

Optimisation through Research of Chemical Incident Decontamination Systems (ORCHIDS)

Work Package 9: Systematic Review of the Needs of Vulnerable and Minority Groups in Emergency Decontamination

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ABSTRACT

In the event of a terrorist attack involving the release of biological or chemical agents, it is probable that those affected will include members of vulnerable and minority groups. These groups include children, the elderly, people with physical, sensory or cognitive impairments, non-native language speakers, the homeless, tourists and members of travelling communities. Vulnerable persons have different needs in emergencies and it is unclear whether existing response plans are capable of meeting these needs.

To explore current evidence and best practice around the management of vulnerable and minority groups in mass casualty incidents involving emergency decontamination, a systematic review of the research literature, existing emergency plans, preparedness exercises and incident reports was conducted. Specific aims of this review were to explore issues associated with the definition of vulnerability in the context of emergency planning, the characteristics of particular groups which are likely to make them vulnerable and the extent to which existing preparedness plans account for the needs of these groups. Where they existed, recommendations for meeting the needs of vulnerable groups in mass casualty incidents were identified and evaluated.

There is widespread agreement that the needs of vulnerable and minority groups must be incorporated into emergency plans for mass casualty incidents, particularly those involving emergency decontamination. Progress has been made toward identifying likely vulnerable populations, the aspects of their vulnerability that may present a challenge to emergency responders and potential recommendations for countering these difficulties. However, gaps exist in the implementation of these recommendations, and current emergency planning appears to fall short in preparing responders to deal with mass casualty incidents that involve significant numbers of vulnerable persons.

EXECUTIVE SUMMARY

This review was carried out to assess the current level of preparedness for responding to the needs of vulnerable and minority groups in incidents which require the implementation of mass casualty decontamination processes. It also examines potential ways in which decontamination provision could be improved to accommodate the needs of these groups and thereby promote a more effective and inclusive emergency response. In order to carry out this review, all available research literature, emergency plans, information from preparedness exercises and incident reports were collated.

Before commencing the review an initial scoping exercise was carried out. This involved a high-level search of the literature which enabled the identification of key themes for coverage by the review. Issues were clarified such as: what is meant by 'vulnerable in the context of mass casualty disasters and emergencies, who is considered vulnerable and the types of published literature available. The results of this scoping exercise were then used to devise a systematic review strategy which could be used to identify all potential sources of information and guidance on the decontamination of vulnerable and minority groups.

One of the initial considerations for the review was how the term 'vulnerable' is defined in the context of emergency planning. Two prominent approaches to the conceptualisation of vulnerability are described: The first is the traditional conceptualisation which focuses on the common characteristics shared by groups of individuals which make them vulnerable. The second is the functional needs approach which focuses on the common needs of groups of people in mass casualty incidents. A further consideration was the extent and adequacy of current decontamination provision for the vulnerable. The general consensus was found to be that emergency plans for mass casualty decontamination incidents contain the implicit assumption that the casualties will not have special needs which result from their vulnerabilities.

The principal vulnerable groups discussed in the literature were identified as: children; pregnant women; people with physical, sensory or cognitive impairments; the elderly; people with chronic illnesses; tourists; the homeless and people who are vulnerable for cultural or language-related reasons. For each of these groups, a description is provided of the characteristics that cause vulnerability and the recommendations that have been made to attempt to accommodate these vulnerabilities and thereby optimise the decontamination process. These recommendations have been evaluated and weaknesses in the existing guidance have been identified.

One of the key observations made during the course of the review was that a number of the recommendations that have been made for discrete vulnerable groups are applicable to a number of other groups, or to all groups. Additionally, many of the recommendations would actually be of benefit to all casualties and the decontamination process as a whole. These generic suggestions for the improvement of mass casualty decontamination processes are discussed before a final summary of existing provision for vulnerable and minority groups and a discussion of how planning for emergencies

involving decontamination must progress in order that the needs of these groups are taken into account.

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1 INTRODUCTION

Numerous incidents in recent history have taught us that the threat of terrorism is a worldwide concern. Events such as the attacks on the World Trade Center on 11th September 2001 and the London bombings of July 2005 illustrate this point all too clearly. What has also become clear is that terrorists are prepared to use every possible method at their disposal to cause the maximum amount of disruption and carnage. The sarin attacks on the Tokyo subway in 1995 and the postal anthrax attacks of 2001 provide a demonstration that chemical, biological, radiological or nuclear (CBRN) weapons could serve as the weapon of choice.

One of the critical components of the emergency response to a CBRN incident is the decontamination of victims that have been, or have potentially been exposed to a contaminant. The purpose of decontamination is threefold: (i) To remove a noxious agent from the casualties' skin and clothing; (ii) to protect others from secondary exposure to the contaminant and (iii) to provide psychological comfort to the victim. Braue, Boardman and Hurst (2009) explain that the primary purpose of decontaminating individuals who have been exposed to chemical-biological agents is to reduce the presence of the contaminant on the skin and hair, thereby reducing the likelihood of serious injury. Decontamination also protects emergency responders and medical personnel and equipment against secondary contamination as a result of contact with the victims; the importance of this was highlighted by Okumura et al. (1998) who carried out a study of secondary exposure of hospital staff following the Tokyo subway sarin attacks in 1995. They found that 23 percent of hospital staff at St Luke's International Hospital (a major receiving hospital for casualties) that responded to a questionnaire complained that they had experienced acute poisoning symptoms following exposure to casualties. In addition to providing physical protection against the effects of chemical agents, decontamination may also provide people who may have been exposed to a contaminant with psychological comfort and thereby reduce distress. As highlighted in the U.S. Army Soldier and Biological Chemical Command report (2003), it may not always be possible for emergency personnel to identify whether a victim's distress is the result of actual exposure to the contaminant and thus necessitating decontamination, or whether it is of purely psychological origin.

Various methods of decontamination are in use in different countries; these include the use of a low-pressure water spray from a fire hose, portable showers, mobile decontamination units and the use of in-situ showers at hospitals some distance from the site of the incident (Home Office, 2004). The decontamination response that is required at a terrorist incident involving CBRN materials is typically referred to as a mass decontamination response; the term 'mass' simply refers to the scale of the incident. This can be illustrated with recourse to the UK specific definition of mass decontamination provided by the Home Office (2004) which states that mass decontamination is the procedure that is used to remove contamination from individuals when the number of people requiring decontamination threatens to overwhelm the capacity of the National Health Service (NHS).

It is generally acknowledged that decontamination should be carried out as quickly as possible after exposure. As highlighted by Braue et al. (2009), early decontamination can mean the difference between an exposed casualty surviving or sustaining minimal injuries and either dying or sustaining serious injury. Therefore, it is essential that effective plans and processes are in place to rapidly decontaminate large numbers of civilian casualties.

Emergency preparedness is defined as, the readiness for unexpected, lethal or harmful events involving more casualties than health-care infrastructures are normally designed to handle (Kollek & Karwowska, 2009). Thus, in the context of civilian mass casualty decontamination, a state of preparedness can only be achieved when those involved in a response to a CBRN incident are fully prepared for the decontamination of all of the casualties that may be involved; this is both in terms of the sheer number of victims and the diverse needs that they present.

The preparedness plans that exist for civilian mass casualty decontamination are frequently derived from those that exist for military personnel (Rotenberg & Newmark, 2003; Markenson & Redlener, 2003). As a result, the systems and processes that are in place are designed to be suitable for fit, healthy, able-bodied adults. They fail to take into account the members of the community that may not fit into this relatively narrow category. Our communities are composed of people of diverse ages and abilities; a large number of people may not be able to respond or act in the ways that are anticipated by existing emergency plans. Such members of the population may include children, the elderly, people with disabilities or impairments of various kinds, the mentally ill, people with chronic illnesses, tourists, non-native language speakers and the homeless. Because of the differing needs of the individuals that belong to these groups, they are collectively 'the vulnerable' in the context of mass casualty decontamination.

It is vital that the needs of vulnerable groups are met in mass casualty decontamination response plans. Failing to do so not only neglects the needs of a significant proportion of our societies, but will also be detrimental to the efficacy of the decontamination processes that are carried out. As stated by Davis and Mincin (2005), ignoring the needs of vulnerable groups is likely to cause disruption and potentially even unnecessary fatalities.

Before it is possible for mass casualty decontamination response plans to incorporate measures and guidelines which are designed to cater for the needs of vulnerable groups, it is necessary to identify those needs and how they should be addressed. A body of work which seeks to address these two issues already exists. The purpose of this review was to provide a comprehensive overview of the information and guidance that is available with respect to the decontamination of vulnerable groups. Following an account of what is meant by the term 'vulnerable' and who it is used to refer to, this review provides a detailed description of the characteristics that are likely to make individuals vulnerable and the recommendations that already exist for meeting any of the needs of these individuals in a mass casualty decontamination incident. These recommendations are evaluated and suggestions are made for potential ways in which mass casualty decontamination processes could be improved or modified for the benefit of all casualties.

2 DEFINING VULNERABILITY

2.1 Who is vulnerable?

According to Lemyre, Gibson, Zlepzig, Meyer-Macleod & Boutette (2009), there are two distinct ways in which the term 'vulnerable population' might be interpreted. Differential exposure to hazards means that some populations are more susceptible to involvement in disasters and emergencies. This may include those who live in high risk areas or regions of pre-existing conflict. On the other hand, regardless of the degree of exposure, some people are more susceptible to the effects of a disaster. Lemyre et al. cite children, the elderly, pregnant women or individuals who rely on medication as those who may be more sensitive for physiological reasons. Persons with pre-existing mental health problems may also be more sensitive for psychological reasons. It is this latter definition of vulnerability, pre-existing individual vulnerabilities rather than higher risk from external hazards, which provides the focus of this report.

2.2 The traditional conceptualisation of vulnerability

The terms 'vulnerable groups' and 'special populations' are frequently used in the emergency preparedness literature to describe those members of a community or population who may be at an elevated risk of negative effects during and following an emergency or disaster. According to James (2005), in the context of disasters, a vulnerable population can be described as a population which is susceptible to injury, illness or premature death. Numerous lists of the groups of people who may fit into this classification are in existence. For example, Levy, Rokusek, Bragg and Howell (2009) identify 14 categories of people who should be classified as vulnerable: (i) the homeless; (ii) non-English speakers; (iii) seasonal workers; (iv) people with physical disabilities; (v) people with sensory impairments; (vi) the mentally disabled; (vii) the functionally illiterate; (viii) the chronically ill; (ix) some rural residents; (x) the frail elderly; (xi) the homebound; (xii) children; (xiii) visitors and (xiv) tourists.

In a paper which describes the determinants of vulnerability, Lindsay (2003) highlights that the social, economic and physical determinants of health such as social support networks, education, working conditions, personal health practices, gender, culture and biological and genetic endowment are often also the determinants of vulnerability. In a further paper Lindsay (2007) draws attention to the fact that, although these determining factors describe individual characteristics, it is important to note that groups of people who share common characteristics may concentrate vulnerability in sub-populations of the community.

Of course, the groups of people who may be considered vulnerable in any given country, region or community is likely to differ. While Levy et al. (2009) specify non-English speakers as a vulnerable group, a more widely applicable term may be 'non-native language speakers'. As a further illustration of this point, Lemyre et al. (2009) highlight that the Canadian Red Cross identify aboriginal residents as a vulnerable group. This clearly indicates a need to define vulnerability locally.

It is undoubtedly important to identify the people who may be at increased personal risk during an emergency; this is necessary to facilitate the formulation and execution of comprehensive disaster plans which incorporate the needs of these individuals. However, there is a mounting concern that the traditional approach of identifying those who may be vulnerable according to the broad group to which they belong (e.g. 'elderly people' or 'people with physical impairments') may be fundamentally flawed.

2.3 Problems with the traditional conceptualisation of vulnerability

A primary criticism of the aforementioned approach to defining vulnerability in the context of emergency preparedness activities concerns the use of the terms 'vulnerable group' or 'special population' (Kailes, 2005; Kailes & Enders, 2007; Westerman, 2005; Lemyre et al., 2009; Purdy, 2008). A broad and heterogeneous set of people are captured under the umbrella terms 'vulnerable group' or 'special population' (Kailes, 2005; Kailes & Enders, 2007). As Kailes (2005) points out, the groups to which these terms refer often have little in common beyond the fact that they are not accounted for in emergency planning. Kailes and Enders (2007) carried out a demographic analysis to estimate the number of United States citizens who fit into the 'special needs' category; they estimated that 50 percent of the population could be categorised as such. While this estimate included what Kailes and Enders describe as the most typical groups of special needs populations (i.e. people with disabilities, people with serious mental illness, children, the elderly and people who cannot speak English), it failed to take into account other potentially vulnerable groups such as pregnant women and the morbidly obese. When over 50 percent of a country's population might be considered 'vulnerable' at a given time, the term becomes almost meaningless and the size of the task for those responsible for incorporating the needs of these people into emergency response plans becomes unmanageable.

When people are put into categories based on broad descriptions of their characteristics, a further problem that may arise for emergency planners is that the capabilities of the people that may comprise any one of these groups are likely to differ greatly. Any one of the traditionally defined 'vulnerable groups' can be taken as an example here; while one 80 year old may have severe mobility impairments and suffer from Alzheimer's disease, a second 80 year old may be a fit and active member of their community. Similarly, one person with a severe visual impairment may lead an entirely independent lifestyle, whilst another may rely on high levels of assistance from family, friends or healthcare professionals. Thus, to put people into categories in this way may not only be unhelpful, but also may be seen as degrading to those people being described (Lemyre et al., 2009).

2.4 An alternative conceptualisation of vulnerability: The functional needs approach

An alternative way in which to conceptualise vulnerability is the functional needs approach (Kailes & Enders, 2007; Purdy, 2008; Powell, 2009). Powell suggests that

instead of grouping people’s needs according to population characteristics such as age, disability etc., the functional needs approach seeks to identify cross-cutting areas of functional need, such as reliance on medication or medical equipment. One of the benefits of this approach is that it is able to accommodate members of any at-risk group that may have one or more functional need (Powell, 2009). Furthermore, it recognises that functional needs can be temporary and, even when people do not identify themselves as belonging to one of a pre-determined set of vulnerable groups, they may have functional needs (Purdy, 2008). As described by Powell (2008), the World Health Organization’s (2001) International Classification of Functioning, Disability and Health forms the basis of the functional needs framework which identifies five essential function-based needs: (i) medical; (ii) communication; (iii) supervision; (iv) maintaining functional independence and (v) transportation. Purdy (2008) provides a detailed description of each of these categories of need; these descriptions are summarised in Table 1.

| Table 1: Descriptions of the five categories of functional-based needs according to the functional needs framework (Purdy, 2008) | |
|---|---|
| Function-based need | Description |
| Medical | People with medical needs may require assistance with the tasks of daily living (eating, dressing, grooming etc). They may have health conditions which require the administration of medications, IV therapy, catheters, tube feeding, respiratory support etc. |
| Communication | People with communication needs may have limited or no ability to speak, see, hear or understand. People with communication needs may not be able to hear announcements, read signs, verbalise concerns or understand messages during an emergency. |
| Supervision | A broad variety of people may have supervision needs. This category includes: Children; people with some psychiatric conditions; the mentally ill and people with brain injury. |
| Maintaining functional independence | Those with needs associated with maintaining their functional independence may require assistive devices or medical equipment (e.g. wheelchairs, crutches, hearing aids, glasses, oxygen, medications) in order to avoid dependence on others. |
| Transportation | Those who may require transportation assistance during an emergency or a disaster may include people who are unable to drive (for reasons such as not having access to a car, mobility problems, age, sensory impairments, poverty or legal restriction). An additional consideration for this category is that particular types of transport may not be appropriate for some people; for example, a wheelchair user may require a wheelchair accessible vehicle. |

As stated by Kailes and Enders (2007), by taking a functional-based needs approach to vulnerability and thereby considering people’s needs in terms of function, rather than in terms of a general impairment or diagnosis, it is possible to include temporary limitations in functionality (such as those that arise from surgery, illness, injury or

pregnancy). Furthermore, the functional-needs approach also takes account of those people who may develop vulnerability as a result of an emergency or disaster (for example a person who suffers temporary hearing loss as a result of a large explosion).

Westerman (2005) states that by adopting an approach to emergency management which focuses on the limitations that interfere with the receipt of information and the effective response to this information, all individuals in the community will benefit, rather than just those with a pre-defined disability. Westerman provides an example involving the communication of information via the radio. Rather than considering just those people who may not be able to hear a radio broadcast, such as the deaf and people with temporary hearing impairments, those people who will not hear a radio broadcast for other reasons should also be taken into account. These will include people who cannot speak English, who do not have access to a radio or who are asleep. Taking account of these factors, it is possible to identify ways in which many more people will receive and benefit from the message that is communicated.

