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The Role of Environmental Health in Disaster Management: An Overview and Review of Barriers and Facilitators for Action

Deanna Eldridge and Thomas D. Tenkate

*School of Public Health, Queensland University of Technology,
Victoria Park Road, Kelvin Grove, QLD, 4059, Australia*

ABSTRACT

Environmental health has a significant role to play in all stages of disaster management, from planning through to recovery. The conceptualization of the environmental health role by environmental health practitioners and other disciplines involved with disaster management is the focus of this review. To provide context for this discussion, we present an overview of disasters and disaster management and the public health and environmental health impact of disasters. The literature indicates that the role of environmental health in disaster management is not clearly conceptualized, and the following barriers have been identified: the continued emergence of environmental health as a professional discipline, ambiguity about environmental health functions in disasters, limited representation in disaster planning, low visibility and profile of the profession, positioning of environmental health within public health, power and politics within agencies that result in a narrow assignment of the environmental health role, and a top-down approach to disaster management. Australian experience indicates that if environmental health practitioners can overcome such barriers and increase their involvement in disaster management, then this achievement will raise the profile of the profession and renegotiate the environmental health role in disaster management.

Ultimately, this success will also improve our capacity to manage disaster situations, and the higher profile, greater recognition, and representation of environmental health that is gained will then be able to flow into normal day-to-day activities.

KEYWORDS

environmental health, disaster management, role, profile

INTRODUCTION

The world has always had to prepare for and respond to disasters, with the way in which disaster management is undertaken providing a visible measure of the capacity of governments to protect their citizens and exposing vulnerabilities in infrastructure, organization, and leadership /1/. In recent years, the number of natural disasters and the number of people affected have been steadily rising, with an estimated 100,000 people killed in disasters globally in 2005 from such events as the Asian tsunami; hurricanes in central and northern America, notably hurricane Katrina; an earthquake affecting Pakistan and India; and volcanic eruptions like Ilamatepec in El Salvador /2/. Add to this the emerging and very real threats of terrorism and disease pandemics (such as avian influenza), and it is clear that disasters represent a major public health problem.

The nature of disasters is constantly evolving and as such, disaster management must reflect the current disaster climate. Even though each disaster is

Reprint requests to: Thomas Tenkate, QUT School of Public Health, Victoria Park Road, Kelvin Grove, QLD, 4059, Australia; e-mail: t.tenkate@qut.edu.au

unique, the similarities among the health effects of different disasters, if recognized and acted upon, can help ensure the most effective management of limited health and emergency resources /3/.

Environmental health has a significant role to play in all stages of disaster management, from planning through to recovery. The conceptualization of the environmental health role, by environmental health practitioners and other disciplines involved with disaster management, is the focus of this review. The literature indicates that the role of environmental health in disaster management is not clearly conceptualized, and this view appears to extend to other aspects of the profession as well.

To explore this issue, we provide an overview of disasters and disaster management as a basis for understanding the role of environmental health. The climate of disasters and disaster management in Australia is also discussed to provide an insight into local issues and to describe the context in which the environmental health role is undertaken in this field. The importance of public health, specifically its environmental health aspects, is then considered in relation to disaster management.

Overall, this review highlights the lack of research in the area of environmental health and disaster management and that difficulties continue in articulating the environmental health role in this field.

DISASTERS

Disasters can cause varying degrees of damage to the infrastructure of communities and can potentially result in mass casualties. Burkle /4/ has defined disasters to be “catastrophic events that overwhelm a community’s emergency capacity and threaten both the public health and the environment”. Disasters can occur suddenly, having a rapid onset, or they can develop over a long period, having a gradual onset /5/. Although often causing great devastation in some form, disasters can also provide an impetus for change, resulting in a “reassessment of cultural norms and political will”, for example, by allowing for the improved redevelopment of affected areas or by resulting in improvements to public

health and emergency medical services /4, 6/. Disasters expose the vulnerabilities of response and management structures and provide a learning experience, albeit a costly one, to responders and authorities /5/. For example, the terrorist attacks of September 11, 2001 exposed weaknesses in the public health system of the United States of America regarding inadequately trained public health staff, limited information and communication systems, and limited public health laboratory capacity, which has led to significant initiatives addressing these areas /5/. Such exposure of vulnerability highlights the changing nature of disasters and the need to address this in disaster management.

Traditionally, the term ‘disaster’ evokes thoughts of natural events, such as floods or earthquakes /4, 7/; yet, the nature of disasters has evolved over time. The rising incidence and threat of manmade disasters, such as bioterrorism and complex humanitarian emergencies, has broadened the term /8/. Several factors that have been suggested as contributing to the complexity of future disasters include the following /9/:

- urbanization of global populations;
- demographic prevalence of the world’s poor in urban settings;
- failing public health infrastructure;
- lack of moral integrity of governments;
- availability of and access to weapons;
- economic inequities and corruption;
- undisciplined military, paramilitary and police;
- suspension of the rule of law;
- wanton violations of protective treaties;
- failures in environmental and ecological security
- food and water insecurity, and
- transmigration of populations due to conflict, political, economic, or environmental issues.

Natural and manmade disasters are different in their manifestation, impact, and effects, and therefore require distinct and appropriate responses. Nevertheless, the principles and structures of a response are broadly applicable to all types of disasters and this will be demonstrated in the following section /10/.

