APIC State-of-the-art Report: The role of the infection preventionist in emergency management

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Background: This report summarizes the scope and role of infection preventionists in emergency management for all types of disasters. Preventing the transmission of infectious agents during a disaster is an essential component of emergency management. Previous disasters have illustrated the need for better infection prevention and the involvement of an infection prevention professional in planning for and responding to such events.
Methods: An evidence-based approach was used, consisting of a literature review and review by members of the Association for Professionals in Infection Control and Epidemiology, Inc, Emergency Preparedness Committee.
Results: Nine domains were identified that describe the role of the infection preventionist in emergency management: knowledge of disasters and emergency management, assessing readiness and emergency management plans, infection prevention coverage, participation in disaster response and recovery, health care policy development, surveillance, patient management, physical plant issues, and infection preventionist as educator. Details for each domain are provided.
Conclusion: Infection preventionists need to become more involved in emergency management at the personal, facility, and community level. This report outlines the infection preventionist's responsibilities related to emergency management.
Key words: Emergency preparedness; hospital preparedness; surge capacity; infection prevention; infection control.

Infection transmission and infectious disease outbreaks can occur during or following any type of disaster. The greatest risk of infection transmission occurs during a disaster involving an infectious disease/agent (ie, an infectious disease disaster), such as a bioterrorism attack, outbreak of an emerging infectious disease, or pandemic. An infectious disease disaster can have a major impact on morbidity, mortality, and costs, regardless of whether it is an intentional event, such as bioterrorism, or a naturally occurring incident, such as a pandemic. For instance, the 2001 anthrax bioterrorism attack resulted in 22 cases of illness and 5 deaths and cost more than $2.5 billion.[1] Larger bioterrorism attacks or ones involving a communicable disease, such as smallpox, have the potential for an even greater public health impact.[2] The disaster that would

likely result in the largest public health impact in terms of infectious disease-related morbidity, mortality, and costs would be a pandemic. The 1918 Spanish influenza pandemic caused 40 to 50 million deaths worldwide.[3] Estimated costs for a future pandemic range from $71 to $166 billion[4] and could require the need for 45 million additional outpatient visits to health care agencies and between 865,000 and 9,900,000 hospitalizations.[5]

Even natural disasters can have a significant public health impact if infection prevention and control strategies are not implemented rapidly and appropriately.[6] Past natural disasters, such as Hurricane Katrina and other events requiring the sheltering of displaced individuals, resulted in infectious disease outbreaks because of overcrowding and the lack of hand hygiene or infection prevention procedures in shelters.[6,7] Researchers who interviewed infection preventionists (IP) involved in past disaster response reported a variety of infection prevention issues that need to be addressed in future disasters.[6] Such topics include infection prevention for shelters; surveillance; occupational health during disasters; participation in the incident command structure; and need for patient, staff, and visitor education.[6]

Historically, IPs have responded to health care-associated infections and public health infectious disease outbreaks. Toward the end of the 20th Century, many IPs expanded their role and became involved in bioterrorism preparedness planning.[8] More recent events,

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such as severe acute respiratory syndrome (SARS) and Hurricane Katrina, have illustrated the importance of IPs becoming involved in emergency management for all types of disasters to decrease secondary morbidity and mortality. The IP's role in emergency management is considered to be essential, regardless of whether it is an infectious disease emergency or some other type of disaster.[6,9-13] What is lacking is a delineation of the IP's role in emergency management.[14] This is needed to help guide IPs as they are called to the emergency management table to help make important planning and response decisions.

METHODS

The aim of this project was to delineate the role of IPs in all phases of emergency management. The role of the IP in emergency management was developed using an evidence-based approach consisting of the following steps: (1) review of literature, (2) review of meeting Proceedings from the *Mini Summit on Emergency Preparedness* hosted by the Association for Professionals in Infection Control and Epidemiology, Inc (APIC) in May 2008,[14] (3) initial drafting of the IP's role in emergency management, and (4) review by members of the APIC Emergency Preparedness Committee.

Literature review

A literature review was conducted in September 2008 using the Cumulative Index to Nursing and Allied Health Literature, Healthstar, Psych Info, and Medline databases for years 1966 through 2008. The following terms were utilized as keyword searches: infection control, infection prevention, disaster, mass casualties, bioterrorism, pandemic, disaster planning, and emergency management. Only English language articles in peer-reviewed journals were utilized; articles that described hospital, community, or noninfection prevention professional preparedness were excluded unless they addressed some aspect of the IP's role in emergency management. Seven hundred eighty-four references were identified and reviewed for relevance; most were eliminated based on the title or journal (nonpeer reviewed or did not meet inclusion criteria) alone. Three hundred sixty-six references were screened by reading the abstract. Of those screened, 21 articles were deemed relevant and were analyzed in their entirety. In addition, 13 Internet sources were used.