Lindsay (2007) raises an important issue for emergency planners who may adopt the functional needs approach to disaster planning: Although different groups may share functional limits on their capabilities or capacities to cope, it is important to recognise that the root causes of these functional needs may be different. An example which is applicable to the context of mass casualty decontamination relates to the difficulties in reading instructions that might be experienced by both a visually impaired person and a child. While it may be suitable to provide the child with a pictorial diagram which illustrates the instructions, this approach will not solve the problem for the visually impaired person. Lindsay points out that any consideration of vulnerability must take into account the reason for a person's vulnerability as well as how they are vulnerable.

Despite its shortcomings, the categorisation-based approach to defining vulnerability provided a useful framework within which to examine mass casualty decontamination provision for vulnerable individuals within the context of this review. It is important for all involved in the planning and provision of mass casualty decontamination to acknowledge the problems that are associated with categorising people in this way and to avoid assumptions about individuals' capabilities based purely on the characteristics that they share with other group members.

2.5 Current mass casualty decontamination provision for vulnerable groups

Communities are not comprised solely of healthy, fit and agile young adults; the ages and abilities of people within any given population are extremely varied and diverse. Similarly, although attendees at large events such as the Olympics, football matches and music concerts may attract more or less people of particular age groups or levels of mobility, some diversity is likely to exist. Because of this, it is essential that the needs of all people are met when planning for a mass casualty incident, especially those involving the release of chemical or biological warfare agents.

It is frequently claimed that emergency planning for vulnerable populations has been insufficient (e.g. Davis & Mincin, 2005; Markenson & Redlener, 2003; Kailes, 2005;

Kailes & Enders, 2007; Taylor, Balfanz-Vertiz, Humrickhouse & Jurick, 2009). According to Markenson and Redlener (2003), and the traditional focus of planning for biological, chemical or radiological attacks has been in a military context. As a result, the research that has been conducted and the treatments, medications and antidotes that are available tend to be appropriate for healthy adults, but fail to take account of the collective needs of communities, including the vulnerable. Kailes and Enders (2007) support this view, claiming that the emergency response systems that currently exist assume that people are able to walk, run, drive, see, hear and quickly respond to directions. Few plans directly address the needs of people who are not able to do these things. According to Hutton (2009), disasters always have the greatest impact on the least able and most disadvantaged members of society. If this is the case, then considerable effort should be made to protect these groups and address the shortcomings in emergency planning that currently exist.

Addressing the needs of vulnerable and minority groups in mass casualty decontamination response plans is vitally important. Not only will this ensure that these groups receive the care and assistance that they require, but it will also ensure that in the event of an incident, the response provided is as efficient, inclusive and effective as possible for all. Davis and Mincin (2005) point out that, "The exclusion of special needs populations can have dire effects and cause undue disruption and perhaps even unnecessary fatalities" (p. 10).

2.6 The need for a review

Although it appears that emergency planning for vulnerable and minority groups may be lacking, it is important to acknowledge that work which has sought to address this deficit by identifying who may be vulnerable and what should be done to provide for these people in disaster situations does exist. The purpose of this review was to identify the published literature on the decontamination of vulnerable groups and more generally on the provision for these groups in mass casualty incidents. This literature includes academic journal articles, decontamination exercise (drill) reports, policy documents and web-based documents.

The first tasks for this review were to examine what is meant by the term 'vulnerable' in the context of mass casualty decontamination, provide an account of who is generally considered to be vulnerable and what characteristics make them vulnerable. The existing evidence-base was then summarised along with any identified recommendations that have been made to optimise the decontamination process for vulnerable groups. The final objective of this review was to evaluate these existing recommendations and to identify any gaps in emergency planning and response management. Where possible, suggestions have been made for ways in which any areas of weakness might be addressed.

By highlighting the importance of mass casualty decontamination provision for vulnerable groups and providing possible solutions and suggestions for enhancing emergency response, it is hoped that this review will serve as a useful tool for all those involved in mass casualty decontamination planning.

2.7 Methodology adopted

An initial scoping exercise was carried out, involving a high level search of the literature which enabled the identification of the key themes for the review. Issues such as: what is meant by 'vulnerable' in the context of mass casualty disasters and emergencies, who is considered vulnerable and the types of published sources that exist were clarified.

From the outcomes of this scoping exercise, it was possible to produce a detailed list of key words which were relevant to the topic of mass casualty decontamination involving vulnerable and minority groups. This list formed the basis of a set of search terms and included words such as 'child', 'sensory', 'chemical', 'biological' and 'toxic' (See Appendix A for the full list of search terms). Where applicable, synonyms for the relevant words were also included in the list; so for example, in addition to the word 'child', the word 'paediatric' (using both the English and the American spelling) was included. Furthermore, where derivative words with the same initial letters were possible (e.g. decontaminate and decontamination), wildcards were used (e.g. decontamin*). In this way, the list of words that was used to formulate the search terms was as inclusive and thorough as possible.

The search terms were used to search for relevant literature using academic search engines (journal databases) as well as more generic search engines such as Google and Yahoo. Search terms were also combined using the Boolean operator 'and' to create search strategies with either two or three key search words (e.g. 'child* AND decontamin*', 'deaf AND emergenc* AND chemical'). Search terms were used in multiple combinations to increase the chances of identifying relevant information sources.

Searches were carried in the academic search engines PubMed, PsychINFO and Scopus. These searches generated a list of journal article titles, some of which were relevant to the review and some of which were not. Where possible the potentially useful articles were filtered using the title alone. In cases where it was ambiguous from the title whether or not the article would be useful, the abstract of the article was downloaded and read. In this way it was possible to generate a list of sources to be read and reviewed. The filtering process that was used to identify the sources that would potentially be useful for the review was pre-determined so that a set of inclusion criteria were adhered to. The inclusion criteria stipulated that information sources should be included in the database if they were related to the issue of people or groups that may be vulnerable in mass casualty incidents. Although the focus of the review (and therefore the literature search) was on decontamination, sources which mentioned vulnerable groups in any form of natural or man-made disaster were also included. This was considered important due to the potentially relevant or transferable information that might be contained in such sources. Only those sources which made reference to the immediate physical or psychological needs of minority or vulnerable groups during an emergency were included. Thus, sources which dealt with the long-term and after-care needs of these groups were rejected. The purpose of the review was to examine the mass casualty decontamination needs of these groups; thus, to extend the review to

focus on the care that they might require after the event was beyond the scope of this work.

In addition to the searches carried out using academic search engines, searches were also carried out using the search engines Google and Yahoo. Large numbers of hits were obtained with these searches, making it difficult to review and assess their relevance (in many cases these searches generated hundreds of thousands of hits). To address this problem, the first 100 hits returned for each search were scanned to determine whether or not the results would be relevant and useful. Relevant sources were added to the literature database. This strategy was particularly useful in identifying web-based or grey literature sources not available in the academic literature.

Having formulated the literature database, the full sources identified were obtained (where this was possible). In many instances, additional information sources were identified in the course of reading the collated literature; these were also added to the database.

Despite the potential merits of the functional needs approach to defining vulnerability (as described in Section 1.4), it was identified that the majority of the available literature discussed vulnerability in terms of the broad category to which a vulnerable individual could be seen to belong. For this reason, the following review is in-keeping with this conceptualisation of vulnerability. The proceeding chapters of this report provide an in-depth overview of the literature that exists in relation to the key vulnerable groups identified: children, pregnant women, people with physical, sensory and cognitive impairments, elderly people, people with chronic illnesses, tourists, the homeless, people who are vulnerable as a result of cultural or religious issues and people who may have language-based vulnerabilities. Summaries are provided of the characteristics of each group which are likely to make them vulnerable and the recommendations that have been made to address these vulnerabilities. The recommendations provided are evaluated and any gaps or areas of weakness are identified. Chapter 13 draws all of the recommendations made for the individual groups together, identifies key themes and makes suggestions for moving mass casualty decontamination provision for the vulnerable forward.

3 CHILDREN

3.1 Introduction

History has shown us that children are susceptible to the effects of terrorist activities. Events such as the siege of the school in Beslan, Russia in 2004 (Freyberg et al., 2008) and the failed terrorist effort to release a chlorine gas bomb at the Disneyland theme park in California in 1995 (American Academy of Pediatrics, Committee on Environmental Health and Committee on Infectious Diseases (AAP), 2000) provide clear evidence that children may be the direct targets of terrorist activity. Brandenburg and Regens (2006) highlight the fact that when children are placed in danger, injured or killed, there is likely to be a considerable emotional impact on the community and in the media. The potential for such profound reactions is likely to increase the risk to children from terrorist activities, whose aim is to maximise disruption.

Even when children are not the specific and direct targets of terrorist activity, it is likely that any incident will impact on the children that live within the affected community. In the Oklahoma City bombing of 1995 for example, 168 people were killed at the Alfred P. Murrah Federal Building, 19 of whom were children who had been in attendance at the building's day care centre (Ginter et al., 2006). Furthermore, of the 5000 casualties resulting from the Tokyo subway sarin gas attack in 1995, 16 of the victims were children (Ginter et al., 2006).

Schools have been highlighted as a particular area where preparedness is crucial to protect children (e.g. Graham, Shirm, Liggin & Dick, 2006; Kubicek, Ramirez, Limbos & Iverson, 2008). Schools are places where large numbers of children spend a large proportion of their time under relatively minimal adult supervision (i.e. there are usually a large number of pupils to each teacher). Thus, it has been suggested (e.g. Graham et al., 2006) that schools should be considered as potential targets for terrorist activity. Appropriate planning is clearly necessary to prepare for such a catastrophic event and to maximise the efficiency of the emergency response.

Not only are children at risk of involvement in incidents involving the release of harmful chemical and biological substances, they also have a number of unique physiological, anatomical, psychological, behavioural and developmental characteristics which set them apart from adults and make them particularly vulnerable in the event of such an incident. It is crucial that emergency plans take account of and accommodate the needs of children in any mass casualty incident which requires decontamination. Rotenberg and Newmark (2003) highlight the fact that optimising paediatric care in the event of a mass casualty incident will not only benefit children, it will also enhance the overall efficiency of the system and, in doing so will minimise morbidity and mortality in all victims.

3.2 What makes children vulnerable?

Children have a number of unique characteristics which differentiate them from adults and are likely to make them particularly vulnerable to the ill effects of a mass casualty incident which involves the release of a chemical or biological agent. These vulnerabilities can be categorised as being related to children's physiology, anatomy, psychology and/or their developmental or behavioural level.

3.2.1 Physiological and anatomical vulnerabilities of children

The physiology and anatomy of children is not simply a scaled down version of that of adults; children are still undergoing development, meaning that a number of key differences exist until they are fully grown (Bearer, 1995). Many of the anatomical and physiological characteristics which are unique to children make them more vulnerable to the effects of exposure to chemical and biological contaminants.

Children have a higher respiratory rate than adults, which may result in a greater inhaled dose of aerosolised agents (e.g. AAP, 2006; Rotenberg & Newmark, 2003; Braue et al., 2009; Bearer, 1995; Kollek & Karwowska, 2009; Wright, 2001). The faster baseline respiratory rate of children may also create a challenge for healthcare providers responding to a mass casualty incident involving aerosolised toxins. This is because for those personnel who do not routinely work with children, it may be more difficult to distinguish developmental variances in respiratory rate from pathogenic variances (Gausche-Hill, 2009).

Any airborne toxin which has a greater density than air (such as sarin, chlorine and toxins from burning substances) will naturally hang closer to the ground. A logical inference drawn is that because of young children's shorter stature, they are at increased risk of exposure to such toxins (e.g. AAP, 2006; Braue et al., 2009; Bearer, 1995; Stokes, Gilbert-Palmer, Skorga, Young & Persell, 2004). The same conclusion can be drawn for nuclear fallout which quickly settles to the ground. However, as highlighted in a policy statement written by the Committee on Environmental Health and Committee on Infectious Diseases (2006) in America, it is necessary to carry out studies of airborne pollutants in order to test the hypothesis that children's short stature brings them into closer contact with fallout as it settles to the ground.

Children's exposure to contaminants is also likely to be increased as a result of the characteristics of their skin. The skin of infants and young children is less keratinised and more permeable than that of adults; this increases the transdermal absorption of toxins that are able to penetrate the skin (such as VX) and therefore increases systemic toxicity (AAP, 2006; AAP, 2000; Mueller, 2006). According to Bearer (1995), newborn babies are most at risk from transdermal absorption of chemicals; this is because skin keratinisation occurs over the initial three to five days following birth. The large surface area to body mass ratio of children is also likely to increase the dose of a contaminant to which a child is exposed (e.g. AAP, 2006; Bearer, 1995; Mueller, 2006; Agency for Healthcare Research and Quality (AHRQ), 2006; Wright, 2001). According to Gausche-Hill (2009), because children have a faster metabolic rate than adults, once a toxicological agent has been inhaled or absorbed, its effects will be more immediate.

Not only is systemic toxicity in children likely to be greater than that in adults; it is also reported that children have immature immune systems which can cause them to be at a greater risk when they are exposed to infectious agents. Furthermore, according to Mueller (2006), it may also be more difficult to identify toxicological illness in children because the signs and symptoms of illness resulting from biological or chemical agents may manifest differently in children than adults. Thus, special expertise or knowledge may be required to identify children who require immediate medical attention in incidents involving such agents.

In a clinical study focusing specifically on the skin manifestations of mustard gas in children and teenagers, Momeni and Aminjavaheri (1994) noted that there are several differences in the manifestations that are observed in this group compared to those observed in adults. Not only was the onset time of symptoms shorter in children; the symptoms observed were often not the same as those in adults. Children and teenagers were more likely to suffer ophthalmic, pulmonary and gastrointestinal symptoms than were adults and they were less likely to suffer from genital manifestations. Lastly, the bullous lesions that often characterise mustard gas exposure appeared sooner in children and teenagers than they did in adults.

In addition to the enhanced effects of contaminants that are likely for children, they are also more at risk of secondary problems such as hypothermia during a mass casualty event. The large surface area to body mass ratio of children compared to that of adults makes them more susceptible to hypothermia (e.g. Chung & Shannon, 2005; Rotenberg & Newmark, 2003; Kollek & Karwowska, 2009; Gausche-Hill, 2009; Wright, 2001); a problem which is particularly significant when children are required to undress and go through decontamination showers. The smaller quantity of subcutaneous fat typically seen in children is also likely to enhance their risk of hypothermia (Chung & Shannon, 2005; Gausche-Hill, 2009). The tendency of children to become very cold relatively quickly was illustrated by Fertel, Kohlhoff, Roblin and Arquilla (2009) in their paediatric decontamination drill: Despite the fact that the drill took place in the summer and that warm water was used in the decontamination showers, many of the children involved began shivering during the exercise; a concern because shivering is an early sign of hypothermia.

Children have a lower fluid reserve than adults; thus when children are involved in incidents or are exposed to certain infectious agents which cause bleeding, burns, vomiting or diarrhoea, they are more susceptible to dehydration and hypovolemic shock (e.g. AAP, 2000; Lynch & Thomas, 2004; Cieslak & Henretig, 2003; Mueller, 2006; Gausche-Hill, 2009; Wright, 2001).

3.2.2 Psychological vulnerabilities of children

In addition to the physical characteristics of children which make them more susceptible than adults to the negative effects of mass casualty events, a number of psychological attributes add to their vulnerability.

It has been suggested that children are particularly vulnerable to adverse psychological reactions when they are involved in disasters; they are at greater risk of anxiety reactions during an incident and of post-traumatic stress disorder in its aftermath (AAP,

2006). Madrid, Grant, Reilly and Redlener (2006) report that the psychological trauma of mass casualty events commonly manifests in symptoms such as regression, clinging behaviour, inattentiveness, aggression, bed-wetting, somatic complaints, irritability, social withdrawal, nightmares and crying.

It is possible that children will become separated from parents or caregivers during a mass casualty incident, or during the triage or decontamination process. According to Ginter et al. (2006), separation anxiety is a possible reaction to such circumstances. The unfamiliarity of the emergency personnel wearing personal protective equipment will not only frighten children during the incident (Braue et al., 2009), but also has the potential to increase the post-traumatic stress response in children (AHRQ, 2006). A potential reality of such an event is that a child will witness the death of a close family member. According to Henretig, Cieslak and Eitzen (2002), children who have injuries or who witness the death of either a parent or sibling will be less able to cope than an adult; Henretig et al. term this 'psychologic immaturity'.

Every aspect of a mass casualty incident is likely to be scary and unfamiliar to a child. Children's inability to understand the event or to put it in any kind of context with which they are familiar is likely to cause intense anxiety, resulting in negative reactions such as inconsolable crying, attempts to run away or a refusal to undergo decontamination (Stokes et al., 2004). Young children are not capable of seeking help when faced with stressful events; they are reliant on adults to recognise the signs of anxiety and to provide help (Ginter et al. 2006). In a paediatric decontamination drill carried out by Fertel et al. (2008) in New York, it was demonstrated that children may not be willing to enter decontamination showers; both a four-year old girl in the company of her mother and an eleven-year old boy refused to go through the decontamination process.

