that underlie this vulnerability. Attention will be directed at three broad factors that will be discussed in some depth, namely poverty, long standing health conditions and psychological trauma. The aim is not, however, to provide a comprehensive systematic review of existing research evidence regarding the older population and disasters. Whilst poverty, chronic illness and psychological issues are discussed in this paper as separate issues, they are interconnected. A map of the synergies between factors is presented that places the older person at the centre of a network of vulnerabilities. Recommendations for strategic planning and clinical practice are made that address this complex problem. The hope is that with insightful preparation the older population can be spared some of the worse consequences of a disaster when it strikes.

Key words: disaster, vulnerability

Introduction

As an opening paper in a Practice Development section, one could reasonably expect a systematic review of current pertinent literature. However, this is not the aim of this paper. Three reasons are offered for this deviation from the expected:

1. There is little in the way of primary research that takes as its focus the older population in disasters (see Table 1).
2. Collecting data in postdisaster settings is fraught with technical and ethical difficulties. The result is research of variable quality in terms of sample size and robustness of data collection. If inclusion/exclusion criteria based on methodology were applied to the relatively small body of research available that covers the older person and disasters, one could reasonable expect to exclude approximately two thirds of the research studies from a rigorous systematic analysis.

3. There are studies which shed light on the position of the older person in pre and post disaster settings (even though these studies are not solely focussed on older people). This existing literature has already been quite comprehensively reviewed and repeating this analysis would add little to the current debate [see for example the reviews conducted by Fernandez et al. (2002) and Cherniack (2008)].

What then is the aim of this paper? The aim is firstly to identify key factors that make all individuals vulnerable to the effects of disaster, by drawing on a breadth of literature that reflects both available research and scholarly comment. Secondly, there is a need to articulate how these general vulnerability factors impact on older persons. This action will allow for the construction a map that captures the unique constellation of disaster vulnerabilities that face the older person (Fig. 1). Finally, recommendations for practice can be made with the hope that the older person can be spared some of the worse consequences of being a victim of a disaster.
The nature of disasters

The word ‘disaster’ is used in everyday conversation to cover everything from the mass fatalities incurred after an earthquake, to the financial meltdown of the banking sector, to a dinner party where the conversation was particularly uncomfortable. Thus this one term covers the both the banal and the catastrophic. In order to aid analysis, the following is offered as sound working definition of what constitutes a disaster in terms of health care:

A situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance ... an unforeseen and often sudden event that causes great damage, destruction and human suffering

International Federation of Red Cross and Red Crescent Societies (2009), p. 194.

Before we consider older people as victims of disaster, it is important to address two commonly held misconceptions about disasters themselves. Firstly, there is no such thing as a

Table 1 Results of literature search

<table>
<thead>
<tr>
<th>Database</th>
<th>Search terms</th>
<th>Dates</th>
<th>Results</th>
<th>Inclusion/exclusion criteria</th>
<th>Results</th>
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<tr>
<td>ScienceDirect</td>
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<td>n = 17</td>
<td>Primary data collection</td>
<td>1 (Seplaki et al. 2006)</td>
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<td>Elderly disaster</td>
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<td>one of the sample groups</td>
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<td>Combined Medline &amp; CINAHL</td>
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<td></td>
<td>n = 130</td>
<td>Focus on catastrophic events</td>
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<tr>
<td></td>
<td>people and disaster</td>
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<td></td>
<td>that meet the IFRC (2009)</td>
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<tr>
<td>Combined Medline &amp; CINAHL</td>
<td>Elderly and disaster</td>
<td></td>
<td>n = 671</td>
<td>definition of disaster</td>
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</tr>
</tbody>
</table>

The diagram illustrates the model of the disaster vulnerability of the older person.
natural disaster (Hilhorst & Bankoff, 2004). For sure large scale seismic and weather related events do happen. In fact such events happen all the time, but they are not considered to be disasters because they occur in remote regions of the world with no impact on human life. It is only when one of these natural events collides with human vulnerability leading to excess mortality, personal injury and illness, and loss of property that a disaster is said to have happened. This human vulnerability to the effects of natural hazards inevitably contains some elements that are of human construction, be this poverty, poor housing stock, food insecurity, environmental degradation etc.. Thus we can safely argue that there is no such thing as a natural disaster, only natural events; the disaster is always, in part at least, man-made.