Natural Disasters

Natural disasters are caused by the forces of nature; they include a wide range of natural occurrences, such as floods, cyclones, earthquakes, fires, tsunamis, volcanic eruptions, tornadoes, and heat waves /11/. Natural disasters have the potential to result in mass casualties and significant damage to infrastructure. Natural disasters, however, are more easily prepared for than manmade disasters, despite their similar unpredictability, as geographic areas prone to these types of disaster can be identified in advance and appropriate responses can be planned to minimize risk /12/.

Natural disasters have both medical and public health impacts. The medical impacts of natural disasters manifest in terms of casualties, which can overwhelm health services like hospitals, depending upon the size and extent of the event. Public health effects are evident in the destruction of infrastructure, such as water supply and electricity, resulting in an increased risk of communicable diseases and epidemics. In Australia, natural disasters have historically had, and continue to have, the most significant impact. This area is, therefore, the one in which Australia has the greatest experience in disaster management.

Manmade Disasters

Manmade disasters are those that are generated by identifiable human actions /11/. Complex humanitarian emergencies and terrorism are the most readily identifiable and common forms of manmade disasters.

Complex humanitarian emergencies. This term describes manmade humanitarian crises that are characterized by political instability, armed conflict, and the targeting of civilian populations of various ethnic, religious, and minority groups. Such crises result in a large population displacement, food shortages, social disruption, and the collapse of public health infrastructure /4, 13–14/. This type of disaster currently causes more morbidity and mortality than any other, primarily through

infectious diseases, malnutrition and trauma /13/. In fact, the term *complex humanitarian emergency* reflects the multi-causal nature and intricate response mechanisms that have characterized recent emergencies /3/. The response to each emergency is therefore unique and distinct from any other disaster, and needs to be based on the public health and primary health models of care that will have the greatest benefit /13/.

Terrorism. The challenge of terrorism has left an indelible mark on the world and spans all inhabited continents, crosses all cultures, and penetrates the borders of all countries /3/. Terrorism, whilst not a new phenomenon, has changed in the manner in which it is perpetrated and the reasons for which it is carried out /16/. The term ‘terrorism’ encompasses a large range of human initiated disasters, from biological to chemical and radiological. However, the most common forms of terrorist violence are bombings and shooting massacres, and this is expected to continue in the future, as they are the cheapest and most effective terrorist methods /15/. A common feature of ‘successful’ terrorist attacks is mass casualties, which raises significant issues for the preparedness of all health services, although undeniably, a medical response is the most significant /15/.

Bioterrorism is a form of terrorism, whereby biological agents are used to induce harm on a population. Until recently, an attack on the general public using a biological agent was considered unlikely but this possibility now forms an integral element of disaster management planning. One reason for this change of attitude is that events occurring over the past decade have demonstrated that moral uprightness and international agreements no longer restrain the use of such methods /17/.

Bioterrorism emergencies are characterized by the potential to spread outside the immediately affected area (having significant implications for containment), slow onset (compared with other disasters), uncertainty if little is known about the agent, and an increased demand on resources to respond /7/. Bioterrorism is most likely to be identified through epidemiologic surveillance, for

which public health is responsible /12/. The response to a bioterrorism attack includes containing the disaster, protection of response personnel and organizations, and management of the medical and public health consequences /12/. The latter are managed through decontamination, mass prophylaxis, patient care, and mass fatality management /12/.

Additionally, a change has also been made in the reasons underlying terrorism. Previously, terrorism was carried out for political motivation to change societies, but today the aim of terrorism is to destroy them /16/. The potential for terrorism is increasingly becoming a reality for many countries, including Australia. This potential is considered heightened by Australia's firm and public alliance with the United States, politically and militarily, thereby being exposed as a target /16/. Although many countries have extensive experience dealing with natural disasters, significant differences can be found in the manifestation of terrorist attacks, which require specific planning. The importance of thorough disaster management that has the capacity to respond to any type of disaster is therefore clear.

DISASTER MANAGEMENT

Disaster management is essential in the case of both natural and manmade disasters. Although most disasters cannot be prevented, their impact can be reduced with planning and preparedness /5/. The area of disaster management has evolved considerably over the past several decades, primarily through a shift in focus from haphazard and expensive post-disaster responses to an emphasis on prevention, mitigation, and preparedness /18–20/. This shift has also been evident in Australia, where a number of disaster management concepts and principles have been developed and applied.

Disaster Management Concepts

Four disaster management concepts are recognized internationally—the *All Hazards' Approach*, the *Comprehensive Approach*, the *All Agencies Approach*, and the *Prepared Community*. These

concepts guide the development of disaster management plans, which are a core component of disaster management and are therefore of great importance.

The *All-Hazards Approach* was founded in Australia in the mid-1990s /4/. Although each disaster requires a specific response, having a generic set of management arrangements to apply to aspects of any disaster is important /21–23/. For example, the activities involved in setting up an evacuation center are the same regardless of the type of disaster. The benefits of such an approach are emphasized by disaster management experts, for example, this approach can enhance coordination among services with different legal, geographic, and functional responsibilities to undertake an efficient and effective method of disaster management /12, 24/. Such coordination occurs through shared approaches, terminology, and structures to planning /24/.