No two children are the same and psychological reactions to mass casualty incidents will clearly differ according children's developmental stage. Galili-Weisstub and Benarroch (2005) describe an evaluation of the psychological consequences of involvement in terrorist incidents in over 260 paediatric terror victims who had been evacuated to the emergency room of two hospitals in Jerusalem. Galili-Weisstub and Benarroch categorise children as belonging to one of four age-defined groups: (i) Infants and toddlers; (ii) preschool age children; (iii) school age children and (iv) adolescents. While it is acknowledged that the evaluation of children who are under two-years old is difficult, evaluations of infants' and toddlers' psychological reactions are noted to be largely dependent on those of their parents or caregivers; most babies become restless, cry and are difficult to settle and soothe. In some cases they become very quiet and fall asleep. With regard to preschool age children, it was observed that any negative psychological reactions were ameliorated by the presence of a close family member or familiar person. Although no acute emotional reactions were observed in children belonging to this age group, some of the children later developed post-traumatic stress disorder (PTSD). These cases corresponded with the presence of PTSD in at least one parent. According to Galili-Weisstub and Benarroch, severe adverse affects were not immediately observed in these children because, whilst in the emergency room, they were still protected from the impact of the event. The emotional reactions that were observed in school age children (six to eleven years) were wide ranging; it was noted that while some of the children appeared sad and subdued, others

were noticeably very anxious about themselves or their family members, drawing a disproportionate amount of attention to very minor injuries or therapeutic interventions. Adolescents generally present with emotional shock, anxiety and sadness; they are often preoccupied with locating friends who were also involved in the incident. Whilst some children of this age group seem unconcerned about their own injuries, others behave in a manner consistent with their younger counterparts, paying considerable attention to very minor injuries.

Of the terror victims observed by Galili-Weisstub and Benarroch, only 18 percent presented what were described as 'extreme acute stress reactions'. Among the clinical symptoms of those that did present with such responses were: dissociative reactions, conversion reactions, intense anxiety and psychosis. It is clear that the potential for such reactions needs to be taken into account when planning for mass casualty events to ensure that the smooth running and efficiency of decontamination processes are not affected.

It is possible that children's experiences during a disaster or mass casualty event will influence their long-term psychological wellbeing. According to a report written by the Agency for Healthcare Research and Quality (AHRQ, 2006), in the aftermath of the incident, children may develop developmentally regressive behaviours, sleep and appetite problems, altered play, school problems or greater dependence on their caregivers. It has been suggested that separation from parents or caregivers will not only cause separation anxiety during the event (Gurwitch et al., 2004), but will also exacerbate the negative psychological consequences of a disaster in children (AHRQ, 2006).

3.2.3 Developmental and behavioural vulnerabilities of children

Children's responses to stress are likely to be very different to those of adults; they are developmentally underprepared to fully comprehend the scale of the situation and its implications, or to act rationally to maximise the chance of their survival. The developmental stage of a child is likely to influence both their physical and psychological response to a disaster (Fox & Timm, 2008). Kollek & Karwowska (2009) highlight that age and level of development will cause variations in children's cognitive and motor skills; these variations will create a challenge in distinguishing whether a child has deviated from his or her usual norm.

Unlike adults, young children are unlikely to have developed the cognitive and motor skills necessary to move away from danger; infants will not be capable of fleeing and a lack of understanding in toddlers and preschool children may even cause them to move towards, rather than away from the source of danger (Chung & Shannon, 2005; Fox & Timm, 2008; AAP, 2000; AAP, 2006). Similarly, young children are unlikely possess the motor skills to shield their eyes, making them more susceptible to ocular injury as a result of an explosive blast (AHRQ, 2006).

Difficulties may arise when attempting to triage or provide treatment to pre-verbal children as they will be unable to vocalise their symptoms (AHRQ, 2006). In the absence of a parent or caregiver, it may be impossible to obtain any information relating to a child's medical history (Freyberg et al., 2008; Kollek & Karwowska, 2009; Mueller,

2006). The registration and tracking of children will also be made difficult if they are not able to identify themselves (Freyberg et al., 2008). Anxiety responses of children may render usually verbal children unable to provide information to emergency personnel (Freyberg et al., 2008).

The decontamination of individuals exposed to hazardous biological and chemical agents is carried out in order to reduce the negative effects of the contaminants on the victims and to prevent secondary contamination of healthcare workers or responders who will subsequently come into contact with the victims. The removal of clothing is an important component of the decontamination process; it is estimated that disrobing can remove 70-90 percent of a contaminant (Koenig, 2003). Previous research has shown that children may be reluctant to undress in the presence of strangers. In the paediatric decontamination drill carried out by Fertel et al. (2008), 40 percent of the children involved were reluctant to undress prior to entering the decontamination showers. This was despite the fact that they were wearing swimwear underneath their clothes. While it is unclear whether there would be similar reluctance in a real incident, the possibility that children may not be willing to undress must be considered.

Infants and children continue to be vulnerable once they have entered the decontamination showers. Infants will not be capable of showering themselves and will require the assistance of at least one adult to complete the showering process. If decontamination is carried out by emergency responders, because of the cumbersome nature of the personal protective equipment that personnel will be required to wear, procedures must be in place to ensure that infants are not dropped (Freyberg et al., 2008). Children who are capable of walking through the decontamination showers and washing independently have the potential to be highly anxious, become immobile or misbehave whilst in the shower. This is likely to disrupt the steady flow of patients through the decontamination process (Freyberg et al., 2008).

3.3 Recommendations for improving mass casualty decontamination provision for children

3.3.1 Optimising the decontamination showering process

Because of the unique physiological and anatomical characteristics of children which make them vulnerable in a mass casualty decontamination scenario, it is vitally important that measures are taken to minimise their exposure to noxious agents and that they receive the appropriate treatment.

Recommendations relating to the optimal showering conditions for children are scarce and where they do exist, they are rarely supported by scientific evidence or justification. Where suggestions are made regarding the conditions in which children should be showered it is generally recommended that children should shower in either water alone, or using a combination of water and soap (Rotenberg et al., 2003; Braue et al., 2009). In a 2006 policy statement written by the Committee on Environmental Health and Committee on Infectious Disease in the United States, the use of water alone is advocated unless the toxic material is oily or firmly adhered to a child's skin; in this case, soap or a mild shampoo should also be used. Bleach or other chemical

decontaminants should not be used because of the risk of injury to children's skin (Rotenberg et al., 2003; Braue et al., 2009).

It is recommended that warm water should be used to decontaminate children (Fertel et al., 2009; Braue et al., 2009); Braue et al. (2009) specify that water should be heated to a temperature of 100°F (38°C). However, this is a recommendation which is made to minimise the likelihood of hypothermia occurring, rather than maximising the effectiveness of decontamination.

As a result of children's susceptibility to hypothermia, a number of other recommendations are made which advocate the implementation of relatively simple strategies to keep children warm throughout the decontamination process: It should be ensured that children are thoroughly dry following decontamination showering and that they are wrapped in either towels or foil 'space blankets' (Freyberg et al., 2008). Radiant heaters should be used to increase the air temperature through the decontamination line (Freyberg et al., 2008; Stokes et al., 2004) and the distance between the decontamination shower and the triage area should be minimised in order that children are exposed to the outside air temperature for the minimum time period (Freyberg et al., 2008). It is clear that all of these recommendations will help to prevent hypothermia not only in children, but in everyone undergoing decontamination.

Whilst it is reasonable to assume that most pre-school and school-age children will be able to move through the decontamination showers with some assistance required in washing, infants are clearly non-ambulatory and will require special care from emergency services personnel and their parents to ensure effective decontamination (Chung & Shannon, 2005). Freyberg et al. (2008) make a number of specific recommendations relating to the movement of infants through the decontamination showers: they recommend that two people should always handle the transfer of an infant through the shower and that whenever it is necessary to hold the child, the child should be held tightly and close to the body of the chaperone in order to prevent slipping. One suggestion for the transportation of infants through the shower is to put them in a waterproof car seat (without the cushion); this will support their head and maintain their airway in a neutral position. However, because this will prevent access to the child's posterior side, it may be more effective to carry infants on a stretcher to facilitate total access to the child. It is noted however, that the child should be placed on their side, rather than on their back to prevent aspiration of the water.

In a set of guidelines for paediatric disaster preparedness produced by Illinois Emergency Medical Services for Children (2005), it is recommended that decontamination systems should be designed so that they are appropriate for use by families, children of all ages and children with special healthcare needs. Although this recommendation may prove costly if it involves the design and purchase of new decontamination facilities, it is possible that it may be implemented when next generation decontamination units are required.

It is generally acknowledged that when it is necessary for children to undergo decontamination, a greater number of staff may be needed to man the decontamination facilities. Additional personnel may be required to assist with the dis-robe and re-robe of children, communicating instructions, guiding them through the showers and

maintaining a sense of order and efficiency (e.g. Fertel et al., 2009; Mueller, 2006; Timm & Reeves, 2007).

An additional consideration which is necessary when preparing for potential incidents which require the decontamination of children is the registering of these individuals and the process by which they can be tracked through the decontamination process. When children are involved in any mass casualty incident or emergency it is clearly necessary for the identities of these children to be established; this will enable the reunification of families who become separated during the incident, the reunification of children with their parents after an incident and will ensure that any follow-up, post-event care can be delivered. One suggestion is to put a wristband on each child in the cold zone; this would display any information that is available for a given child (Fertel et al, 2009; Freyberg et al, 2008; Braue et al., 2009). A further potential solution may involve the use of digital or Polaroid photographs (Freyberg et al., 2008; Braue et al., 2009). However, Freyberg et al. acknowledge that the use of photographs is controversial because of the associated privacy issues.

One issue which receives very little attention in the literature is the prioritisation of decontamination, that is, who should be decontaminated first? Henretig, Cieslak and Eitzen (2002) state that owing to the unique skin characteristics of children which increase dermal absorption, children should be decontaminated as early as possible. Although this recommendation is seemingly valid, it is not clear what is meant by 'as soon as possible'. Should young children be decontaminated before older children? Should lone children be decontaminated before families? Should families be prioritised above adults without children? It is not clear whether it is even possible to provide workable solutions to these questions – even if an algorithm was available to emergency responders which dictated the order in which people should be decontaminated, would it be possible to adhere to such guidelines in a real-life mass casualty event? These are issues that emergency planners should explore and attempt to address in the future.

3.3.2 Meeting the mental health needs of children

Given claims that children are particularly susceptible to negative psychological reactions as a consequence of involvement in mass casualty events or disasters (e.g. AAP, 2006), it is reasonable to conclude that a key consideration for emergency response plans should be the mental health needs of this group. In the summary of recommendations that arose from a national consensus conference on paediatric preparedness in the United States, Markenson and Redlener (2003) claim that there is a need for children's mental health needs to be incorporated into all stages of disaster preparedness, including response, recovery and mitigation. In accordance with this claim, Markenson and Redlener make a number of recommendations relating to meeting the mental health needs of children during and following a disaster. Among these recommendations, Markenson and Redlener claim that: the mental health needs of children should be incorporated in preparedness planning; the mental health implications that may be associated with announcements and preparedness activities should be considered and, it is important that an infrastructure is created which is capable of addressing the mental health needs of children and families during disasters.

While these recommendations are clearly important and valid, Markenson and Redlener do not provide any guidance on how these suggestions might be implemented or any specific indication of the steps that could be taken to achieve the desired outcomes. It is important that, if progress is to be made towards meeting the needs of children in disasters, any recommendations that are made are evidence-based and explicitly describe the particular actions that should be taken.

In relation to the topic of the psychological impact of disasters on children and families, Gaffney (2008) raises the topic of psychological first aid as a tool for minimising the negative psychological impact of a traumatic event. According to Schonfeld and Gurwich (2009), by providing supportive services and psycho-education, health care providers are able to foster normative coping and accelerate the adjustment and healing process. The US Department of Health and Human Services (2005) have produced a leaflet which provides guidance on psychological first aid for emergency and disaster response workers. The leaflet presents information on the emotions that people may experience and the reactions that they may exhibit when faced with a disaster. It also provides recommendations on how to promote an optimal psychological response and outcome for the victim. These recommendations include communicating calmly with the victim, establishing a relationship with them, promoting safety, calm and connectedness and speaking to the person with respect.

Mitigation against potential negative psychological reactions during a mass casualty event is important not only because it is likely to facilitate a smooth and efficient recovery attempt by the emergency responders, but also because it is likely to promote the long-term psychological well-being of the victims. In a report by Fertel et al. (2009) which summarises a paediatric decontamination drill carried out in New York, a wide range of reactions to stress and trauma were highlighted as likely to be exhibited by children, even within groups of children of a similar age. Fertel et al. advocate the importance of an individual-based approach and that it is not possible to generalise across children; the needs of each must be considered separately. While this approach is clearly an ideal and may even be possible in pre-planned exercises and small-scale incidents, the feasibility of such a recommendation is questionable in a real event involving very large numbers of children.

A further recommendation which is common to almost all literature which discusses the prevention of anxiety reactions in children is that, where possible, families should be decontaminated together. This will enable parents to help their children throughout the process whilst receiving directions from emergency services personnel (Fertel et al., 2009; Freyberg et al, 2008; AAP, 2006; Klein, Devoe, Miranda-Julian & Linas, 2009; Braue et al., 2009; Kollek, & Karwowska, 2009). Where children are not accompanied by members of their family or caregivers, it has been suggested that custodial care be provided throughout the decontamination process and the period following it (AAP, 2006). In a discussion of hospital-based decontamination Freyberg et al. (2008) even suggest that unaccompanied children be allocated a dedicated chaperone to provide comfort and reassurance in the cold zone. Fertel et al. acknowledge the resourcing issues that are associated with this suggestion and suggest that volunteers from the local community could be trained to perform such a function. A potential alternative to the resource intensive suggestion of operating a chaperone scheme is the use of a

'buddy system'. Such a system involves children being paired-up at the start of the decontamination process and accompanying one-another through from the removal of clothing, through to showering and re-dressing. Exercise Young Neptune, an exercise involving the decontamination of 65 children, carried out by the Health Protection Agency (HPA) on behalf of the Department of Health (DH) in 2006 also recommended such a strategy. Turner, Jewkes, Amlôt and Simpson (2007) reported that children who either knew each other, or older children grouped with younger children, were better able to manage all aspects of the decontamination process. The report concluded that formalising a buddy system would help the children to feel safe as well as accelerating many of the procedures.

Freyberg et al. are not alone in their recommendation that planning for mass casualty events should go beyond the training and preparing of emergency service personnel, hospitals and officials and should extend to people within local communities. In a policy statement written in the United States in 2006 by the Committee on Pediatric Medicine and Committee on Medical Liability and the Task Force on Terrorism, it was suggested that parents can be encouraged to prepare their children for disasters, terrorist incidents or other emergencies. According to this document, it is possible to take an approach similar to that taken when discussing threats such as fires or approaches by strangers with a child. By talking about what the child should do in a disaster, who they should rely on for help and appropriate steps that should be taken, it is possible to help a child feel in control of a threatening situation and to develop the resiliency needed to deal with traumatic experiences.

3.3.3 Increasing children's compliance and understanding

It is likely that children will have more difficulty following instructions than adults during an emergency situation; it is possible that anxiety reactions may hinder their ability to understand and follow instructions and, developmentally, children may not have the cognitive ability to understand what is being asked of them. Freyberg et al. (2008) claim that any instructions given to children should be clear, short and specific. The use of a short cartoon, video or a simple poster with illustrations of actions is recommended in order to enhance the communication of instructions to children. Freyberg et al. specifically advocate the use of posters as these will also overcome any problems that are associated with the existence of language barriers. Although intuitively the use of such communication tools would appear to be highly beneficial, Fertel et al. do not provide any evidence to support the claim that these methods enhance children's understanding. A field trial carried out by the UK Health Protection Agency in 2008 demonstrated that the use of pictorial instructions resulted in a *decrease* in objective decontamination washing performance, attributed to the mis-interpretation or mis-remembering of the instructions which were not placed inside the decontamination showers (Amlôt et al., In press). Further research is clearly needed to establish the most effective methods of communicating instructions to children.

It is possible that even when children understand the instructions that are given, they may refuse to do what is required of them. This was clearly demonstrated in the decontamination drill carried out by Fertel et al. (2009), in which 40 percent of the children involved were reluctant to undress before entering the decontamination

showers. To prevent such reactions and to therefore maximise the efficiency and steady flow of the decontamination process, Fertel et al. recommend that privacy is maintained with the use implementation of cordoned off gender-specific areas. Furthermore, only adults of the same sex as a child should help them with undressing, and the gowns provided for re-robe at the end of the shower should be of a sufficient size to fully envelop the patient.

