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1   Recurring Pitfalls in Hospital Preparedness and Response

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Hospitals are an essential component of community preparedness for terrorism and other hazards, both natural and manmade. Despite general preparedness requirements within the industry, hospitals typically are a weak link with respect to community disaster preparedness, particularly for those incidents involving contaminated patients. Significant systemic constraints make most hospitals reluctant partners in preparedness and generate ineffective response; this condition has been highlighted by the antiterrorism training and preparedness programs in the past few years. Results of numerous exercises and actual responses across the United States indicate a predictable list of pitfalls, most of them related to inherent system limitations that continue to hinder effective disaster operations in hospitals:

- Communications
- Hospital security
- Decontamination procedures, equipment, and training
- Hospital staff management
- Exercise realism, content, follow-up

1.1   Introduction

Recent events have focused attention on the ability of communities to respond to acts of terrorism. In addition to intentionally generated incidents, most communities have been struggling with preparedness against a range of natural and technological hazards. Public safety and emergency management personnel have developed and tested response plans, and considerable federal resources have been expended toward the same end—albeit with inconsistent results. With some exceptions, community preparedness efforts have faltered at a common, though not exclusive, point: hospitals. Those involved in preparedness and response recognize the quandary: hospitals are essential, irreplaceable resources for planning, response, and recovery associated with disasters, but they carry a unique set of constraints that makes effective participation in such efforts challenging at best.

1.2   Hospital Challenges and Constraints

Barbera et al. [1] cogently discussed the constraints and challenges facing hospitals, along with public expectations. Hospitals as a whole face difficult financial times: approximately 30% of U.S. hospitals are operating at a financial loss, with many more teetering on the financial brink [2]. Hospitals face increasing operating costs coupled with decreasing reimbursement rates. Emergency departments (EDs) have become primary care intake points for much of the public [3], regardless of their insurance status. Staffing shortages are becoming the rule for most departments across a wide range of skill levels and specialties [4]; loss of experienced staff exacerbates the problem. High staff turnover rates further burden the remaining staff and add overtime and incentive costs to already strained budgets [5].

Costs have not been the only increasing item. Healthcare facilities are hardly exempt from

government regulations (a recent example is the Health Insurance Portability and Accountability Act [6]—HIPAA) and are strongly affected by changes in Medicare reimbursement patterns, but accredited hospitals also deal with the non-governmental Joint Commission for the Accreditation of Healthcare Organizations (JCAHO). To achieve and maintain accreditation, hospitals must adhere to JCAHO's consensus standards as demonstrated during periodic onsite and remote surveys. Standards are diverse in scope and generally derived from clinical, ethical, technological, environmental, or occupational indications. Like many government regulations, they tend to add expense and are not accompanied by new revenue streams.

Hospitals rely on public trust as much as on reimbursement revenue. More than most corporations or government agencies, a healthcare facility that suffers a crisis of public confidence stands to lose both funding and patients along with its reputation. Public expectations, commonly in the form of blind assumptions, are that hospitals should be able to handle whatever they receive—and do it right the first time. With respect to disasters, this includes:

• Managing medical assessment, treatment, and continuing care for acute incidents involving large numbers of patients

• Effectively managing contaminated patients

• Recognizing, identifying, and managing consequences of bioterrorism

• Protecting employees, patients and their families, and anyone else within the facility

• Dealing with all of these while continuing to provide everyday emergency care

Public agencies responsible for preparedness and response have little direct control over public hospitals and none over private facilities (which are not accountable to public officials). There is no suitable alternative to engaged hospitals when trying to plan for or manage a mass-casualty incident or other type of large-scale disaster affecting a community. Should the incident be at the hospital itself (such as a fire or hazardous material release)

or involve the hospital (for example, a flood or hurricane), a prepared facility and staff may be the difference between minimal loss of life and a true catastrophe.

1.3   Hospital Requirements

Hospitals have been required to have and exercise emergency preparedness plans (formerly known as "disaster plans") for many years. As of January 2001, hospitals wishing to achieve or retain JCAHO accreditation had to have a comprehensive plan in place, covering the four traditional phases of emergency management (mitigation, preparedness, response, and recovery) [7]. A hazard vulnerability analysis, part of the new standards, not only determines both the most likely and the most catastrophic incidents, but also identifies the range of hazards for a given hospital. This all-hazard approach, like municipal emergency operations plans, allows preparedness and a measured, flexible response to a variety of potential incidents. Plans may contain annexes for specific hazards, but an all-hazard plan should obviate a separate plan for each hazard (an "earthquake plan," a "terrorism plan," etc.). Plans are supposed to be tested and updated by at least one tabletop or similar exercise and one full-scale exercise or actual activation per year. The standards also establish requirements for staff training and familiarization with the plan.