The second misconception to address is the notion that disasters are random killers. Disasters kill, injure and disable in predictable patterns (Eberwine, 2005). These patterns arise out of the differential spread of human vulnerabilities across the disaster affected population. One of these vulnerabilities to the effects of a disaster is being an older person.

This paper seeks to explain why the older population are uniquely susceptible to the effects of disasters. Before entering into the main discussion, three caveats are offered. Firstly there is no possibility of an exhaustive discussion of all the elements of the disaster vulnerability that face older people. Three issues will be discussed in some detail, namely poverty, chronic health conditions and depression; however the key issues of mobility and sensory impairment that impact directly on the elder person’s response to catastrophic events will not be addressed (for a full discussion of these issues please see the AARP post hurricane Katrina report (AARP, 2006), and the literature review by Chernack (2008)).

Secondly, the choice of chronic health conditions and poverty is in no way intended to stereotype the older population, but rather to raise awareness of the impact of these often overlooked issues when considering the relationship between being an older person and disasters. The final caveat regards the time span of the evidence presented. Large scale catastrophic events that are well researched and evaluated happen infrequently. This forces those interested in disasters and vulnerability to look back to events that may have occurred over a decade ago. One benefit of this historical approach is the realisation that certain factors reappear as consistent features of the impact of a disaster. This allows us to conclude that although the specifics of individual disasters may be different, they are all experienced by older people in pretty much the same way across time and around the world. With these notes of caution in mind, our attention can turn to a more detailed discussion of older people and their disaster vulnerability.

Being an older person, poverty and vulnerability

Poverty is of itself a risk factor when faced with a disaster (Hilhorst & Bankoff 2004; Elliott & Pais, 2006; Chen et al., 2007; Masozera et al., 2007). Poverty rates for older people in developed economies such as the USA and the European Union range between 9 and 19 percent, with regional pockets of elder poverty in excess of 30% being identified (AARP, 2008; Eurostat, 2009). Such poverty can increase disaster vulnerability directly through its association with poorly constructed housing that is either unable to withstand windstorms, flooding or earthquakes, or is sited in disaster prone areas such as reclaimed land, flood plains etc. (Chan et al., 2003; Woersching & Snyder, 2003). The supposition that all poor housing occupies suboptimal locations, and that natural hazards are unfavourably concentrated on poor housing stock is confounded by examples of million-pound beach front properties exposed to hurricane damage or the expensive mountain side villa at risk of landslide and forest fire. In these latter situations, the ability to afford such accommodation is accompanied by an ability to pay matching insurance premiums. The older person who is poor maybe unable, or unwilling, to use their restricted financial resources to pay such premiums, thus further increasing their vulnerability to the effects of any catastrophic event. Whilst elder poverty can be seen to be a background factor that increases a person’s overall disaster vulnerability, poverty can also be a factor that directly increases a person’s vulnerability in the short term. Financial resources are the prerequisite for self evacuation and escape from disasters. A lack of available cash can make it impossible for the poverty stricken to meet the transport costs and purchase the incidentals needed to flee the disaster affected area leaving them stranded in the midst of the catastrophe (Elder et al., 2007). Years of evidence from around the globe has established the clear link between poverty and vulnerability to the effects of large scale natural events, we also see high levels of poverty in older populations thus it is reasonable to claim that older people have a particular vulnerability to disasters mediated through financial hardship. However, the older person’s vulnerability to disasters is far more complex than a simple financial matter.

Chronic illness and disasters

The stark reality is that people with long term health conditions and chronic illnesses get sicker during disasters. In 1995, Hyogo Prefecture and the city of Kobe in Japan were hit by an earthquake that measured 7.2 on the Richter scale, an event known as the Hanshin-Awaji Earthquake. Collapsed buildings and extensive fires resulted in 5 500 deaths and
41 000 injuries. Tanaka et al. (1999) surveyed patient data from a total of 95 hospitals for the 15 days following the Hanshin-Awaji Earthquake. Whilst traumatic injury dominated the cumulative patient census data up to day six postevent, from day six to day 14 non–traumatic illnesses dominated. Non–traumatic illness incidence tripled from day three to day 14, eventually accounting for 3 389 patients (53.5% of all patient admissions). Also of note is the higher death rate associated with non–traumatic illness. The death rate for trauma was 5.5% for trauma cases, whilst the death rate for illnesses was nearly double that at 10.3%.