3.3.4 Paediatric decontamination exercises and personnel training

One of the most prevalent recommendations made relating to preparing for mass casualty incidents which involve children is that all hospital staff and emergency responders (fire, ambulance and police) should regularly take part in disaster exercises (drills) which involve children (e.g. Allen, Parillo, Will & Mohr., 2007; Timm & Reeves, 2007; American Academy of Pediatrics (AAP), Committee on Environmental Health, 2003; Stamell, Foltin & Nadler, 2009; Chung & Shannon, 2005; Davis & Mincin, 2005). This will help to prepare the personnel that are likely to be involved in such events for how to treat and respond to the unique needs of children. Allen et al. (2007) recommend that disaster drills should incorporate paediatric victims at various settings where children are likely to spend time, including schools, day-care facilities and school buses.

Although decontamination exercises form a vital component of staff preparedness, they are not alone sufficient; personnel taking part in responding to mass casualty events which require decontamination also require training on the treatment and care of children. In addition to the training that is required in order that emergency personnel are able to respond to an incident of chemical or biological agent release, such as training on how to use personal protective equipment, the various agents of concern and the techniques of field decontamination (AAP, 2000), it is recommended that training is provided on specific aspects of dealing with children in disasters. As outlined previously, children have unique characteristics which make them more vulnerable than adults in a mass decontamination incident. Because of these characteristics, Allen et al. (2007) advocate that formal training of emergency responders on childhood growth, development and paediatric triage, as well as managing the needs of children with special needs is crucial.

A further important point in relation to staff training is made by Ablah, Tinius and Konda (2009) who carried out a review of paediatric emergency preparedness in the U.S. Ablah et al. highlight that in addition to providing training for emergency personnel, it is vitally important that the effectiveness of this training is evaluated. Clearly it is necessary to ensure that the methods and content of any training provided are endowing personnel with the skills that they require.

3.3.5 Specific recommendations for schools

Because children spend a large proportion of their time in school, it is crucial that schools are prepared to deal with any emergency situation that could take place, including the exposure of students to harmful chemical or biological agents. The National Advisory Committee on Schools and Terrorism (2004) propose that emergency

responders and public and mental health agencies should work together with schools and education agencies during their planning processes.

Edwards, Caldicott, Eliseo and Pearce (2006) make a number of recommendations which are targeted at preparing a school to respond effectively in any emergency or disaster situation. Among these recommendations Edwards et al. propose that classrooms should be equipped with what they term 'jump and go' folders; these contain information about each child's health needs, emergency contact information and name tags. A further recommendation is that all school staff should have clearly defined roles in the event of an emergency; this will facilitate a smooth and efficient response. According to Edwards et al., one of the most important aspects of school preparedness involves ensuring that parents understand the emergency plan and the reunification process. Plans should also be in place to keep parents informed of activities; these plans should provide for parents who may not be fluent in the first language of the school. Despite the generic nature of these recommendations, it is clear that they are suitable for an incident which requires children to undergo decontamination.

3.3.6 Specific recommendations for emergency responders and healthcare professionals

It is clearly essential that those people responsible for the immediate response to a mass-casualty incident involving the release of chemical or biological agents are properly prepared to deal with and treat all of the victims that may be involved. Because children's anatomy and physiology and the way in which they respond and behave in an emergency are different to adults, emergency responders will need to be competent and comfortable with working with children. In light of this, it is proposed that emergency medical staff should complete educational programs on chemical and biological terrorism and that this training should include a specific paediatric component (Ngo, Ponampalam, Leong & Han, 2007; Timm & Reeves, 2007; Fox & Timm, 2008).

One of the key recommendations made in the literature relating to paediatricians and healthcare professionals relates to their involvement in the planning process. It is suggested that the vulnerabilities of children will be more likely to be taken into account in emergency plans if paediatricians participate in local public health activities relating to biological and chemical preparedness (AAP, 2006; AHRQ, 2006). The American Academy of Pediatrics Committee on Environmental Health and Committee on Infectious Diseases (2006) also suggest that paediatricians should work with local schools to ensure that suitable plans are in place should a biological or chemical terrorism event occur. Along similar lines, Kaji and Lewis (2006) recommend a cooperative approach to emergency planning, claiming that the efficacy of any response to an emergency or mass casualty incident will be enhanced if pre-existing relationships between hospitals and other community response services such as the fire service, law enforcement and local government are in place.

4 PREGNANT WOMEN

4.1 Introduction

In 2008, the UK's Office for National Statistics (2008c) reported that there were 708,711 live births and 3,617 stillbirths in the UK. This shows that pregnant women make up a significant proportion of the population and demonstrates that it is important for emergency planners to prepare for incidents in which pregnant women are involved.

A substantial amount of evidence has shown that pregnant women are at increased risk during disasters and conventional mass-casualty incidents (e.g. Sela, Shveiky, Laufer, Hersch & Einav, 2008; Lynch, 2004; DePalma & Hodgson, 2009). In addition, researchers have examined the specific vulnerabilities which pregnant women might face during CBRN incidents (e.g. Teran-Maciver & Larson, 2008; James, 2005; Cono, Cragan, Jamieson & Rasmussen, 2006; Brent, 2006; Wood, Johnson, Omori, Kawamoto & Keehn, 1967; Yamazaki, Wright & Wright, 1954). It has been noted that the care of pregnant women during disasters and CBRN incidents is particularly difficult, as it involves providing the best possible treatment for both the mother and the foetus (Lynch, 2004). This can create a difficult situation for emergency responders, as the best treatment for the mother may not always be the best treatment option for the fetus. For example, Cono et al. (2006) suggest that concern for the fetus may influence an emergency responder's decision to prescribe and a woman's decision to accept, potentially life-saving vaccines or treatments in the event of a bioterrorist attack.

Given the unique vulnerabilities of pregnant women during disasters and mass-casualty incidents, it is not surprising that a number of guidance documents have been produced to help emergency responders address the needs of pregnant women during disasters (e.g. Strikas et al., 2008; Lynch, 2004; Guardian of Public Health Update, 2008; Balbus & Malina, 2009; Wilkinson, 2009; Ewing, Buchholtz & Rotanz, 2008). However, whilst many guidance documents have been produced which attempt to examine the effect of disasters on pregnant women, it has been recently acknowledged that there is currently too little guidance relating to the specific vulnerabilities of pregnant women during CBRN incidents (Jamieson, Theiler & Rasmussen, 2006; Cono et al., 2006; Brent, 2006). This includes a lack of guidance on the treatment of pregnant women during decontamination incidents, with very few identifying ways to optimise the decontamination process for pregnant women.

4.2 What makes pregnant women vulnerable?

4.2.1 Physiological vulnerabilities of pregnant women

The risks to pregnant women during conventional mass-casualty incidents are well-documented (Sela et al., 2008; Lynch, 2004). However, pregnant women also have specific physical characteristics which could lead them to be more susceptible to the effects of attacks involving chemical and biological agents. During pregnancy, a woman's immune response is suppressed, to allow her body to tolerate the 'foreign' presence of the fetus. This decreased immune response leaves pregnant women at

increased risk from biological agents, such as those which might be released during a biological terrorist attack (James, 2005; Jamieson et al., 2006). Pregnant women are therefore at increased risk during biological attacks, as they may be more likely to become seriously ill than non-pregnant women or men of the same age (Rao, 1972). As well as this decrease in immune function, pregnant women may also be at increased risk during biological attacks because physicians may be reluctant to prescribe and women may be reluctant to accept, potentially life-saving vaccines or medications due to the possible adverse health effects on the fetus (Jamieson et al., 2006; Cono et al., 2006). Thus, because of pregnant women's greater susceptibility to biological agents and pathogens, effective and rapid decontamination are more important for this group.

As well as a decrease in immune function during pregnancy, pregnant women also experience changes in pulmonary and respiratory function (Little, 1999). These factors could have serious implications following a chemical attack, as changes in respiratory and pulmonary function could lead to increased exposure to a noxious agent. This highlights the importance of rapid decontamination following chemical attacks, with the goal of reducing the length of time that a pregnant woman is contaminated, and to minimise adverse outcomes resulting from contamination.

The fetus of a pregnant woman involved in a chemical or biological attack is at increased physiological risk of negative effects from biological or chemical agents. It has been found that certain biological agents can cause high rates of premature termination. For example, Rao (1972) found that smallpox caused premature termination in nearly 75 percent of pregnant women who contracted the disease in the early stages of pregnancy (up to and including 24 weeks). In addition, 55 percent of the children who were born alive following their mother's infection with Smallpox died within 15 days of the birth, with most of them dying during the first 72 hours of life. It has also been found that biological agents such as Anthrax and tularemia affect the respiratory system of the mother, and can therefore decrease the amount of oxygen received by the fetus (Foltin, Schonfeld & Shannon, 2006). The fetuses of pregnant women may also be at increased risk from the negative effects of chemical agents, especially for women in their first trimester; this is because the first trimester is the time during which most cell divisions take place (Steward, 2006). This is particularly important for women involved in incidents requiring emergency decontamination, as this period of increased vulnerability is also the time during which the pregnancy would be least visible to emergency responders. If emergency responders are unaware that a woman is pregnant, they will be unaware of the increased risks that she may face.

As well as risks from chemical and biological agents, fetuses are also at increased risk from radiological and nuclear agents. It has been widely shown that the incidence of miscarriages and stillbirths increases following pregnant women's exposure to radiation (e.g. Michal, Grigor, Negro-Vilar & Skakkebaek, 1993). This is due to the higher rate of dividing cells present in a fetus, which are more likely to mutate, causing neurological damage (Haber & Rothstein, 1969).

4.2.2 Psychological and behavioural vulnerabilities of pregnant women

Reproductive health is likely to be affected by any interference with hormonal control (neuroendocrine homeostasis), including that which can be caused by stressful situations. It has been acknowledged that it is necessary to reduce, as far as possible, pregnant women's exposure to stressful events, as this may lead to better reproductive health (Michal et al., 1993). In a study of pregnant women who were within the immediate vicinity of the World Trade Center collapse, Landrigan et al. (2008) found that PTSD and moderate depression were correlated with longer gestational durations, whilst those with PTSD were also more likely to give birth to a child with smaller head circumference at birth. Being involved in a CBRN incident, and having to undergo decontamination, is likely to be extremely stressful for a pregnant woman. It has been suggested that CBRN incidents may be more stressful than natural disasters, due to the fact that they score highly on aspects of 'dread risk' – a factor which has been shown to increase an individual's fear of an event (Slovic, 2001). Aspects of CBRN events which are likely to increase dread risk include the fact that they have high catastrophic potential, often cause fatalities, and may be perceived as uncontrollable (Sheppard, Rubin, Wardman & Wessely, 2006). The highly stressful nature of an event involving decontamination might therefore place the pregnant woman at a higher risk of developing PTSD, and consequently leave her child at risk for decreased head circumference and slower development.

Concerns have been raised regarding pregnant women's compliance with public health recommendations. It was suggested in the Guardian of Public Health Update (2008) that a pregnant woman may be reluctant to comply with recommended health behaviours during a bioterrorist attack, as she may be afraid that vaccines or medications will harm her unborn baby. This may also be the case during a chemical attack involving decontamination, in which pregnant women may be reluctant to accept an antidote, such as atropine, for fear that this may damage the fetus. Refusal of the antidote may lead to increased length of exposure time, because any refusal will delay decontamination.

4.3 Recommendations

4.3.1 The decontamination showering of pregnant women

The first recommendation which can be made regarding pregnant women and decontamination is that emergency responders be trained to ask all women between the ages of 10-50 if they are pregnant (DePalma & Hodgson, 2009). Fetuses are most susceptible to the effects of chemical and radiological agents during the first trimester of pregnancy (Steward, 2006; Wood et al., 1967). This is the stage during which pregnancy is most likely to be invisible to emergency responders, so it is imperative that women are questioned about pregnancy prior to undergoing decontamination. Once emergency responders have established that a woman is pregnant, they will be able to implement any of the necessary recommendations outlined below.

It may be necessary for pregnant women to be decontaminated before other groups, due to their increased likelihood of experiencing negative effects from biological agents (James, 2005; Jamieson et al., 2006), chemical agents (Steward, 2006), and

radiological or nuclear agents (Wood et al., 1967; Yamazaki, Wright & Wright, 1954). Current recommendations suggest that every effort should be made to minimise the exposure of pregnant women to CBRN agents (Home Office, 2003). By decontaminating pregnant women as a priority, negative effects such as those outlined above could potentially be avoided, or at least reduced.

4.3.2 Reducing the stress experienced by pregnant women

In addition to reducing physical harm to the pregnant women and her fetus, the decontamination of pregnant women before other groups could also reduce the amount of stress experienced by the woman, a factor which has been shown to lead to negative birth outcomes (Landrigan et al., 2008). A further way in which stress could potentially be reduced for pregnant women during decontamination incidents is by emergency responders providing increased reassurance and information. Evidence has shown that public reassurance can be achieved by providing clear, credible, and timely information after a bioterrorist attack (Glass & Schoch-Spana, 2002). Information provided to pregnant women during a decontamination incident should therefore contain specifics about how decontamination will reduce harm to the fetus, and should also contain any available information on how the antidote (in the case of chemical attacks) or vaccine (in the case of biological attacks) might affect the fetus. Emergency responders who attend decontamination incidents should therefore carry generic information relating to any antidotes or vaccines which they carry, and the effect of these on the fetus, so that they can be provided immediately to pregnant women in the event of a CBRN attack. This information could help to reassure the pregnant woman, reducing the stress she experiences, as well as aiding her in making an informed decision about the risks and benefits of any antidotes.

5 PEOPLE WITH PHYSICAL IMPAIRMENTS

5.1 Introduction

The category of people with physical impairments is a diverse one and includes people with a broad range of abilities. Categories of physical disability may include multiple sclerosis, cerebral palsy, neuromuscular disorders (such as Parkinson's disease and muscular dystrophy), spinal cord injury, spina bifida, post-polio syndrome and limb loss. This is clearly not an exhaustive list and represents a small number of the disabilities that may be considered as physical disabilities.

It seems that just as the needs of other vulnerable groups are often ignored in emergency planning, the needs of people with disabilities (of all types) are rarely acknowledged or taken into account. A study of emergency personnel training practices in Northeast Kansas, U.S. carried out by Rowland, White, Fox and Rooney (2007) clearly illustrated this weakness in preparedness to respond to incidents which involve people with mobility impairments. During interviews with emergency services administrators and first responders (fire fighters), it was found that no specific emergency preparedness policies, guidelines or practices designed to assist people with mobility impairments existed.

Although the precise needs of people with different disabilities will clearly vary, it has been claimed by disability experts (e.g. Pichler, Myers & Ross, 2009) that most of the difficulties that people with physical impairments will face in a mass decontamination incident will involve the equipment that they rely on for moving around.

5.2 What makes people with physical impairments vulnerable?

5.2.1 Vulnerabilities associated with reliance on mobility equipment

Mobility aids such as wheelchairs, walking canes and walkers are relied upon by many physically disabled individuals as a means of maintaining independence; if this equipment is removed from them they will become reliant on the assistance and help of others. In addition to the physical effects of removing a person's mobility aid, it is likely that they will also experience some anxiety or frustration at losing the independence that they are used to (Pichler, et al., 2009).

A decontamination drill carried out by the Sinai Health System in Chicago, U.S. in 2007 (Taylor, Balfanz-Vertig, Humrickhouse & Jurik, 2009) involved the decontamination of a number of individuals with physical disabilities. When these participants were subsequently questioned about the feelings they had experienced when mobility aids were removed from them, a number of the casualties reported feeling that their independence had been removed. According to a report compiled by the Centers for Public Health Preparedness Network (2009), during the aftermath of Hurricane Katrina some wheelchair users refused to leave their homes because they did not want to lose access to their wheelchairs. It is possible that reluctance to participate in decontamination may also arise if physically disabled individuals are threatened with the

loss of the only means by which they can maintain their independence. Thus, it is essential that plans are in place which take account of these issues and ensure that the decontamination of disabled casualties is as efficient as possible.

5.2.2 Vulnerabilities relating to movement and transfers

One of the most significant points of concern reported by the physically disabled casualties that took part in the Sinai Health System decontamination exercise (Taylor et al., 2009) was the issue of transferring from wheelchairs to the chairs that were used in the decontamination showers. A number of the casualties felt that decontamination personnel did not have the skills that were required to help them transfer, which led to the use of unsafe practices. Furthermore, it was reported that, staff were not aware that in some cases, assistance was not required. These findings were reiterated in a further decontamination drill described by Taylor, Balfanz-Vertiz, Humrickhouse and Truitt (2008). This drill involved ten casualties with spinal cord injury, three of whom were quadriplegic and seven of whom were paraplegic. Again, in focus groups following the drill, many of these participants expressed dissatisfaction over the help that they had received with transferring from their wheelchair to a plastic shower chair. They stated that they were competent in transferring themselves and the assistance provided by staff not only hindered their movement, but also undermined their independence.