A public health example of the activation of the all-hazards approach was the New York City electricity blackout of August 2003. In response to this emergency, the New York City Department of Health and Mental Hygiene (DHMH) deployed its all-hazards, public health Incident Management System. This system recognizes that certain public health issues are common to most incidents, but that during an emergency, the public health activities may not necessarily correspond to the routine activities of the DHMH. Therefore, the Incident Management System has established eight emergency response sections that are aligned with but cross-over regular work boundaries. In this incident, these sections responded to the following public health impacts: a failure of multiple hospital emergency generators, patients dependent on electricity-powered equipment, loss of electronic data input to the public health disease surveillance system, potential for vaccine spoilage from loss of refrigeration, beach contamination with untreated sewage, heat-related health effects and a potential increase in food-borne disease, and the potential for an increased rodent population resulting from increased amounts of discarded perishables /25/.

The *Comprehensive Approach* comprises four elements: prevention, preparedness, response, and recovery. There has been an Australia-wide uptake of this model, however it should be noted that the components are neither always of equal importance nor are they necessarily sequential /26/. Such elements should be incorporated into a disaster management plan, keeping this point in mind /21, 24/. This approach has implications for areas such as public health, where limited resources need to be focused toward the most effective and sustainable means of risk management rather than response and recovery /18/.

All Agencies Approach. Also known as the integrated approach, the All Agencies Approach requires an active partnership between each level of government and the agencies responsible for disaster management. Each section is likely to play a role in the emergency response and must be represented in the disaster management planning phase /21/. Bashir /27/ acknowledged the presence of a considerable scope for disagreement when a number of organizations are involved; planning is more successful, however, when collaboration occurs among various levels of government and agencies. Taking an all-agencies approach enables the role and responsibility of each responder to be defined and understood while enabling an integrated and coordinated response.

Prepared Community. Disasters principally affect the communities in which they occur, and as such, the local community must be able to respond. Those responsible in the community include individuals, community organizations, and local government /21/. Each has a responsibility toward disaster management, specifically in the area of preparation—for example, being aware of hazards and taking the appropriate precautions.

Disaster Management Principles

In addition to the above mentioned concepts, the following principles are an inherent feature in disaster management arrangements and along with

disaster management concepts, guide disaster planning—Organization, Command and Control, Coordination and Support, Information Management, Timely Activations, and an Effective Disaster Plan /21/.

Organization refers to a requirement of a disaster management plan, that it must be supported by an organization in which to operate. This point is essential for defining functional responsibilities to carry out the principles of disaster management in Australia: prevention, preparedness, response, and recovery. Australia's organizational body is Emergency Management Australia (EMA) and in the State of Queensland, the body responsible for the organization of disaster management is the State Disaster Management Group (SDMG). Nevertheless, a structure such as this does not diminish the need for inter-agency arrangements to support planning, control, coordination, and resource management.

Command and Control refers to the responsibility for the overall control of the disaster situation and the command of each element comprising the disaster response. The designation of command and control structures in disaster plans is crucial. It ensures a coordinated response by identifying reporting relationships, communication channels, and ensuring an integrated disaster response.

Coordination and Support refers to the responsibility of organizing resources to support disaster response activities. Resource management issues are significant issues in disaster response in developed countries, particularly relating to coordinating available resources, rather than a lack of resources. Therefore, mechanisms for coordinating resource support must be addressed in disaster management plans.

Information Management. Effective communication among all agencies involved in disaster response and with the community is vital. This principle ensures the coordination and appropriateness of response efforts. Mechanisms for communi-

cation and intelligence distribution must therefore be detailed in disaster management plans.

Timely Activations again refers to disaster plans, specifically their timely activation in the event of a disaster. Activation occurs distinct from a disaster declaration, and the responsibility for activation rests with a designated authority and controller. The point at which a disaster plan is activated and at what point further assistance is required must therefore be clearly articulated before a disaster. This approach serves to improve the response time to a disaster and minimize the consequences.

An Effective Disaster Plan results from the successful application and incorporation of the above concepts and principles. Such a plan is an outcome and a formal record of the arrangements and agreements of disaster management, according to the concepts and principles. It is critical that the organizational structure in a disaster plan correlates with disaster management functions /18/. For ease of implementation and activation, plans should be written, simple, properly disseminated, and regularly tested and revised.

Overall, these disaster management concepts and principles are the foundation for disaster management and as such, should infuse disaster planning.

DISASTERS AND DISASTER MANAGEMENT IN AUSTRALIA

Australia is prone to natural disasters, predominantly cyclones, bushfires, drought, flooding, storms, and earthquakes /28/, all of which have significant public and environmental health effects. As such, Australia has thoroughly developed disaster management structures for these events. Manmade disasters have not been as prevalent, the most significant being the Bali Bombing of 2002, which although occurring outside of Australia, still required a disaster management response from Australia /16, 29–30/. Additionally, Australia assisted in the response to the most recent bombing

attacks in Bali in October, 2005, although this disaster did not require a response of the same magnitude. Despite the lack of terrorist attacks on Australian soil, the potential for terrorism cannot be ignored. The greatest threat from terrorism is the perception that no threat exists because such a view fosters complacency /16/. Australian figures are not readily available for the incidence and costs of manmade disasters; although data are available for natural disasters because of their significance in Australia.

On average, there are ten natural disaster events per year in Australia at a minimum cost of AU\$10 million each /28/. Among Organization for Economic Cooperation and Development (OECD) countries, Australia had the highest annual percentage of its population affected by disaster /31/. Between 1967 and 1999, the total cost of disasters in Australia was AU\$37.8 billion or an average of AU\$1.1 billion per year /28, 32/. According to disaster trends, Queensland is the most susceptible state to tropical cyclones, severe storms, and flooding /28, 32/. Statistics such as these highlight the local significance of disasters.