An Internet search was conducted in September 2008 using the same search terms as above to identify existing book chapters, reports from response agencies, published standards and guidelines, and other relevant materials related to the role of IPs in emergency management that were outside the peer-reviewed literature. Reports that did not address the role of IPs in emergency management were excluded. Data from the relevant sources identified through the literature review and Internet search were extracted. A spreadsheet was created that delineated the IP's duty/task(s) or role(s) in emergency management identified by each source.

APIC-sponsored emergency preparedness *Mini Summit*

In May 2008, the APIC hosted a *Mini Summit on Emergency Preparedness*.[14] This meeting involved representatives from a variety of key organizations involved in emergency management, including local and state public health agencies, Department of Homeland Security, National Association of City and County Health Officials, Centers for Disease Control and Prevention (CDC), American Society of Healthcare Engineering, Federal Emergency Management Agency, first responder agencies, home health, long-term care, academic institutions, industry partners, and other agencies/groups. The goal of this *Mini Summit* was to begin a dialogue about the APIC and IPs' roles in emergency management. The proceedings from the meeting were used as a source to help inform the development of the IP's role in emergency management document.[14]

Drafting and review of IP's role in emergency management

Following the analysis of published literature and reports, the primary author drafted the APIC State of the Art Report: The Role of the Infection Preventionist in Emergency Management document. Members of the 2008 APIC Emergency Preparedness Committee reviewed the initial draft document, and updates/edits were made as needed.

RESULTS

In total, 34 relevant sources were identified from the peer-reviewed literature and Internet search. Many authors described the infectious disease impact of mass casualty incidents and infection prevention interventions that will be required for an effective disaster response but did not specify the role an IP will play in emergency management.[6,15-31] Although it may seem that identifying the infection prevention interventions for a disaster is the same as outlining the role an IP will play in emergency management, they are different. Some interventions that can help prevent and contain infection transmission during a disaster, such as diagnosing infectious diseases rapidly and ordering confirmatory laboratory testing, will not be performed by an IP. However, many of the strategies to prevent infection transmission in health care and

community settings following a disaster will be implemented and/or coordinated by the IP. There is a lot of crossover between the role of the IP in emergency management and the components of an infection prevention program for mass casualty events. This document focuses solely on the role or tasks of an IP in emergency management, which have been divided into themes or domains.

Domain 1: Knowledge of disasters and emergency management

The infectious disease impact of a mass casualty incident and interventions needed to control the situation will vary, depending on the nature of the event.[12] Infectious disease disasters, such as a pandemic, will require much more involvement from an IP than a natural disaster.[6] IPs must be familiar with the potential consequences of various types of disasters.[6,8,11-13,32-34] IPs must also understand the infection prevention strategies needed for mass casualty incidents, including surveillance, patient placement, reporting, outbreak investigation, and communication/coordination.[6,8,11-13,32-34]

In addition to understanding mass casualty incidents and the potential infectious disease impact of such events, IPs need to have a basic understanding of emergency management principles.[6,11-13,35] There are 4 phases of emergency management: mitigation, preparedness, response, and recovery.[36] Mitigation involves interventions to either prevent or reduce morbidity and mortality and ease the economic and social impact of the event on the affected community. The preparedness phase involves all of the measures taken to prepare for an emergency, such as developing an emergency management plan and educating the workforce. The response phase occurs after disaster strikes when the plan developed in the preparedness phase is implemented. The recovery phase of the emergency management model consists of the interventions needed to return a facility and/or community to its predisaster baseline as soon as possible. Other mass casualty incident-related topics with which IPs must be familiar include surge capacity, responding agencies' roles in emergency management, incident command system, environmental concerns in the physical plant, occupational health during disasters, and prioritizing limited resources that may affect infection transmission.[6]

Domain 2: Assessing readiness and emergency management plans

IPs need to be involved in assessing all aspects of readiness for mass casualty events as it relates to potential disease transmission.[6,9,11-14,28,29,37-40] This includes being involved in preparedness efforts at the personal, facility, and community level for all types of mass casualty events. An all-hazards approach to emergency management should be used because all types of mass casualty incidents can result in infectious disease implications and the type of emergency that might occur cannot always be anticipated.[12,13,35] Personal, facility, and community emergency management plans must be assessed, but the approach to each varies.

