

Medical Relief After Earthquakes: It's Time for a New Paradigm

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Global-scale disasters, such as the Haiti earthquake, generate huge numbers of casualties and simultaneously damage local infrastructure, including medical facilities. In such cases, the mix of resources sent to the scene by the international community may determine how many lives can be saved. Unfortunately, there is no internationally sanctioned after-action process to enable national disaster relief agencies and large nongovernmental organizations to learn from their experiences so that the next global response is more efficient and effective than the last. For example, data from 6 recent earthquakes suggest that the tradition of dispatching large numbers of urban search and rescue teams provides scant benefit relative to the substantial resources involved. Sending fewer urban search and rescue teams and more medical teams might save more lives.

Earthquakes are one of the most devastating forms of natural disaster. They usually strike without warning, produce widespread damage, and can cause massive loss of life.¹ The recent quakes that struck Chile, New Zealand, and Japan showed that temblors of sufficient magnitude can wreak havoc in the best-built and most well-prepared nations. But earthquakes of lesser magnitude can produce even greater loss of life if they strike densely populated regions filled with poorly constructed buildings. When a disaster clearly exceeds the afflicted nation's capacity to respond, the international community is often asked to assist. In such cases, actions taken in the first days after the event can save many lives.

Currently, national delegations and nongovernmental organizations generally act on their own, without the benefit of a unified command structure. As a result, they have little knowledge of one another's plans and resources. And because major earthquakes invariably disrupt communications, little is known about conditions on the ground during the initial hours after a catastrophic event.

Lacking specific information about local needs, international aid missions often rush whatever manpower, equipment, and supplies they have readily at hand to the scene, regardless of what is needed.^{2,3} The primary motivation for this practice is a strong desire to help, but national pride and organizational self-interests also play a role. Governmental agencies rely on public

support to sustain their budgets, and nongovernmental organizations require a steady stream of donations to fund their work. Both are enhanced by swift action, regardless of how unfocused it may be.

Another problem is that decisions about whom and what to send are largely based on dogma, rather than knowledge gleaned from previous events. The tradition of sending large numbers of urban search and rescue personnel to major earthquakes is a case in point. The rationale for this practice is that collapsed structures entrap occupants, many of whom can be saved if found in time.⁴ Urban search and rescue teams also play an important morale-building role. Their early arrival, in brightly colored uniforms, signals the sponsoring nation or nongovernmental organization's commitment to help. Successful recoveries boost morale and provide powerful images to telecast back home.

But dispatching large numbers of urban search and rescue teams to every earthquake is costly. The teams are expensive to train, equip, and deploy. Once they are on scene, substantial resources must be devoted to their sustenance, shelter, and security. Because the volume of aid that can be sent to a region during the first few days is often constrained, resources transported to support urban search and rescue teams necessarily diminish those available for other priorities such as food, shelter, sanitation, and health care.³ Do urban search and rescue teams' benefits justify these costs? Consider the following examples.

BAM, IRAN

On the morning of December 26, 2003, a magnitude 6.5 Richter scale (RS) earthquake struck Bam, Iran. Before the earthquake, Bam had a population of 240,000. Within seconds, large sections of the city collapsed, killing roughly 40,000 people and injuring 30,000 more. At least 75,000 were left homeless. In response, 34 national urban search and rescue teams, consisting of 1,345 personnel, reported to the United Nation's On-Site Operations Coordination Center.^{2,5} Despite several days of intensive searching, the urban search and rescue teams found no additional survivors beyond those pulled from the rubble by the local population.⁶⁻⁸

KASHMIR, PAKISTAN

On October 8, 2005, a magnitude 7.6 RS earthquake hit a wide area in South Asia, especially Pakistan-administered Kashmir, killing 73,338 people and injuring more than 100,000. Despite an immediate United Nations Disaster Advisory Committee response, only 24 survivors were extricated by urban search and rescue teams.³

PADANG, INDONESIA

On September 30, 2009, a magnitude 7.6 RS earthquake struck Padang, the capital of West Sumatra, Indonesia, a city of 900,000. According to official sources, the quake killed 1,117 persons, injured 3,000 more, and affected 2.5 million. Responding nations sent 21 urban search and rescue teams, consisting of 688 personnel and 67 dogs, to the scene.^{9,10} No survivors were found beyond those rescued by local citizens.^{11,12}

PORT-AU-PRINCE, HAITI

On January 12, 2010, a magnitude 7 RS quake struck Port-au-Prince, the capital of Haiti. Because most of the city's public and private buildings were poorly constructed, they swiftly collapsed, killing 200,000 people and injuring 300,000 more.¹³ Forty-three urban search and rescue teams equipped with advanced detection and extrication equipment were sent to the scene by various nations.¹⁴ Because access was restricted to a badly damaged airport, some of these teams did not reach Haiti until the fifth day after the quake. Eventually, more than 1,800 urban search and rescue personnel and 161 dogs participated in the response. Collectively, they rescued 120 to 134 people, a fraction of those saved by the Haitian people themselves.^{15,16}