Because of its history of natural disasters, Australia has made significant changes in its approach to emergency management in accordance with internationally evolving principles. Such changes have included shifts toward a whole-of-government approach, sustainability, a community view of disaster management, seeing disasters as “manifestations of vulnerabilities” rather than a “function of the presence of hazards”, and recognizing the need for interdisciplinary and inter-sectoral partnerships in disaster management /26/. This approach has had significant implications for disaster management planning.

In disaster management planning, environmental health professionals have a critical role to undertake. The context of plan development provides a forum for professional role negotiation through communication and interaction among the various disciplines involved in the process. Disaster management plans are essentially an outcome and record of the arrangements and agreements of disaster management, according to the identified concepts and

principles. The importance of such plans cannot be overemphasized. When a disaster occurs, significant decreases in morbidity and mortality result when an effective disaster management system and plan have been in place /4/. The quality of the plan is also an issue; inadequate plans can magnify the consequences of a disaster /12/ and such plans might not cater for the extent of damage that results /6/. Research into the environmental health role in disaster management could therefore result in an improved quality of disaster management plans.

Significant developments have taken place in disaster management planning over recent decades that aimed to improve effectiveness by employing a more holistic approach. In the early 1990s, the literature for disaster management focused primarily on hospital emergency management plans, with these having a focus on disaster medicine and the treatment of mass casualties from a disaster /33/. This focus has evolved to increasingly recognize the broader community impacts of disasters and has resulted in greater acknowledgment of the importance of areas such as public and environmental health /34–35/.

PUBLIC HEALTH AND DISASTER MANAGEMENT

A range of public health and environmental health consequences of disasters has led to the increased recognition of these fields in disaster management /36/. As environmental health is a subset of public health, specific environmental health consequences and functions are rarely defined. Environmental health is therefore usually considered in relation to the overall functions of public health. Ousley /5/ defines the goals of a public health agency as follows:

The purpose of a public health agency is multifaceted. It works to promote and encourage health behavior, prevent injuries, limit environmental hazards, and prevent epidemics and the spread of diseases. It responds to disasters, assists

communities in recovery, and ensures the quality and accessibility of health services (page 58).

The pertinence of public health to disaster management is therefore obvious. Disasters have the capacity to destroy the public health infrastructure of communities, and thus public health services have to be re-established. Specific examples of the public health consequences of disasters are available in the literature, and many of these are directly related to environmental health:

- Population displacement, whereby large populations move to areas where the health and other services cannot cope in the event of a disaster, results in increased morbidity and mortality through unsanitary living conditions, communicable diseases, and overcrowding /5, 37–38/.
- Food shortages /5, 38/.
- Disruptions in or contamination of water supply and waste management /38/.
- Psychological and social behavior can be adversely affected /5, 37–38/.
- Environmental hazards and communicable diseases, causing increased morbidity and mortality and reduced quality of life /5, 37, 38/.
- Destruction of local infrastructure, including health services, thereby limiting the capacity to respond to a disaster and rendering agencies unable to service the community after the event. The absence of local infrastructure results in a significant disruption to health care delivery and in the long term, prevents routine health services and preventative measures, resulting in increased morbidity and mortality /5, 37–38/.

The public health effects of disasters demonstrate the importance of the public health system in disaster management, and this view has been emphasized in recent literature /39–40/. A prepared public health system is not only considered necessary for an effective and appropriate emergency response but can also be a key link in communication and collaboration between agencies /5/. The role of public health officers in conducting rapid health and needs assessments following many

natural disasters is a good illustration of how an effective emergency response can result in improved outcomes and rapid restoration of essential services /41–42/. Furthermore, it has been suggested that in the United States, disaster preparedness at the state level is a reflection of the integration between public health agencies and the medical community /43/. Khan /36/ believes that through a flexible public health system, the disaster response will result in decreased morbidity and mortality, and an investment in such a prepared system “*provides the best civil defense against bioterrorism and may also act as a deterrent*”. This view has highlighted the importance of public health in disaster management and the broad public health issues in relation to disasters. In several of the public health consequences of disasters, specific environmental health effects can be easily identified and these will now be discussed in detail.

ENVIRONMENTAL HEALTH AND DISASTER MANAGEMENT

Understanding the environmental health consequences of disasters is essential for determining the responsibilities and functions of environmental health agencies in disaster management. Specifically, the environmental health impacts of disasters relate to water supply, wastewater disposal, solid-waste handling, air and soil quality, food hygiene, vector control, overcrowding and home sanitation /3, 44–45/. Each category can result in an increase in incidence of diarrhea, malaria, respiratory infections, measles, and other communicable diseases /40/.

The primary responsibilities of public health agencies are considered to be epidemiology, notification, communication, assessment, management and identification of equipment and transportation systems /5, 12–13/. Environmental health is most importantly responsible for environmental surveillance, hazardous materials management, vector control and ensuring food and water quality /12, 18/. This demonstrates that environmental health has a significant responsibility towards the health of the public, especially in disasters, and shows the

necessity of environmental health involvement in disaster management. What is not known; however, is whether the level and manner of environmental health involvement is appropriate, given such significant responsibility in disasters. This raises issues regarding the environmental health role in disaster management and how this role is perceived by environmental health practitioners and other disciplines involved with disaster management. Key issues which have been identified in the literature as influencing the role of environmental health in disaster management are as follows.