IPs need to be prepared for mass casualty events on a personal level, which includes having a personal/family response plan and knowing their role in their workplace's emergency management plan. It is important that IPs have a personal/family response plan for disasters that accommodates their specific needs.[11-13,28,29,34] Individual strategies will vary, but there are essential components that need to be addressed, such as arrangements for back-up food and water supplies; alternative means of child, elderly individuals, or pet care; and transportation during nonnormal working hours.[41] IPs also are responsible for knowing their role in their workplace's emergency management plan.[12,13] Guidelines for the content of IP's personal response plans have not been outlined in the literature, although necessary components of response plans have been described for the general public by agencies such as the Federal Emergency Management Agency.[42] In addition, IPs may have unique needs that the general public will not have, such as the ability to stay at work for extended periods of time if a work quarantine is implemented.[29] Each IP must assess their own family's needs when developing a personal/family response plan for disasters.

At the facility level, IPs need to be involved in assessing mass casualty event readiness, including being involved in the facility hazard vulnerability assessment.[6,9,11-13,31,32,34,37,38] Health care facilities need to assess all components of their all-hazards emergency management plan. Infection prevention-related aspects of the emergency management plan are only a small piece of the overall plan, but these issues require IP input to guide decision making. Various researchers have outlined strategies for assessing emergency management plans,[43-45] including an appendix in the APIC Bioterrorism Readiness Planning Suggestions document.[9] However, these assessment guides address all components of an emergency management plan, most of which do not require input from an IP. Examples would include information on how the hospital will address implementation activities required for adoption of the National Incident Management System (NIMS), development and evaluation of the emergency management plan, implementation of a staff education program related to emergency management, and set-up of an emergency operations center at the facility.[43-45] IPs would only be expected to address

Table 1. Components of an emergency management plan that require IP input

Issue/topic requiring infection prevention input
Having around the clock infection control coverage[27,29,47]
Facility assessment/hazard vulnerability assessment[9,11-13]
Participation in disaster drills involving a biologic agent[6,9,11-13,28,29,39]
Strategies for receiving and posting health alert messages within the facility[29]
Negative-pressure surge capacity[27,29,38,39]
Safe patient specimen collection procedures[9,11,32]
Patient management[6,9,11-13,38,39]
Food safety[6,11-13,39]
Water management[6,12,13,28,39]
Sanitation control[12,13,39]
Pet management[39]
Environmental decontamination[6,9,11-13,28,30,32,38,39]
Development of crisis standards of care that affect infection transmission[6,9-14,16,25,29,31,38,39]
Prioritization for limited supplies of antiinfective therapy[9,11-13,26,39]
Screening/triage protocols[6,8-13,17,19,25,26,37,39]
Occupational health/safety procedures[6,9,11-13,26,28,32,35,37,39]
Outbreak investigation coordination[6,11-13,19,25,31,32,35,37-39]

components of the facility emergency management plan that pertain to preventing or controlling the spread of disease, although IPs should be familiar with the findings from their facility and community hazard vulnerability assessments.[11-13] Some components of an emergency management plan that require IP input have been outlined, including surveillance, triage, patient placement, and isolation.[8-13,25,26,32,38,39] Although a comprehensive list of topics that require IP input have not been delineated in the literature, some issues that may affect infection transmission during disasters are listed in Table 1. It is important that every health care facility have an IP as a member of the emergency management planning team to consult on issues that affect infection transmission in the health care setting during mass casualty events.[9,10,12,13,27,29,31,37,39]

One component of facility readiness with which IPs need to be involved is resource assessment.[9,11-13,16,39] IPs will not need to help in assessing all health care facility resources for mass casualty incidents; only those that can affect infection transmission will require IP input. Examples of resources that may have an impact on infectious disease spread include personal protective equipment (PPE), hand hygiene products, antiinfective therapy, environmental decontamination products, patient linens, and isolation rooms/areas.[9,11-13,16,39] It is anticipated that resources will be limited or unavailable during a mass casualty event, especially one involving an infectious agent such as a bioterrorism attack or a pandemic. Health care emergency management planning teams will need to make difficult decisions regarding how to allocate scare resources, and

the potential infectious disease implications of these decisions must be taken into account.[11-13,16,29,39] IP input will be vital in developing prioritization plans for therapy, prophylaxis, and vaccination when doses are limited[9,11-13,26,39]; allocation of PPE when resources are insufficient or unavailable[6,11-13,16,26,29,37,39]; and safe patient placement when isolation rooms are depleted.[6,8-14,17,25,35,37-39]