CHRISTCHURCH, NEW ZEALAND

On February 22, 2011, a magnitude 6.3 earthquake struck Christchurch, New Zealand. Because the epicenter of the quake was very shallow, it produced widespread damage. When this article went to press, the casualty count stood at 159 fatalities, 700 injured, and more than 200 missing. According to various reports, the approximately 600 urban search and rescue personnel deployed to assist rescued between 1 and 3 survivors.¹⁷

NORTHEASTERN JAPAN

Reports on the international response to the massive 9 RS earthquake and subsequent tsunamis are still being compiled. To the best of our knowledge, responding urban search and rescue teams found no survivors beyond those rescued by the local population.^{18,19}

Contrast the cumulative results of these 6 international responses with the effect of a single field hospital in Haiti. This facility, which was staffed by 120 physicians, nurses, paramedics, and support personnel of the Israeli Defense Force, reached Port-au-Prince on the third day after the earthquake. During the next 11 days, the hospital admitted 737 victims, some of whom were subsequently transferred to other nearby

field hospitals. More than half of patients admitted had open fractures or severe soft tissue infections.¹⁴ Many were septic on arrival and probably would not have survived without aggressive intervention. The Israeli Defense Force team performed a total of 243 major surgical procedures, at least 200 of which were deemed to be lifesaving. During this short time, the hospital treated 1,111 patients with problems ranging from major trauma to simple fractures, soft tissue injuries, infectious diseases, and obstetric and newborn emergencies.²⁰ Similar results were achieved by other field hospitals.²¹

No country can afford to send an unlimited number of personnel and resources to a disaster. It is therefore imperative that international relief groups deploy the proper mix of urban search and rescue personnel, health care providers, sanitary engineers, logistics specialists, and others to do the most good. In general terms, the resources required to deploy and support a small urban search and rescue mission are equivalent to those of a field clinic. The cost of deploying a medium-sized urban search and rescue mission is roughly equivalent to that of a small field hospital. A heavy urban search and rescue team costs approximately \$900,000 to deploy. The Israeli Defense Force spent \$1.7 million on its heavy field hospital in Haiti (all sums are estimated).

Urban search and rescue providers are highly dedicated and skilled. The fact that they rescue few survivors is not because of lack of effort. But by the time they reach the scene of a distant disaster, most trapped victims have either been rescued by the local population or died.⁴

In Haiti, field hospitals and medical teams had far greater influence. Even those that arrived several days after the quake were immediately flooded with casualties, many of whom had life-threatening problems. This forced them to allocate scarce resources to those who had the greatest likelihood of benefitting, rather than the most severely injured.²² Had more medical teams been sent to Haiti and their efforts better coordinated, it is likely that more lives could have been saved.²³

This is but one lesson among many that should be drawn from recent disasters. But to date, no policy has been developed to optimize the mix of personnel involved in global relief efforts. To ensure that the next global response is more effective than the last, the national organizations and major nongovernmental organizations that regularly participate in disaster relief should regularly convene under the auspices of the United Nations Disaster Advisory Committee or the United Nations's Office of Civil and Humanitarian Assistance to share their experiences, offer insights, and critique their response in a nonjudgmental way. Each meeting should produce an official "after-action report" that addresses, at a minimum, how the host country's needs were ascertained; what personnel, equipment, and supplies were sent; how arriving teams and resources were staged; how transportation and security were arranged; how various groups interacted with the host country, the local population, and one another; and the ultimate effect of the effort. Given the political sensitivities involved,

institutionalizing this process may be challenging at first, but it is essential to improve future responses.

In *The Life of Reason*, George Santayana wrote, “Those who cannot remember the past are condemned to repeat it.”²⁴

Failing to learn from past disasters denies future victims the benefits this wisdom could bring. The global community can do better.