More detail on the burden of chronic illness in postdisaster settings emerged from the work of Woersching and Snyder (2003) following the two earthquakes that hit El Salvador in January and February 2001. Their team surveyed the postearthquake healthcare needs of affected urban and rural communities by interviewing 100 families, representing a total of 594 family members. Unsurprisingly 38% of households reported at least one member of the family being injured during one of the two earthquakes. More surprisingly, 79% of households reported at least one family member experiencing an exacerbation of a chronic illness.

Moving forward again to 2005 and we see similar high incidence rates of chronic illness in the population affected by Hurricane Katrina which impacted on more than 2.5 million households along the Gulf Coast areas of the USA. Greenough et al. (2008) surveyed the medical needs of the population displaced from New Orleans and surrounding areas that were accommodated in Red Cross shelters in Louisiana. These shelters were not designated as ‘Special Needs Shelters’ and had been identified as reception sites for the general population rather than those with identified medical needs. Data were obtained from a total of 499 respondents across 18 different sites. Of the respondents, 35.6% had at least one preexisting medical condition, with 33.4% exhibiting signs or symptoms of acute exacerbation of a chronic illness when arriving at the shelter.

Exacerbations of underlying health conditions in postdisaster settings are not random. They follow a predictable pattern where we see a worsening of underlying cardiovascular and respiratory diseases, and instability of preexisting diabetes mellitus.

In 1978, Thessaloniki in northern Greece was struck by an earthquake. This one-off, time-limited event allowed for a audit of pre and post event cardiac mortality patterns (Katsouyanni et al., 1986). Echoing the findings of Tanaka et al., (1999) and Woersching and Snyder (2003), injury was the leading cause of death, with cardiac related events second to trauma as a cause of death. In the historical control period, the mean number of cardiac related deaths registered in the city lay at 2.9 cardiac deaths per day. On the day of the quake this rose to four deaths per day, rising again to seven deaths per day on the day after the earthquake, and remaining elevated at five deaths per day two days after the earthquake. In 1994 the Northridge area of Los Angeles was struck by an earthquake resulting in 101 deaths (Leor et al., 1996). Of this group, over 50% were cardiac related deaths, with trauma being the second most common cause of death (Leor et al., 1996). In the aftermath of the 1995 Hanshin-Awaji earthquake a similar spike in cardiac related events was recorded by Suzuki et al. (1995). Their examination of patient admission data from a regional referring hospital in Hyogo Prefecture revealed a historical control rate of 1.5 acute myocardial infarction (AMI) related admissions per week, whilst for the seven days following the Hanshin-Awaji quake the number of AMI admissions quadrupled to six. In a broader survey of 6 107 patients admitted to 95 hospitals in and around Kobe in the two weeks following the Hanshin-Awaji earthquake there were a total of 509 instances of cardiovascular disease covering ischaemic disease, arrhythmia, heart failure and hypertension (Tanaka et al., 1999). A similar pattern of cardiovascular exacerbation was revealed by Greenough et al. (2008) in their survey of the health status of the Hurricane Katrina–displaced population. For respondents arriving at shelters they report a prevalence rate of 11.5% for shortness of breath and 9.7% for chest pain. In addition to AMI and cardiac death, sudden onset catastrophic events have also been associated with increases in blood pressure in hypertensive patients (Kario et al., 2001), and with increased risk of thromboembolic events and pulmonary embolism (Inoue, 2006; Watanabe et al., 2008).

These exacerbations of cardiovascular disease are multifactorial in origin. Activation of the sympathetic nervous system, catecholamine release from the adrenal medulla and initiation of the renin-angiotensin-aldosterone-system in the immediate post disaster period is certainly one potential cause of acute cardiovascular deterioration. The net effect of the complex neuroendocrine response to acute stress results in, amongst other things, increased force and rate of contraction of the heart, increased peripheral vascular resistance, and an increased intravascular volume, all of which increase cardiac workload (Suzuki et al., 1997; Davies et al., 2001). Other factors that can lead to a destabilisation of previously well controlled cardiovascular disease include disruption to access to prescribed medication (Deal et al., 2006; Jhung et al., 2007; Greenough et al., 2008), and the increased physical workload associated with self rescue and reconstruction (Suzuki et al., 1997; Mori et al., 2007).