A recent development in emergency management is the recognition that IP input is needed in community emergency management planning. Community disaster planners will need infection prevention guidance when setting up and running alternative care sites and shelters for displaced individuals.[6,14,28] Alternative care sites are needed for all events involving mass casualties in which the affected community needs to deliver medical care outside the traditional health care system.[6,14,28,40,45] Alternative care sites may consist of a hotel, closed hospital, converted warehouse, school, sports arena, convention center, or any building or space that is adapted for providing medical care.[46] Community shelters are buildings/areas used to house displaced individuals during a mass casualty incident and can range from a small evacuation center to a large sports arena.[39] The level of medical treatment provided at alternative care sites and community shelters will vary by the community and the size/scope of the event. Because health care staff and/or volunteers will deliver medical care at these sites, the risk of infection transmission exists. Therefore, it is essential that both alternative care sites and shelters have an infection prevention program to prevent the spread of infectious organisms.[6,14,28] This will require having IPs involved in community emergency management planning before an event and perhaps serving as a consultant during a mass casualty incident if resources allow.

Domain 3: Infection prevention coverage

All settings that administer health services will require an infection prevention program to prevent the spread of infectious organisms, including having access to an IP for consulting purposes (ie, having infection prevention coverage).[40] The need for IP coverage as part of an infection prevention program was identified by all authors as an integral component of emergency management; some researchers specified that this coverage needs to be available around the clock through either phone or face-to-face interaction.[27,29,47] Researchers indicate that this is not currently available at all US hospitals,[27,29] but it is a standard to which health care facilities need to aspire. In addition to hospitals, it is important that long-term care, home health, alternative care sites, and community shelters have infection control coverage.[14,17,19,39,40] Because of limited

resources during a disaster, infection prevention coverage in nonhospital settings may need to be assigned to an infection prevention designee.[6,28,39] If an infection prevention designee is to be used, this individual or group of workers should receive training in infection prevention principles and practice before a disaster. In addition, an IP should be involved or consulted when setting up the infection prevention program for all health care settings to ensure that appropriate standards are implemented, even if an infection prevention designee will be responsible for managing the program during a disaster.[39] Identifying IP coverage and/or infection prevention designee(s) for nonhospital settings should be coordinated with local health care facilities and public health communicable disease officials who may be aware of additional local/regional resources to assist.[39]

Domain 4: Participation in disaster response and recovery

In addition to playing a key role in preparing for mass casualty incidents, IPs will be essential to an effective response and recovery from an emergency.[11-13] IP's level of involvement will vary, depending on the type and scope of the event. Small incidents with no infectious disease cause will likely require little IP participation, whereas an infectious disease disaster will necessitate a great deal of time and input from IPs. The exact role of the IP in mass casualty incident response and recovery may vary from facility to facility; IPs need to verify their responsibilities by checking their facility emergency management plan for details. Regardless of the facility, or type or scope of the disaster, most IP's primary responsibility during a mass casualty incident will be to prevent and control infectious disease spread during the event. This will involve implementation of infection prevention strategies outlined in facility policies and procedures and the facility emergency management plan, as well as monitoring the effectiveness of these interventions.[10,26,35]

In some facilities, IPs may be asked or expected to fulfill a role in the incident command system (ICS).[6,9,11-13] Hospitals and health care systems are required to manage all emergencies using structures and principles in accordance with NIMS, including the implementation of an ICS.[48] Development and implementation of an ICS for health care facilities is not within the scope of the IP's responsibilities. However, IPs may be designated by the health care facility as employees who need NIMS and ICS training.[48] This is most likely to occur in facilities that plan to utilize IPs as members of the ICS during a disaster. IPs should check with their facility emergency management committee to verify whether they will be assigned a position within the ICS during a disaster and require NIMS and ICS training. Regardless of whether or not an IP is assigned a position within the ICS, IPs will be expected to have a basic understanding of the system and be able to communicate important information concerning infection prevention through the proper channels.[12]

Reporting events, communication, and coordination are vital components of disaster response and recovery and are functions that IPs will be expected to perform. Health care facility emergency management plans need to delineate procedures for reporting disasters internally and externally. IP involvement in developing reporting guidelines for most disasters, such as floods or fires, will not be needed. However, IP input will be vital when developing reporting protocols for all disasters involving an infectious agent, such as bioterrorism or a pandemic.[6,8,9,11-13,19,26,35,37-39] Policies for internal reporting of infectious disease disasters should include, at the least, notification of the Infection Prevention and Control and/or Infectious Disease Department.[11-13] Other departments may also need notification, such as Nursing Services, Internal Medicine, Safety, and others. Rapid notification of the IP during any type of disaster is vital so that proper assessments can be made concerning the potential infectious disease implications of the event. Even events that might not seem to have an affect on infection transmission, such as a power outage, can cause unexpected complications that contribute to disease spread in health care facilities.