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REFERENCES

- International Disaster Database. Number of natural disasters registered in EMDAT 1900-2005. Available at: <http://www.em-dat.net>. Université Catholique de Louvain, Brussels, Belgium. Accessed February 26, 2011.
- Abolghasemi H, Radfar MH, Khatami M, et al. International medical response to a natural disaster: lessons learned from the Bam earthquake experience. *Prehosp Disaster Med*. 2006;21:141-147.
- Smith P. Earthquake relief: shifting attention? Aon Benfield UCL Hazard Research Centre, disaster studies working paper 19, February 2009. Available at: <http://www.abuhrc.org/Publications/Working%20Paper%2019.pdf>. Accessed June 27, 2011.
- Macintyre A, Barbera J, Smith E, et al. Surviving collapsed structure entrapment after earthquakes: a “time-to-rescue” analysis. *Prehosp Disaster Med*. 2006;21:4-19.
- USAID. *Iran Earthquake—Fact Sheet #7*. Washington, DC: US Agency for International Development, Bureau for Democracy, Conflict and Humanitarian Assistance (DCHA), Office of US Foreign Disaster Assistance (OFDA); 2004.
- Astill J. Our children are dead, our grief is endless. *Guardian*. January 3, 2004. Available at: <http://www.guardian.co.uk/environment/2004/jan/03/iran.naturaldisasters>. Accessed June 27, 2011.
- Cater N. All search, no rescue. *Guardian*. December 31, 2003. Available at: <http://www.guardian.co.uk/society/2003/dec/31/internationalaidanddevelopment.comment>. Accessed June 27, 2011.
- Pennington M. More quake survivors rescued in Iran. *Washington Post*. January 2, 2004. Available at: <http://www.highbeam.com/doc/1P2-148183.html>. Accessed June 27, 2011.
- Vos F, Rodríguez J, Below R, et al. *Annual Disaster Statistical Review 2009. The Numbers and Trends*. Brussels, Belgium: Centre for Research on the Epidemiology of Disasters (CRED), Université catholique de Louvain; 2010. Available at: http://www.cred.be/sites/default/files/ADSR_2009.pdf. Accessed February 26, 2011.
- Kusumastuti D, Suarjana M, Sengara W, et al. Overview of the West Sumatra earthquake of September 30, 2009. Special report. MCEER-10-SP01, MCEER, Buffalo, 2010. Available at: <http://mceer.buffalo.edu/publications/Reconnaissance/10-SP01/default.asp>. Accessed February 26, 2011.
- Gelling P. Indonesia earthquake: one week later hope is abandoned, as rescue workers officially end the search for survivors. *Global Post*. October 7, 2009. Available at: <http://www.globalpost.com/dispatch/indonesia/091007/indonesia-earthquake-one-week-later>. Accessed June 27, 2011.
- Thin-Lei W. Foreign rescue teams call off search for survivors in quake-hit Padang. Alertnet. October 7, 2009. Available at: <http://www.trust.org/alertnet/news/foreign-rescue-teams-call-off-search-for-survivors-in-quake-hit-padang/>. Accessed June 27, 2011.
- Pan American Health Organization. Earthquake in Haiti: the response of the Pan American Health Organization/World Health Organization. Available at: http://www.zbornica-zveza.si/dokumenti/ICN/PAHO_Report_Haiti_March3_2010.pdf. Updated March 3, 2010. Accessed April 22, 2011.
- IRIN (Humanitarian News and Analysis), a service of the UN Office for the Coordination of Humanitarian Affairs, GLOBAL-HAITI. Search and rescue standards turn 20. Available at: <http://www.irinnews.org/PrintReport.aspx?ReportID=91584>. Accessed February 26, 2011.
- OCHA. Situation report, Haiti—international humanitarian action overview, 19 January 2010. Available at: http://vosocc.unocha.org/Documents/13139_PaP%20Int%20Humanitarian%20Action%20Overview.pdf. Accessed April 24, 2011.
- United States Department of State, Agency for International Development, Bureau for Democracy, Conflict, and Humanitarian Assistance, Office of US Foreign Disaster Assistance. Haiti earthquake, fact sheet #5, fiscal year 2010. January 17, 2010. Available at: <http://www.usaid.gov/help/haiti/documents/01.17.10-USAID-DCHAHaitiEarthquakeFactSheet5.pdf>. Accessed February 26, 2011.
- Chappel B. New Zealand ends rescue search to focus on recovery. NPR. March 3, 2011. Available at: <http://www.npr.org/blogs/thetwo-way/2011/03/03/134229722/new-zealand-ends-rescue-search-to-focus-on-recovery>. Accessed June 27, 2011.
- New Zealand Fire Service. New Zealand Fire Service in Japan—all updates. Available at: <http://www.fire.org.nz/Media/News/2010/Pages/USARinJapan.aspx>. Accessed June 27, 2011.
- JEMS.com. Virginia USAR team returns from Japan: many say just being there, finding victims, helped give survivors closure. March 21, 2011. Available at: <http://www.jems.com/article/news/virginia-usar-team-returns-jap>. Accessed June 27, 2011.
- Kreiss Y, Merin O, Peleg K, et al. Early disaster response in Haiti: the Israeli field hospital experience. *Ann Intern Med*. 2010;153:45-48.
- Centers for Disease Control and Prevention (CDC). Post-earthquake injuries treated at a field hospital—Haiti, 2010. *MMWR Morb Mortal Wkly Rep*. 2011;59:1673-1677.
- Merin O, Ash N, Levi G, et al. The Israeli field hospital in Haiti—ethical dilemmas in early disaster response. *N Engl J Med*. 2010;362:e38.
- Hopmeier MJ, Pape JW, Paulison D, et al. Reflections on the initial multinational response to the earthquake in Haiti. *Popul Health Manag*. 2010;3:1-9.
- Santayana G. *The Life of Reason*. Vol 1. 1905, The Project Gutenberg eBook. Available at: <http://www.quotationspage.com/quote/2042.html>. Accessed April 20, 2011.