

Vulnerable Populations in Disasters: Health Effects and Needs

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Introduction

Surge *capacity* is simply, if not easily, measured in terms of numbers of facilities and equipment, such as beds, ventilators, imaging units, and operating suites that could be pressed into service should a sudden and overwhelming need arise. Surge *capability*, on the other hand, is measured in terms of the numbers of staff and resources truly available to provide the services for which these facilities and equipment are required. Estimates vary according to the type of hazard being encountered, such that as few as fifty percent of staff state they would report to work in large scale bioevents, but in truth, no reliable estimates of local or national surge *capability* currently exist. For no population group is this gap between expectation and realization more acute and critical than for vulnerable populations with special health care needs—the very young, the very old, the disabled, and the dispossessed, as was amply demonstrated in the aftermath of Hurricane Katrina.

Unfortunately, little has been published in the scientific literature to date regarding the needs of such populations, despite the fact that special populations appear to account for the majority of patients “stranded” in areas of limited health care resources, particularly following natural disasters.¹ At the same time, the effective surge capacity of emergency departments in the United States has fallen sharply during the past fifteen years, perhaps by as much as one third, when one takes into account both the increase in annual visits to emergency departments, and the decrease in the number of emergency departments.² The Health Resources and Services Administration (HRSA) set targets for surge capacity in the nation’s hospitals at 500 cases per one million population for large scale bioevents and 50 cases per one million population for blast and radiation injury.³ However, it is unclear whether these targets, extrapolated largely from the Israeli experience, are truly applicable to the far larger American health care system—a system unused to managing major disasters and manifestly lacking the military training and experience of the Israeli population—let alone the American health care system as used by American children.⁴⁻⁶

On the Ground Successes: State of the Art

Outside assistance following a major disaster cannot be expected to arrive before 24 hours, and may arrive as late as 96 hours, even though the peak demand for emergency services can be expected to occur within the first 24 hours—84% to 90% for conditions manageable on an ambulatory basis.⁷ The majority of hospitals in densely populated urban environments appear to have well established incident command systems, protocols for hospital lockdown, early discharge, and cancellation of elective operations, designated victim overflow areas, predisaster “preferred” vendor agreements, emergency

medical services-compatible communications systems, a minimum of three days' worth of supplies on hand, and day care for children of staff. However, mutual aid agreements with law enforcement, other hospitals, and long term care facilities are generally lacking, while few hospitals have fully engaged in community wide disaster planning or have involved other agencies in their disaster training. Moreover, less than one third of such hospitals may have reliable surge capacity in excess of 20 beds or access to six or more ventilators, while less than one half may have access to pharmaceutical stockpiles.⁸

This is especially troubling when one considers the fact that pandemic modeling based on the Toronto experience with Severe Acute Respiratory Syndrome (SARS) indicates that the increase in hospital admissions associated with even a mild pandemic may well exceed the reduction in hospitalizations resulting from early discharge and cancellation of elective operations.⁹ Even more problematic is the fact that fewer than one quarter of all nursing homes may have specific pandemic response plans.¹⁰ In addition, the initial drafts of the National Pandemic Influenza Preparedness Plan (N-PIPP) provided little in the way of explicit guidance addressing the special needs of infants, children, or elders.¹¹ Fortunately, the response of the Centers for Disease Control and Prevention (CDC) to the ongoing Novel Influenza Virus H1N1 pandemic has been far more encouraging, as indicated by the presence of frequently updated treatment guidance on its public website, although specific guidance with respect to surge capability has been far less robust.¹²

Identified Short-Term Goals: The Low-Hanging Fruit

What is clear from the foregoing is that while special needs populations can be expected to consume the majority of resources in the event of a major regional disaster, there are no short cuts to effective community disaster planning. When local health resources are rendered scarce or dysfunctional after a disaster, chronic conditions become acute, most especially among racially and ethnically diverse segments of the most vulnerable groups of victims—children, elders, the infirm, and the impoverished.^{13,14} Unfortunately, efforts to enhance health system surge capacity increasingly proceed side by side with efforts to curtail health care expenses, making community wide planning processes that invoke infrequently utilized social capital increasingly crucial.^{15,16} The effects of such mismatch between health needs and resources after a major disaster can be truly devastating, as shown by the well chronicled events that followed in the wake of Hurricane Katrina.^{17,18}