External reporting must include local public health agencies[6,8,9,11-13,19,26,35,37-39]; in addition, notification of law enforcement will be needed for known or suspected bioterrorism attacks because they are a crime.[9] Other external response agencies may also need notification of infectious disease disasters; these agencies and their contact information should be included in the health care facility emergency management plan.[43-45] During disaster response, all communication should be coordinated through the incident command structure.

Every author stressed the importance of both internal and external communication/coordination. For IPs, this would include development of an internal communication plan to inform all health care facility staff, patients, and visitors about infection prevention strategies that need to be implemented.[10,19,37] Examples of infection prevention strategies that need to be communicated to employees, patients, and visitors include screening measures/procedures, the need for and appropriate use of isolation precautions, PPE, hand hygiene, social distancing practices, and postexposure follow-up. In addition, it is vital that IPs communicate changes in protocols related to PPE use or protective measures to staff, even if they occur mid-disaster response. This has been identified as being

critical to effective infection prevention in previous emergencies.[28]

Communication and coordination will also need to occur between the IP's health care facility and external response agencies, such as other local hospitals and public health agencies. The IP's role in external communication and coordination will depend on the health care facility emergency management plan. For some facilities, a member of the ICS will be responsible for all external communications. Other facilities may make this the responsibility of the IP. IPs should verify their role in internal and external communication and coordination by checking their facility emergency management plan for details.

Domain 5: Health care policy development

An important role of IPs is to help create or reform health care policy and practice related to emergency management.[9-11,13,16,17,26,32] Many issues surrounding emergency management have potential policy implications, especially those involving creation of new standards and recommendations related to infection prevention during a mass casualty incident. Health care policy development needs to take place during emergency management planning; it will be much more difficult to implement change during disaster response. IPs should consult with facility emergency management planners and response agencies when developing and implementing emergency management plans to help shape decisions regarding how to prevent the spread of infections in all health care and community settings during mass casualty incidents. Health care policy needs to occur at the local, regional, state, and federal level. Most IPs will only be involved in policy development at the local level.

One critical health care policy area in which IPs need to be involved is the development of altered or crisis standards of care.[6,9-14,16,25,29,31,39] Given the projected lack of resources that will be available during a mass casualty event, alternative approaches to patient care must be considered. Tough decisions need to be made regarding how to allocate limited numbers of ventilators or medications, where contagious patients will be housed if all isolation rooms are full, and which staff will be given PPE if stocks become depleted. Some of these decisions will have infectious disease implications and require IP input to determine the best course of action. Facility disaster planning teams and ethics committees will be responsible for development of crisis standards of care. IP's responsibility in this process is to consult with these teams and committees to create the most protective crisis standards of care possible in relation to preventing the spread of infectious organisms in health care settings. To this end, IPs should

be involved in all policy development decisions that have potential infectious disease implications. Examples of such decisions include which staff will care for potentially infectious patients, how and when to cohort potentially contagious patients, prioritization plans for limited supplies of antiinfective therapy for staff, what to do when hand hygiene or environmental decontamination supplies become insufficient, and how PPE will be allocated or reused if resources become depleted. Researchers and national organizations have begun work in this area, such as the development of guidelines on how to safely reuse respiratory protection when resources become insufficient or unavailable,[16] but more needs to be done.

IPs need to create or inform health care policy related to staff safety during emergency management.[13,16,25,28,29,37,39] Protocol development should be coordinated with facility Occupational Health Department personnel. IPs will not be responsible for development of all occupational health policy related to emergency management; only issues that affect infection transmission will fall under the auspices of the IP. Examples of emergency management occupational health issues with infectious disease implications include developing protocols for monitoring and following up on staff work exposures, informing staff prioritization plans for antiinfective therapy and/or vaccination, identifying staff at high-risk for infection development, and ensuring adequate stocks of PPE for staff use.[13,16,25,28,29,37,39] Although it will be the Occupational Health Department's responsibility to track and follow-up on staff work exposures, it is important that IPs be involved in the development of these protocols as they relate to infection prevention. This includes defining an exposure, identifying appropriate postexposure prophylaxis, and informing decisions regarding staff reassignment or furlough. IPs should also be involved in developing protocols related to staff immunization, including seasonal influenza, smallpox, and other vaccines.[10,37] Another occupational health emergency management policy with which IPs should be involved is the development of protocols for designating staff limited to work with infected patients.[13,16,25,29,39] This process includes both patient and health care worker cohorting procedures to decrease the risk of infection spread and maximize staff resources.[29]

