Environment International 72 (2014) 66–74

Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Understanding public responses to chemical, biological, radiological and nuclear incidents — Driving factors, emerging themes and research gaps ☆

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ARTICLE INFO

Available online 20 May 2014

Keywords:
CBRN
Emergency response
Trust
Protection motivation theory
Human factors
risk perception and communication
Behaviour

ABSTRACT

This paper discusses the management of public responses to incidents involving chemical, biological, radiological and nuclear materials (CBRN). Given the extraordinary technical and operational challenges of a response to a CBRN release including, but not limited to, hazard detection and identification, casualty decontamination and multi-agency co-ordination, it is not surprising that public psychological and behavioural responses to such incidents have received limited attention by scholars and practitioners alike. As a result, a lack of understanding about the role of the public in effective emergency response constitutes a major gap in research and practice. This limitation must be addressed as a CBRN release has the potential to have wide-reaching psychological and behavioural impacts which, in turn, impact upon public morbidity and mortality rates. This paper addresses a number of key issues: why public responses matter; how responses have been conceptualised by practitioners; what factors have been identified as influencing public responses to a CBRN release and similar extreme events, and what further analysis is needed in order to generate a better understanding of public responses to inform the management of public responses to a CBRN release.

1. Introduction

On March 20th 1995, members of the Aum Shinryko cult released the chemical toxin Sarin on three different lines of the Tokyo subway. Twelve people died. 1000 people suffered adverse symptoms, such as miosis, nausea and vomiting (Ohbu et al., 1997).

The Tokyo Sarin attack and the response to this incident have been analysed and discussed from a number of angles, the majority of which focus on the technical capabilities and the effectiveness, or lack, thereof, of the co-ordination of the overall response (Beaton et al., 2005; Okumura et al., 1998a,b,c, 2003). For example, the initial misidentification of the agent and the resultant four-hour (approximate) delay in detection and identification of the agent led to a failure to apply appropriate treatment within hospitals. This delay also resulted in a failure to protect medical and emergency response staff, many of whom removed the chemical without simple personal protective equipment (PPE) such as protective gloves. Moreover, once the chemical was identified as Sarin, the receiving hospitals were not equipped to undertake the necessary decontamination (Okumura et al., 1998b). The Tokyo Sarin attacks therefore illustrate some of the technical challenges associated with CBRN releases, in this case: developing rapid hazard detection capabilities, as well as problems of coordination and management between different emergency response organisation and quasi-private operators (e.g. hospitals and subway).

This article adopts a unique perspective by moving away from the traditional focus on technical and organisational response capabilities, and moving towards an understanding of public responses to CBRN releases. Scholars, policy-makers and practitioners, alike, are increasingly recognising the fact that many of the psychological effects of CBRN releases on members of the public can be greater than the direct physical harm caused by levels of exposure to CBRN materials. Moreover, the potential of members of the public to influence the success of the overall response to CBRN releases has been acknowledged as an important factor in determining the effectiveness of the response efforts (Krieger and Rogers, 2013; Lemyre et al., 2006; Wessely et al., 2003), with "*…the success of government interventions before, during and after a crisis…*" relying "*…on the cooperation of the public*" (Rogers and Pearce, 2013:66).

The Tokyo case study captures many of the human and societal dynamics that form the public response to CBRN releases. In this case, five times the number of individuals who were found to be contaminated reported to hospitals for assessment and treatment (Okumura et al., 1998b). In fact, '*…5,510 of those who flooded hospital emergency departments were "psychological casualties" — that is, they experienced physical symptoms without direct exposure to nerve agent*' (Lemyre et al., 2005:2).

☆ Acknowledgements: The research for this paper was undertaken in the context of the project PRACTICE (Preparedness and Resilience against CBRN terrorism using Integrated Concepts and Equipment) funded by 7th Framework Programme of the European Union (grant number: 261728). We would like to thank the partner organisations in the PRACTICE consortium for their feedback on the research report this paper draws on.

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http://dx.doi.org/10.1016/j.envint.2014.04.017
0160-4120/

This phenomenon of the 'worried well' or low-risk patients (Rubin and Dickmann, 2010; Stone, 2007) constitutes a major challenge to medical facilities during a CBRN release. Moreover, the victims of the Tokyo subway attacks reported longer term psychological symptoms, such as fear of using subways, a year after the attacks (Ohbu et al., 1997; Okumura et al., 1996).

The development of a greater understanding of the variety of ways in which public behavioural responses can influence the effectiveness of the overall response to a CBRN release has implications for our ability to inform and manage public responses to CBRN releases. In this article, the authors will discuss the importance of developing a better understanding of the public response to CBRN releases. In doing so, Section 2 will move the discussion towards improving the effectiveness of emergency response *during* a crisis. The authors will call for a greater recognition of a much broader understanding of longer-term, post-event consequences, such as declining trust in political institutions and adverse effects on everyday life. Second, when arguing what factors shape public responses (Section 3), the authors move beyond perceptions of the threat itself, as a key determinant of behavioural response. Instead, they include a wide range of additional influential perceptions, including trustworthiness of responders and state authorities, as well as the perceived personal costs and benefits of response costs. Third, in an extension of the discussion of the key factors that shape public responses to CBRN releases (Section 4), this paper will emphasise the importance of viewing four factors (threat perception; perceptions of responders; perceptions of costs and effectiveness of response measures; quality of risk and crisis communication) in a contextualised and dynamic manner. We argue that the perceptions of members of the public are influenced by socio-economic, socio-cultural and politico-institutional contexts, requiring cross-country, cross-sectional comparative research. Additionally, it is important to recognise the interplay between the factors driving public responses. In a concluding section (Section 5), we discuss how our insights can help improve emergency responses to CBRN releases and how further research can contribute to this.

