RESEARCH PAPER

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Addressing the gap between public health emergency planning and incident response

Lessons learned from the 2009 H1N1 outbreak in San Diego County

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Objectives: Since 9/11, Incident Command System (ICS) and Emergency Operations Center (EOC) are relatively new concepts to public health, which typically operates using less hierarchical and more collaborative approaches to organizing staff. This paper describes the 2009 H1N1 influenza outbreak in San Diego County to explore the use of ICS and EOC in public health emergency response.

Methods: This study was conducted using critical case study methodology consisting of document review and 18 key-informant interviews with individuals who played key roles in planning and response. Thematic analysis was used to analyze data.

Results: Several broad elements emerged as key to ensuring effective and efficient public health response: 1) developing a plan for emergency response; 2) establishing the framework for an ICS; 3) creating the infrastructure to support response; 4) supporting a workforce trained on emergency response roles, responsibilities, and equipment; and 5) conducting regular preparedness exercises.

Conclusions: This research demonstrates the value of investments made and that effective emergency preparedness requires sustained efforts to maintain personnel and material resources. By having the infrastructure and experience based on ICS and EOC, the public health system had the capability to surge-up: to expand its day-to-day operation in a systematic and prolonged manner. None of these critical actions are possible without sustained funding for the public health infrastructure. Ultimately, this case study illustrates the importance of public health as a key leader in emergency response.

Introduction

Since September 11, 2001, public health has played an increasingly large role in emergency response, thus expanding the functions of what is typically thought of as public health.[1] Following 9/11 and the anthrax mailings, Congress enacted legislation and appropriated significant funds for public health to develop response plans, establish requisite infrastructure, and create relationships with an array of partners to ensure the provision of public health and medical services during emergency incidents. These services comprise Emergency Support Function (ESF) 8, an annex of the National Response Framework that guides overall response actions. Since that time, local, state and federal public health agencies and their partners have assumed a growing role in the emergency response system to coordinate responses to incidents. Still, public health has still been considered on the periphery of emergency response.[2]

Public health agencies were required to become National Incident Management System (NIMS) compliant by 2005 to maintain funding. Achieving compliance necessitated embracing two organizational structures to manage and coordinate response activities—the Incident Command System (ICS) and Emergency Operations Centers (EOC). ICS defines roles and responsibilities of individuals, the organization of response functions, lines of authority and communication, and management procedures.[3] An EOC is a physical or virtual location where staffs with ICS responsibilities are located to manage information and coordinate activities. EOCs have been likened to "military command posts."[4] While highly structured, both are designed to be scalable to incidents of varied scope and flexible to adapt to different incident requirements.

ICS and EOC are relatively new concepts to public health (since 2002), which typically operates using a less hierarchical

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approach to organizing staff and instead works in a collaborative environment.[5] Public health preparedness competencies developed by the Council on Linkages are still undergoing modification and integration into workforce training and public health practice.[6] Thus, much of the public health workforce is on a "learning curve" regarding ICS and EOC use and has not fully transformed these elements into emergency response practice.

This paper describes the events that unfolded during the 2009 H1N1 influenza outbreak in San Diego County to explore the use of ICS and EOC in public health emergency response. The study uses qualitative methodology through case study analysis to provide a deeper contextual understanding of the initial H1N1 outbreak.

The San Diego County Division of Public Health Services (PHS), as well as other local public health agencies throughout the US, began extensive planning for avian flu (H5N1) in 2005. This planning was premised on human-to-human transmission being identified outside of North America. On April 19, 2009, the Centers for Disease Control and Prevention (CDC) confirmed H1N1, a previously unknown influenza virus, in a specimen submitted from a US Navy clinic in San Diego County. This identification was made public by CDC and PHS on April 21. An "epidemic" in Mexico, just across the San Diego County border, was announced on April 23. These events set in motion an extensive response, with the PHS immediately establishing an ICS and opening an EOC that remained activated for the next seven weeks. H1N1 ultimately spread world wide, resulting in the World Health Organization declaring a Level 6 (highest level) pandemic in June 2009. In a post-event hotwash, the PHS health officer, Dr. Wilma Wooten, noted that the incident management process supported all phases of the response from awareness to initial assessment, notification, mobilization, response and recovery, demobilization and evaluation.[7]