Domain 6: Surveillance

Surveillance is a critical component of emergency management, especially for disasters involving a biologic agent.[6,8-13,17,25,26,32,35,39,40] There are 2 types of surveillance programs needed for disasters: a system that aids in identifying a biologic event (ie, syndromic

surveillance) and one to monitor an event once it has been identified. IPs need to be involved in the development of these surveillance programs to ensure that appropriate indicators are chosen. In addition, IPs need to assist in surveillance program evaluation to determine the effectiveness of the systems used.[10,26,35] In some facilities or communities, the IP may assist with data collection and reporting, but this is not required if a trained individual or group of people are available to do these functions.[11] In most communities, public health officials will be responsible for setting up and managing community-based surveillance programs. However, IP consultation may be needed when setting up surveillance in the community, such as in shelters for individuals displaced by the disaster and alternative care sites.[39] IPs need to communicate and coordinate with public health officials regarding setting up and managing/running surveillance systems for health care facilities and community settings.

For most disasters, such as floods, hurricanes, and traditional terrorist events using an explosive device, surveillance will not be needed to identify that an event has occurred because there are immediate, obvious signs that something unusual has happened. However, surveillance will be needed to identify rapidly a disaster involving a biologic agent.[9-11] Surveillance to identify an infectious disease disaster consists of the collection and analysis of any non-traditional data and is referred to as *syndromic surveillance*. Syndromic surveillance systems are often regional or state-wide programs managed by public health authorities, and all health care facilities may be mandated to collect the same indicators.[10] IPs may not need to help design these programs but should participate if requested. IP input would be critical if a health care facility decides to collect additional indicators for early detection of a biologic event. IPs need to help design and evaluate syndromic surveillance programs when possible and train the data collectors/reporters or assist with data collection and reporting.

Once a disaster is identified or underway, surveillance will be needed to monitor the event. Surveillance indicators for mass casualty incidents are specific to the nature of the event. For example, a natural disaster resulting in sheltered individuals displaced by the event would require surveillance for food- and waterborne illnesses, respiratory-related syndromes, and skin/wound infections,[39] whereas an influenza pandemic would likely focus on respiratory-related syndromes and laboratory specimen monitoring to identify new cases.[10] Screening is an important component of surveillance and the details of how, when, where, and whom will do the screening need to be outlined in the emergency management plan for health care facilities, alternative care sites, and community shelters.[6,8-13,17,19,25,26,37,39]

Table 2. Patient management issues that have infectious disease implications and require IP input

Patient management issue/topic requiring infection prevention input
Screening/triaging patients for infection[6,8-13,17,19,25,26,37,39]
Patient decontamination[11-13,39]
Patient transport[9,39]
Patient placement and cohorting[6,8-14,17,25,35,37,39]
Isolation[6,8-13,25,26,32,37-39]
Quarantine[10-13]
Supply shortages[6,11-13,16,26,37,39]
Procedures for obtaining and handling patient specimens safely[9,11,32]
Discharge management[9,39]
Postmortem care[6,9,11,12,39]

Possible screening mechanisms include setting up triage centers at entrances for staff, patients, and visitors[10-12,19,26,39]; following up on staff occupational exposures[6,9,11-13,26,32,35,37,39]; and floor or area surveillance cultures as part of outbreak investigation.[11-13,31] IPs need to aid in development of these screening protocols, including outlining procedures for managing potentially contagious individuals who are identified through the screening/triage process. IPs must communicate information gathered from the screening process and outbreak investigation to local public health officials.[19,37,39]

Domain 7: Patient management

Patient surge is expected after any type of mass casualty incident, and, in some events, such as an infectious disease disaster, the patients may pose a risk of infection transmission. Health care disaster planners must develop protocols for managing patient surge, including procedures for minimizing the risk of disease transmission.[6,9,11-13,38,39] IPs need to consult with facility disaster planners and response agencies when developing and implementing emergency management plans to manage an influx of potentially contagious patients.[6,8,11-13,32,37,38] Patient management issues that have infectious disease implications and need to be addressed in emergency management plans are listed in Table 2. Examples of such patient management issues include how to identify, transport, and isolate potentially contagious patients.