The paper reviews relevant scholarly literature targeted at understanding the role of the public in the context of CBRN releases and their management. Where available, we report concrete empirical research findings and refer to real world case studies to underpin our arguments about the key factors shaping public responses, as well as the identified gaps in research.

2. The role of the public in CBRN management

A better understanding of the public response to CBRN releases can help improve emergency response processes for a number of reasons.

First and foremost, it is necessary to acknowledge the psychological impact of CBRN events. CBRN releases are rare and the agents are often unknown and unfamiliar to members of the public. As a result, individuals can experience fear, anxiety and confusion in response to a CBRN release (Hyams et al., 2002). These emotions can have a significant impact on the mental health of individuals who have been directly or indirectly exposed, resulting in an increased likelihood of the development of post-traumatic stress disorder, insomnia, and depression in a minority of cases (Bleich et al., 1991; Page et al., 2008). The potential psychological impact can be seen during incidents involving 'mass sociogenic illness' (DiGiovanni, 1999), i.e. (massive) episodes of physical symptoms of acute injury triggered by unusual odours and rumours of contamination, along with actual toxic exposures. This suggests that even "*the impact of episodes in which there is no actual environmental hazard at all but only the perception of such a threat can be as damaging as those in which there is at least some chemical exposure*" (Page et al., 2006:413).

Second, the wider societal implications of CBRN releases have the potential to cause damage *beyond* physical harm. Specifically, incidents with CBRN releases can impact the level of trust that members of the public invest in state institutions. Trust can increase or decrease in relation to the state's perceived ability to discharge certain duties (e.g. emergency response to an extreme event), thus leading to broader questions about the state's core task or responsibility, which is to protect its citizens. For instance, the Tokyo attack demonstrated that the identification of the hazardous substance may not always be immediately possible. In the absence of clear knowledge, medical authorities may not be able to give any reassurances to members of the public or may need to use vaccines and antidotes that have not been approved by medical regulators[1]. This, in turn, has the potential to be detrimental to public trust in the medical profession and government officials (Berezuk and McCarthy, 1992; Birchard, 1998). Additionally, '*lack of trust may not only lead to an increase in unnecessary care seeking, but may also lead to refusal to adopt recommended protective health behaviours*' (Rogers and Pearce, 2013:70).

Other implications concern the effects of the psychosocial dynamics on the wider economy — via economic decisions by the individual as consumer. For example, the public avoidance of air travel crippled the American aviation industry in the months following the September 11th attacks on the USA in 2001 (Myers, 2001; Rogers and Pearce, 2013). Long-term psychological consequences also have the potential to affect the everyday behaviour of victims, such as decreasing willingness to visit the post office or grocery store (Whoriskey and Jenkins, 2001). CBRN releases increase the likelihood that economic life will also be affected for entire communities if they and their products and properties become stigmatised after a contamination event (Petterson, 1988).

Third, it is important to recognise that the public behavioural response has the potential to impact the professional emergency management of CBRN releases. One aspect is that members of the public are normally the first on the scene in an emergency situation as it can take some time for the emergency services to arrive (Barton, 1970). For instance, in the case of a CBRN release, performing first aid to affected individuals – as one possible response to emergency situations by members of the public – can lead to the contamination of the helping person. Another aspect is that members of the public may be unwilling to undertake certain actions recommended by the emergency responders, such as disrobing for decontamination. This has the potential – as real world case discussions below will show – of slowing down the response.

Finally, it is important to recognise that many emergency planning assumptions '*…fail to incorporate human behaviour and are based on contradictory expectations*' about public behaviour (Rogers and Pearce, 2013:72). In this case, assumptions of public panic are the norm, as are assumptions of public compliance to official advice (Pearce et al., 2012; Rogers and Pearce, 2013). For example public authorities assume that "*large gatherings have a tendency to act illogically and instinctively in the event of an emergency*" (Sheppard et al., 2006:220). However, research has illustrated that such irrational behaviour is rare cases and that public responses have an internal logic (e.g. in view of available information and individual cost–benefit-appraisals) and can thus be amended (Edgar et al., 2006; Keating, 1982; Sheppard et al., 2006). In fact, a growing body of literature identifies instances of pro-social behaviour and calm (e.g. 9/11 World Trade Centre evacuation; 7/7 London Bombings, and more), leading to the belief that, '*…when faced with disasters and emergencies, people become co-operative and panic is rare*' (Rogers and Pearce, 2013:72).

In spite of the prevalence of pro-social helping behaviour at the scene of an incident, recent research indicates that some of the public behavioural responses may interfere with the requirements of the emergency services. For example, parents are willing to go against official advice to shelter and potentially expose themselves to contamination in order to

[1] CBRN releases often require the use of non-standard, investigational drugs that have not been approved by medical regulators. In general, approval might be difficult to achieve in line with the standard procedures because clinical trials with humans are difficult to organise as they imply exposing humans to harmful substances (Berezuk and McCarthy, 1992).