The incident marked the first time that national, state, and local public health agencies assumed a lead response role in a major emergency based on the national response framework and NIMS. As the designated lead agency for a biological incident, PHS's role in the H1N1 outbreak was to manage the overall response and coordinate the activities of all involved partners and stakeholders. While the PHS had participated in responses during several previous complex emergency incidents (e.g., wildfires) as a support agency, this was the first time it was the lead agency.

This paper identifies the challenges and the solutions that emerged during the outbreak, specifically as related to ICS and EOC use. This paper also demonstrates the key role public health plays in emergency response. Further, the paper concludes with recommendations to improve pre-incident preparedness and incident-response actions through engaging the public health workforce. Ultimately, this paper demonstrates the importance of using qualitative methods to enhance understanding of emergency preparedness.

Methods

Design and sample. A qualitative methodology was selected because it offered a means of gathering information describing the complex interactions of the social and professional networks during the H1N1 outbreak in San Diego. This data collection methodology is considered the preferred strategy when the research conditions represent a new experience and lack standardized measures. The outcomes for this type of study provide potential suggestions for improved organizational management, communication, stakeholder engagement and resource allocation. The study used a type of purposive sampling called critical case study, which looks for sites or individuals who will provide the most information.[15] This study consisted of 18 key-informant interviews (several with more than 1 interviewee for a total of 24 key informants). Informants were selected jointly by the Emory research team and key PHS staff to include a mix of individuals with an overview of the entire event and those who played specific roles in planning and the response. Researchers interviewed at least one individual from the following groups: PHS Epidemiology which housed the H1N1 Departmental Operations Center (DOC); PHS Emergency Medical Services (EMS) which operates the EMS DOC, also known as the Medical Operations Center (MOC) that supports the county EOC for other incidents; PHS Public Health Laboratory; PHS Border Health; County of San Diego Health and Human Services Agency (HHSA); hospital emergency coordinators; County of San Diego Office of Emergency Services; San Diego County public schools; United States Navy; and other partner organizations.

Three researchers conducted the in-person, semi-structured interviews in October 2009. The following domains were explored during the interviews: roles and responsibilities, information and resource coordination, communication methods, information technology and lessons learned. All interviews were audio-recorded and transcribed, then de-identified to ensure study participant anonymity. In addition, the study team reviewed background documents, including response plans and the after action report (AAR), and observed a post-event hotwash with external partners. All study protocols were approved by the Emory University IRB.

Data analysis. Thematic analysis was used to identify, analyze, and report patterns of interactions in the outbreak response across the response sectors. Two trained research assistants, led by a lead qualitative methodologist, independently read three transcripts and began to identify and define codes.[8] Discussions among the research assistants and lead methodologist further developed and refined the codebook. The research assistants wrote weekly reflective memos to provide a foundation for these discussions. Research assistants confirmed codebook definitions and hierarchy with three additional transcripts, and then validated the codebook by confirmation from two other qualitative methodologists. Each research assistant coded half of the remaining transcripts, then coded a section of every transcript not assigned to him or her to ensure reliability. Transcripts were discussed at weekly meetings, with any disagreements reconciled by the lead methodologist.

Results

Results of this study explore the following: (1) overall challenges faced by the public health agency in managing and coordinating

Table 1. Response roles of key San Diego County Division of Public Health Services H1N1 Influenza Outbreak Response key partners

