

Invited paper

Emergency preparedness and humanitarian action: the research deficit. Eastern Mediterranean Region perspective

I.A. Shaikh¹ and A Musan²

الاستعداد للطوارئ والأعمال الإنسانية: بعض التقصير في إجراء البحوث، من منظور إقليم شرق المتوسط

إرشاد شيخ، أطف موصاني

الخلاصة: يعاني إقليم منظمة الصحة العالمية لشرق المتوسط، الذي يمتد من باكستان شرقاً إلى المغرب غرباً، ويزيد عدد سكانه على 490 مليون نسمة، من نسبة كبيرة من الكوارث الطبيعية وغيرها من الكوارث التي هي من صنع البشر. ومع أن الشركاء في الأعمال الإنسانية في القطاع الصحي قد قاموا بدور رئيسي في تجنب ارتفاع معدلات الوفيات والمرضاة في حالات الطوارئ السابقة، فلا يزال هناك الكثير الذي ينبغي عمله من أجل توفير البيئات في هذا الخصوص، من خلال اعتماد أساليب بحثية صارمة ودقيقة، بُعِثَ توحيد العناصر الأساسية الأخرى للاستجابة للمتطلبات الصحية في حالات الطوارئ الإنسانية. وقد خلصت الدراسة إلى أن تعزيز المؤسسات الأكاديمية، وتحديد أولويات البحوث، وتوفير الموارد المالية، وتعزيز الاتصال بالمؤسسات المعنية في البلدان المتقدمة، كل ذلك من شأنه أن يحسّن الوضع في الإقليم.

ABSTRACT The WHO Eastern Mediterranean Region, extending from Morocco in the west to Pakistan in the east, with a population exceeding 490 million, suffers a large proportion of both natural and man-made disasters. Humanitarian partners in the health sector have played a major role in averting the excessive mortality and morbidity in response to previous emergencies; nevertheless much remains to be done to provide the evidence through rigorous research methods to standardize other essential elements of the health response to humanitarian emergencies. Strengthening of academic institutions, prioritization of research, financial resources and linkages with institutions in the developed world can ameliorate the situation in the Region.

Préparation aux situations d'urgence et action humanitaire : le déficit en matière de recherche - Perspective de la Région de la Méditerranée orientale

RÉSUMÉ La Région OMS de la Méditerranée orientale, qui s'étend du Maroc à l'ouest au Pakistan à l'est, et dont la population dépasse 490 millions d'habitants, connaît une grande proportion de catastrophes d'origine naturelle et humaine. Les partenaires humanitaires dans le secteur de la santé ont joué un rôle majeur pour éviter une mortalité et une morbidité excessives dans les situations d'urgence précédentes ; néanmoins, il reste beaucoup à faire pour fournir les bases factuelles, par des méthodes de recherche rigoureuses, afin de normaliser d'autres éléments essentiels de l'action sanitaire dans les urgences humanitaires. Le renforcement des établissements universitaires, l'établissement des priorités de recherche, les ressources financières et les liens avec des institutions dans le monde industrialisé peuvent améliorer la situation dans la Région.

¹Medical Epidemiologist; ²Regional Adviser, Emergency Response and Humanitarian Action, Regional Office for the Eastern Mediterranean, World Health Organization, Cairo, Egypt (Correspondence to I.A. Shaikh: Shaikhi@emro.who.int).

Background

The frequency of natural disasters and impact in terms of human and economic costs has increased alarmingly at global level in the past 2 decades, and this increase has been much greater in developing countries than in developed ones. From 1984 to 2003, more than 4.1 billion people were affected by natural disasters [1]. The number affected grew from 1.6 billion in the first half of this period (1984–93) to almost 2.6 billion in the second half (1994–2003), with yearly estimates of up to 200 million [2]. In constant dollars, disasters between 1990 and 1999 contributed to material losses of US\$ 652 billion [1]. In the years 2004–05 alone, over 160 countries were affected by natural and technological disasters, resulting in over 350 000 deaths and over US\$ 254 billion in related costs [3].