The wave of training and other preparedness programs, accompanied by requirements and expectations regarding preparedness for acts of terrorism, has not ignored hospitals. The Defense Department's Domestic Preparedness Program (continued by the Justice Department) in the late 1990s provided basic training on medical management of casualties affected by chemical, biological, and radiological warfare agents. Curriculum and training were limited by design: it was largely military in origin, focused on the response phase, and did not contain much depth in hospital preparedness. The Metropolitan Medical Response System (MMRS) [8], initially overseen by the Department of Health and Human Services and now part of the Department of Homeland Security,

was the first large-scale federal program to focus on improving the ability of healthcare systems to detect, identify, and manage incidents involving large numbers of potentially contaminated casualties. The goal of incorporating first responders (public safety agencies), public health agencies, hospitals, and emergency management and linking local, state, and federal agencies was an innovative global approach to a healthcare system that is commonly approached via its components. The challenges faced by MMRS participants and administrators in the program's initial incarnation were less a result of the philosophy than of the style and method of administration. The MMRS is now part of the multi-faceted Homeland Security Grant Program [8A], addressing key issues of medical surge capacity in the community.

Surge capacity, the ability to handle a large influx of ill or injured people beyond standard community resources, is a critical component of hospital preparedness. As additional (i.e., unused) hospital bed-space has dwindled over the years, surge capacity in American hospitals has been allowed to reach an extreme low [9,10]. Even were there significant excess hospital beds, it would be difficult to staff and equip them. Realistically, solutions must involve alternative assessment and treatment centers rather than physically expanding hospitals—and most do (either via adapting existing alternate facilities or setting up temporary ones). Providing adequate staffing for these alternative centers is the greater challenge.

In addition to preparedness requirements, hospitals fall under regulations of the Occupational Safety & Health Administration (OSHA) and the Environmental Protection Agency (EPA). As with many detailed federal standards, OSHA's requirements for hospitals are open to interpretation, with a great deal riding on sources such as OSHA opinions and interpretations: often the closest to a de facto standard. The lack of a clear and consistent application of OSHA regulations has been an obstacle to developing consistency, although progress appears to be in the making when this was written.

Plan development, staff training, and equipment maintenance are non-reimbursable costs in terms of billing, but some financial support has developed. In June 2002, the Healthcare Resources and Services Administration (HRSA) initiated grants to states and a few cities focusing on preparedness for bioterrorism in state and local governments and hospitals [11,12]. The grants were supposed to assist states in achieving "critical benchmarks for bioterrorism preparedness planning," promulgated by the Department of Health and Human Services. Three of the initial benchmarks were to designate a bioterrorism preparedness coordinator, establish a hospital preparedness planning committee to advise the state health department, and develop a plan for managing epidemics, regardless of origin [13]. States have some discretion on disbursement (provided that funds are directed toward fulfillment of primary grant goals), with many aiming for general hospital preparedness as a first step in bioterrorism preparedness. Subsequent and planned grants from HRSA have allowed expansion of preparedness funding from hospitals to health systems and encourage regional and statewide coordination. In combination with public health preparedness grants from the CDC and the MMRS component of the Homeland Security Grant Program, the HRSA National Bioterrorism Hospital Preparedness Program [13A] is addressing local, regional, and state aspects of health-system surge capacity and capability.

Despite requirements, some standards, and best intentions, significant obstacles remain, including the combination of staff and equipment shortages, lack of surge capacity, and minimal funding. Although there have been (and likely will continue to be) substantial improvements, most hospitals are still unprepared to effectively manage the results of a major incident—whether due to mishap, terrorism, natural disaster, or infectious disease outbreak—requiring treatment of mass casualties, staff protection, or facility evacuation [14,15]. An incident contemporaneous with local or regional infrastructure disruption will not only magnify hospital shortcomings, it will further hamper effective hospital response and hospital and community recovery.

1.4 Observations

Milsten [16] surveyed 22 years of incidents in the United States and abroad, identifying a broad list of hospital challenges (communications and power failures, water shortages and contamination, structural damage, hazardous materials exposure, facility evacuation, and resource allocation), accompanied by general suggestions (such as developing plans and procedures for disasters).