Response partner	Anticipated incident response role	H1N1 influenza response role
County of San Diego Office of Emergency Services	Assume incident command role; open county EOC; operate joint information center (JIC) and 211 public hotline	Level 1 activation (lowest level) to support activities; established liaison to San Diego Public Health Services; opened 211 hotline
Hospital Association of San Diego and Imperial Counties/ San Diego County Hospitals	Association: provide information and coordination point for hospitals; Hospitals: carry out ESF 8 activities	Association/Hospitals –functioned as anticipated
Council of Community Clinics/San Diego County Community Health Centers	Council: provide information and coordination point for community health centers; Community Health Centers: carry out ESF 8 activities	Council/Health Centers-functioned as anticipated with Council providing additional support to those health centers whose plans were not fully established
San Diego County Office of Education/ School Systems	Formal role not part of overall response plan	Office of Education brought together a collaborative group of local school systems and colleges to function as a coordinating point for public schools and colleges
US. Navy, Navy Medicine Region West	Carry out ESF 8 activities; function as liaison with San Diego Public Health Services	Functioned as anticipated; provided laboratory services for surge specimens

the response; (2) each sector's specific operational challenges; and (3) approaches used to address challenges. **Table 1** summarizes the differences between the anticipated role of key community partners in a major community emergency incident and the roles they actually played in the H1N1 outbreak response.

Public health services. During the 2009 H1N1 outbreak response, PHS assumed two new and different roles: (1) the incident command post in which it directly responded to the H1N1 outbreak, and (2) the lead agency coordinating all other agencies involved. The initial period surrounding the outbreak was particularly challenging due to uncertainty regarding the severity and spread of H1N1, as well as the unknown nature of the exact agent causing the illness.

Response structure. Despite uncertainty about specifics and scope of the outbreak, PHS quickly activated an EOC and enacted ICS at the highest level with all positions filled. Initially, it faced challenges managing both the broader ICS coordination role and continuing epidemiological surveillance responsibilities that were critical to outbreak response actions. These challenges were reflected in difficulty implementing the planning function and the prescribed ICS activities related to planning. As the H1N1 response evolved, this function and the overall PHS incident management role became more structured and well-developed.

"We went into ICS mode pretty early on. We established a structure, but … until we actually surged up big, big time, we were not able to manage the ICS structure because the people that were in the roles actually were also doing the work."

The early days of the outbreak were heavily operational and focused on immediate concerns, with limited time and available staff resources to take a more strategic and long-range view.

"In the midst of the pandemic … there was not adequate time to do the planning and the prioritization that was needed for the next hour or the next day."

The PHS Community Epidemiology Branch became an EOC-like hub, with outbreak control as its initial response focus; its branch chief functioned as the incident commander. As response activities moved beyond the epidemiologic focus, the PHS EMS branch opened the Medical Operations Center (MOC), to handle resource management and distribution, interaction with the healthcare sector, and support of the Epidemiology-run EOC. Division leadership provided policy direction for EOC and MOC activities. This differed from the existing plan in which the County EOC activates and the MOC located in a separate facility provides medical resources for the EOC and serves as the coordination point for PHS.

Situational awareness. A primary incident management objective is situational awareness to shape both initial and on-going decisions and actions. H1N1 was marked by several inter-related issues that complicated situational awareness: (1) incomplete information related to the nature of the virus; (2) necessity of rapidly identifying and controlling a potentially lethal infectious agent that might result in a pandemic; and (3) a rapidly changing situation regarding spread of the virus in the community, its impact on responding sectors, and actions being taken to address the outbreak. Not only did PHS need situational awareness about conditions within its jurisdiction, but as "ground zero" PHS input was essential to providing the CDC with information to needed to characterize the virus and describe the emerging pandemic. These sometimes competing roles resulted in significant time spent in meetings and conference calls, taxing limited PHS staff resources:

"In the first few days there was a lot of frantic calls, conference calls with CDC and the state designing the epidemiological response to this situation….that took up a lot of resources. …Numerous calls and subject matter experts from the flu branch, immunization branch, respiratory and disease branch, CDC, and the lab and just a lot of continuous [calls]."

The dual function of PHS as on-site commander and incident manager required information acquisition related to H1N1 epidemiology, resource availability and distribution, and the actions of partners and the public. In addition to the sheer volume of information, strategies shifted constantly in both substance and direction, particularly as new guidance emerged from the CDC. WebEOC, the electronic emergency management application

used by PHS, helped to centralize information shared between the PHS, the hospitals and community health centers. PHS was heavily pen and paper reliant for epidemiologic activities during the initial period, but began deploying electronic tools, finding SharePoint particularly useful as a protected shared work space.