A large proportion of disasters, both natural and man-made, occur in our Region, the Eastern Mediterranean Region (EMR) of the World Health Organization (WHO). War, internal conflict and eruptions of violence increase the vulnerability of populations. Countries such as Afghanistan, Iraq, Palestine, Somalia and Sudan have had, or

are currently experiencing, complex humanitarian emergencies—complex political disasters where the capacity to sustain life and livelihood is threatened, primarily by political factors and in particular by high levels of violence [4]. With respect to natural hazards, Egypt, the Islamic Republic of Iran, Lebanon, Pakistan, Somalia, the Syrian Arab Republic and Yemen have experienced floods, droughts, earthquakes and landslides. Recently the major earthquakes in the Islamic Republic of Iran and Pakistan affected large numbers of people and were responsible for significant material losses.

The public health effects of disasters and complex humanitarian emergencies include direct and indirect mortality, morbidity and trauma resulting in an over-burdening and/or possible collapse of the health system (Table 1). Though no accurate and comprehensive data are available for the EMR on cumulative mortality and morbidity from either natural disasters or complex humanitarian emergencies, nevertheless guesstimates of proportional mortality and disability adjusted life years (DALYs) lost because of war are 12.56 % and 13.25% respectively [5]. The human and societal

Table 1 Mortality and numbers affected in reported major emergencies in 2004/05 [3]

Event	Country (most affected)	Reported deaths	Total affected (injured, homeless, etc.)
Hurricane Jeanne, September 2004	Haiti	2 754	315 594
Tsunami, December 2004	Indonesia, Sri Lanka, India, Thailand, Somalia	225 841	2 273 723
Hurricane Katrina, August 2005	United States of America	1 053	500 000
South Asia earthquake, October 2005	Pakistan	73 320	3 269 392

toll that natural and complex humanitarian emergencies exact is, nevertheless, amenable to humanitarian public health response and interventions.

In response to previous emergencies, humanitarian partners in the health sector have played a major role in averting excessive mortality and morbidity, despite the fact that preparedness and risk reduction policies and programmes are not fully evidence-supported and, arguably, leave much to be desired in terms of being sound and effective [6]. The *Humanitarian response review* [7] commissioned by the United Nations also identified serious gaps in current international humanitarian action, and suggested accelerating measures aimed at improving predictability, effectiveness and accountability of humanitarian aid efforts. The establishment of cluster coordination mechanisms with clear accountability to manage a cluster has been suggested as one means of improving humanitarian aid in support of Member States. This mechanism will depend significantly on data and information derived from rapid assessments from the area affected in order to ensure evidence-based actions/interventions are made.

Considerable advances have been made recently in assessment, management, education and training in disaster response. To be both successful and effective in complex emergencies, however, those responding to health needs in humanitarian crises will need to expand their knowledge base and utilize scientific methods to incrementally learn and apply best practices in a complex environment.

Current status and research deficit

The current process through which knowledge of disaster risk is being generated,

transferred and translated into action is increasingly being challenged, in particular by academics and practitioners from developing countries [8]. At a recent meeting of relevant experts convened by WHO, it was agreed that "...in practice, humanitarian actors, including international and national workers, host governments and donors, seldom know whether, and to what extent, their actions have impact on survival, livelihoods and dignity of those affected by crisis" [6].

A critical factor that further compounds this lack of knowledge, especially in complex humanitarian emergencies and large scale natural disasters, is the partial or total collapse of systems for routine information collection and analysis in an event of structural, social and political instability. Compromised information systems at all levels stifle the process of prioritization and the capacity to monitor trends and, as a result, hinder evidence-based shifts in priority setting and resource allocation.

The information available is too often derived from a variety of sources using non-standardized methods. It inherently lacks consistency and is of poor reliability and validity, and is arguably of limited use for establishing baselines, making comparisons or tracking trends. Furthermore, while valuable data may be collected at the level of the individual project/crisis, there is rarely sufficient real-time evidence on whether humanitarian outcomes are improving or deteriorating at the level of crisis situation as a whole. The WHO has been asked on several occasions to address the need to establish baselines as well as demonstrate the overall effectiveness of humanitarian assistance. In particular, during the initial onset of the Darfur crisis in Sudan, many organizations and agencies reported crude mortality rates well beyond the acceptable threshold (generally accepted threshold in

emergency settings being crude mortality rate of 1/10 000 per day) in many camps of displaced populations. The WHO, along with other health partners, conducted 2 retrospective mortality surveys with the aim of identifying the leading causes of mortality as well as assessing the change in health status of displaced persons after 6 months.