The observations on which the discussion and conclusions in this chapter are based on multiple sources:

- Direct personal observation (generally as controller or evaluator) of tabletop, functional, and full-scale exercises, along with actual incidents such as tornadoes, ice storms, floods, hazardous materials spills, and multiple-casualty events.
- Personal communications and written after-action reports from local exercises and actual incidents elsewhere.
- Published observations and after-action reports from three large-scale exercises: TOPOFF (May 2000) [17], Dark Winter (June 2001) [18], and TOPOFF 2 (May 2003) [19–21].

Hospitals consistently encountered challenges in the following areas: communications, security, decontamination, staff training, staff protection, and exercise design and conduct. The most significant aspect of these observations may be their consistency: the challenges and pitfalls encountered by hospitals and the agencies supporting them are definable and reproducible—and thus predictable. As such, there is value in their description, discussion, and analysis.

1.5 Communications

Intrafacility communications during exercises and actual events have been described as "difficult," "inconsistent," "marginal," and "nonexistent." Phones are overloaded, radios—when available—are insufficient in number, range, and frequency options (or a combination of those), and staff commonly lack adequate training in communications procedures or equipment operation. This should come as little surprise, because similar complaints are expressed about everyday operations—that is, a system that does not work well under normal conditions should not be expected to do so under extreme stress. Few facilities devote planning or resources to external communications. Although most acute-care facilities are able to use the Hospital Emergency Area Radio network, it was designed for short communications between EMS providers and EDs as well as limited interfacility traffic; it was not intended for continuous heavy traffic among multiple parties. Many hospitals host licensed amateur radio operators during disasters; the ham networks provide an important communications resource, allowing voice, data, and even video transmissions among incident scenes, hospitals, emergency operations centers, and other critical facilities.

1.6 Security

Security staff in most hospitals that have them are private guards, either hospital or contract employees. Most are unarmed and have no powers of arrest. Although their responsibilities vary considerably, most are there as deterrents and to restrain violent patients or visitors. Hospital security is an important part of JCAHO's "secure environment," protecting patients, staff, visitors, information, and the physical infrastructure [22,23]. Some hospitals, particularly large ones in urban areas, employ sworn law enforcement officers, either on contract or as employees. Regardless of the type and powers of security staff, the trend of minimal staffing applies across the board, commonly resulting in inadequate coverage for most facilities. Recurrent security-related challenges have internal and external foci: lockdown and the role of local law enforcement.

Lockdown is a common constituent of hospital emergency plans, but there is little consistency to its definition, even between facilities in the same community. In its ideal use, lockdown is an incident management tool that allows hospital staff to assert or regain control of a situation that appears or escalates with little warning. Lockdown is

analogous to cardiopulmonary resuscitation (CPR): it is a short-term step intended for use early in the incident to buy time for more definitive measures. In securing all or part of the facility against additional entry, staff implementing lockdown can gain some breathing room while providing short-term protection to themselves and their patients. Also, as with CPR, lockdown can make the difference between success and failure in implementation of an emergency plan but is rarely effective on its own; a plan that ends with lockdown is doomed to fail.

In most exercises simulating a terrorist incident, naturally occurring disease outbreak, or unintentional hazardous material release, the hospital in question has been "overrun," meaning that a portion (generally the ED) or all of the facility is no longer able to function cohesively, protect its staff, or provide organized care to current and prospective patients. This can be due to contamination of the area, an unmanageable crush of incoming patients, perceived threat of violence, or loss of infrastructure. In many of these exercises, hospital staff recognized impending failure and requested assistance from law enforcement agencies for facility security and crowd control. With few exceptions these requests were not met (or were met too late), although it eventually became apparent to most participants that these needs were indeed urgent and the loss of hospitals disastrous. Although it is not an exaggeration to say that law enforcement was not an eager player in hospital security, this was not due to laxity on the part of police. As expressed in the first TOPOFF exercise after-action report [24], law enforcement agencies were overrun with urgent requests for multiple types of assistance. As they were given little to no external guidance on how to rank request urgency, they found themselves with too many priorities. This issue offers a compelling example of the need to consider hospital preparedness within the context of *community* resources.