History of the Profession

The first issue relating to the role of environmental health is the history of the profession. Environmental health was one of the first organized public health activities. Kotchian /46/ describes the history of environmental health as having origins in Biblical times, with pronouncements by Leviticus on food safety and quarantine. In the thirteenth century, despite a lack of understanding of the mechanisms of disease transmission, there was an awareness of the importance of sewage, protection of water supply, regular waste disposal and quarantine in Rome and England /46/. As understanding of epidemiology and disease transmission improved in the nineteenth century, the health or sanitary inspector became the first documented public health profession /46–48/. The sanitary inspector had responsibility for what are now known as the environmental impacts on human health.

The environmental health officer was initially known as the ‘Inspector of Nuisance’ in early nineteenth century Britain. This was a poorly paid and lowly government position, lacking status and requisite skills /47/. Toward the end of the nineteenth century, the term changed to ‘Sanitary Officer’ with increased professionalisation in the form of qualifications and the formation of a number of professional associations /47/. In Australia, cadetships and training programs were the primary way in which to become a health inspector, or an Environmental Health Officer (EHO) as it is currently known, up until approximately the last

fifteen years, since which time tertiary qualifications have been offered by academic institutions.

The history of the environmental health profession demonstrates that it is still emerging as a professional discipline and discovering its collective identity. This has implications for the role of environmental health in disaster management, as it is likely to be less firmly established than the roles of other disciplines. The history of the profession may play a significant part in determining how other disciplines perceive environmental health in disaster management, and how environmental health professionals see themselves.

Functions of Environmental Health

A common theme emerging in the literature is that there are ambiguities in environmental health functions in disasters. Forsting /35/ claims that the definition of functions and responsibilities of environmental health professionals has been more difficult than for other strands in the public health field, due to difficulty in its distinction from communicable diseases and other public health activities. Similarly, Fabian /34/ after a review of terrorism response plans, was unable to locate a reference to environmental health or environmental health personnel as distinct from public health, and expressed concern that further attention was not given. As direct evidence of this function ambiguity, Lyman /49/, in the report *Messages in the Dust: What are the lessons of the environmental health response to the terrorist attacks of September 11?*, describes how the Environmental Protection Agency (EPA) usurped the role and responsibilities of the local environmental health officers, which had been indicated by disaster management structures, when arriving at the World Trade Centre site /49/. This ambiguity requires the clear articulation of environmental health functions in disasters.

Establishing clarity in functions and responsibilities is crucial in disaster response to ensure integration, coordination and the most effective response /27/. Clearly, such definition has been lacking within the area of environmental health in Australia. In the state of Queensland, this has been

demonstrated in the past by a lack of appropriate disaster management planning for environmental health by the Queensland Department of Health (Queensland Health). For example, Public Health Units, the operational arm of Queensland Health, previously conducted disaster management in isolation from their Corporate/Central Office (which has a policy development and leadership role). This approach can result in poor coordination when a disaster overwhelms Public Health Units and requires corporate office involvement. The lack of clearly articulated functions of environmental health in disasters could be due in part to the poor representation and the low visibility/profile of the environmental health profession.

Improving Representation, Visibility, and Profile of the Environmental Health Profession

The representation, visibility, and profile of environmental health are also significant issues for disaster management. Berg /50/ claims that public health discussions on terrorism have bypassed environmental health and that the environmental health profession has had a “*longstanding invisibility problem*”. The author suggests that due to the profession’s key position, this barrier could be overcome to “*provide insight during terrorism preparedness and response*” /50/. Fabian /51/ also advocates the involvement of environmental health in a terrorism response as an opportunity to improve the visibility of the environmental health profession /51/. This theme is also evident in Lyman /49/, who asserted that the September 11, 2001 terrorist attacks resulted in the recognition of the vital role that environmental health plays in terrorism preparedness and similar disaster situations. The author states that,

September 11 crystallized the importance of environmental health and the various professionals engaged in this field, and signaled the rise of this discipline on a par with other emergency response professions /49/.

Despite this view, Berg’s /50/ descriptive article, including interviews with environmental health

professionals, expresses the fear that other government or community sectors are establishing plans and procedures in relation to emergency response that will undermine the role of environmental health.

This literature indicates that the environmental health profession has had low visibility and consequently, a low profile. Fabian /51/ explicitly describes the process that has caused this low profile.

- First, the belief amongst environmental health professionals is that if they do their job well, then they receive no recognition or support.
- Second, the resulting invisibility of environmental health work results in the dismissal of the profession as lacking importance.
- Finally, if an environmental health problem does emerge, then the profession receives negative publicity for not having prevented the problem.

This process causes concern for the environmental health role within disaster management, whereby low visibility of the environmental health role could result in a less than ideal level of involvement in disaster management /51/. In support of this view, it is noted that before 2001, the environmental health system received little individual attention in disaster planning, funding, or research /19/. Public health emergency preparedness has since been thrust into the limelight with greater funding and resources, but it is not a quick process to recover after many years of being under resourced to such a large extent /52/. Hence, the representation of the environmental health profession, and the way in which it is seen (or not seen) by other professions in relation to disaster management, creates another issue for consideration in exploring the environmental health role in this field.

The necessity for increased public health—and thus environmental health—involvement in disaster management, is recognized internationally and in Australia. In the wake of September 11, 2001, Emergency Management Australia specifically recognized the need for greater public health involve-

ment in disaster planning and exercises /53/. Despite a lack of reference specifically to environmental health—as has often been the case in disaster management literature /34/—public health involvement in such activities is assumed to include environmental health. This assumption raises a further theme, that of the relationship between environmental health and broader public health.