Unfortunately it is assumed that all disaster response has been, and will be, based upon “scientific evidence” [9]. However, there is also a lack of researched strategies/practice-based evidence, “assumptions used in emergency preparedness and planning are based on conventional wisdom and stereotypes rather than on systematically collected evidence” [7].

The bulk of knowledge and practice in humanitarian assistance resides with a few time-honoured public health prevention and control measures—communicable disease surveillance [10] and control [11], vaccination [12], nutrition [13,14], safe drinking water, vector control and environmental health in general—all yielding standardized responses [15,16]. However, much remains to be done in order to come up with evidence through rigorous research methods to standardize other essential elements of humanitarian health responses (Table 2).

Mental health and HIV/AIDS have, however, gained increasing focus recently and information and knowledge on short-term mental health effects of disasters as well as remedial response measures continues to grow at a healthy pace [17–22]. This process of generation of knowledge and learning in the field of natural hazards and disaster risk reduction has generally been dominated by academics and research centres from the developed world [8]. Furthermore, the mechanisms (scientific journals) through which research findings are disseminated to end-users of research results, especially those in developing countries, are also un-

suitable. Another aspect that disproportionately affects the humanitarian settings, especially from an EMR perspective, is a lack of applied research evaluating the reasons behind systems successes or failures in humanitarian settings.

This paucity of evidence-based practices and/or practice-based evidence, coupled with a lack of consensus among humanitarian partners, makes the justification for programmatic choices in relief and recovery phases arbitrary, and thus the potential for humanitarian interventions to be inappropriate, inefficient and ineffective. To date, for the same reasons, no global performance standards for accountability exist.

The situation in the EMR is not any different. Many global factors cited earlier, coupled with social and ecological factors that enhance vulnerabilities, continue to pose serious risks. Despite the existence of “lessons learned” exercises [23–26], and epidemiological research that has provided a scientific basis and shaped, to some extent, prevention and intervention strategies [27–29], this research is not a result of a common understanding and systemic effort. Thus, it is subjective, sometimes incoherent and not generalizable. Furthermore, the body of knowledge available at a global level may not always be relevant to this Region: it may be outdated, the threats faced may be of a different nature, or it may be culturally inapplicable [7]. In the recent devastating earthquake in Pakistan, a conservative Muslim region in which many men refuse to allow the female members of their households to be examined by male clinicians, staff members of several organizations reported numerous cases of severely injured women being denied medical care by their families. Anecdotal evidence from the early days indicated that “less than 10% of the patients in some clinics were women” [30]. Hence, it is important to

Table 2 Operational and institutional status of essential elements of health response programmes (adapted from Burkle) [40]

Status	Element
Operational and fully standardized	Water Sanitation Nutrition Communicable diseases Essential drugs
Not fully standardized/institutionalized	Collecting and sharing standardized assessment tools Impact assessments Reproductive health Human rights and protection Mental health Education and training (providers)
Seriously deficient	Evaluation methods Long-term physical and emotional consequences Issues of integrated health management Information management Information, communication and technology Logistics Incident command system Civil military coordination Transition (from relief to recovery) Recovery aspects

develop strategies and interventions based on local knowledge and perceptions prior to an emergency situation.

Critical data/information gaps exist in the Region as to how health systems respond to disasters. A clear case in point is the unwarranted primary focus for disaster medical planning on hospital treatment of the critically injured [7], whereas the evidence, barring big earthquakes affecting large urban areas, is to the contrary [31]. Thus, appropriate facility planning needs to be an integral part of overall disaster preparedness plans. Similarly, another critical gap on the subject of health facilities is the lack of a systematic overview of the structural and non-structural integrity of major hospitals—the cornerstone in case of mass casualty management—in key disaster

earthquake-prone metropoli. Certainly a number of major urban centres, such as Cairo, Karachi and Tehran, need to ensure that their secondary and tertiary care hospitals are resilient to natural events and prepared to respond to mass casualty situations.

Similarly, though there is a good understanding of humanitarian issues linked to health information management [32–34], these issues have rarely been addressed explicitly at country level in the Region [5,35]. These include key issues such as information in endemic diseases of concern in emergencies and the impact of the latter on health care availability and access.