1.7   Decontamination

Mass decontamination has been a common focus since antiterrorism training became a mass-market product in the late 1990s. Considerable sums have been spent on extensive training and equipment designed to decontaminate thousands of people at an incident scene and hundreds at a hospital. Common goals in cities participating in MMRS contracts were for hospitals to be able to decontaminate at least 100 ambulatory patients without relying on external assistance (i.e., a fire service hazmat team). Goals related to HRSA grants focus on 500 per million of population, but do not specify an interval. Both MMRS and HRSA goals represent significant expectations, and to date they have proved largely fanciful. Terrorism aside, all acute-care hospitals should be able to successfully manage a *single* contaminated patient without external resources [25]. A 2002 American Hospital Association survey [26] reported that a majority of hospitals had plans in place for managing chemical and biological attacks; this is a marked increase relative to surveys taken before 11 September 2001 [27]. This encouraging report notwithstanding, most hospital plans likely fall into the category of "fantasy documents" [28]—that is, meeting legal and political requirements but not grounded in realistic capabilities or expectations and not conferring functionality. The great majority still find single-patient decontamination an elusive goal.

1.8   Staff Training

As with the public-safety sector, there is no shortage of training and equipment for hospital preparedness; there is also little in the way of functional standards, guidelines, or quality control among programs and their purveyors. Few hospitals have full-time emergency managers or emergency preparedness coordinators: most commonly those responsibilities fall under "other duties as required" for clinical managers, facilities staff, environmental health and safety officers, or administrative staff. Whether the purview of an individual or committee, the decisions are the same. The lack of standardization and the vast range of executive support almost guarantee that each facility or hospital market will go through its own set of decisions, all driven at least as much by financial considerations as by need.

1.8.1 What Type of Training Should be Provided?

There are many training options, but the most common (and the most applicable) include the HEICS (currently being updated) [29], terrorism and weapons of mass destruction, and general and medical management of hazardous materials. HEICS is a standardized incident management system adapted from incident command system variants used by local, state, and federal public-safety and emergency-management personnel. It is specified in the JCAHO emergency manage-ment standards and is one of the few consis-tencies in hospital preparedness training. Beyond HEICS, options are numerous and unregulated, with varying degrees of standardization. How much training should be provided? What are useful and realistic competencies? What will an indi-vidual hospital, hospital group, or regional consor-tium support? To add to the mix, sweeping (and verging on the arbitrary) training requirements related to compliance with the National Inci-dent Management System and other federal home-land security initiatives consume substantial staff resources while yielding little apparent benefit.

1.8.2 Who Should be Trained?

Principal distinctions include clinical vs. non-clinical, executive vs. managerial vs. labor, deter-mining which departments should be included, the number of trained staff needed to provide adequate coverage on all shifts, frequency of initial and refresher training, and how much effort should be made to include physicians, particu-larly those who contract with hospitals (a common arrangement, especially in the ED). High turnover rates can quickly deprive a facility of trained employees. Insufficient or ineffective refresher training can produce the same effect as high turnover, as hard-won skills deteriorate due to lack of use. Many preparedness and decontami-nation training programs are provided in "train-the-trainer" format—that is, a small group of employees is trained and expected to cascade the training down to fellow employees, even though their newly acquired "expertise" is unac-

companied by experience, additional knowledge, or implementation capability. Lack of effective follow-up creates the all-too-common phenomenon of "trainers" who teach few if any classes and soon lose whatever competencies they may have acquired—particularly if there is no executive support for continued training.

1.9 Staff Protection

Essential components of staff protection include personal protective equipment (PPE) for common tasks and decontamination, chemoprophylaxis and immunization, and sufficient training, education, and policy development to ensure that they are available and appropriately used. Common PPE pitfalls include inadequate training for existing equipment, inadequate equipment itself, and inef-fective policies and procedures governing PPE use. The SARS outbreak of 2003 and the effect it had on hospitals and EMS staff is an excellent example: insufficient and inappropriate PPE contributed to the disruptive effect on health systems and exposure among healthcare workers [30,31]. The safety net that chemoprophylaxis (for example, antibiotics for possible anthrax exposures) and immunization (for example, smallpox vaccine for healthcare workers) can provide will fail if it is not made available promptly and to all affected and potentially affected employees. Employees who are not confident that their employer will offer appropriate protection are unlikely to show up for work during a crisis. Likewise, employees who are concerned about the health and safety of their fami-lies are unlikely to perform their duties well, if at all, if their concerns are not adequately addressed. This is by no means limited to issues of terrorism, but extends to all potentially catastrophic events.