5.3 Recommendations

5.3.1 The decontamination showering of people with mobility impairments

Because the individual capabilities of people with physical disabilities are likely to be diverse, the requirements and needs of this group during a mass casualty decontamination incident will vary widely. Despite this, a number of recommendations are described in the literature relating to how the decontamination of people with physical impairments should be conducted.

A consensus document produced by the U.S. National Center for Disaster Preparedness (2007) details the recommendations that were made at a conference held in 2005, the purpose of which was to determine how communities, first responders and levels of government can incorporate the needs of people with disabilities into disaster preparedness. The document outlines a number of recommendations which relate to the decontamination of disabled people; some of these recommendations are relevant to individuals with physical impairments as well as sensory impairments (information from the document relating specifically to sensory impairments can be found in Chapter 6). With regards to emergency preparedness activities, the report recommends that protocols and procedures should be established in advance to facilitate the decontamination of individuals who rely on equipment such as wheelchairs, walking canes or crutches.

According to Braue et al. (2009), any casualties who are able to walk independently should be processed through the normal ambulatory decontamination line. Thus, according to this recommendation, only those physically impaired individuals who are reliant on mobility aids or other people to move about should be processed through the

non-ambulatory line. Braue et al. suggest that, if possible and where required, ambulatory friends, family or acquaintances should be encouraged to assist people with movement limitations to wash in the ambulatory decontamination showers. Rooney and White (2007) provided findings which support this recommendation; they carried out a survey of people with physical disabilities who had been involved in catastrophic events. When asked about their experiences, survey respondents revealed that their personal networks (including family, friends, colleagues and neighbours) had proved extremely useful both during and after disasters by providing them with assistance with tasks such as moving and navigating around disaster sites. This finding also strengthens the recommendation made in the literature relating to paediatric decontamination (See Chapter 3) that families should be decontaminated together. In addition to decontaminating families as a unit, the efficacy of the decontamination process would likely be enhanced if physically disabled people were assisted by and underwent decontamination together with people they knew. Although this would only benefit disabled casualties able to undertake ambulatory decontamination, it is likely that the ease and effectiveness of decontamination for this group would be significantly enhanced.

A further recommendation made by Braue et al. in relation to assisting physically disabled people to decontaminate is that that plastic chairs could be placed in the dis-robing, showering and re-robing areas; they do stipulate however that these should be washed between use by different casualties. The addition of plastic chairs to the shower area was one of the modifications made to the decontamination process in the exercise carried out by the Sinai Health System (Taylor et al., 2009); the chairs were used as a replacement for the backboards or the roller system platform which are customarily used to transport people who are unable to walk independently through the decontamination showers. Although this modification was successful within the context of the exercise, it seems wise to suggest that further work is required to determine whether such a system would be feasible in a mass decontamination incident involving a large number of casualties who may, or may not be physically disabled.

In addition to the incorporation of shower chairs, the exercise carried out by the Sinai Health system also involved a number of other modifications to the standard decontamination protocol. Of particular significance for physically disabled participants, four physical therapists were recruited as members of the decontamination team to help physically disabled casualties to move through the decontamination corridor. Although physical therapists would undoubtedly ease the process of decontamination for people with mobility impairments, the plausibility of such a modification to general mass casualty decontamination protocol is questionable.

5.3.2 The decontamination of mobility equipment

While it is often necessary to remove an individual's mobility equipment from them so that they are able to safely undergo decontamination showering through the non-ambulatory route, it is clearly desirable that their equipment is returned to them as soon as possible after showering in order that they can resume independence.

A number of authors make recommendations regarding the decontamination of mobility equipment. A protocol for the decontamination of physically disabled victims produced by the New York Centers for Terrorism Preparedness and Planning (2006) draws attention to the fact that removing items such as assistive devices and mobility aids from casualties is likely to cause undue stress, agitation and will also hinder their ability to cope with the disaster and decontamination procedures. Despite this, it is suggested that it is not possible to decontaminate mechanical wheelchairs and any leather attachments or components of other items. Items that can be decontaminated include: non-electric wheelchairs, prosthetic limbs (without leather components), walkers and crutches (without foam cushions or parts). An alternative recommendation offered by the U.S. National Center for Disaster Preparedness (2007) is that the manufacturers of medical equipment should be required to provide guidelines on the decontamination of the equipment. Although this would ensure that appropriate guidance were available for the equipment that can and cannot be decontaminated, it may be difficult for decontamination personnel to differentiate between all the various types of equipment and the guidelines that are available in a mass casualty situation.

With regard to the methods that should be employed to decontaminate mobility aids, Braue et al. (2009) recommend that items such as wheelchairs, walking canes and crutches should be thoroughly washed using soap and water, dried and then returned to the casualties after they have gone through the decontamination shower themselves. Wheelchairs require special attention because of their moveable parts; thorough washing should be carried out and items such as cushions which can absorb water should be discarded.

5.3.3 Assisting people with physical disabilities to move and transfer

One of the simplest recommendations made in the literature relating to the provision of assistance to physically disabled casualties is that decontamination personnel should ask casualties about any physical disabilities that they have, and the help that they may require to move from place to place within the decontamination system (Taylor et al., 2008; Taylor et al., 2009; Pichler et al., 2009). It is likely that physically disabled people themselves will be the greatest experts on their abilities and requirements and thus, the suggestion is that decontamination personnel should capitalise on this.

One of the problems experienced by physically disabled casualties in the Sinai Health System's decontamination exercise carried out in 2007 (Taylor et al., 2009) was the inability of decontamination personnel to help them to transfer safely. Thus, one of the recommendations made by these participants was that decontamination personnel should undergo increased training on appropriate methods of lifting and transferring. This will promote the safety of the casualties and the staff as well as helping to ensure that the decontamination process is as smooth and efficient as possible.

5.3.4 Mass casualty decontamination exercises

A recommendation which appears through the vulnerability literature concerns the inclusion of vulnerable groups in mass casualty decontamination exercises and drills. The literature on people with physical impairments and disasters is no exception. It is

commonly claimed that people with disabilities are not included in decontamination exercises and other emergency drills (e.g. Davis & Mincin, 2005; National Center for Disaster Preparedness, 2007).

Given that people with disabilities are members of the communities that might be involved in a mass casualty incident, it is essential that any activity designed to prepare for such an incident recognises this and involves disabled individuals in decontamination exercises. It has been suggested that at least five percent of the participants involved in any disaster exercise or drill should be disabled adults and children and that this proportion should be greater if more than five percent of the local community is disabled (National Center for Disaster Preparedness, 2007). People with physical (and sensory) impairments should be involved in all stages of a disaster drill, from planning through to conducting the exercise and evaluating it. Furthermore, in order that exercises are truly able to represent the reality of decontaminating people with physical impairments, they should incorporate the assistive equipment that may be used by these individuals, such as wheelchairs, false limbs and walking canes (National Center for Disaster Preparedness, 2007).

6 PEOPLE WITH SENSORY IMPAIRMENTS

6.1 Introduction

The term 'sensory impairment' has been taken, within the context of this review to refer to people with difficulties in hearing (i.e. partial or total deafness) and/or seeing (i.e. partial or total blindness). In 2008 153,000 people in the England were registered blind and 156,000 people were registered as partially sighted (NHS, 2008b). In 2007, 54,000 people were on England's register of the deaf and 164,000 were on the register of the hard of hearing (NHS, 2007). The U.S. census in 2000 indicated that 93 million people had a sensory disability which involved either sight or hearing (Fox, White, Rooney and Rowland, 2007). These figures are substantial and highlight the fact that the needs of these people in disaster preparedness cannot be discounted.

6.2 What makes people with sensory impairments vulnerable?

6.2.1 Communication challenges

People with visual impairments will have very different requirements to people with a hearing impairment in a mass decontamination situation. However, what is common to both of these groups is that they may not be able to communicate using the modes of communication that are commonly relied upon during emergency response. As discussed previously, the plans that are in place to respond to incidents requiring mass decontamination are often based on the needs of military personnel; thus, they do not take account of how information should be conveyed to people who cannot hear verbal instructions or those that cannot read written instructions.

6.2.2 Navigation through the decontamination system

People who are blind or who are visually impaired may have difficulty in independently navigating their way through the decontamination system; even for people who are usually very self-reliant, the lack of familiarity with the environment and the situation may pose problems for someone who is not clearly able to see where they are required to go in order to perform the actions that are necessary in order for decontamination to take place (removing clothing, showering etc).

Difficulties in navigating through the decontamination process may also arise for people with sensory impairments (involving either sight or hearing) if they do not receive notification of what the process involves and what is necessary for them to do in a format that is appropriate for them. For example, if all instructions provided by decontamination personnel are provided verbally, they are unlikely to be able to follow these instructions.

6.3 Recommendations

6.3.1 The decontamination showering of people with sensory impairments

Because individuals with sensory impairments, particularly visual impairments, may have difficulty independently navigating their way through the decontamination process, it is important that as much as possible is done to ensure that these difficulties are prevented and that they are able to complete the process while maintaining their functional independence.

The individual needs and requirements of people with sensory impairments in a mass casualty decontamination incident will clearly differ greatly. Whereas deaf people are likely to be able to navigate their way through the system independently if they are clear of what is required of them, because of their lack of familiarity of the environment, it may be necessary to escort people with visual impairments through the decontamination process. If such escorts are required, additional staff will be required to support the decontamination process (Braue et al., 2009).

In the previous chapter, a description was provided of a decontamination exercise carried out by the Sinai Health System in Chicago in 2007 (Taylor et al., 2009). In addition to the participants with physical disabilities, a number of deaf individuals whose primary language was American Sign Language (ASL) also took part in the exercise as casualty actors. One of the recommendations that arose from the focus groups carried out after this exercise was that groups of deaf people should be allowed to go through the decontamination process together. This will enable individuals who may have difficulty understanding instructions provided by decontamination personnel to help one-another (Taylor et al., 2009).

6.3.2 The decontamination of assistive devices and service animals

People with sensory impairments are often reliant on assistive devices (such as corrective lenses, white canes or hearing aids) or service animals to maintain their functional independence. Because of this reliance it is imperative that wherever possible, people do not become separated from these devices or animals and that, if separation is necessary, reunification is achieved quickly where possible.

According to protocol for the decontamination of disabled victims produced by the New York Centers for Terrorism Preparedness and Planning (2006), it is possible to decontaminate service animals (such as guide dogs), eye glasses and prosthetic eyes, but it is not possible to decontaminate hearing aids or contact lenses. Braue et al. (2009) specify that items that can be decontaminated should be washed thoroughly with soap and water, dried and returned to the casualty after they have undergone decontamination.

With regard to the decontamination of service animals, it is recommended that service animals should go through the decontamination process with their owner or handler. Furthermore, it may be beneficial to decontaminate the service animal in an area where other people are not simultaneously being decontaminated – this will avoid any problems that may arise if the animal reacts in an unexpected way (National Center for Disaster Preparedness, 2007). Although the benefits of this recommendation are clear,

the impact that this would have on the rate of flow of casualties through the decontamination process is not addressed in the document. If it is necessary for a member of decontamination personnel to take charge of a service dog, the animal should be held by its leash (not by its harness) and it should not be petted unless its owner indicates that it is okay to do so (Center for Development and Disability, no date).

6.3.3 Ensuring effective communication

Given the problems that people with sensory impairment are likely to have if information is conveyed using only one medium in an emergency situation, it is important that information is provided in more than one form. According to the U.S. National Center for Disaster Preparedness (2007), the instructions provided to casualties during the decontamination process should be available in audible, text and picture formats. This will help to ensure that people with visual, hearing and cognitive impairments as well as those with language barriers will be able to understand what is required of them.

To facilitate the understanding of deaf casualties in the 2007 decontamination drill carried out by the Sinai Health System (Taylor et al., 2009), American Sign Language (ASL) interpreters were present throughout the exercise. Despite the involvement of these interpreters it was found that the majority of the deaf participants, at some point during the exercise, had difficulty in understanding the actions that were required of them, or where they should go. Although it was generally felt that the presence of ASL interpreters was beneficial, there was some concern that these interpreters would not be available in the event of a real incident and that decontamination personnel should therefore be able to effectively communicate with people with sensory impairments. It was suggested that personnel could make more use of body language and gestures and that it would be useful if there were signs displayed to provide information on what was required at the various stages of the decontamination process. The use of broad gestures such as pointing to the next part of the decontamination process and mimicking washing actions would help not only people with hearing impairments, but also people who find it difficult to hear the instructions given by personnel because of the personal protective equipment that they are wearing.

One of the key lessons identified during the course of this exercise was that any signposts or information sheets displayed during the decontamination process must be large and easy to see. Although bilingual signs were used in the exercise (benefitting the Spanish speakers and the deaf casualties), these signs were in a colour that was difficult to see (white) and were not positioned in easily visible locations. It was suggested that signs should be large and brightly coloured and that they should be placed in the hot zone so that casualties are able to read them while they are waiting to be decontaminated.

During a presentation on the needs of people who are deaf or hard of hearing in Winsconsin, U.S. in 2009, Altman and Mueller (2009) provided a number of recommendations for decontamination personnel which relate directly to communication with deaf individuals. Altman and Mueller claimed that while it is a common assumption that deaf people are able to lip read and thus, that this can be relied upon when attempting to convey information, this is not the case; only 25 percent of the English

language is visible on people's lips. Altman and Mueller also advise that it is not always helpful to raise one's voice when talking to someone with a hearing impairment. It is likely that a raised voice and the facial expressions that accompany it will be interpreted as anger, thus unnecessarily raising anxiety and potentially causing the hearing impaired individual to assume that they had done something wrong. Altman and Mueller concur with the point made by the participants in the Sinai Health System's decontamination drill: the most effective way to communicate with someone who may not be able to hear is to use gestures and body language.

As part of a set of guidelines for first responders in mass casualty scenarios, the US Center for Development and Disability (no date) produced a set of recommendations which specify the methods that should be adopted when communicating with a casualty who is visually impaired. Personnel are encouraged to announce their presence, speak naturally and directly to the individual and to avoid shouting. All written instructions should be communicated to the individual verbally.

6.3.4 Helping people with visual impairments to navigate around the decontamination site

According to the recommendations provided by the US Center for Development and Disability (no date), when providing assistance to an individual with a visual impairment, the individual should always be asked what assistance is required. If required, the individual should then be offered an arm which can be grasped lightly for guidance. It is suggested that in some cases the individual may choose to walk slightly behind his or her guider in order that they are able to gauge the reaction that is exhibited toward obstacles. In any case, all obstacles or potential hazards such as stairs, doorways, ramps etc should be mentioned. When guiding a person to a seat, their hand should be placed on the back of the chair and when guiding more than one person with a visual impairment, each person should be asked to guide the person behind them.

6.3.5 Mass casualty decontamination exercises

As outlined in the previous chapter, one of the key recommendations made in the literature relating to the decontamination of people with both sensory and physical impairments is that these groups should be involved in disaster exercises, serving not only as casualties, but also as organisers, advisors and evaluators (National Center for Disaster Preparedness, 2007). The report written by the National Center for Disaster Preparedness also highlights the importance of incorporating the assistive equipment that people with sensory impairments might use (e.g. hearing aids, white canes, guide dogs) in exercises. In the context of mass casualty decontamination exercises, this will help to ensure that the correct procedures are in place for personnel to understand how such equipment should be dealt with.

7 PEOPLE WITH COGNITIVE IMPAIRMENTS

7.1 Introduction

The category of 'people with cognitive impairments' is a broad one; it may be seen to incorporate people with mental health conditions such as schizophrenia, phobias, panic disorder and generalised anxiety disorder, as well as people with learning difficulties and those with conditions such as autism. Just as the characteristics of people who experience these different cognitive impairments are likely to differ markedly, so are the specific requirements of these individuals during an emergency decontamination incident. What is clear however, is that these needs cannot be ignored; it is estimated that one in four people will experience some kind of mental health problem in the course of a year (Mental Health Foundation, 2006), one percent of the U.K. population have autism spectrum disorder (Baron-Cohen et al., 2009) and approximately two percent of the population have a learning disability (Foundation for People with Learning Disabilities, 2007).

7.2 What makes people with cognitive impairments vulnerable?

7.2.1 Psychological and behavioural vulnerabilities

Although there is little information available which relates to the vulnerabilities of people with specific mental health conditions during disasters, one of the conditions that has received attention is schizophrenia. According to Kubicek (2009), the hallucinations and delusions that are experienced as symptoms of this illness are likely to cause a schizophrenic individual to believe that authority figures are trying to harm them. If thoughts such as these are apparent during the course of a decontamination incident, it is possible that the instructions provided by decontamination personnel would be ignored. Conversely however, Kubicek also notes however, that in many cases a person with a chronic mental illness will have mentally prepared themselves for the occurrence of a catastrophic incident and will therefore be well prepared.