Many micro- and macro-level barriers exist to developing applied research in humanitarian emergencies specific to the EMR, e.g. the low priority for applied re-

search in general, lack of end-user-friendly research, limited impact of research on improvement of policies and functioning of health systems, limited use of existing knowledge, limited resources (for example, only 2.7% of total health expenditures worldwide went into research and development [36]), limited research capacities [27], dynamic complexity of humanitarian situations and inability to conduct controlled experiments.

Research rationale

Strict application of scientific methods has been the mainstay of the great advancements in medicine and public health. Present day double-blind, prospective, randomized control trials and diligent adherence to the protocols is the most reliable way of generating evidence needed to improve health policy and health outcomes [37]. In the normal arena of health care delivery systems, evidence-based health policy has been gaining greatest credence in academic and public health practice-based settings. However, the challenge of applying controlled experiments as a research instrument and generating evidence-based practices creates a paradox in humanitarian settings: dire and immediate needs, coupled with ethical and security concerns, preclude any design, plan or execution of controlled experiments. Humanitarian settings provide naturally-occurring settings affording, at best, opportunities to observe trends, make a positive impact and learn for future application. Nonetheless, repeated occurrence of such events and the response initiated should, in principle, incrementally afford evidence for what works best: evidence-based practices. Unfortunately, most of the evidence available, so far, is not practice-based at global or Regional level. No foundation of applied

research exists in the Region or for Member States to deal with essential elements of response other than perhaps nutrition and communicable disease surveillance and control.

In contrast, the availability of reliable evidence may be a prerequisite, but it does not guarantee learning. The history of health is replete with examples where learning has failed despite evidence. In the era of information technology, where generation of knowledge and its dissemination can occur in real-time, one would expect best practices to converge to optimal levels; many studies, however, document large, persistent differences in performance across organizations [19].

For preparedness planning and mitigation programmes that capitalize upon risk management models [38], research is essential to identify various risks and generate information for risk mitigation and hazard reduction. Furthermore, while crises and ill effects of disaster are felt across all social groups, the evidence clearly shows that the poor are worst affected because of the devastating impact on their livelihoods, bordering on destitution [23]. Research on the post-crisis impact on marginalized groups and community-based and participatory recovery mechanisms can play a vital role in poverty and vulnerability reduction interventions in humanitarian settings. It can also facilitate the much-desired interface with development activities.

Conclusions

The need for emergency preparedness for humanitarian action and recovery in the EMR is evident. Humanitarian situations are an ideal opportunity to learn and apply international experiences, while respecting and accommodating the specific needs

of the countries of the Region, where the traditional health challenges of poverty, poor nutrition, poor hygiene and lack of sanitation have been compounded by increases in environmental and occupational problems associated with the rapid growth of cities and industries. The risk factors that can compound/contribute to the impact of future disasters (urbanization; health disparities and economic inequities; lack of environmental and ecological safeguards; food and water insecurities; inter- and intra-country population migration due to conflict, food or water insecurities or political, economic and environmental issues) continue to grow unabated in the Region [39]. Epidemiological approaches in priority areas and well-researched, sound, public health interventions that have so far played an important role in normative functions can play a similar mitigating role in priority areas of emergency preparedness and response and would reduce the health impact of humanitarian emergencies of all kinds.

Priority-setting is as critical as conducting research itself [27]. The Millennium Development Goals can provide useful guidance from a developmental perspective, and can be useful in prioritizing research in preparedness and response at the country level: there is evidence for the disproportionate impact of disasters on vulnerable sub-groups in disaster-affected populations: the poor, the politically and socially marginalized, women and children.

Recommendations

For research capacity strengthening in EMR, the following recommendations are made:

Resource allocation

- at least 1% of all resources allocated for emergency preparedness and response

must be earmarked for research capacity and strengthening for applied research in priority areas.

Education and training

- restructuring and enhancing the education of all relevant health professionals in community-based disaster management and emergency preparedness and response, through the incorporation of effective, action-oriented and user-driven approaches to research, learning and knowledge management methods into professional practices and encouraging interdisciplinary collaboration with the delivery of health care services;
- strengthening of academic centres in applied research capacities to close the gap between academic theory and field-level practice;
- development and application of ethical codes and guidelines appropriate to research in humanitarian settings and their instruction and institutionalization through the creation of relevant bodies: institutional review boards.

Human resources for health

- develop a critical mass of able and qualified scientists and practitioners who can undertake research on priority issues and can suggest ways to translate these into actions.