Although most patient management issues that have infectious disease implications are covered in health care facilities routine infection prevention policies, procedures may need to be altered during a disaster. As mentioned previously, limited resources may necessitate the use of crisis standards of care for patient management. In addition, some patient management issues are unique to infectious disease disasters. One patient management issue that is unique to infectious

Table 3. List of groups requiring infection prevention education related to emergency management

Health care groups	Community-based groups
Nurses and nursing students[6,9,10,12-14,34,35,40]	Emergency medical services[6,12,14,34]
Physicians and medical students[6,9,10,12-14,34,35,40]	Firefighters[6,12,14,34]
Patient care technicians/assistants[10,12-14,34,35,40]	Food services[14,34]
Physical and occupational therapists[6,9,10,12-14,35,40]	General public[6,9,10,13,14,28,34,35]
Pharmacists[10,12-14,34,35,40]	Law enforcement[6,12,14,34]
Mental health practitioners[10,12-14,34,35,40]	Mail carriers and handlers[14,34]
Ambulatory care workers[10,12-14,35,40]	Media/public relations[14,34]
Nonclinical health care workers	Morgue workers[12,14,34]
Housekeepers[10,12-14,34,35,40]	Relief organizations (Red Cross, Medical Reserve Corp, and others)[12,14,34]
Environmental services[10,12-14,35,40]	Transportation services[14,34]
Health educators[10,12-14,34,35,40]	Utility services[14,34]
Administration[10,12-14,34,35,40]	Veterinarians[14,34]
Laboratory personnel[10,12-14,34,35,40]	Public health[6,12-14,34]
Medical records[10,12-14,34,35,40]	Medical examiners[14,34]
Risk management[10,12-14,34,35,40]	Federal/governmental agencies (CDC, FEMA, and others)[12,14,34]
Security[10,12-14,34,35,40]	Military[14,34]
Support staff (food service and others)[10,12-14,34,35,40]	Political leaders[14,34]
Clergy[10,12-14,34,35,40]	College students[6,14]
Volunteers[10,12-14,35]	Funeral directors[14]
Health care teachers/faculty[14,34,35]	Shelter workers[14,39]
School nurses[14,34,35]	
Long-term care[10,12-14,35,40]	
Home care and hospice[10,12-14,35,40]	

FEMA, Federal Emergency Management Agency.

disease disasters is quarantine. Quarantine would only be needed for the most potentially severe infectious diseases, such as smallpox and SARS, and may not be implemented at all.[12] If quarantine were implemented, it would likely be in the form of a community- or home-based system. However, hospital-based quarantines have been implemented in the past and remain a possibility for future infectious disease disasters.[10,49] Patient decontamination to remove biologic particles is another patient management issue that is unique to infectious disease disasters. For most mass casualty incidents, patient decontamination will not be necessary or will only be needed to remove chemical or other toxic agents; these issues do not require IP input. Patient decontamination to remove biologic particles is an infection prevention issue because these contaminates can lead to secondary disease spread if they are not removed in a timely and appropriate manner. IPs need to aid health care facility and community disaster planners develop protocols for when and how patient decontamination to remove biologic particles should be performed.[11-13,39] Patient decontamination to remove biologic particles is only needed after an announced bioterrorism attack occurs and then only if the event is known within 12 to 24 hours after the exposure.[11]

Domain 8: Physical plant issues

Research indicates that the environment can play a part in infection transmission.[50] This is especially true in mass casualty events when bioburden may be higher than usual, staff shortages may prevent adequate environmental decontamination, and cleaning/disinfection products may be limited.[11,12] IPs need to consult with facility emergency management planners, facilities engineering, and response agencies regarding assessing the physical plant for potential infectious disease implications and implementation of environmental controls for mass casualty incidents.[6,9,11-13,28,30,32,38,39] Examples of physical plant issues that have potential infectious disease implications include having sufficient airborne infectious isolation rooms or negative-pressure rooms/areas, procedures for environmental decontamination, and protocols for reprocessing of patient care equipment. Assessing the physical plant for potential infectious disease hazards and implementing prevention and control measures are important for all mass casualty incidents. However, certain disasters pose a greater risk of environmental contamination and need for intervention than other emergencies. For instance, environmental decontamination will be most critical after a flood or an outbreak of an infectious disease (such as smallpox or SARS) that is spread by direct and indirect contact.[11,12,38] IP input will also be important for making decision regarding when to reopen a room, floor, or building after it has been closed for a length of time and procedures to follow before patients are admitted to those areas.[11,12] These decisions need to be made by a multidisciplinary team, such as the health care facility emergency management planning committee, of which the IP should be a member.

