Optimizing Medical Response to Large-scale Disasters: The Ad Hoc Collaborative Health Care System

During our recent experience in Haiti in the early aftermath of a major earthquake, we found that more optimal use of field hospitals could be achieved through increased coordination among the deployed medical resources. Moreover, if it were possible to standardize both the capabilities of these resources and their interoperational guidelines, further improvement in resource utilization could be achieved. We explain later the problems we identified, how we adapted to them, and how that led us to a model that could be implemented in future disasters in an effort to make more efficient use of available medical resources.

Hospitals and hospital staff are not immune to the destruction caused by earthquakes.[1] Arriving field hospitals serve to replace temporarily and partially the destroyed health care infrastructure,[2] perhaps especially important in places such as Haiti, where the infrastructure is already significantly challenged.[3] The capabilities of field hospitals are quite variable, though they tend to fall into 2 categories: "light" and "advanced." The former are generally capable of dispensing antibiotics, intravenous hydration, and minor bedside procedures, whereas the latter may have operating rooms, intensive care units, laboratories, and imaging facilities and appropriate specialists and staff. Each country or organization determines when and with which type of field hospital it wishes to deploy, leading to wide variation in available resources.

We brought an advanced field hospital to Haiti, including surgeons in various subspecialties. However, within 2 days of becoming operational, we were at full capacity and were faced with the stark prospect of allowing only 1 additional patient admission for each patient discharged. Because no recovery beds were available for patients who required potentially life-saving surgery, the operating room could have been brought to a standstill, severely curtailing our added value. We considered discharging postoperative patients prematurely to self-care, but the risk of complications, especially in the disaster setting, made it untenable.

ISSN: 0003-4932/11/0000-0001
DOI: 10.1097/SLA.0b013e318206bedf

Resolving the bottleneck was particularly crucial as the impact on mortality that specialized field hospitals may effect in disasters is observed primarily early on.[4] Confronted with tremendous need in the face of massive devastation, we improvised a solution: For every patient requiring a higher level of care sent by a light hospital, the light hospital would have to take one of our patients in exchange. This arrangement allowed us to admit patients who had been screened by other health care professionals as requiring an acute intervention that we were in a unique position to provide and ensured that patients would remain under medical care (even if not our own) until they were stable enough to be discharged. (For example, a patient is transferred to us and undergoes surgery. After 1 to 2 days of postoperative observation, the stable and improving patient may then be transferred to a light hospital.) In addition, we sent our senior medical staff to light hospitals to help identify which patients would most likely benefit from being transferred to our facility. With the other hospitals' teams cooperation, our surgeons performed needed morbidity- and mortality-reducing operations on more patients than would have otherwise been possible. We believe that the ad hoc interagency network that we improvised in Haiti lays the groundwork for a more comprehensive system that can be implemented after any large-scale disaster. In its essence, the idea is that of a collaborative health care system, built around whatever medical assets are available. The flow of patients within such a system would help each field hospital make more optimal use of its available resources.

Bringing such a system under central coordination, perhaps facilitated by the World Health Organization's Global Health Cluster, would further improve patient outcomes, given the available resources. The system would require considerable flexibility because both patient needs and the health assets available to the network are dynamic. Although bottlenecks will continue to exist as disasters are, by definition, situations in which there is an imbalance between resources and need, more optimal resource utilization would still be anticipated.

To better match resources with patients most likely to benefit from them, trauma experts could conduct twice-daily rounds at light hospitals to help the physicians there identify those patients who would most likely benefit from advanced procedures. The same experts could round in the advanced hospitals to identify patients ready either for transfer to light hospitals or for discharge. The level of acuity at which transfers would be recommended in either direction would depend on the mismatch between patient need and available resources.