Position of Environmental Health within the Field of Public Health

Because of its role in ensuring a healthy ecologic and human environment, environmental health is demonstrably linked to public health /54/. Based on this contribution to ensuring and promoting the health of communities, environmental health has therefore traditionally been seen as part of public health /5/. Nevertheless, a debate is currently in progress about whether environmental health is distinct from public health /46, 54–55/. Such a separation is suggested to be due to the regulatory role of environmental health and the perception that regulation is the primary activity of environmental health /54/. Kotchian /46/ articulates the issue of environmental health and public health separation as follows:

The field of environmental health and protection and the entire field of public health have repeatedly found themselves isolated from one another, unable to articulate the definition, mission and goals of public health and the essential role for environmental health and protection in the provision of a healthy ecological and human environment. (page 245)

This statement can be specifically related to disasters in that although a vast amount of research has been undertaken into the public health response to disasters and environmental health, “the proper linkage between the two has not been made” /19/. This issue is another that affects the role of environmental health in disaster management.

Power and Politics

The development of any kind of arrangement occurring in a formal environment and dominated by professions usually results in a politically charged situation. To bring together individuals who are responsible for representing the policies and practices of 'their agencies' is a huge challenge, even for those who operate within similar cultural frameworks /27/. The environmental health role in disaster management is a result of negotiating perceptions through interaction with other disciplines, resulting in the assignation of a 'role' to environmental health, which will affect interaction with the profession on a day-to-day basis. The view that other disciplines hold about the environmental health role in disaster management will affect their communication with environmental health agencies, the level of environmental health involvement in planning, and representation in the field. Potential exists for disjuncture in the view that environmental health has of their role compared with the view that other disciplines have of the environmental health role.

A primary example of such a disjuncture, specifically in relation to environmental health and disaster management, is the expressed fear that other government or community sectors are establishing plans and procedures in disaster management that will undermine the role of environmental health /50/. This situation indicates that agencies other than environmental health either lack knowledge of the environmental health field or have attributed a role to environmental health that relegates the profession to being not relevant or less important in disaster management, or incapable of providing the response that others have determined as necessary.

To assist this process of clear role establishment, ensuring the transparency of the decision-making process is essential, yet, as Bashir /27/ has determined, such clarification does not usually occur. This lack of transparency and clarity has an impact on the perceived roles of participants in the process and can result in conflict.

To achieve successful collaboration, establishing trust is vital, as are encouraging open and honest communications and keeping a common ground at

the forefront of negotiations /27/, otherwise strained relationships and conflict are likely. This issue therefore represents a further potential barrier to a visible role of environmental health in disaster management.

Top-Down Approach

The top-down approach to disaster management has been identified as a barrier to successful collaboration of disciplines in disaster management, and hence the development of successful disaster plans /27/. For example, traditionally within the Queensland Health corporate office, disaster management activities are driven from a top-down approach, with directives coming from higher authorities within Queensland Health. Specifically in relation to disaster management, the level of cooperation has been found to be higher when disaster planning is developed in response to a need that those creating the plan have themselves identified /24/. This is the case for local governments in Queensland and for Queensland Health Public Health Units. The increased cooperation in bottom-up planning has been attributed to greater proactivity when those developing the plan 'own' the initiative, rather than having it forced upon them by top-level policy changes at a central government level /24/. Such control is strongly related to power and political issues that are inherent in bureaucratic organizations /56/. For example, top-down approaches may lead to the enforcement of values and ideas of senior persons in the organization, which may translate into inappropriate and ineffective disaster management.

The Australian Experience

We have recently completed a comprehensive qualitative study into the disaster management experiences of environmental health practitioners in Australia /57/. This study explored the role of environmental health in disaster management and how this role is perceived by environmental health practitioners and others involved in disaster management. The results of the study were largely

consistent with the common themes identified in the literature, with the environmental health role in disaster management found to be a result of the socially constructed view of health. The traditional 'medical' view of health has resulted from a complex interplay of the concepts of visibility, public perception, politics, and recognition.

Because of the more popular 'medical' view of health, public health—inclusive of environmental health—has been relegated to second place behind medical health services within disaster management. Environmental health in particular had a very low profile. McGinnis /58/ provides further confirmation of the historic and contemporary divide between public health and medicine.

Recent increased involvement in the disaster management planning process in Queensland has been found to improve the profile of environmental health. With representation on local and district disaster management groups (DMG), the value of environmental health is increasingly being recognized, resulting in a higher profile. Authority and influence also come with DMG representation, due to the development of relationships with those in charge of coordinating disaster response efforts. Ultimately, the heightened environmental health profile and increasing recognition by others involved in disaster management will result in an effective and appropriate response to a disaster and flows on to benefit normal work activities.

CONCLUSION

The importance of the role of environmental health in disaster management has never been as apparent as it is at present. The changing nature of disasters and the factors that contribute to these are resulting in a re-evaluation of the role of public health and environmental health in the planning, response, and recovery aspects of disaster management. This review has highlighted a number of barriers and facilitators for action with regard to the role of environmental health agencies in disaster management. In particular, the specific role of the environmental health profession in disaster manage-

ment was rarely investigated until after the terrorist attacks of September 11, 2001. This tragic event not only highlighted the vital role environmental health plays in terrorism preparedness and similar disaster situations but also identified the ambiguity in the functions of environmental health in disaster response. The latter has been related to the poor representation in disaster planning and the low visibility and profile of the environmental health profession. This low visibility and consequently low profile has resulted from the inherent nature of the preventive role undertaken by environmental health, in which often the best work is unrecognized by the public or by other professions who have a role in disaster management. In the wake of September 11, 2001, many agencies specifically recognized the need for greater public health involvement in disaster planning and exercises, with this involvement flowing on to environmental health.