Resource acquisition and management. Surge resource needs changed throughout the outbreak response, shifting from personnel to medical supplies. Personnel were the initial resource needed, and the EOC brought in staff from other units to support both the core ICS structure and perform specific field operational tasks.

"We brought in a lot of bodies to help us out. It was hard to know exactly when to bring them in though because, especially in the beginning we almost waited until we were overwhelmed before we brought in help. So we should have done that, I think, a little earlier."

Some non-epidemiology staff used in the surge had minimal knowledge of ICS or their assigned roles that required experienced staff to conduct just-in-time training. While additional personnel were needed to carry out critical functions, the training of surge staff initially drew experienced staff away from other responsibilities.

"I was in charge of notifying, keeping staff up to date of what was going on… And it was really hard because there's so many different types of staff doing so many different types of things… Like just telling our phone intake people, you're going to be swamped with calls, here's how you triage."

A barrier to integrating PHS workers, CDC Epidemic Intelligence Service (EIS) officers, and CA Department of Public Health staff into various roles was the lack of access rights to the secure PHS epidemiology shared drives and information repositories. Moreover, HIPAA requirements limited access to patient information by non-PHS staff. (The Public Health Service Act gives CDC staff authority to assist a state or locality if a Stafford Act declaration is issued; this occurred somewhat later.)

Dealing with the management and distribution of medical supplies and pharmaceuticals was driven by national guidance and decisions. CDC released anti-virals from the Strategic National Stockpile (SNS) counter to plans that states would initiate requests. Large numbers of masks were used resulting in a national scarcity, despite the medical community's disagreement regarding the need for N-95 masks. Many facilities found it impossible to obtain needed N-95 masks even with surge supplies from local caches and SNS. Both prior planning and preparedness activities and the use of ICS and EOC helped PHS manage needed supplies:

"Logistically for the Tamiflu, that worked exactly like how we've trained it. I mean, I was sitting back at my desk going, this is just how we trained it, it worked. You put in your request and they e-mail you back on WebEOC. I remember sitting there thinking, wow, it worked exactly like it was supposed to."

Communication. Risk communications and dealing with media relations is an inherent aspect of disaster response usually guided by a JIC under the direction of the EOC, which in San Diego County is operated by the Office of Emergency Services (OES). OES went to a Level 1 monitoring activation and maintained a liaison with the PHS EOC, but did not open its EOC or consequently the County of San Diego JIC. The overall public information role was assumed by the Office of Media and Public Relations, which functioned as a communications hub during the outbreak. The PHS EOC provided content input and County Office of Communication gave overall direction. The PHS health officer was seen as a strong and credible media spokesperson. Without a JIC, normally available support resources, such as a public call line, and in-place procedures for effective coordination in disseminating information to the public, hospitals and health providers, and other partners were not fully available.

"… the JIC opening … could have taken a lot of pressure off of the phone calls … When the JIC opens … they have a hotline … That's bringing in all your county PIOs … and it's bringing them all together with one message …"

The risk communication mission was complicated by the rapidly changing available information about the extent and severity of the pandemic locally, nationally, and internationally; shifting advice on what to do if exposed and how to treat sick individuals; and a stream of updates related to daily life, such as school closings. While much of this information was being generated through formal routes, the echo chamber of social media and informal personal communication often resulted in misinformation that took on the same validity as formal information in shaping public and provider perceptions and actions. Health providers expressed frustration in getting accurate and timely information, in addition to dealing with the added challenge of a surge in patients.

"…it was a little frustrating for me…We were very busy trying to assess and trying to figure out what the heck was going on. I mean, like on the 28th of April, we had eight different guidances that came down from CDC, OSHA and the state…Trying to determine what was it that impacted us and how was it going to impact us and what do we need to do with it."