Table 4. Education topics requiring infection preventionist involvement

Education topics IPs need to cover for staff, patients, and visitors
Screening/triaging procedures[6,8-13,17,19,25,26,37,39]
Patient decontamination[11-13,39]
Patient management (patient discharge instructions, when to isolate, and others)[6,9,11]
Disease-specific information on bioterrorism agents, emerging infections, and pandemic influenza[6,10,12,33]
Self-screening and reporting of symptoms[10,39]
Isolation procedures[6,8-13,25,26,32,37-39]
PPE use and reuse[6,11-13,16,26,29,37,39]
Procedures for obtaining and handling patient specimens safely[9,11,32]
Hand hygiene[6,9,11-13,26,28,32,39]
Respiratory etiquette[6,9-13,26,32,37-39]
Cleaning and disinfection of toys in shelters[39]
Cot or sleeping area configuration for evacuation shelters[39]
Waste management[9,39]
Emergency management procedures and policies that affect infection transmission[10,13,14,26,39]
How to safely reuse respiratory protection when resources are insufficient or unavailable[16,39]
Postmortem care[6,9,11,12,39]

A newly identified issue in emergency management that requires IP input is the need for policies related to pet management in health care facilities during disasters.[39,51,52] This is different from the issue of managing service animals or those involved in animal-assisted interventions in health care settings, which has long been identified as an infection prevention issue.[53] Pet management for community shelters and hospitals became an issue in 2005 during Hurricane Katrina when displaced individuals brought their pets with them to evacuation centers and hospital staff brought their pets with them to work.[39,52] Many community shelters and all hospitals cannot accept pets because of health and safety regulations.[51] IPs should assist in development of community and health care facility emergency management policies related to pet management. This may include coordination with local and state animal rescue agencies or area veterinary services to provide shelter for pets.

Domain 9: IP as educator

One of the IP's primary roles is to educate others regarding infection prevention and control strategies,[35,40] and this remains true for emergency management.[6,12-14,19,26,28,32,34,35,37,39] There are a variety of worker groups who need training on infection prevention in relation to emergency management. These groups, including both health care workers and response agency personnel, are outlined in Table 3. Examples of health care worker and response agency groups for which IPs will need to develop training material include nurses, physicians, respiratory therapists, housekeepers, laboratory workers, environmental services, home health and hospice, first responders, governmental agencies, public health, and veterinarians. In addition, the general public needs education related to preventing infection transmission during disasters, and IPs are ideally suited for creating this type of training material.

IPs should use competency-based curriculum whenever possible when developing infection prevention in emergency management education. Competencies for hospital-based health care workers related to infection prevention have been developed[54] but do not currently exist for other worker groups. These competencies should be used for education development for hospital-based health care workers and may serve as a starting point for creating training for other worker groups. Competency domains for hospital-based health care workers include basic microbiology, modes/mechanisms of infection transmission, standard and transmission-based precautions, occupational health, patient safety, critical thinking, and emergency preparedness.[54] Within the emergency preparedness domain, additional education topics have been identified. Education topics that IPs need to cover when developing training materials for staff, patients, and visitors are outlined in Table 4. Examples of such topics include how and when to perform hand hygiene and respiratory etiquette, isolation precautions, PPE use, safely reuse respiratory protection, and screening procedures. Most of these topics are applicable for routine practice; differences between day-to-day activities and disaster situations need to be incorporated into the training. For instance, routine PPE use and procedures for safely reusing respiratory protection when resources are insufficient or depleted because of a disaster need to be included in staff education.[16] In addition, educational material needs to be targeted to each group. Previous research indicates that there are discipline-specific competencies related to infection prevention.[54] IPs should take these differences into account when education is created for various groups of individuals. During response to a mass casualty incident, all responding staff will require some level of training that is specific to the event. Whenever possible, IPs should have "just in time" training materials on hand to distribute during disaster response.[6]

CONCLUSION

Mass casualty incidents pose a risk of infection transmission, especially if the event is an infectious disease disaster such as bioterrorism or a pandemic. IP input is needed when developing facility and community emergency management plans. In addition, it is important that IPs have a personal/family response

plan so that they are prepared to assist during mass casualty incident response and recovery. This report outlines the role of IPs in emergency management. Nine domains were identified that describe the role of the IP in emergency management: knowledge of mass casualty incidents and emergency management, assessing readiness and emergency management plans, infection prevention coverage, participation in disaster response and recovery, health care policy development, surveillance, patient management, physical plant issues, and IP as educator. IPs should use information from this report as a guide for becoming more involved in emergency management at the personal, facility, and community level.

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