Another barrier to the role of environmental health in disaster management has been its intrinsic relation to public health and the traditional medical model of health. As such, some debate has taken place about whether environmental health should be distinct from public health, with such a distinction potentially allowing environmental health to define itself more effectively and to create opportunities for public exposure and profile enhancement.

The role of environmental health in disaster management is also a result of negotiating perceptions through interaction with other disciplines. In this case, the view held by other disciplines of the environmental health role will affect communication and the level of environmental health involvement in planning and representation in disaster management. In order to achieve successful role establishment and collaboration, it is vital to establish trust, open and honest communications, and to keep common ground at the forefront of negotiations.

Additionally, the top-down approach to disaster management has been identified as a barrier to successful collaboration of disciplines and has the potential to constrain innovation and limit the role of environmental health. Recent Australian experiences, however, have demonstrated that if environmental health practitioners can overcome these barriers and

increase their involvement in disaster management, then this approach will result in raising the professional profile and renegotiating the role of environmental health in disaster planning, response, and recovery activities. Following such role renegotiation and recognition, a higher profile, greater recognition, and representation will then be able to flow on to normal day-to-day activities because of the improved relationships with high-level and inter-agency personnel who have ascribed importance to the role of environmental health.

REFERENCES

- Burkle FM. Globalization and disasters: issues of public health, state capacity and political action. *J Int Aff* 2006;59(2):241–265.
- Braine T. Was 2005 the year of natural disasters? *Bull World Health Organ* 2006;84(1):4–6.
- Noji EK. Disasters: Introduction and state of art. *Epidemiol Rev* 2005;27:3–8.
- Burkle FM. Disaster management, disaster medicine and emergency medicine. *Emerg Med Australasia* 2001;13(2):143–144.
- Ousley E, Atluri S, Dang C. Public health issues of a disaster. *Top Emerg Med* 2002;24(3):56–60.
- Batho S, Williams G, Russell L. Crisis management to controlled recovery: the emergency planning response to the bombing of Manchester City Centre. *Disasters* 1999;23(3):217–233.
- Rawlin G. Managing biological emergencies: a new approach. *Aust J Emerg Man* 2001;16(1):40–46.
- Hamburg MA. Bioterrorism: A Challenge to public health and medicine. *J Public Health Man Pract* 2000;6(4):38–44.
- Burkle FM. Lessons learnt and future expectations of complex emergencies. *Br Med J* 1999;319:422–426.
- Perry RW, Lindell MK. Preparedness for emergency response: guidelines for the emergency planning process. *Disasters* 2003;27(4):336–350.
- Noji EK. Disaster epidemiology. *Emerg Med Clinics North America* 1996;14(2):289–300.
- Flowers LK, Mothershead JL, Blackwell TH. Bioterrorism preparedness II: The community and emergency medical services systems. *Emerg Med Clinics North America* 2002;20(2):457–476.
- Brennan RJ, Nandy R. Complex humanitarian emergencies: A major global health challenge. *Emerg Med Australasia* 2001;13(2):147–156.
- Burkholder BT, Toole MJ. Evolution of complex disasters. *Lancet* 1995;346:1012–1015.
- Frykberg ER. Principles of mass casualty management following terrorist disasters. *Ann Surg* 2004;239(3):319–321.
- Caldicott DGE, Edwards NA. The global threat of terrorism and its impact on Australia. *Emerg Med Australasia* 2002;14(3):218–229.
- Noji EK. Bioterrorism: a new global environmental health threat. *Global Change Human Health* 2001;2(1):46–53.
- Keim ME, Rhyne GJ. The CDC Pacific emergency health initiative: A pilot study of emergency preparedness in Oceania. *Emerg Med Australasia* 2001;13(2):157–164.
- Logue JN. Disasters, the environment, and public health: improving our response. *Am J Public Health* 1996;86(9):1207–1210.
- Martin B, Capra M, van der Heide G, Stoneham M, Lucas M. Are disaster management concepts relevant in developing countries? The case of the 1999–2000 Mozambican floods. *Aust J Emerg Man* 2001;16(4):25–33.
- Emergency Management Australia. Concepts and Principles in Emergency Management. 2005. http://www.ema.gov.au/agd/EMA/emaInternet.nsf/Page/Publications_Publications_Menu_Principles_Concepts_and_Principles_Concepts_and_Principles
- State Counter Disaster Organisation. State Counter Disaster Plan. Brisbane: State Counter Disaster Organisation, 2001.
- Abrahams J. Disaster Management in Australia: The national emergency management system. *Emerg Med Australasia* 2001;13(2):165–173.
- Rasmussen J, Jensen S. Incident Management Systems: a means of enhancing coordination, communication and decision-making in a disaster. *Nat Emerg Man* 1998;13(3):13–15, 17–18.
- Beatty ME, Phelps S, Rohner MC, Weisfuse MI. Blackout of 2003: public health effects and emergency response. *Public Health Rep* 2006;121(1):36–44.
- Gabriel P. The development of municipal emergency management planning in Victoria, Australia. *Aust J Emerg Man* 2003;18(2):74–80.
- Bashir Z, Lafronza V, Fraser MR, Brown CK, Cope JR. Local and state collaboration for effective preparedness planning. *J Public Health Man Prac* 2003;9(5):344–351.
- Bureau of Transport Economics. Economic Costs of Natural Disasters in Australia (No. 103). Canberra: Bureau of Transport Economics, 2001.
- Fisher D, Burrow J. The Bali bombings of 12 October, 2002: lessons in disaster management for