Still, helpful guidance to aid in community planning for the health care needs of special populations following major disasters is available. Several general and specific strategies have been proposed not only for the population as a whole, but also for children and elders, in particular.¹⁹⁻²⁴ For children, these involve recognition of the need for pediatric expertise in local disaster planning, age linked strategies for pediatric decontamination, minimized parent-child separation, development of comprehensive pediatric resources to assist non-pediatric hospitals in preparing for a large influx of pediatric patients following major disasters, careful matching of pediatric population density and pediatric medical resources, and development of alternate care strategies in case of—and in advance of—disasters with overwhelming pediatric need.²⁰⁻²³ For seniors, these involve education of the elderly for preparedness and response, recognition of the value of existing community

resources in planning and preparedness, assistance to community based agencies in developing disaster continuity capabilities, incorporation of the needs of the elderly into the overall emergency management system, and consideration of recovery needs.²⁴

Long-Term Goals: A Star Is Falling, Fasten Your Seat Belt!

The only acceptable long-term goal is for every community in the nation to have in place specific plans for its special needs populations in the event of major disasters as part of the comprehensive disaster plans that are vital to community disaster management. This will only happen through concerted effort on the part of all public and private entities concerned with the health and well-being of the community as a whole—including its corporate leaders, who depend upon a healthy population for the continuity of businesses. While the approaches noted above provide useful information about what has succeeded in the recent past, it is interesting to cite the uncanny parallels between disaster planning efforts and time-tested injury prevention strategies first advocated by William Haddon, founding administrator of the National Highway Traffic Safety Administration, known universally within the public health sector as the Haddon Factor-Phase Matrix.²⁵ This approach to injury prevention and control relies upon identification of factors that impact on the *host*, *agent*, and *environment*, *before*, *during*, and *after* the traumatic event, and seeks to modify these factors through individually crafted strategies involving *education*, *engineering*, *enforcement*, and *economics*, to reduce the burden of preventable injury—strategies such as widespread adoption and insistence on use of seat belts and shoulder harnesses that have substantially reduced the unacceptably high burden of highway traffic fatalities in the United States since this approach was first proposed in the early 1970s, and are most successful when applied by comprehensive injury prevention and control systems that link the public health system with the trauma care system in partnership.²⁶

Emergency managers, of course, have adopted a nomenclature that is unique to disaster management. However, it follows a pattern that will be readily recognized by experts in trauma care and injury control: *preparation* is analogous to *primary* injury prevention, which seeks to *avoid* injuries before they occur, chiefly through targeted educational programs; *mitigation* is analogous to *secondary* injury prevention, which seeks to *attenuate* injuries as they occur, mainly through system or product engineering strategies; *response* is analogous to *tertiary* injury prevention, which seeks to *ameliorate* the effects of injury through timely application of sustentative, followed by definitive, pre-hospital and in-hospital emergency medical care; *recovery* is analogous to what might be called *quaternary* injury prevention, which seeks to (re)*activate* local public health and health care systems to effectively manage intercurrent or recurrent injuries and illnesses using surviving or restored community based resources. While it has become fashionable for many disaster experts to ask why it seems we are incapable of learning from the mistakes made in past disaster events, the answer lies in the very nature of the disaster event—the word “disaster” itself being derived from the Latin words for “evil” and “star”—for falling stars are seldom seen, and even when seen, vanish from view almost immediately. The fact, however, is this: while the exact date, time, and place of the next disaster is unknown to us—just as the exact date, time, and place of the next motor vehicle crash was unknown to William Haddon—the lessons learned from previous disasters, when

applied through systematic effects on the host, agent, and environment, before, during, and after disaster events, can be invaluable in assisting us to prepare for future disasters.