Types 1 and 2 diabetes mellitus represent another set of conditions that can be destabilized by sudden catastrophic
events. The biological stress response to a disaster, disruption to medication regimens, alteration in patterns of rest-activity coupled with enforced changes in nutritional intake subsequent to relocation to shelters and temporary housing all have the potential to cause disruption of glycaemic control (Woersch & Snyder, 2003; Greenough et al., 2008). Kirizuka et al. (1997) conducted an audit of glycaemic control of 177 known diabetic patients by comparing subject’s HbA1c levels following the Hanshin-Awaji earthquake with baseline measures taken prior to the event. Mean HbA1c levels rose from 7.74% one month prior to the earthquake to 8.34% three months postquake, a rise that was held to be significant (P < 0.01). The observed rise in HbA1c level was seen to be strongly related to inappropriate diet due to relocation to temporary housing and reliance upon mass feeding sites, and discontinuation of medication uptake (Kirizuka et al., 1997; Mori et al., 2007). Diabetic subjects reported that concerns about continuation of medication and obtaining what they felt to be an appropriate diet were the biggest obstacles they faced in self-management of their diabetes following the earthquake. Whilst emergency feeding centres were well established, the food offered was seen by respondents to be high fat, energy dense, high in salt and lacking fresh fruit, all characteristics which countered what they had been instructed was an appropriate diet for them to follow.

The third chronic disease grouping that shows deterioration following a disaster is that of respiratory diseases. As indicated above, shortness of breath was a key symptom experienced by the Katrina-displaced population, with 12.9% of subjects reporting preexisting lung disease (Greenough et al., 2008). Forty percent of disaster households affected by the 2001 El Salvador earthquakes reported at least one family member with either an upper or lower respiratory tract infection (Woersch & Snyder, 2003), whilst 1,259 cases of respiratory disease were reported out of 6,107 admissions following the Hanshin-Awaji earthquake (Tanaka et al., 1999). Increased physical activity, disruption of work-rest patterns, environmental exposure to cold, disruption of medication regimens, and dehydration leading to thickened respiratory secretions have all been cited as causes of exacerbations of underlying respiratory illness (Woersch & Snyder, 2003; Mori et al., 2007; Platz et al., 2007). In addition, certain disasters cause unique environmental pollution that impacts directly upon respiratory function. Large scale fires, building collapse and vulcanism are associated with airborne particulate matter, and flood events have been associated with mold spores, all of which have the potential to cause, or exacerbate respiratory disease (Young et al., 2004; Wu et al., 2006; Linscott, 2007).

Psychological response to disaster

It is clear that the older person with one or more chronic underlying health conditions is particularly vulnerable to the effects of the disasters, even if these long-term conditions are well managed and present no problem to the person in their usual, pre-disaster, day-to-day life. However, the older person’s vulnerability to disasters is not only physical, it is also cognitive and emotional.

Those with chronic health needs and the older people frequently report a feeling of ‘stress’ and physical and emotional exhaustion following a disaster (Keene, 1998; Enarson, 2001; Mori et al., 2007). Seplaki et al. (2006) investigated in detail depression in 1,160 older aged earthquake survivors following the 1999 Chi-Chi earthquake in Taiwan. Not surprisingly they found a significantly increased level of depression one year postevent. However, they identified important factors that increased the degree of depression, namely having one’s home destroyed, and difficulty in meeting financial expenses incurred by the disaster. Conversely, a high number of close social ties was found to be protective of depression in this group. Physical disability, problems with performing activities of daily living and the number of current health conditions were also found to be positively related to the degree of depression experienced.

These latter findings are reflected in the work of Zemomar et al. (2007) who examined the degree of mental distress experienced by 4,898 residents of the state of Florida in the run up to the anticipated hurricane season of May–November 2004. Respondents who identified themselves as disabled (either experiencing some activity limitation, or using specialist equipment) had a Frequent Mental Distress (FMD) rating of 21% prior to the hurricane season, this level rose to 25.7% by the end of the season. By contrast, people without disability had a pre-season rating of FMD of 6.6% rising to 8.7%. These figures indicate the high degree of anxiety experienced by people with functional limitations when faced with the possibility of disasters, anxieties that may reflect the person’s uncertainty about their ability to evacuate the disaster affected area, and concerns about whether temporary accommodation will be designed or equipped to meet their specific needs. There is limited information available about the cognitive impacts of disasters on the older population. Masuda et al. (1996) undertook a small scale review of five survivors of the Hanshin-Awaji earthquake with senile dementia and mild cognitive impairment. All five had been self-caring and independent in their own homes, but were required to move and live with family members following the earthquake. All five developed delusions and hallucinations following relocation. The study authors conclude that living
by themselves in communities that are familiar may have protected the subjects from showing dementia symptoms, and that the forced removal from this environment removed this protection.