1.10 Exercise Design and Conduct

So far we have examined common pitfalls that relate to staffing, equipment, training, and proce-dures. One of the mechanisms for determining and evaluating these and other challenges can itself be a challenge: exercises. The purpose of an exercise is to evaluate one or more measurable performance

items via objective criteria. Performance items may include use of specific equipment, procedures, emergency plans, communications systems, or a combination of those. Given the longstanding JCAHO requirement of at least two exercises per year, hospitals should house considerable expertise in exercise design, conduct, and evaluation. In fact, a most significant recurring pitfall in hospital exercises is a distorted picture. An exercise, like a written plan, may meet JCAHO standards without conferring significant benefit in terms of actual preparedness or response capability on the hospital(s) in question.

The most common types of exercises (tabletop and functional) do not involve hands-on operations but rather focus on decision making and plan evaluation. Even full-scale exercises, which combine command-level decision making with hands-on tasks, are limited in terms of space, personnel, use of supplies, and the exercise schedule itself. Hospitals must be able to receive and manage actual patients during exercises, requiring either additional staffing to allow exercise operations to go on alongside everyday operations or limiting the scope and duration of play. Additional staffing for exercises means additional cost and staff scheduling challenges.

Because of the need for advance scheduling of personnel and simply having sufficient personnel on hand, two common exercise deficiencies ensue: lack of surprise and preferential testing of the most populated shifts. Lack of surprise may manifest itself in numerous ways, including on-duty staff having recently reviewed emergency procedures (when they otherwise would not have done so), necessary equipment and supplies in unusual states of readiness and/or stocked in unusually high levels, and specialized equipment set up in advance of the exercise, even though there would have been no reason to do so under non-emergency conditions. Examples include ED physicians immediately diagnosing rare conditions that are part of the exercise scenario, with equally rarely used medications being immediately available in the ED or pharmacy and, in more than one exercise, a large ED having a full decontamination station set up, with staff wearing full PPE, before

play even began. Any exercise scenario induces a certain degree of artificiality, but effective exercises are designed so that artificiality does not interfere with evaluation of identified objectives. Untoward, artificial, staff preparation for an exercise adds artificiality that directly compromises effective evaluation. In addition, the overwhelming lack of exercises on evening and night shifts tests capabilities only when a hospital is at its highest staffing levels. This not only deprives some staff of exercise experience, but also deprives the facility of evaluating performance during off-shifts.

The combination of insufficient training and ineffective exercises deprives staff of experience in improvisation and decision making, thus increasing the likelihood that a single significant obstacle (for example, difficulty setting up decontamination equipment, or even presentation of a contaminated patient) can derail the exercise or actual response.

1.11   Suggestions

There are multiple potential solutions for the challenges herein identified. Clearly, fundamental changes are needed, either in the expectations of hospitals (unlikely) or the resources made available to them to further the cause of preparedness (more likely and currently improving). The following suggestions are based largely on operational, intrafacility details ("what works"). There is no question that hospital preparedness must be part of a regional approach to health systems and general preparedness across agency, jurisdictional, and corporate boundaries. Hospitals are part of a greater whole, but *each* hospital must also have a degree of self-sufficiency to enable independent operations should regional assistance be unavailable. My suggestions focus on making things work better in individual hospitals; in so doing I temporarily de-emphasize larger-scale financial, political, and legal issues, which I will reexamine at the end of this article.

1.12   Communications

The first step in designing an internal communications system that works in emergencies is to

have one that works on an everyday basis. The second step is to realize that any system can be overtaxed and that there will be some incidents in which even the most durable system will fail. Realistic expectations for communications systems in disasters are essential for effective implementation of an emergency operations plan. Redundancy is an obvious and desirable solution; simple low-tech equipment can be effective. Satellite phones and trunked and repeated radios that allow flexible external communications are important, but if the trunking system and/or repeaters are external to the hospital, the most the hospital can do is buy into the system. Likewise, amateur radio offers a vital and achievable link to other hospitals and public-safety providers, but by definition they are *outside* the facility. This is not meant to de-emphasize the importance of being able to communicate with public safety and other agencies, but rather to focus on what can be done internally. A hospital's communication system might be improved by use of the following:

- *Business radios*: Inexpensive handheld radios that do not require a license but will work in multi-storey buildings with reinforced construction and extensive electronic machinery. These are similar to the popular family radios but are intended (and required) for business use.
- *Phone/intercom systems*: An internal communications system that is powered by emergency generators and does not require functioning external equipment (such as remote switching stations). These systems can be surprisingly robust, even if communications into and out of the facility are disrupted. A facility that owns its own phone switch (that is, switching is done by an internal rather than an external computer) is more likely to retain internal function than one relying on a service provider's switch. This is even more important for large campuses comprising multiple buildings.
- *Status boards*: The bane of many a JCAHO survey, further restricted by HIPAA (due to open display of confidential patient information). Simple dry-erase boards in operational areas are an effective way of providing

updated information to the staff working there. Most hospitals have such boards in place, but they are not necessarily used during emergency operations. Status boards serve an important function away from patient-care areas as well: information management in hospital emergency operations centers (also known as command centers, coordination centers, and facility command posts). Effective display media in emergency operations centers are essential for managing incoming information, tracking resources and events, and making appropriate resource allocation decisions.

- *Runners*: When all else fails—and even when it does not—runners are commonly employed to carry information between functional areas or groups. Given the universality of this function, it might as well be part of the plan, to be practiced and tested. Combining runners, status boards, and digital cameras creates the opportunity to receive quick, non-intrusive status reports from various parts of a hospital: literally a snapshot of status that may be delivered to the hospital's emergency operations center and displayed there.
- *Self-initiation*: This is more a training than a communications issue, but the point is that the better trained and exercised employees are, the more capable they will be of independent implementation of an emergency operations plan when activation is initiated. If employees can perform critical initial functions without needing centralized communications in place, successful implementation is far more likely.

1.13 Security

Of all the issues related to hospital preparedness, security is one of the most important and one of the least directly controllable by most hospitals. Functional security is an everyday issue that is greatly magnified during disasters; it is part of staff protection and allows implementation of emergency plans. Many potential solutions to security issues require hospitals to increase their level of interaction with local emergency management and

public safety agencies and may require substantial revision of those agencies' existing policies, procedures, and mutual aid agreements:

- *Meet with local law enforcement agencies*: Hospitals are essential resources during disasters and may be targets of terrorism. Law enforcement must see protection of hospitals as a high priority. Everyday security resources, where present, are likely to be insufficient during disasters, particularly those involving terrorism. If possible, special units may be identified and preassigned to hospitals; this ideal arrangement removes a decision step during an incident.

- *Consider private security to provide or augment protection*: Although private security guards do not have powers of arrest, they can provide substantial numbers for securing facility access. Some private security companies provide bonded personnel, trained and equipped for use of lethal and non-lethal force, but the presence of a trained, uniformed staff may be the most important. Contrary to popular perception and many exercise scenarios, panicking mobs overrunning hospitals are not a realistic expectation [32–35]. If numerous self-referred patients arrive at a hospital and are met with clear information and directions, they will likely comply. Incorporation of private security personnel into emergency plans should include specifications of available staff, call-up procedures, and consultation with local law enforcement regarding policies and procedures for disasters.

- *Make lockdown a realistic part of the plan*: Facilities in a multi-hospital region should reach consensus on a functional definition and share it with local emergency management and public safety providers. All staff should understand the purpose of lockdown and when and how it is to be implemented. Internal training and resources should include readily understandable designation for building entrances and exits. Prepositioned, or readily available, signage and pre-scripted messages (both for public address systems and local media broadcast as needed)

to direct patients and families to appropriate entrances will speed emergency implementation and improve compliance. All doors with outside access should be numbered in a simple, consecutive fashion, so that staff may be sent to secure "door number two" rather than "northwest access 1.4." Once in place, this numbering system can be added to facility floorplans and shared with public safety agencies for routine, emergency, and disaster response.

1.14   Decontamination

Focus on the achievable. The biggest step is to be able to decontaminate a single patient without endangering staff, patients, or visitors and without rendering the ED unavailable to incoming traffic [36]. Only when and if that step is achieved is it appropriate to examine multi-patient scenarios. Industrial incidents can contaminate several patients, making multi-patient capability particularly important for hospitals in industrial areas. Most incidents resulting in contaminated patients occur at fixed facilities or in agricultural applications [37], but they can happen anywhere there is a transportation route; moreover, contaminated patients do not always go to the nearest hospital. The leap from multi-patient to mass decontamination is expensive, requires far more extensive training and drilling, and may be unrealistic (both in capabilities and likelihood) for smaller facilities. For facilities where mass decontamination is considered a legitimate potential need, temporary facilities will likely need to be established; either "dry" decontamination or self-disrobement and decontamination ("strip and shower") [38] should be seriously considered. Whether in the form of trailers, tents, canopies, or large open areas, equipment (and training) must be provided with the foreknowledge that it will be used rarely if at all. This is an important consideration: the greatest likelihood is that employees' only exposure to the knowledge, skills, abilities, and decision-making processes involved in mass decontamination will be gained and applied only in training and exercises.