Linkages

- establish linkages with international research networks and create public-private partnerships for research capacity strengthening as well as implementation of research findings. Specific areas of collaboration in infectious and chronic disease, diffusion of research based best practices, education and training, and demonstration projects to facilitate

health delivery systems development for emergency preparedness and response.

Research

Specific priority research areas, with due emphasis given to ethical conduct may include:

- identification of key challenges to the provision of critical, life-saving clinical care and public health interventions in humanitarian settings;
- identification of what integrative and innovative steps may be undertaken in the context of health challenges and opportunities in emergency preparedness and response at Regional and country levels;
- applied research to identify strategic, operational and cultural barriers to the application of research results and best practices;
- identification of health promotion and communication strategies needed to:
 - transform complex, multidisciplinary research results into easy, comprehensible messages for decision makers, practitioners and community members;
 - dispel the myths that are disseminated post-disaster, e.g. the issue of the management of dead bodies as a public health threat;
- documentation and compilation of studies and “lessons learned” exercises to gradually institutionalize best practices, build a foundation of research and advocate the operationalization of key aspects;
- improving information sharing to enhance collaboration between organizations with vertical programmatic mandates;
- identifying the essential elements of humanitarian response and performance indicators;
- measuring and quantifying other subtle/indirect consequences of disasters/complex humanitarian emergencies;
- compiling descriptive case studies of past as well as new disasters;
- evaluation of the effectiveness of health interventions with the aim of achieving incremental improvement in health systems response;
- assessing the relevance of available global best practices to the EMR;
- methods for dissemination of politically sensitive information;
- information priorities and efficient information collection methods/tools;
- application of current risk management and hazard mitigation models for identifying and understanding various risks and hazards to health in high-risk countries for planning and preparedness;
- compilation of case studies on the magnitude of post-crisis recovery among marginalized groups and generation of recommendations for relief-to-recovery-to-development models for the EMR.

References

1. *Hazards of nature, risks to development: an IEG evaluation of World Bank assistance for natural disasters*. Washington, DC, World Bank, 2006.
2. *Hyogo framework for action 2005–2015: building the resilience of nations and communities to disasters*. Geneva, International Strategy for Disaster Reduction, 2005.
3. Wahlström M. Keynote speech. In: *Symposium on multi-hazard early warning systems for integrated disaster risk*

- management: 23–24 May 2006*. Geneva, World Meteorological Organization (http://www.wmo.int/disasters/ews_symposium_2006/download/P2.%20MargaretaWahlstrom,%20Keynote%20Address.pdf, accessed 17 July 2006).
4. Zwi A, Uglade A. Political violence in the third world: a public health issue. *Health policy and planning*, 1991, 6:203–17.
 5. *Technical discussion. Health under difficult circumstances: the impact of war, disasters and sanctions on the health of populations*. Cairo, World Health Organization Regional Office for the Eastern Mediterranean, 2002 (EM/RC49/Tech. Disc.1).
 6. *Report of a workshop on tracking health performance and humanitarian outcomes, Geneva, 1–2 December 2005*. Geneva, World Health Organization, 2006.
 7. *Humanitarian response review*. New York, United Nations, 2005.
 8. *Expanding risk research and learning* [online factsheet]. Geneva, ProVention Consortium (International Federation of Red Cross and Red Crescent Societies) (<http://www.proventionconsortium.org/?pageid=14>, accessed 17 July 2006).
 9. Noji EK. Disasters: introduction and state of the art. *Epidemiologic reviews*, 2005, 27(1):3–8
 10. Coulombier D, Pinto A, Valenciano M. Surveillance épidémiologique lors d'urgences humanitaires [Epidemiological surveillance during humanitarian emergencies]. *Médecine tropicale*, 2002, 62(4):391–5.
 11. Connolly MA, ed. *Communicable disease control in emergencies: a field manual*. Geneva, World Health Organization, 2005.
 12. Immunization during complex emergencies. In: *Global Alliance for Vaccines and Immunization. Fifth Board Meeting, London 21–22 June 2001. Annex 5.2*. (http://www.gavialliance.org/resources/5thmtg_rept.pdf, accessed 17 July 2006).
 13. Arbelot A, ed. *Nutrition guidelines*, 1st ed. Paris, Médecins Sans Frontières, 1995.
 14. Bagchi K et al. Nutrition in humanitarian crises. *Eastern Mediterranean health journal*, 2004, 10(6):747–53.
 15. Médecins Sans Frontières. *Refugee health: an approach to emergency situations*. London, Macmillan Education, 1997.
 16. Wisner B, Adams J, eds. *Environmental health in emergencies and disasters: a practical guide*. Geneva, World Health Organization, 2002.
 17. Ghosh N, Mohit A, Murthy RS. Mental health promotion in post-conflict countries. *Journal of the Royal Society for the Promotion of Health*, 2004, 124(6):268–70.
 18. Mollica RF et al. Mental health in complex emergencies. *Lancet*, 2004, 364(9450):2058–67.
 19. Baingana F, Bannon I, Thomas R. *Mental health and conflicts: conceptual framework and approaches*. Washington, DC, International Bank for Reconstruction and Development/World Bank, 2005 (Health nutrition and population discussion paper).
 20. Spiegel PB. HIV/AIDS among conflict-affected and displaced populations: dispelling myths and taking action. *Disasters*, 2004, 28(3):322–9.
 21. Mock NB et al. Conflict and HIV: A framework for risk assessment to prevent HIV in conflict-affected setting in Africa. *Emerging themes in epidemiology*, 2004, 1(1):6.
 22. *The need for HIV/AIDS interventions in emergency settings*. Geneva, Inter-Agency Standing Committee, 2004.
 23. Humanitarian Policy Group. *Saving lives through livelihoods: critical gaps in the re-*