Implications for practice
We can see that the older person sits at the nexus of a web of interconnected factors that work synergistically and they may have more interest in the day to day financial realities that face the older population. Advocating and enabling activities aimed at maximising the income of the older person might be one concrete way that healthcare professionals can reduce poverty-related disaster vulnerability. Encouraging the older person to save for that ‘rainy day’, and raising awareness of their natural hazard risk exposure are other vital interventions that care providers can undertake. If a truly catastrophic event does hit a community, statutory and voluntary agencies will be overwhelmed. In which case the idea that help is coming is false and self-reliance will be the key to survival, and money is one of the basic resources needed to achieve this.

Temporary accommodation
A consistent theme arising from accounts of forced or voluntary evacuation away from established residences into temporary accommodation is the negative impact this can have on physical and mental well-being. Temporary accommodation needs to be able to meet the specific needs of the older population that arise out of physical impairment, sensory disabilities and disease specific issues and long term medical interventions (for example altered patterns of elimination, domiciliary oxygen therapy, chronic wound management and renal dialysis). Alternative accommodation needs to provide a suitable physical environment that supports independent self-care and preserves dignity, and provides the physical and emotional support services that preserve and enhance well-being. For the older person, maintenance of established social contacts and occupation in appropriate physical activity such as shelter administration, food service etc. can all serve to reduce the likelihood of negative psychological impacts. Whilst many reports highlight the negative impacts of translocation to new residential environments, there are also many examples of such moves being a positive experience (see for example Deal et al. (2006) and Missildine et al. (2009)).

Critical infrastructure
Critical infrastructure is a concept that is frequently cited in disaster planning and response. The concept has its roots in industry and business continuity models where the aim is to identify those elements essential for a process to continue. In disaster preparedness it has traditionally looked at the prerequisites for providing services such as health care, law and order etc. in post-disaster settings. However, this macro-concept can be translated to the micro level of the individual older person. Using this concept, three broader questions can be asked regarding an individual’s critical infrastructure:

1. ‘What are the essential materials, services and knowledge the person needs to …
   i. maintain their well-being, stay disease and ill-health free?’
   ii. continue to self manage their own health related needs?’
   iii. have their medical needs met by others?’

2. ‘How will an anticipated disaster impact on this critical infrastructure?’

3. ‘What can be done prior to any disaster striking to either reduce the size of the critical infrastructure or to strengthen it?’

By asking these questions a pre-assessment can be drawn up that identifies the specific needs and vulnerabilities of the older client, this plan should also reflect the specific hazards presented by anticipated catastrophic events (extremes of temperature, flooding, forest fire, windstorm, seismic and volcanic events, etc.). Subsequent to the assessment a robust plan can be drawn up to protect the health and well-being of the client. A feature of this plan should be an ability for some elements of the plan to fail without jeopardising the success of the overall scheme, for example the whole plan should not hinge upon the ability to admit the client to hospital or for them to remain in their own home with next of kin. Such a plan should allow for the graceful degradation of care during any disaster, rather than its catastrophic failure. A further key element of this plan must be education about the nature of the hazards faced and the impact these can have on the person, and education regarding self-care and disease management. Such education should not only be directed at the older person and their support network, but also at the
statutory and voluntary agencies that have responsibility to plan and respond to disasters. This latter issue is vital if disaster preparedness and response initiatives are to meet the specific needs of the older population.

Conclusion

The older population is exquisitely vulnerable to the risks imposed by catastrophic natural events. They sit at the nexus of a web of interconnected factors that work synergistically to increase the danger posed to their life, health and well-being. There is no simple fix to this complex problem. Imagination and a willingness to tackle both large scale strategic decisions and the day-to-day minutiae are both needed. By doing so it is hoped that we can avoid repeating the mistakes of the past and so better serve the needs of some of the most vulnerable who may find themselves in the most desperate of situations.

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References


Eurostat (2009) 79 million EU citizens were at-risk-of-poverty in 2007, of whom 32 million were also materially deprived. *Statistics in Focus* 46, 1–11.