The Agency for Healthcare Research and Quality (AHRQ) has produced numerous useful references and guidelines for hospital preparedness [38A], including models for decontamination, PPE, and isolation and quarantine [38B], and California's Emergency Medical Services Authority has updated their Patient Decontamination Recommendations for Hospitals [38C]. These and similar references represent substantial resources in planning an training for single-patient and mass decontamination.

1.15 Staff Training

Hospital training staff tend to be overloaded with a wide variety of responsibilities, including clinical competencies, continuing education, community education, and non-clinical staff training. Most hospital staff have little expertise in developing and providing training for disaster procedures, particularly patient and facility decontamination. Although "train-the-trainer" classes are popular and readily available, newly minted trainers commonly find themselves with few resources and little or no experience, with a resultant dearth of cascaded training. The following steps can help compensate:

- *An effective training program requires executive support*: A directive, backed up by appropriate resource allocation, is the basis on which a successful program progresses.

- *Contract for specialized training*: Rather than attempting to develop and maintain such expertise, hospitals, hospital groups, or—even better—communities should strongly consider contracting for expertise. As with any contract service, it is essential to select reputable, competent providers. Contracts should include follow-up services (refresher training and assistance with exercise development as needed) and provide the option of developing internal capability for conducting informal training and drills within individual units. This approach requires the same degree of executive commitment as internally derived training, particularly with respect to initial and recurring expenses. Hick

et al. [39] effectively summarized healthcare-specific needs and goals for decontamination training that incorporate recent OSHA interpretations [40–43].

- *Let clinicians be clinicians*: There are a few positions within a HEICS organization that should be filled by physicians, but in general the most important function for physicians in a disaster is that of a clinician. As many hospitals contract with physician groups, particularly for ED coverage, ensuring training is difficult. Therefore, hospitals should include select staff physicians in HEICS and other disaster training and provide brief orientations to the bulk of physicians, so that they understand the roles, responsibilities, and function of the emergency organization.

- *Move some training to the schools*: New guidelines from the Association of American Medical Colleges [44] suggest a *curriculum* for future physicians in medical schools. Several nursing schools have been offering disaster courses for a year or more.

1.16 Staff Protection

No emergency plan can be implemented without staff. The most important provision for staff protection is irrespective of specific issues, procedures, or equipment. *Staff protection must be an executive priority, and it must be communicated as such*. To enable operations to continue under emergency conditions, staff protection measures must be designed with the intent of demonstrating an institutional commitment to employee safety. This is as much an exercise in trust as in deed; facilities with strained labor-management relations will face greater difficulty in this pursuit than those with smooth partnerships.

- *PPE must meet realistic needs*: There is no consistent standard for PPE for incidents involving hazmat or weapons of mass destruction. These incidents would send potentially contaminated patients to hospitals. Personal protection standards defined by OSHA [45] and the National Fire Protection Association [46]

are unrealistic for an acute-care environment—and recent OSHA interpretations support this. Level B ensembles (splash protection with self-contained or supplied-air breathing apparatus) offer substantial respiratory protection, but there is little evidence that it is necessary in this setting, and the additional equipment weight, maintenance, and potential claustrophobic reaction of its users may make it deleterious. In addition, regulatory, financial, and training requirements for Level B are likely to render it both prohibitive and ineffective. Self-referring patients arriving at an ED under their own power are likely to have minimal if any contamination (as distinct from exposure) and are well removed from the site of initial contact; effective decontamination training and equipment make Level C (splash protection with air-purifying respirators) appropriate for the great majority of incidents. Clearer guidelines and national consensus standards are essential; the White House's National Strategy for Homeland Security [47] tasked the (EPA) with developing standards for decontamination equipment and procedures, but the EPA's Strategic Plan for Homeland Security [48] does not indicate a focus on hospital activities. Hick et al. [49] lucidly summarized recent interpretations, considerations, and justifications for Level C PPE in healthcare settings until more definitive standards are promulgated. OSHA has issued comprehensive and functional best practices for "first receivers" [49A] (the first hospital providers to make contact with patients from a large-scale external event), but at this writing they have not been formally adopted as standards.