What Will It Take To Get There? Research Needs

Injury prevention and trauma care did not improve in the United States until population based surveillance systems, and detailed trauma registries, were in place to reliably document both the scope of traumatic injury, and best practices for trauma care. The same is likely to be true for disaster and emergency management. A comprehensive nationwide disaster registry that recorded not only the nature of the disaster event, but in very simple terms the types of illnesses and injuries encountered and their final outcomes, will be essential to accurate identification of the host, agent, and environmental factors, before, during, and after the disaster event that have greatest impact on ultimate survival and functional outcome. Without such real-time data, it becomes nearly impossible to reconstruct the past, even through review of detailed after-action reports, because of the limitations of human memory and its tendency to ignore information it cannot recognize.

Without such a structured system, reliable information on the fate of special populations during disasters will continue to be hard to come by. One clear cut example exists in the methods that have been utilized to estimate true case fatality rates in the adult population following Hurricane Katrina: review of death notices from local newspaper obituaries.²⁷ However, due to the potential underreporting of such death notices among children, it has been difficult to adopt the same methodology for children.²⁸ In the opinion of the author, therefore, only minimal data points, collected in real time as part of a nationwide disaster registry, are likely to solve the problem, and as such should become a key requirement of the Hospital Preparedness Program (HPP) of the Office of the Assistant Secretary for Preparedness and Response (ASPR) of the Department of Health and Human Services.

Conclusions

It is often said that a society is judged by how it cares for the most vulnerable among it. The widespread media coverage that followed Hurricane Katrina showed the United States that its disaster response was sorely lacking in its capabilities to care for its young, its old, its disabled, and its dispossessed. Recent anecdotal reports following Hurricane Ike indicate that much progress has been made during the intervening years. This is good news, but much still remains to be done for these segments of the American population.

That said, there will likely never be sufficient facilities, resources, or expert personnel to care for all America's vulnerable populations when a disaster strikes. What America can do, however, is to ask those with expertise in the care of vulnerable populations to teach others how to stabilize such patients until surge resources can be made available, either locally, or through mobilization of distant assets. Such social capital is available in every community across the nation, and it is the duty of every citizen with the intellectual or material means to help fellow citizens in distress to do so in the event of a disaster. "We the People of the United States of America" established our Constitution, among other

purposes, to “insure domestic Tranquility” and “promote the general Welfare,” and it is therefore incumbent upon us to embrace these duties in disasters, as on all other days.

References

1. Swienton RW. Personal communication. February 27, 2009.
2. Institute of Medicine Committee on the Future of Emergency Care in the U.S. Health System. *Hospital-Based Emergency Care: At the Breaking Point*. Washington, DC: National Academies Press, 2006.
3. Health Resources and Services Administration. *National Bioterrorism Hospital Preparedness Program: Fiscal Year 2004 Continuation Guidance*. Available from <http://www.hrsa.gov/bioterrorism/hrsa04biot.htm#beds>.
4. Schultz CH, Koenig KL. *State of research in high-consequence hospital surge capacity*. *Acad Emerg Med* 2006;13:1153-1156.
5. Kanter RK, Moran JR. Pediatric hospital and intensive care unit capacity in regional disasters: expanding capacity by altering standards of care. *Pediatrics* 2007;119:94-100.
6. Kanter RK, Moran JR. Hospital emergency surge capacity: an empiric New York statewide study. *Ann Emerg Med* 2007;50L314-319.
7. Stratton SJ, Tyler RD. Characteristics of medical surge capacity demand for sudden-impact disasters. *Acad Emerg Med* 2006;13:1193-1197.
8. Kaji AH, Lewis RJ. Hospital disaster preparedness in Los Angeles County. *Acad Emerg Med* 2006;13:1198-1203.
9. Schull MJ, Stukel TA, Vermeulen MJ, Guttman A, Zwarenstein M. Surge capacity associated with restrictions on nonurgent hospital utilization and expected admissions during an influenza pandemic: lessons from the Toronto Severe Acute Respiratory Syndrome outbreak. *Acad Emerg Med* 2006;13:1228-1231.
10. Smith PW, Shostrom V, Smith A, Kaufmann M, Mody L. Preparedness for pandemic influenza in nursing homes: a 2-state survey. *JAMA* 2008;300:392-394.
11. Woods CR, Abramson JS. The next influenza pandemic: will we be ready to care for our children? *J Pediatr* 2005;147:147:155.
12. Centers for Disease Control and Prevention. *H1N1 Flu (Swine Flu)*. Atlanta, GA: Centers for Disease Control and Prevention, 2009. Available from: <http://www.cdc.gov/h1n1flu>.
13. Mokdad AH, Mensah GE, Posner SF, Reed E, Simoes EJ, Engelau MM, and the Chronic Diseases and Vulnerable Populations in Natural Disasters Working Group. *Prev Chronic Dis* 2005;Nov. Available from: http://www.cdc.gov/pcd/issues/2005/nov/05_0201.htm.
14. Andrulis DP, Siddiqui NJ, Gantner JL. Preparing racially and ethnically diverse communities for public health emergencies. *Health Affairs* 2007;26:1269-1279.
15. Felland LE, Katz A, Liebhaber A, Cohen GR. Developing health system surge capacity: community efforts in jeopardy. *Research Brief No. 5, Center for Studying Health System Change*, 2008. Available from: <http://www.hschange.org>.