- physicians. *Intern Med J* 2003;33(3):125–126.
30. Vinen J. Bali: a wake-up call. *Intern Med J* 2003; 33(3):71–73.
31. Bradt DA, Abraham K, Franks R. A strategic plan for disaster medicine in Australasia. *Emerg Med Australasia* 2003;15(3):271–282.
32. Gentle N, Nitz A. Economic costs of natural disasters in Australia. *Aust J Emerg Man* 2001;16(2):38–43.
33. Anteau CM, Williams LA. The Oklahoma bombing: lessons learned. *Crit Care Nurs Clin North Am* 1997;9(2):231–236.
34. Fabian N. Post September 11: Some reflections on the role of environmental health in terrorism response. *J Environ Health* 2002;64(9):78,77,65.
35. Forsting SL. Environmental Health Professionals and Emergency Preparedness: Canadian Perspectives. *J Environ Health* 2004;67(4):31–35.
36. Khan AS, Morse S, Lillibridge SR. Public-health preparedness for biological terrorism in the USA. *Lancet* 2000;356:1179–1182.
37. Noji EK, ed. *The Public Health Consequences of Disasters*. New York, NY, USA: Oxford University Press, 1997.
38. Pan American Health Organization. *Natural Disasters: Protecting the public's health*. Washington DC, USA: World Health Organization, 2000.
39. Noji EK, Toole MJ. The historical development of public health responses to disasters. *Disasters* 1997; 21(4):366–376.
40. Noji, EK. Public health in the aftermath of disasters. *Br Med J* 2005;330:1379–1381.
41. Bayleyegn T, Wolkin A, Oberst K, Young S, Sanchez C Phelps A, et al. Rapid assessment of the needs and health status in Santa Rosa and Escambia Counties, Florida, after hurricane Ivan, September 2004. *Disaster Manag Response* 2006;4(1):12–18.
42. Brennan RJ, Rimba K. Rapid health assessment in Aceh Jaya District, Indonesia, following the December 26 tsunami. *Emerg Med Australasia* 2006; 17(4):341–350.
43. Mann NC, MacKenzie E, Anderson C. Public health preparedness for mass-casualty events: a 2002 state-by-state assessment. *Prehospital Disaster Med* 2004; 19(3):245–255.
44. Wisner B, Adams J, eds. *Environmental health in emergencies and disasters: A practical guide*. Geneva, Switzerland: WHO, 2002.
45. Noji EK. Public health issues in disasters. *Crit Care Med* 2005;33(1 Suppl):S29–S33.
46. Kotchian SB. Perspectives on the place of environmental health and protection in public health and public health agencies. *Annu Rev Public Health* 1997;18:245–259.
47. Brimblecombe P. Historical perspectives on health: the emergence of the Sanitary Inspector in Victorian Britain. *J Royal Soc Prom Health* 2003;123(2):124–131.
48. Roberts R. EHO's do have ancestors! *J Environ Health* 1996;59(5):20.
49. Lyman F. Messages in the dust: what are the lessons of the environmental health response to the terrorist attacks of September 11? Denver, Colorado, USA: National Environmental Health Association, 2003.
50. Berg R. Terrorism response and the environmental health role: the million-dollar (and some) question. *J Environ Health* 2004;67(2):29–39.
51. Fabian N. It Can Be Done—Making the invisible visible. *J Environ Health* 2004;67(2):70, 51.
52. Lurle N, Wasserman J, Nelson CD. Public health preparedness: evolution or revolution? *Health Affairs* 2006;25(4):935–945.
53. Emergency Management Australia. *Mapping the Way Forward for large-scale urban disaster management in Australia: Building on the lessons from September 11 2001, 2003*. [http://www.ema.gov.au/agd/EMA/rwpattach.nsf/VAP/\(63F21BC6A4528BAE4CED2F9930C45677\)~EMALessonsLearntbookletfinal.pdf/\\$file/EMALessonsLearntbookletfinal.pdf](http://www.ema.gov.au/agd/EMA/rwpattach.nsf/VAP/(63F21BC6A4528BAE4CED2F9930C45677)~EMALessonsLearntbookletfinal.pdf/$file/EMALessonsLearntbookletfinal.pdf)
54. Leggat P. Environmental health: global initiatives and new analytical approaches. *J Rural Remote Environ Health* 2003;2(2):36–37.
55. Kotchian SB. Environmental leadership in a public health agency. *J Environ Health* 1993;55(5):60–61.
56. Brewer L. Bureaucratic organisation of professional labour. *Aust N Z J Sociol* 1996;32(3):21–38.
57. Eldridge D. *An exploration of the role of environmental health in disaster management*. BHLthSc honours thesis, Brisbane, Australia: Queensland University of Technology, 2005.
58. McGinnis JM. Can public health and medicine partner in the public interest? *Health Affairs* 2006; 25(4):1044–1052.