- sponse to the drought in the greater Horn of Africa. London, Overseas Development Institute, 2006 (HPG briefing note) (<http://www.reliefweb.int/library/documents/2006/odi-hpg-gen-30may.pdf>, accessed 17 July 2006).
24. Beck T. *South Asia earthquake 2005: learning from previous recovery operations*. London, Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP)/Provention Consortium, 2005.
 25. Houghton R. *Tsunami emergency – lessons from previous natural disasters*. London, Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP), 2005.
 26. *Natural disasters: protecting the public's health*. Washington, Pan American Health Organization, 2000 (Scientific publication No. 575).
 27. Liu S et al. Assessment of a severe weather warning system and disaster preparedness, Calhoun County, Alabama, 1994. *American journal of public health*, 1996, 86(1):87–9.
 28. Staes C et al. Deaths due to flash floods in Puerto Rico, January 1992: implications for prevention. *International journal of epidemiology*, 1994, 23(5):968–75.
 29. Armenian HK, Noji EK, Oganessian AP. A case-control study of injuries arising from the earthquake in Armenia, 1988. *Bulletin of the World Health Organization*, 1992, 70(2):251–7.
 30. Brennan RJ, Waldman RJ. The South Asian earthquake six months later—an ongoing crisis. *New England journal of medicine*, 2006. 354(17):1769–71.
 31. Van den Berg B et al. Medically unexplained physical symptoms in the aftermath of disasters. *Epidemiological reviews*, 2005, 27:92–106.
 32. Lippeveld T, Sauerborn R, Bodart C, eds. *Design and implementation of health information systems*. Geneva, World Health Organization, 2000.
 33. Kaiser R et al. The application of geographic information systems and global positioning systems in humanitarian emergencies: lessons learned, programme implications and future research. *Disasters*, 2003, 27(2):127–40.
 34. Maxwell D, Watkins B. Humanitarian information systems and emergencies in the Greater Horn of Africa: logical components and logical linkages. *Disasters*, 2003, 27(1):72–90.
 35. Thieren M. Health information systems in humanitarian emergencies. *Bulletin of the World Health Organization*, 2005, 83(8):584–9.
 36. *Helping correct the 10/90 gap. Annual report 2003–04*. Geneva, Global Forum for Health Research, 2004.
 37. Sterman JD. Learning from evidence in a complex world. *American journal of public health*, 2006, 96(3):505–14.
 38. Alexander B, Chan-Halbrendt C, Salim W. Sustainable livelihood considerations for disaster risk management: implications for implementation of the Government of Indonesia tsunami recovery plan. *Disaster prevention and management*, 2006, 15(1):31–50.
 39. Donohoe M. Causes and health consequences of environmental degradation and social injustice. *Social science and medicine*, 2003, 56(3):573–87.
-