It is known exposure to stressful or traumatic experiences have the potential to trigger panic attacks in susceptible individuals (NHS, 2008a). Consequently, it is reasonable to conclude that individuals that suffer from panic disorder or who are susceptible to panic attacks should be considered as vulnerable in mass casualty decontamination incidents. The occurrence of a panic attack during any stage of the decontamination process would not only be distressing for the sufferer, but may also require that decontamination or medical personnel become involved in treating the individual, therefore diverting their resource from elsewhere.

In a document which provides guidance on the evacuation of disabled people from buildings (Safer Scotland, 2007), it is reported that people with cognitive impairments may not have the same perception of risk as people without impairments. Furthermore, in a study of the evacuation behaviours of occupants with learning disabilities from a residential home, it was reported that during an unannounced evacuation drill, only 3 out of the 10 residents displayed any awareness of the emergency and evacuated

(Shields, 1999). This finding suggests that in some cases, people with learning disabilities may fail to grasp the importance of decontamination processes and may therefore fail to respond appropriately.

According to Foley and McCutcheon (2004), an individual's ability to report the symptoms of pain, the location and nature of the pain and to behave in a manner that is consistent with this description is largely based on their cognitive ability. The implication of this in the context of mass casualty decontamination is that people with cognitive impairments may be unable to appropriately express any pain that they are experiencing during the triage stage. The effectiveness with which they are able to wash themselves in the decontamination shower may be impaired if pain that has not been realised during triage interferes with the individual's movement.

7.2.2 Communication challenges

During an emergency or disaster such as a CBRN incident, a person with autism is likely to find themselves in a chaotic situation involving a large number of strangers. According to Shore (2006), autistic individuals may respond to such an experience by 'shutting down' or reverting to self-stimulatory behaviour such as hand flapping, body rocking, or unusual attachment to objects. Difficulties are likely to occur for autistic individuals in following emergency responders' instructions and in reading their body language (Debbaudt, 2006) It is also possible that misunderstandings will occur if a commanding tone is adopted when communicating with autistic individuals as this is likely to be interpreted as an angry tone (Vig Saucier, 2009).

7.3 Recommendations

7.3.1 Ensuring effective communication

The American Red Cross (2004) provide a number of recommendations for interacting with an individual with a chronic mental illness. They claim that the individual should be approached from the front, the emergency responder should identify themselves and make eye contact, pointing and touching should be avoided, communication should be kept simple and speech should be slow, the individual should not be spoken down to or shouted at, and attention should be paid to the individual's body language. If the individual makes claims regarding delusions or false beliefs, these should not be argued with; rather, it is best to simply listen and show understanding. Finally, every effort should be made to keep the person calm and reassured. These suggestions are likely to reduce the anxiety that is experienced and to increase compliance with decontamination instructions.

When communicating with an individual with learning difficulties it is suggested that information should be presented in a clear, concise and concrete manner and that clichés and idiomatic language should be avoided (American Red Cross, 2004). Corneliuson (2009) suggests that pictures can often be successfully employed to provide information about what is about to happen. All assistance should be provided gently; an individual should never be taken by the arm and led somewhere without prior explanation. Although it can be useful to talk to an accompanying

relative or carer (Sowney, Brown & Barr, 2006), it is recommended that the individual should always be addressed first and only if this fails should a companion be spoken to for information (American Red Cross, 2004).

When interacting with people with autism during emergencies it is suggested that emergency responders should speak slowly, use simple language, repeat or rephrase instructions or information if required, allow extra time for a response to be provided, provide encouragement and praise and consider the use of pictures, written commands or sign language (Debbaudt, 2006). The use of an authoritative tone should be avoided as should unnecessary touching (Saucier, 2009). Debbaudt notes that it is important for emergency responders to recognise that each individual with autism is likely to act and react differently in an emergency situation. In the case of children with autism, parents or caregivers can serve as a useful source of information on how to effectively interact with the child in their care (Debbaudt, 2006). It may also be helpful to encourage a parent or caregiver to undergo decontamination showering first so that they serve as a role model (Vig Saucier, 2009).

8 ELDERLY PEOPLE

8.1 Introduction

According to the UK Office for National Statistics (2008a), the fastest population increase in recent years has been amongst elderly members of the population, with the largest increase being seen in the 'oldest old' – those aged 85 and over. Numbers of those aged 85 and over in the UK have increased from just over 600,000 in 1983 to 1.3 million in 2008. This number is projected to more than double in the next 13 years, to reach 3.2 million by 2033. If this projected figure is correct, members of the 'oldest old' would account for 5% of the total population (Office for National Statistics, 2008a).

The rapid increase in the numbers of older people makes it increasingly likely that these members of the population will be amongst those affected by a CBRN incident and that they will be required to undergo mass-decontamination. Thus, the vulnerabilities that are associated with old age and the potential requirements of this group during decontamination processes can not be ignored.

The vulnerability of elderly people during natural disasters has been widely recognised (e.g. Eldar, 1991; Hall, Hall & Chapman, 2006; Powell, Plouffe & Gorr, 2009; Hutton, 2008; Pekovic, Seff & Rothman, 2007). In an examination of the literature on 16 international disaster case studies for example, Powell, Plouffe and Gorr (2009) revealed that the mortality rates for elderly people were disproportionately higher than those for other age groups in five of the disasters. Research has also begun to examine ways in which elderly people might be at increased risk during CBRN incidents (e.g. Hall, Hall & Chapman, 2006; Stokes, Gilbert-Palmer, Skorga, Young & Persell, 2004; Foster, 2007; Johnson et al., 2006; Skorga et al., 2003; O'Byrne, Terndrup, Kiefe & Weissman, 2003). The research carried out into the effects of disasters, both natural and man-made, on the elderly, has enabled the creation of many guidance documents relating to the needs of elderly people during disasters (e.g. Hutton, 2008; Dyer, Regev, Burnett, Festa & Cloyd, 2008; Torgusen & Kosberg, 2006; Department for the Aging, 2008; World Health Organization, 2008; Second International Workshop on Seniors and Emergency Preparedness, 2008; Roush, 2007). Despite this, however, very little specific guidance has been developed on the needs of elderly people during incidents involving decontamination, and on ways in which mass-decontamination processes can be improved and adapted to accommodate the needs of elderly people.

8.2 What makes elderly people vulnerable?

8.2.1 Physiological vulnerabilities

One of the main physiological factors which could make older people vulnerable during incidents involving mass-decontamination is their reduced mobility. For example, results from the 2001 U.K. Census revealed that 41 percent of men and 38 percent of women in the 60-74 age group reported having a limiting long-term illness, many of which resulted in decreased mobility (Office for National Statistics, 2006). Many older adults suffer from impaired balance and decreased strength, which can lead to limitations in

performing activities of daily living (ADL's), such as walking, washing and eating (Dyer et al., 2008; Lamb, O'Brien & Fenza, 2008; Inter-Agency Standing Committee, 2008; Fernandez, Byard, Lin, Benson & Barbera, 2002; Rothman & Brown, 2008). It has been suggested that one of the most important ADL's is the ability to walk and that anyone who cannot walk will experience great difficulty in carrying out recommended actions, such as evacuating or seeking shelter, during a disaster (Rothman & Brown, 2008). The ability to balance is often also reduced in older people (Lamb et al., 2008; Fernandez et al., 2002). Functional impairments such as arthritis which are particularly prevalent among older adults can also impair mobility (Lamb et al., 2008); according to the Office for National Statistics (2008b), nearly one-quarter of women aged 65-74 suffer from either arthritis or rheumatism. Given that the process of self-decontamination requires that an individual can walk between the various components of the decontamination process and that they are able to remove clothes, wash themselves thoroughly and get dressed whilst standing, elderly people who experience mobility difficulties are likely to undergo this process independently. Current UK mass-decontamination units do not provide anywhere for casualties to sit, or anything for them to hold on to, whilst undergoing decontamination.

The functional abilities of older adults during disasters are also likely to be impaired as a result of the high prevalence of conditions such as hypertension (Lamb et al., 2008), heart disease, cancer, stroke, depression, and dementia (Torgusen & Kosberg, 2006). Not only are conditions such as these likely to decrease a sufferer's physical strength, leaving them less able to undergo independent decontamination, but they may also weaken the individual's physiological response to chemical and biological agents (Johnson et al., 2006; Salerno & Nagy, 2002). Furthermore, it is claimed that a number of conditions such as hypertension, heart disease, cancer, and diabetes can be exacerbated by stressful situations, such as incidents involving decontamination (Lamb et al., 2008), thus further increasing a person's susceptibility to the effects of a CBRN incident.

Elderly people tend to have lower levels of physiological reserves, including diminished pulmonary and neurological reserves, and decreased ability to remove toxins from the body (Lee, 2003). Even older people who appear outwardly healthy will have decreased immune response (O'Byrne et al., 2003). The inherent reductions in physiological function that occur during the aging process can leave older adults frail; this can affect aspects of functioning such as the speed and energy with which elderly people are able to comply with recommended behaviours during a disaster (Fried et al., 2001). In the context of a mass decontamination scenario, this is likely to hinder an individual's ability to carry out effective decontamination.

A further physiological factor which contributes to the potential vulnerability of older adults during mass decontamination is their increased susceptibility to extremes in temperature. A person's ability to regulate body temperature decreases with age (Janicek, 2009) and neuro-sensory changes in older adults can decrease awareness of body temperature (Lamb et al., 2008). This is likely to increase the risk of hypothermia occurring during decontamination processes where there is a requirement to undress and shower.

8.2.2 Sensory vulnerabilities

8.2.2.1 *Hearing impairments*

In the 2002 General Household Survey, it was found that 52 percent of men and 38 percent of women aged 75 and over suffered from hearing problems. Hearing difficulties have been shown to leave elderly people vulnerable during disasters. For example, in a case-study on the effects of Operation Desert Storm on elderly people in Israel, it was found that those with hearing difficulties struggled to hear the alert sirens, and were therefore unaware that an attack was imminent and were unable to respond effectively (Eldar, 1991).

It has been acknowledged that the hearing difficulties faced by many older people can be problematic during incidents and disasters involving excessive background noise and crowding (Lamb et al., 2008; Fernandez et al., 2002; Oriol, 1999). The noisy and stressful situation created by a disaster, combined with the hearing difficulties faced by many elderly people, can create significant barriers to communication between elderly people and emergency responders during disasters (Lamb et al., 2008). During a mass casualty decontamination incident, where communication between emergency responders and casualties is already hindered by the PPE equipment that personnel are required to wear, this may prevent elderly people from receiving the instructions that they require.

8.2.2.2 *Visual impairments*

In 2008, 64 percent of all registered blind people and 66 percent of all partially sighted people were aged 75 or over (Information Centre for Health and Social Care, 2008). Elderly people are also susceptible to age-related changes in the eye which can lead to a reduced ability to adapt to changes in light and distance (Lamb et al., 2008). Not only are visual impairments likely to cause problems for elderly people if they are required to read written instructions or to interpret pictorial instructions, they are also likely to increase the anxiety experienced by elderly people during disasters (Lamb et al., 2008) and to reduce their willingness to enter unfamiliar surroundings (Benson, 2007). Thus, elderly individuals with visual difficulties may display reluctance to enter the decontamination showers and will therefore require additional encouragement from decontamination personnel.

Hutton (2008) reports that visual deficits are likely to increase the risk of elderly people becoming disorientated and confused in unfamiliar surroundings; such confusion is likely to prevent them from understanding or being able to carry out what is required of them during emergency decontamination. It has also been suggested that visual difficulties are likely to increase the risk of elderly people falling during a disaster incident (Lamb et al., 2008). The wet and potentially slippery floor of a decontamination shower is likely to increase this risk and thereby further enhance the likelihood of an elderly individual sustaining an injury requiring medical intervention.

8.2.3 Psychological and socioeconomic vulnerabilities

According to Lamb et al. (2008), the principal psychological factor which is likely to contribute to the vulnerability of the elderly during disasters is cognitive decline, either

as a result of dementia or normal age-related cognitive deterioration. During the normal aging process, brain cells are lost and blood flow to the brain decreases; this can result in delayed verbal and physical response times in older adults (Janicek, 2009). It has been suggested that cognitive impairments in the elderly may reduce an elderly individual's ability to retain information (Lamb et al., 2008), to understand what is happening during disaster situations and to follow rescue instructions (Hutton, 2008; Johnson et al., 2006; Roush, 2007; Lamb et al., 2008). Cognitive impairment may also cause the elderly to become disorientated or confused in unfamiliar surroundings (Hutton, 2008). In a discussion of the effects of Operation Desert Storm on elderly civilians in Israel, Eldar (1991) describes how six of the seven people who died as a result of the incorrect use of gas masks were over the age of 70. This provides an illustration of the effect that cognitive decline is likely to have on elderly people's ability to follow instructions during an emergency situation. In the case of a mass casualty decontamination incident, this may result in confusion and misunderstandings over what actions are required to decontaminate effectively.

In addition to the communication challenges that may be posed as a result of cognitive decline, the low levels of education and high levels of literacy that are common among the older population of all countries (World Health Organization, 2008) may leave them less able to understand and respond to emergency information (Inter-Agency Standing Committee, 2008).

8.3 Recommendations for improving mass casualty decontamination provision for the elderly

The sensory difficulties that are likely to be experienced by many elderly people necessitate that more than one mode of communication is used to convey all information and instructions provided during the decontamination process (including visual, verbal and Braille instructions). It is recommended that instructions to be conveyed visually should be presented on non-glare material (Lamb et al., 2008) and that they should incorporate pictures to accommodate those with literacy difficulties (Governor's Office of Emergency Services, 2006). Written instructions should be presented in a large font (Lamb et al., 2008) and should be worded simply (World Health Organization, 2008; Inter-Agency Standing Committee, 2008). These recommendations will help to ensure that elderly people are provided with an information source that they are able to utilise.

To ensure that elderly people who may have difficulties in retaining information as a result of cognitive difficulties are able to follow the required procedures, instructions should be repeated. The Governor's Office of Emergency Services (2006) suggests that a short, repeating instructional video could be played at the entrance to the decontamination shower. It is likely that elderly people's understanding will also be enhanced if any information provided during the course of the incident is broken down into specific parts and if older people are given time to digest the information without being hurried.

8.3.1 Specific recommendations for emergency responders

To prepare emergency responders for the requirements of older adults during emergency decontamination and the difficulties that they may experience, it has been recommended that all first responders receive special training in geriatric emergency preparedness and response. This will ensure that they are able to recognise the specific vulnerabilities of the elderly during disasters and are capable of providing the necessary care.

9 PEOPLE WITH CHRONIC ILLNESSES

9.1 Introduction

In 2004 it was estimated that almost half of all Americans were living with a chronic condition (Partnership for Solutions, 2004). As with other vulnerable groups, care is required when defining chronically ill individuals as vulnerable in the context of mass casualty decontamination, both because of the broad range of illnesses that people within this category may suffer from (e.g. arthritis, heart disease, respiratory diseases, diabetes, high cholesterol) and because of the diverse nature of individual's symptoms and capabilities. Nevertheless, the debilitating nature of some chronic illnesses are likely to have implications for sufferers' ability to independently undergo mass casualty decontamination processes.

The range of different chronic illnesses with which casualties at a mass decontamination incident might present also makes the task of detailing the precise vulnerabilities associated with each condition unfeasible in the context of this review. However, the available literature on this subject has been used to identify and describe the characteristics of some of the most frequently occurring illnesses that are likely to pose difficulties and obstacles for sufferers who require decontaminating.

9.2 What makes people with chronic illnesses vulnerable?

9.2.1 Physiological vulnerabilities of individuals with chronic illnesses

Individuals with chronic conditions such as diabetes, asthma and epilepsy are likely to be reliant on medications to keep their illness under control. If medications are not accessible or available at the required time during the decontamination process, it is likely that such individuals will suffer adverse health consequences which may have implications for their ability to independently undergo decontamination as well as necessitating additional medical attention to alleviate their symptoms. For individuals with epilepsy, timely access to medications is crucial in order to prevent the occurrence of epileptic seizures (NHS, 2009). Without access to this medication, epileptic individuals are at risk of breakthrough seizures which occur when the concentration of the drug in their blood falls below the therapeutic level (Epilepsy Foundation, 2005). Breakthrough seizures are particularly dangerous as in some cases they can take the form of non-stop seizures (status epilepticus), which can cause neurological damage, disability and even death.

The pain and mobility difficulties experienced by people with rheumatic conditions such as arthritis have the potential to cause difficulties for this group of individuals in carrying out aspects of the decontamination process such as undressing and washing. Cold conditions are likely to aggravate symptoms such as joint swelling (Mori et al., 2007), thus any difficulties experienced by individuals with such conditions are likely to be worse in the event that they cannot maintain warmth during decontamination.