- *Level C is still a step up*: The decision to use Level C protection does not encompass an escape from OSHA standards for respiratory protection; [50] it requires personnel using respirators to undergo medical screening, fit-testing (not necessary if hooded positive air-purifying respirators are used), training, and refreshers. Certain circumstances could justify Level B PPE, but this would be beyond the

baseline and would be limited to facilities capable of implementing and maintaining the training and regulatory upkeep.

- *Plan to provide staff with chemoprophylaxis and/or immunizations as indicated*: Whether chemoprophylaxis and/or immunizations come from internal stocks (most likely for initial use), locally cached supplies, or the material from the Strategic National Stockpile (SNS) [51], internal and community plans and policies and must specify priority distribution for critical staff and must include procedures for doing so. Cities participating in a Metropolitan Medical Response System contract are required to incorporate caches and SNS deliveries into their plan, but they must specify priority recipients.

- *Consider staff families in plans*: It is the unusual healthcare employee who will be satisfied with individual protection that does not cover the family. Plans providing for employee chemoprophylaxis and/or immunizations should include distribution to employee families; this will complicate planning and implementation but will help achieve the goal of having staff available to perform critical functions.

1.17   Exercises

Exercises, traditionally (and still) a JCAHO requirement, are now part of the HRSA National Bioterrorism Hospital Preparedness Plan as well. Beyond compliance issues, exercise are an excellent method of testing plans, training, and equipment—but only if the exercises are designed and conducted with that intent. This requires that hospitals:

- *Base exercises on realistic plans and models*: Start at manageable scales and build on demonstrated principles and procedures. An exercise where everything goes great can be just as counterproductive as one where everything *fails*. Exercises should focus on specific measurable objectives and be conducted realistically. Pre-exercise warning should be minimized, and all shifts should be involved as

much as possible. External evaluators will enhance objectivity and help keep employees out of difficult situations (such as evaluating their supervisors). Focused exercise design and competent controllers can prevent or minimize distractions arising from obstacles encountered during play. Local and state emergency management and public safety agencies are excellent resources.

- *Use realistic staffing patterns for exercises*: In addition to the need for covering all shifts on training and exercises, it is essential to employ staffing patterns that are likely to be in effect when a real incident happens. Task-based drills may not need scenarios, but larger-scale exercises do. Exercises for off-peak shifts should use off-peak staffing; incidents that would require callbacks to provide additional staffing or specialized skills should not assume that *those assets are present at the outset*.

- *Recognize that success has multiple definitions*: An exercise that evaluates its intended objectives and yields action items is a success, but only if there is action. "Lessons" are not necessarily "learned." It is appropriate to determine whether a plan or procedure was successful, particularly regarding specific tasks or functions. Failure requires corrective action, but the objective determination of success or failure has value as well—not everything is relative. Successes should be publicized, internally and externally. An effective preparedness program can use successes and failures as motivators for continued improvement.

1.18 Critical Steps

To facilitate hospital and community preparedness, there are some essential needs that require action on the federal level (and in some cases require not just a federal but a national approach):

- *Financial incentives and support for hospital preparedness*: As long as preparedness is competing with everyday essential needs, it will fail to thrive. Whether by grant, reimbursement, or other means, hospitals must have some type

of dedicated (and internally immutable) funding stream to cover not just equipment but planning, initial training, refresher training, and exercises. Preparedness is an ongoing process and must have ongoing support. The current multi-year cycle of HRSA preparedness grants is an important step in the right direction (albeit already reduced from in its initial funding levels), but it needs to evolve into a secure funding stream and be tied to measurable, sustainable improvements in broad-spectrum (as opposed to bioterrorism-dominant) preparedness. For now and the foreseeable future, NIMS compliance is a necessary price to pay for maintaining access to federal preparedness grants.

- *Realistic consensus standards*: Hospitals and public safety agencies still rely on unproven tenets, many incorporating military models that have little application in the civilian world. In the absence of national standards, states and even localities have been developing their own. In many areas and individual facilities, equipment and training are determined in the absence of standards or even an identified strategy. Such standards are most important with respect to PPE, mass decontamination (including "no decontamination"), and dealing with mass illness. The EMSA and AHRQ best practices and models are substantial resources, but they are not yet standards.

- *Ethics and liability*: As discussed by Pesik et al. [52], triage following use of a weapon of mass destruction on the U.S. civilian population will not fit familiar models. In particular, mass illness related to bioterrorism could create a paradox in which the sickest patients receive palliative care only. Effective, ethical planning is as essential as the legal protection to conduct it. Currently such indemnity from liability does not exist in most states.

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