16. Koh HK, Cadigan RO. Disaster preparedness and social capital. In Kawachi I, Subramanian SV, Kim D, eds. *Social Capital and Health*. New York, NY: Springer New York, 2007, pp 273-285.
17. Berggren RE, Curiel TJ. After the storm—health care infrastructure in post-Katrina New Orleans. *N Eng J Med* 2006;354:1549-1552.
18. Johnston C, Redlener I, eds. Hurricane Katrina, children, and pediatric heroes: hands-on stories by and of our colleagues helping families during the most costly natural disaster in US history. *Pediatrics* 2006;117:S355-S460.
19. Hick JL, Koenig KL, Barbisch D, Bey TA. Surge capacity concepts for health care facilities: the CO-S-TR model for initial incident assessment. *Disaster Med Public Health Preparedness* 2008;2:S51-S57.
20. Allen GM, Parrillo SJ, Will J, Mohr JA. Principles of disaster planning for the pediatric population. *Prehosp Disast Med* 2007;22:537-540.
21. New York City Department of Health and Mental Hygiene Centers for Bioterrorism Preparedness Planning Pediatric Task Force (Foltin GL, Arquilla B, Uraneck K, Aird S, Caram M, Chackes E, Cooper A, Contreras G, Freyberg, Hessler R, Hom J, Kellner P, Kohlhoff SA, Kovac J, Mattera G, Montella K, Nadler E, Tejani N, Tunik M, Webb E, contributors): *Pediatric Disaster Tool Kit: Hospital Guidelines for Pediatrics in Disasters*, 3rd ed. New York: New York City Department of Health and Mental Hygiene, 2008. Available from: <http://www.nyc.gov/html/doh/html/bhpp/bhpp-focus-ped-toolkit.shtml>.
22. Meranus DH, Campbell C, Uraneck K. Surge capacity planning for public health emergency events: examining the distribution of pediatric resources in relation to pediatric population density in New York City. Presented at the 136th Annual Meeting and Exposition of the American Public Health Association, San Diego, CA, October 25-29, 2008 (Abstract #186219).
23. Kanter RK, Andrade JS, Boeing NM, Callahan J, Cooper A, Lopez-Dwyer CA, Marcin JP, Odetola FO, Ryan AE, Terndrup TE, Tobin JR: Developing consensus on appropriate standards of disaster care for children. *Disaster Med Public Health Preparedness* 2009;3:27-32.
24. Fernandez LS, Byard D, Lin C-C, Benson S, Barbera JA. Frail elderly as disaster victims: emergency management strategies. *Prehosp Disast Med* 2002;17:67-74.
25. Haddon W. Advances in the epidemiology of injuries as a basis for public policy. *Public Health Rep* 1980;95:411-421.
26. Cooper A: Early assessment and management of trauma. In Ashcraft KW, Holcomb GW, Murphy JP, eds: *Pediatric Surgery*, 4th ed. Philadelphia: Elsevier Saunders, 2005, pp 168-184.
27. Stephens KU, Grew D, Chin K, Kadetz P, Greenough G, Burkle FM, Robinson SL, Franklin ER. Excess mortality in the aftermath of Hurricane Katrina: a preliminary report. *Disaster Med Public Health Preparedness* 2007;1:15-20.
28. Kanter RK. Personal communication. May 8, 2007.