A further potential vulnerability for people with many types of chronic illness is that a number of the symptoms of exposure to various chemical-biological agents are also symptoms of some chronic illnesses and diseases. For example, anthrax, Q fever and nerve agents can cause respiratory symptoms and ricin, hantavirus and nerve agents can cause cardiovascular symptoms (AAP, 2006). This has the potential to complicate the triage of people who normally suffer from these complaints. As stated by DiGiovanni (2003), failing to give an antidote to a victim of nerve agent exposure, or giving it mistakenly to a person who has not been exposed but has a pre-existing medical condition could be equally dangerous.

9.2.2 Psychological vulnerabilities of individuals with chronic illnesses

Research has repeatedly shown that exposure to stressful events which illicit emotions such as anxiety can have detrimental consequences for people suffering from a range of chronic illnesses. The psychological impacts of mass casualty events such as earthquakes for example have been linked to the precipitation of asthma symptoms (Ritz, Steptoe, Dewilde, & Costa, 2000; Levenson, 1979), the elevation of blood pressure in individuals with hypertension (Minami, Kawano, Yoshimi, Ishimitsu & Takishita, 1997) and even sudden cardiac deaths in people suffering from atherosclerotic cardiovascular disease (Leor, Poole & Kloner, 1996). Stress has also been linked to the occurrence of seizures in epileptic individuals. In a study of epileptic patients, Haut, Vouviouklis and Shinnar (2003), 64 percent said they believed that stress caused the frequency of their seizures to increase. Not only do these research findings illustrate the heightened health risks that are likely to be associated with mass decontamination incidents for people suffering from these conditions, it also highlights the likely impact on the time and resource required from decontamination personnel and healthcare professionals responsible for caring for these individuals.

Psychological stress has also been implicated as a causal factor (in addition a lack of medication and a change in diet) in the ability of diabetic individuals to control their blood glucose levels, with mis-management putting them at risk of hypo- or hyperglycaemia (American Diabetes Association, 2007). A lowered blood glucose level is likely to be particularly detrimental to a diabetic's ability to undergo decontamination as it is likely to cause impaired cognitive functioning (Taylor & Rachman, 1987), shakiness, dizziness, light-headedness, sleepiness, confusion, difficulty speaking, anxiety and weakness. Consequently, diabetic individuals may require additional medical attention or assistance during an incident involving emergency decontamination.

9.3 Recommendations for improving mass casualty decontamination for people with chronic illnesses

Few recommendations relating specifically to the decontamination of chronically ill individuals were identified in the published literature. This may be because of the diverse needs that different individuals that fall into this group may present with; it is difficult to make recommendations which are generic enough that they will benefit people with the range of chronic conditions that may cause vulnerability during the

mass decontamination process. However, it is apparent that many of the recommendations made in relation to other vulnerable groups are likely to be equally applicable to individuals with various chronic illnesses. For example, the recommendations that are made in relation to assisting people with mobility impairments to move and transfer (Chapter 5) and those made in relation to keeping children warm (Chapter 3), are likely to be directly relevant to people who experience movement difficulties as a result of arthritis which are aggravated by cold conditions. Furthermore, the implementation of a buddy system is a common recommendation in the vulnerability literature. According to this idea, casualties are paired up in order that they can assist one another and provide psychological support throughout the decontamination process (e.g. Braue et al., 2009; Taylor et al., 2009; Federal Emergency Management Agency Chemical Stockpile Emergency Preparedness Program, 2007). The presence of a buddy, particularly where it is someone known to the individual, could also help in the management of medications and identifying signs of distress associated with their condition for individuals with chronic illnesses.

9.3.1 The provision of medication and medical equipment for people with chronic illnesses

One of the few recommendations of specific relevance to the care of chronically ill people during disasters relates to the reliance of many chronically ill individuals on medication and/or medical equipment. In a report published by the Centers for Disease Control and Prevention (CDC, 2005) which assesses the impact of a number of hurricanes in America, the need for access to medication and oxygen was highlighted. Although the focus of this report was the aftercare requirements of affected individuals, the relevance of this recommendation to mass casualty decontamination is clear; in some cases it will be crucial for chronically ill individuals to have access to the medication and equipment that enables them to control their condition.

10 TOURISTS

10.1 Introduction

There is much evidence to suggest that tourists are likely to be the specific targets of terrorism (Richter & Waugh, 1986; Paraskevas & Arendell, 2007; Sonmez, 1998; Henderson, 2003). Numerous reasons have been proposed for why tourists are likely to serve as potential targets. Amongst these reasons are that tourists may be targeted because such attacks are seen to symbolize attacks on the government of the tourists' home country (Richter & Waugh, 1983), foreign-looking and foreign-speaking tourists provide cover for international terrorists (Richter & Waugh, 1986), transportation facilities, such as airports, where large numbers of tourists are likely to be present, provide means of escape and channels for transporting weapons (Richter & Waugh, 1986); tourists often represent all of the ideologies and values which terrorists are fighting against (Paraskevas & Arendell, 2007) and attacks on tourists weaken the tourist industry, and can therefore destabilize the economy (Sonmez, Apostolopolous & Tarlow, 1999).

Despite the risks posed by terrorists to tourists, it is surprising that little specific guidance has been developed that considers this group during a biological or chemical attack. The advice which does exist appears to be limited to ways in which tourists can protect themselves from becoming victims of a terrorist attack, such as avoiding displays of wealth; keeping a low profile; varying daily routines during lengthy business trips; and flying economy class (D'Amore & Anuza, 1986). Little emphasis has been placed on how tourists can be protected once an attack has occurred.

As well as their obvious high risk of becoming a terrorist target, tourists are vulnerable in other ways in the event of a terrorist attack. For example, they may not speak the language, and so could miss out on important emergency information. Specific ways in which tourists are vulnerable in the event of a terrorist attack involving mass decontamination are outlined below.

10.2 What makes tourists vulnerable?

10.2.1 Psychological, behavioural and socio-economic vulnerabilities

Tourists might be especially psychologically vulnerable to the effects of a terrorist attack because they are away from their family and friends, and are in an unfamiliar environment (Richter & Waugh, 1986). This lack of a familiar support network is likely to increase their propensity to experience serious psychological distress during a terrorist incident. According to Sonmez et al. (1999), tourists may be more likely than local residents to become distressed and anxious during a terrorist incident; this could affect their ability to seek help and take protective action. It is possible that stress of this kind could have negative implications for tourists' ability to undergo effective decontamination showering.

Tourists who are unable to fluently speak the native language of the country that they are in are likely to experience difficulty in getting help in the event of a terrorist incident (Aziz, 1995). Language barriers are likely to be a particular concern in the event of a CBRN incident which requires mass casualty decontamination. It may be difficult for non-native language speaking tourists to understand the purpose of decontamination and the instructions that they are required to follow. For further information about the vulnerabilities of non-native language speakers, please see Chapter 12.

Tourists are also more vulnerable in the event of a terrorist attack as they are likely to be unfamiliar with local resources which can be relied upon for help in emergency situations, and are less independent than local citizens (Drabek, 1992). This lack of independence and reliance on others around them could make tourists especially vulnerable during decontamination incidents, as they would be responsible for washing themselves in the showers, and may have to go through the showers alone (without others they know). Given the communication difficulties inherent when speaking to individuals in Personal Protective Equipment (PPE) and the potentially isolating, unfamiliar and uncertain experience of decontamination, tourists' increased reliance on others could greatly increase their vulnerability during incidents involving emergency decontamination.

10.2.2 Physiological vulnerabilities

Tourists are no more likely to have adverse health issues than any other members of society, and may actually be less likely to have serious ill health, as they would be unable to travel if they were unwell. However, given the language barriers mentioned previously, tourists would find it more difficult to tell healthcare providers about any health problems which they did have. In the event of an incident involving mass casualty decontamination, tourists might find it especially difficult to communicate any concerns to health care providers, as the language barrier, combined with PPE, could make communication almost impossible.

10.3 Recommendations

10.3.1 Optimising the decontamination showering of tourists

It has been suggested that the provision of increased information during an emergency situation can decrease anxiety (Glass & Schoch-Spana, 2002). Thus, this recommendation should be applied to the decontamination of tourists who are at an increased risk of psychological distress and panic behaviour during the decontamination process (Richter & Waugh, 1986).

A further recommendation which is likely to decrease anxiety and increase the efficiency of decontamination showering is that groups of individuals who speak the same language (such as groups of tourists) should be kept together through the decontamination process (Taylor et al., 2009). When tourists do not present in groups, an alternative buddy scheme whereby they are paired up with local residents could be a potential alternative. This may go some way to alleviating anxiety and preventing

feelings of isolation. This is a purely speculative recommendation, the efficacy of which would require testing before implementation.

10.3.2 Ensuring effective Communication

Problems associated with language barriers between non-native language speaking tourists and decontamination personnel could be alleviated by ensuring the presence of translators at the decontamination site. Taylor et al. (2009) suggest that interpreters of common tourist languages should be available to be called upon during decontamination incidents in order to relay instructions and information from personnel to casualties. Although the benefits of this suggestion are clear, the feasibility of such a recommendation is questionable given its resource implications. An alternative and potentially more achievable proposal made by Taylor et al. is that decontamination personnel should ensure that they use body language and gestures to ensure that non-native language speakers understand the decontamination process. An additional suggestion is that the emergency services should carry generic decontamination information in as many different languages as possible (Governor's Office of Emergency Services, 2006). According to Carter-Pokras, Zambrana, Mora and Aaby (2007), this information should provide simple, low-literacy messages which will ensure that foreign-speaking tourists are able to understand why they are being decontaminated, and what is expected of them.

11 THE HOMELESS

11.1 Introduction

Recent statistics from Crisis, a national charity for the homeless in the UK suggest that nearly 500,000 people were homeless in the UK in 2007 (Crisis, 2008). Homeless people represent a significant proportion of any large urban community and thus, they are at risk of becoming the victims of terrorist incidents which are targeted at well-populated areas (Fullerton et al., 2009).

There does exist some current guidance (Edgington, 2009) and recommendations (Fullerton et al., 2009) which relate to the protection of homeless people during emergencies. However, no specific recommendations relating to the management of homeless people during CBRN incidents involving decontamination have been identified in this review. A number of factors have been identified however which indicate that homeless people are likely to be vulnerable during these types of incidents; this highlights the need for guidance on the decontamination of this group.

11.2 What makes homeless people vulnerable?

11.2.1 Psychological, behavioural and socio-economic vulnerabilities of homeless people

There is a substantial rate of mental illness among homeless populations. It has been estimated that approximately 22 percent of the homeless experience mental illness and 30 percent are substance abusers (US Conference of Mayors, 2007). It is possible that the acute stress experienced during a mass casualty incident could exacerbate mental health problems. Furthermore, the disruptive and chaotic nature of a CBRN emergency could trigger symptoms of pre-existing Post-traumatic Stress Disorder (PTSD), a condition common to many homeless people (Edgington, 2009).

It is possible that homeless people may be unwilling or hesitant to participate in emergency decontamination procedures. Edgington (2009) suggests that homeless people who have previously been incarcerated, or who are undocumented, may avoid participating in disaster services due to fears of incarceration or arrest. This hesitation or non-compliance may result in delayed decontamination for homeless people; this is likely to result in increased exposure to the contaminant and a greater likelihood of ill effects.

Many homeless people have difficulty in reading and interpreting written instructions, regardless of the language that they are written in (Edgington, 2009). This may be problematic in the event of an incident involving decontamination, as many of the instructions used in emergency decontamination processes are written or require the interpretation of symbolic cues accompanied by text. This creates an additional

vulnerability for homeless people as it may leave them unable to understand what is required of them during the mass decontamination process.

11.2.2 Physiological vulnerabilities of homeless people

In addition to suffering from high rates of mental illness, homeless people are also at a disproportionately greater risk of being disabled or being persistently physically ill. According to Edgington (2009), common acute conditions experienced by homeless people include respiratory infections, trauma (lacerations, wounds, sprains, contusions, fractures, burns), and minor skin ailments. Common chronic conditions include neurological disorders (mainly seizures), arthritis and other musculoskeletal disorders, and chronic pulmonary obstructive disease. Pre-existing physical conditions such as these are likely to hinder a homeless person's ability to independently and successfully undergo decontamination. For example, the difficulties that are experienced as a result of arthritis may cause an individual to experience difficulties in washing themselves.

11.3 Recommendations

11.3.1 Specific recommendations for emergency responders and healthcare professionals

Because of the high incidence of mental illness and substance abuse among the homeless population (US Conference of Mayors, 2007), it is essential that emergency responders and healthcare professionals are trained to identify mental illnesses and are informed of the incidence of these conditions amongst the homeless. It is also necessary that those involved in the decontamination of civilians are capable of responding to the needs of people with mental health or substance abuse problems and providing them with the care that they require. Without these skills, it is likely that the treatment of many homeless individuals will be inadequate.

11.3.2 Communicating with homeless people

To avoid the problems that may arise if homeless individuals display reluctance to undergo decontamination procedures, decontamination personnel must promote feelings of trust and confidence when communicating with members of this group. According to guidance provided by the Substance Abuse and Mental Health Services Administration (2002), potentially harmful communication approaches such as fear-driven persuasion should be avoided. By adopting these communication strategies homeless people can be reassured and encouraged to accept the help and assistance which is offered. The time critical nature of decontamination makes this advice particularly critical for emergency situations which involve a decontamination response.

Given the difficulties that may be experienced by homeless individuals in reading and interpreting written instructions and directions (Edgington, 2009), it is essential that alternative modes of communicating this information are also used (Governor's Office of Emergency Services, 2006). If instructions are communicated verbally in a clear

manner, there is a greater chance that they will be understood and followed by people with reading difficulties than if written instructions alone are used. Edgington (2009) suggests that where written instructions are provided, they should have clear simple messages, should use a large font and should include diagrams. They should also focus on actions which need to be undertaken, rather than actions which should be avoided.

11.3.3 The decontamination showering of homeless individuals

Just as other individuals with acute or chronic health conditions may require additional assistance to participate in decontamination showering, the same is true of homeless people who suffer from such illnesses. For a full explanation of the recommendations that have been made in relation to the decontamination of people with mobility difficulties or pre-existing illnesses, see Chapters 5 and 9 respectively.

12 PEOPLE WITH CULTURAL AND LANGUAGE-BASED VULNERABILITIES

12.1 Introduction

Within the UK alone, it is estimated that ethnic minority groups comprise 7.9 percent of the population (Gill, Kai, Bhopal & Wild, 2007). The range of cultural practices that exist within any given community and the language barriers that are likely to exist as a result of this diversity necessitate that the plans that are in place to decontaminate civilians take account of the specific needs and vulnerabilities which may arise as a result of cultural and language issues.

12.2 What are the cultural and language-based vulnerabilities that people may experience?

12.2.1 Communication challenges

Individuals who are unable to fluently speak the native language of the country in which they reside are likely to experience difficulties in understanding the instructions provided during a disaster (Shiu-Thornton, Balabis, Senturia, Tamayo & Oberle, 2007; Hoffman, 2009). It is also possible that the existence of language barriers between the healthcare professionals providing treatment at the decontamination site and casualties could prevent casualties from expressing their needs (Department of Health, 2008) and may lead to the provision of incorrect treatment or diagnosis or to the identification of co-morbid conditions being overlooked (Bolton & Weiss, 2001). Ozolins and Hjelm (2003) even suggest that language barriers may prevent emergency responders from being able to accurately assess an individual's level of consciousness due to their inability to respond to questions or instructions. During a CBRN incident these communication challenges are likely to promote confusion and misunderstanding and to delay the process of decontamination.

Even when information and instructions are interpreted into the native language of the casualties involved in a mass casualty incident, it is possible that vital components of the message communicated are lost in the process of translation. Some words, phrases and concepts are not always directly transferable from one language to another (Leyva, Sharif & Ozuah, 2005; Bolton & Weiss, 2001). Arabic for example is a language which includes many elaborate descriptions and metaphors which may not be represented in the English Language (Giger & Davidhizar, 2002).

Ozolins and Hjelm (2003) highlight that it may be difficult for an emergency responder to identify when a foreign language speaker is illiterate or has problems with literacy. When written instructions are provided in the appropriate language and an individual is unable to read and therefore follow them, there is the potential for emergency responders to assume that the individual is uncooperative (Ozolins & Hjelm, 2003). This is likely to result in frustration on the part of the casualty and may delay decontamination.

12.2.2 Psychological, behavioural and socio-economic vulnerabilities

It has been suggested that people from minority cultures may lack trust in authority figures and members of the medical community (Office of Health Preparedness, 2003). In a study of Swedish healthcare workers and immigrants for example, Hultsjo and Hjelm (2005) demonstrated that the distrust of the police which may be felt by members of migrant communities can quickly manifest as symptoms of extreme panic and anxiety. In a discussion of emergency provision in Australia, Stevens et al. (2009) suggest that people who speak a language other than English are less likely to follow instructions given by authority figures; it is suggested that this may be because they lack confidence in the communication that has taken place. In a mass casualty decontamination situation it is imperative that casualties trust the information and instructions that are provided by the emergency responders; if this trust does not exist, it is possible that compliance will be low, therefore affecting the efficiency of the response.