The transportation of patients within the system presents a risk, just as in a standard hospital system with interfacility transfers. Judgment would be needed to determine whether the hazards entailed in moving a patient would be worth the potential benefit to that patient and/or to the patients who would then have access to the vacated resource. In addition, further dislocation of families should be minimized if possible, and clear communication from medical staff would be important in ensuring that transferred patients do not perceive that they are being abandoned.

The coordinated health care system would continue to play a role until sufficient, consolidated resources were available to meet local need. In Haiti, for instance, the United States Navy's hospital ship *Comfort* arrived 8 days after the initial earthquake, bringing a 1000-bed hospital facility with 12 operating rooms. The coordinated health care system's central command may still assist in triaging and directing appropriate patient transfers, though the flow at this stage would likely be unidirectional.

To achieve still further optimization of medical resources, the medical disaster response community could create a model based on the United Nation's International Search and Rescue Advisory Group (ISARAG). The ISARAG uses the Urban Search and Rescue (USAR) team classification system to categorize available USAR teams into 3 levels, with agreed-upon requirements in terms of personnel, equipment, and capability. In the ISARAG guidelines and methodology state: "Teams are able to integrate effectively as they will have the same basic structure, comprise of the same components and will have standardised qualifications for the primary aspects of a USAR team response. This results in a safe, effective multinational operational response."[5 (p33)]

A similar system, perhaps coordinated by the Global Health Cluster, would help to optimize the medical response in several ways. With standardized levels of field hospital capabilities, it would be much easier for the central command to incorporate available assets into the collaborative health care framework. More importantly, the rules for cooperation among the field hospitals would have already been assimilated by the individual teams as part of their training. With a common language, guidelines and methodology, and standardized expectations of other field hospital capabilities within the system, it would be much easier for interoperation among these entities to result in more optimal use of all available resources. This would be especially true during the first days of deployment when central coordination—and even regular communication—may not be fully functional. Finally, deployed

clinics could also be incorporated into this system.

We believe that implementing a collaborative health care system would help to achieve more optimal use of all the medical resources available in a disaster. Further optimization could likely be achieved if participating countries and organizations adhered to a standardized classification and coordination system. The increased coordination at both the preparatory and deployment stages would very likely lead to decreased mortality, morbidity, and disability among the devastated population.

Kobi Peleg, PhD MPH
National Center for Trauma & Emergency Medicine Research, The Gertner Institute for Health Policy & Epidemiology
Tel Hashomer, Israel
Disaster Medicine Department School of Public Health, Tel-Aviv University, Tel-Aviv, Israel

Yitshak Kreiss, MD, MHA, MPA
Israel Defense Forces Medical Corps
Field Hospital, Haiti

Nachman Ash, MD, MS
Israel Defense Forces Surgeon General
Tel Hashomer, Israel

Ari M. Lipsky, MD PhD
National Center for Trauma & Emergency Medicine Research, The Gertner Institute for Health Policy & Epidemiology
Tel Hashomer, Israel aril@alum.mit.edu

REFERENCES

1. Noji EK, Kelen GD, Armenian HK, et al. The 1988 earthquake in Soviet Armenia: a case study. *Ann Emerg Med.* 1990;19(8):891–897.
2. Heyman SN, Eldad A, Wiener M. Airborne field hospital in disaster area: lessons from Armenia (1988) and Rwanda (1994). *Prehosp Disaster Med.* 1998;13(1):21–28.
3. Chatterjee P. Haiti's forgotten emergency. *Lancet.* 2008;372(9639):615–618.
4. Schultz CH, Koenig KL, Noji EK. A medical disaster response to reduce immediate mortality after an earthquake. *N Engl J Med.* 1996;334:438–444.
5. United Nations Office for the Coordination of Humanitarian Affairs. *INSARAG Guidelines and Methodology*. Geneva, Switzerland: United Nations Office for the Coordination of Humanitarian Affairs, Field Coordination Support Section; January 2007:33. http://ochaonline.un.org/ochalinkclick.aspx?link=ocha&docid=1059451. Accessed March 28, 2010.