It is possible that the differences that exist between prominent gender roles and gender-appropriate behaviours in different cultures may pose challenges for the decontamination of some minority groups (Taylor et al., 2009). In some cultures it is unacceptable for a woman to be touched by any man who is not her husband, women may be prohibited from undressing in front of men that are not their husbands and, in some cases women may not be allowed to undress in front of other women (Hultsjo & Hjelm, 2005; Giger & Davidhizar, 2002). In some cultures, women are not permitted to speak to men who are not their husbands and so can only communicate with other women (Giger & Davidhizar, 2002). It is possible that these prohibitions may cause difficulties during the decontamination process, in which other male casualties and male emergency responders will be present throughout and communication with male decontamination personnel may be necessary. The existence of culturally-driven ideas about gender-appropriate jobs and career choices is also highlighted as a potential cause of difficulty. In some cultures it is unacceptable for women to perform certain roles (e.g. doctors); this may result in unwillingness to follow the directives and instructions given by women (Hultsjo & Hjelm, 2005).

Finally, people from other cultures may have their own beliefs regarding health and illness and about the ways in which different health problems should be treated. For example, in a study of Swedish healthcare workers and immigrants, Ozolins & Hjelm (2003) found that staff often found it difficult to deal with patients who wanted to administer their own homeopathic treatments. It is possible that in incidents involving decontamination, valuable time could be lost in attempting to convince those from other cultures of what the best course of treatment is.

12.3 Recommendations

12.3.1 Ensuring effective communication

Given the likely existence of language barriers between responders and casualties of different cultures and ethnic origin, it is essential that efforts are made to provide information and instructions in a format which can be understood. It has been suggested that all information including signage and instructions should be displayed in

as many different languages as possible (Budd, Rega & Burkholder-Allen, no date) and that casualties who speak a different language should be provided with as much information as possible in order to relieve anxiety about the decontamination process (Taylor et al., 2009).

It may be beneficial to provide interpreters during the decontamination process in order to ensure the understanding of non-native language speakers (Home Office, 2004). In a decontamination exercise carried out in U.S. which involved Spanish speakers, Taylor et al. (2009) identified that it was useful to have an interpreter present in each of the decontamination zones (hot zone, warm zone and cold zone). Although potentially beneficial, the feasibility of recruiting interpreters to work in the hazardous environment of a CBRN incident has not been explored, nor has the logistical difficulty of providing interpreters of all relevant languages. In cases where interpreters are used, it is important to stress to the interpreter that elaborate metaphors (which may be common in other cultures) should be minimised, and that the basic facts of what the casualty is expressing should be interpreted (Giger & Davidhizar, 2002). Under normal circumstances it is not normally considered acceptable for family and friends to act as interpreters for a casualty. However, this may be necessary during a disaster, as it is likely that resources will be limited and that external interpreters will not be available (Central Ohio Trauma System Ethics Committee, 2003).

To help non-native language speaking illiterate casualties it has been suggested that generic pictorial representations should be used alongside any written guidance (Budd et al., no date). A further potentially useful recommendation made in relation to non-native language speakers which may also benefit illiterate casualties is that gestures and body language should be used to communicate instructions (mimicking hair washing for example) (Taylor et al., 2009). Care should be exercised with this approach however the meaning of body language and gestures can vary widely between cultures, potentially leading to confusion and misunderstanding (Hultsjo & Hjelm, 2005).

12.3.2 Recommendations relating to the process of decontamination

One of the most common recommendations made in relation to all vulnerable groups is that casualties should not undergo the process of decontamination alone; a buddying scheme should operate so that each casualty has at least one companion to accompany them through undressing, showering and re-dressing. Non-native language speakers are no exception: in the decontamination exercise carried out by Taylor et al. (2009), one of the key findings was that Spanish speakers were more comfortable going through the decontamination process when they were accompanied by other Spanish speakers.

12.3.3 Specific recommendations for emergency responders

To ensure that all emergency response personnel have an understanding of cultural and language-based issues that may have implications for the decontamination process, it has been recommended that emergency response personnel should receive training on how best to communicate across different languages and cultures (ACEP Board of Directors, 2008). Furthermore, all emergency response teams, especially

those in multi-cultural areas should make a conscious effort to recruit multi-cultural and bilingual staff (Emergency Management Australia, 2009).

13 GENERAL RECOMMENDATIONS FOR DISASTER PREPAREDNESS

Through the process of reviewing the recommendations that have been made for a variety of vulnerable groups in the published literature, it has become apparent that many of the recommendations were either the same or similar across different groups. Additionally, in many cases it is clear that particular recommendations would in fact be of benefit to more than one group or to casualties in general. Recommendations that fit into this category and can thus be considered as generic recommendations for improved mass casualty decontamination emergency response planning are reported in this chapter.

13.1 Community engagement

Rather than making assumptions about the needs and requirements of vulnerable and minority groups in the process of disaster planning, it has been suggested that the skills, knowledge and self-expertise of these groups should be utilised to inform and optimise any planning that takes place (Hutton, 2009; Lemyre et al. 2009). Lemyre et al. use the term 'community engagement' to describe the collaborative approach to problem solving and decision making that would allow vulnerable members of the community to inform disaster planning by offering their expertise on their specific needs and capabilities. In addition to enhancing the emergency planning process, Lemyre et al. identify that a community engagement approach will also build and strengthen the relationships between public health authorities and citizens, and will empower people to personally plan and prepare for a potential threat by giving them the knowledge to do so.

Hutton (2009) advocates the need for 'people-focused planning methodologies'; this involves engaging communities, raising people's awareness of hazards and risks, identifying the resources that are available to be used in an emergency and building the partnerships that are necessary to facilitate a coordinated and collaborative response. Such an approach requires that emergency planners work together with all segments of society, including the most vulnerable to ensure that the needs of these people are really met. Through involving vulnerable and minority groups in the planning process, it will be possible to not only ensure that emergency plans are fully inclusive of these people's requirements, but this will also empower them to prepare themselves for disasters. Hutton highlights that a secondary advantage of engaging with community groups and networks in the emergency planning process is that these groups are often able to raise awareness among the people that they represent.

13.2 The representation of vulnerable groups in disaster exercises

It is commonly recommended, particularly in the literature relating to disaster preparedness for children and people with physical impairments, that disaster exercises

(known in some countries as 'drills') should include members of vulnerable groups. This will help prepare emergency responders for the needs and requirements of these groups and facilitate the acquisition of the knowledge through problem-solving that is required in the event of a real incident. It seems appropriate to suggest that disaster preparedness exercises should in fact involve people who are representative of the population as a whole. This means that all vulnerable groups would be represented and thus, emergency services personnel and healthcare professionals would be prepared to deal with all of the people who may realistically be involved in a disaster.

A number of general recommendations relating to the planning and execution of exercises have been made and are applicable to exercises that involve the decontamination of vulnerable groups. Cicero and Baum (2008) advise that even before an exercise is planned, the scope and goals of the activity should be defined and the objectives for all departments, teams and individuals should be established. All of the objectives of the exercise should be both specific and measurable in order that it is possible to judge the strengths and weaknesses of the response.

Stokes et al. (2004) advocate that disaster drills and exercises should be made as realistic as possible by avoiding their announcement in advance; this will prevent those involved from engaging extra personnel and supplies in readiness. According a report written by Edwards et al. (2006), this was the approach taken in Exercise Supreme Truth; a large scale exercise involving a decontamination component which took place in Adelaide, Australia in 2003. The hospital and emergency staff involved in this exercise were kept unaware of the details of the exercise until the day of the event and the mock casualties that took part did not receive briefings until the morning of the exercise. Furthermore, there was no pre-deployment of other emergency services (such as the fire service). According to Edwards et al., the aim of these measures was to prevent any rehearsal from taking place and thereby make the exercise as realistic as possible.

13.3 Communicating instructions to casualties

One of the key findings from the decontamination drills and exercises reviewed is that while the use of personal protective equipment by decontamination personnel is essential, it hinders the process of communicating with casualties (e.g. Taylor et al., 2008; Taylor et al., 2009). Masks make it difficult for verbal instructions to be heard and the bulky gloves worn make it very difficult for personnel to provide complex information using hand signals and gestures (Taylor et al., 2009). It is of course imperative that casualties understand what is required of them during the decontamination process in order to maximise its effectiveness, hence it seems sensible to ensure that mechanisms and processes are in place so that all casualties receive and understand instructions. Meredith et al. (2008) state that in order to reach at-risk populations, information must be communicated using multiple formats, channels and tools. Instructions should be available in audible, text and picture formats; this will help to ensure that all casualties are informed of what the decontamination process involves and what is required of them.

In a discussion of the decontamination of children, Freyberg et al. (2008) propose that any instructions given to children should be clear, short and specific and that a short cartoon, video or a simple poster with illustrations of actions should be used. It is likely that these recommendations would benefit other vulnerable groups such as people who are unable to hear verbal instructions and non-native language speakers. A suggestion made by deaf casualties following involvement in a decontamination drill carried out by the Sinai Health System (Taylor et al., 2009) was that the use of broad hand signals and gestures such as the use of actions by personnel which mimic those of hair washing will benefit people who may be unable to hear verbal instructions. Again, it is likely that using such techniques would be of benefit to all casualties to reiterate any other instructions that they receive.

While these recommendations relating to enhancing the communication of instructions to casualties appear logical and valid, it is important that they are tested in practice before implementation. A decontamination field trial conducted by the UK Health Protection Agency in 2008, found that the use of pictorial instructions to communicate washing actions actually hindered objective adult decontamination performance (Amlôt et al., In press). This unexpected finding was attributed to reports from the volunteers that they had misinterpreted or misremembered the instructions, which were given to them before, but not *inside* the decontamination units. This outcome supports the need to field test any communication materials planned for use in emergency decontamination response and refine and adapt these following feedback from the target audience.

13.4 The use of 'buddy' systems

A common recommendation that appears in the literature is that people should not go through the decontamination process alone; people should be decontaminated in family groups or at least within groups of people with whom they are familiar. One of the main areas in which the merits of this recommendation are advocated is within the paediatric decontamination literature. It is suggested that by allowing parents to undergo decontamination with their children and thereby provide them with assistance, the process of efficient decontamination will be enhanced and the anxiety reactions experienced by children will be lessened (e.g. Fertel et al., 2009; Freyberg et al., 2008; Klein et al., 2009; Kollek & Karwowska, 2009).

Just as it is suggested that families should be kept together, it has also been suggested that groups of people who speak the same (non-native) language and groups of deaf people should be able to stay together through the decontamination process (Taylor et al., 2009). It is suggested that this will enable these groups to communicate with one another and help each other to understand what is required of them. Buddy systems are also suggested for other vulnerable groups. For example, a recommendation made in relation to the decontamination of people with mobility difficulties is that friends, relatives or acquaintances should be encouraged to provide assistance during the showering process (Braue et al., 2009).

Given the proposed benefits of allowing casualties to move through the decontamination process together to enable mutual helping, it seems worthwhile advocating the benefits of a general buddy system, whereby casualties who do not present as family or familiar group units, should be paired-up so that they are able to help each other during the process. Vulnerable elderly individuals for example may benefit from the assistance of a younger adult who is able to provide them with guidance throughout the decontamination process and to ensure full understanding of the instructions given by decontamination personnel. Although no specific evidence is available, it is possible that by encouraging people to help one-another during decontamination, decontamination efficacy would be increased and anxiety would be reduced.

13.5 Training decontamination personnel to work with vulnerable groups

If vulnerable individuals are to receive the care and assistance that they require during a mass casualty decontamination incident, it is clearly necessary that the personnel who are responsible for providing this care are properly trained to do so. It is important that the education and training provided addresses both the characteristics that might make a member of any given group vulnerable and, for each characteristic, the impact that this has on the care and treatment that they provide. For example, for children, it is important for decontamination personnel to understand that various anatomical features of children render them more susceptible to hypothermia *and* that specific measures must be taken during the decontamination of members of this group to ensure that they are kept warm. In relation to the decontamination of people who are deaf or hard of hearing, personnel must be aware of the difficulties that might be experienced in understanding instructions that are conveyed verbally *and* that attempts should be made to use gestures and actions where possible.

13.6 The development of vulnerability maps

For emergency planners to effectively accommodate the needs of the vulnerable people that exist in their community, it is clearly necessary that they understand who these people are and where they live. In order to achieve a clear picture of the vulnerability that exists in any given community, Morrow (1999) advocates the development of 'vulnerability maps'. This is an inventory of where the vulnerable groups that exist in a community are concentrated and may, according to Morrow, also be described as a community hazard or risk assessment. By understanding the needs of the community that they serve, emergency and disaster planners will be better able to plan and provide for the needs of these groups in the event of a mass casualty incident, such as the release of chemical or biological agents.

It is likely to prove more difficult to plan for tourists and transient or temporary residents such as the homeless, because it will never be possible to predict the exact numbers or characteristics of these groups in advance of an event. However, it is possible to

ascertain the areas where high numbers of such groups are likely to be found and the seasonal fluctuations that exist in their residency.

14 SUMMARY AND CONCLUSION

The current provision that exists for the decontamination of vulnerable and minority groups in mass casualty incidents has been examined through a systematic review of research literature, existing emergency plans, preparedness exercises and incident reports. The principal vulnerable groups that were identified were: children; pregnant women; people with physical, sensory or cognitive impairments; the elderly people with chronic illnesses; tourists; the homeless and people who are vulnerable for cultural or language-related reasons. Within all of these groups, there exists a wide diversity in the potential needs and requirements of its members during a mass casualty decontamination incident. However, as a collective unit, they are likely to have an elevated risk of negative effects during and after the incident; thus they are categorised as vulnerable. It should also be noted that even members of the population who would not assign themselves to one of these groups could be rendered vulnerable during a mass casualty incident because of injuries or trauma that they suffer.

For each of the vulnerable groups identified, the characteristics of the group which are the cause the groups vulnerabilities and the recommendations that have been made to mitigate against potential difficulties that may arise in an emergency decontamination scenario have been described. Although the recommendations that appear within the literature are usually made with specific reference to a particular group, it has emerged that many of the recommendations made are common to more than one of the groups (e.g. the incorporation of vulnerable groups into decontamination exercises; the operation of a buddy scheme; the provision of communication that is accessible). If these recommendations were incorporated into mass casualty decontamination preparedness plans and practices, the decontamination process as a whole would likely become more efficient and resilient; benefiting all casualties and the emergency response as a whole. In addition to the general process efficiency benefits, many of the recommendations that have been made would actually be directly advantageous for non-vulnerable casualties. The provision of instructions in written, verbal and diagrammatic formats for example, would provide all casualties with as many opportunities as possible for assimilating the necessary information about the decontamination process.

This review has also highlighted that there exists a substantial and growing literature detailing guidance on how mass casualty decontamination processes for vulnerable groups could be improved. What is lacking in most cases however, is any primary evidence that supports these claims. Whilst many of the recommendations made are clearly intuitive, suggestions made to tackle the problems experienced by vulnerable individuals in emergencies must be subject to rigorous testing to establish whether they are genuinely of use. For example, recent data has shown that intuitive assumptions concerning enhanced instructions for decontamination showering will not always result in an improvement in decontamination outcomes (Amlôt et al., In press). Having field-tested novel strategies to improve the management of casualties in emergency decontamination to establish that they are effective in practice, the next stage is for their implementation into national mass casualty decontamination protocols. The existing literature on emergency decontamination of vulnerable groups in mass casualty

incidents suggests that whilst the need for enhanced protocols is well recognised, the widespread implementation of effective strategies to meet the needs of vulnerable groups is lacking. It is likely that simple strategies (such as buddy systems and enhanced communication) may go a long way to address not only the needs of vulnerable groups, but will also improve decontamination processes for all casualties.

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APPENDIX A

LIST OF WORDS (INCLUDING WILD CARDS) USED TO FORMULATE SEARCH TERMS

Vulnera*
Decontamin*
Special populations
Vulnera*
Crisis
emergenc*
HazMat
Drill*
CBRN
Exercise*
Preparedness
Research
Trial
Protocol
Guidance
Policy
Management
Chemical Warfare Agents
Chemical
Radiological
Biological
Nuclear
Disaster
Terror*
Casualt*
Child*
Pediatric
Paediatric
Older people
Elderly
Aged
Mobility impairment
Disabil*
Geriatric
Blind
Deaf
Visually Impaired
Mental*

Sensory impairment
Cognitive*
Special needs
Learning disabilities
Intellectual disabilities
Psychiatric patients
Autism
Chronic illness
Diabetes
Epilepsy
Respiratory
Asthma
Mass-casualty
Bioterrorism
Incident
Pregnant
Homeless
Travel*
Touris*
Language
Minority group*
Ethnic minorit*
Non-English
Culture
Religion