Public Health Laboratory. The PHS Public Health Laboratory (PHL) assumed unusual prominence with its role to confirm H1N1 in specimens sent by providers. One of the greatest challenges was the combination of a surge of specimens submitted and the lack of sufficient specialized staff and necessary laboratory resources to analyze the specimens. Issuance of an emergency declaration assisted with funding and procurement issues. However, the availability of this funding did not resolve the lack of licensed, trained staff to conduct testing. Nor, did the emergency declaration waive the myriad of legislative, regulatory, and licensing requirements under which the PHL operated. To provide adequate trained staff, the hours of existing staff were increased to allow them to both train new workers and continue necessary lab work unrelated to the H1N1 outbreak:

"There's like 18,000… med-techs, lab scientists, but there's only 500 microbiologists [in California]. So it's like you don't really have a bunch of people….It's not like nursing could call another nursing home."

The PHL was deluged with calls from hospitals, clinics, and individuals wanting individual H1N1 test results, often with multiple requests from different people for the same result. Explaining the priority for testing specimens from high-risk individuals (e.g., hospitalized people and pregnant women)

caused additional difficulty. In addition to not having enough staff to answer and triage calls and send results, HIPAA further complicated matters by creating a perception of withholding information and further fueled a stressful environment for PHL staff.

"We don't give out results locally and we've had some problems with getting people to understand that because of the privacy rules and all, that we're not giving results out to everything … So, you would get people calling and nagging and being angry that you would not just immediately print out a report and fax to them."

During the response, the PHL functioned somewhat independently from the ICS structure, mostly through an Epidemiology Program liaison. The PHL had not developed a formal surge response plan and had little previous ICS training or exercise participation prior to the H1N1 incident. There was concern that using the unfamiliar ICS structure would add to the significant challenges the PHL was already experiencing.

Hospitals and community health centers. All the issues surrounding situational awareness, resource management and distribution, communications, and laboratory capacity discussed above played out on the front lines in San Diego County's hospitals and community health centers (CHC). The hospitals and CHCs were overwhelmed with calls and visits—their normal patient load, diagnosing and treating H1N1 patients, and addressing the anxieties of the worried-well. This required additional personnel, particularly in the emergency departments and ambulatory clinics, along with necessary protective equipment, medical and laboratory supplies, and anti-virals.

While hospitals were able to bring in additional nursing staff, they experienced unforeseen challenges. For example, many staff were not current on the ever-shifting facility infection control procedures, often resulting from changes generated by CDC guidance. Each issuance of updated guidance by CDC necessitated re-educating health facility staff:

"Let's say you can have nurses that come in that don't know anything, any of the subject matter. You orient them, but the subject matter changed so rapidly and so constantly, there were inconsistencies with the CDC's recommendations."

The hospitals relied on the PHS cache for N-95 masks when their own supplies were exhausted and a national shortage occurred. This necessitated logistics between PHS and the hospitals based on in-place plans. When masks could be obtained, additional tasks ensued since those using the masks had to be fit-tested and trained on mask use. With the mask shortage, nonstandard brands were used, which further contributed to ordering and fitting issues:

"You want to have people fit tested before, and yet there's these barriers that make it really hard to get people fit tested before, so it's kind of this … strange catch-22 kind of situation."

Overall the San Diego hospitals had robust emergency response plans and well-established structures shaped around the hospital incident command system (HICS). The ability of the San Diego hospitals to respond during H1N1 was facilitated by previously established working relationships among themselves and with PHS, a comfort level with HICS and operating in an EOC, and participation in exercises:

"Disaster is local. I don't care how anybody wants to slice and dice it … We learned that a long, long time ago … We had to be able to do it on our own. And we had the assets, we had the infrastructure and we had the relationships in place to be able to do that … You have to recognize your assets in your community."

In contrast, CHCs had only more recently initiated emergency planning and preparedness. This resulted in varying plans and capabilities to manage the H1N1 patient surge. Support from their membership association, the Council of Community Clinics, provided coordination and needed assistance.

Schools. School closing became a looming issue because of the perceived effect of closings on spread of disease, as well as the large portion of the population affected by school closure decisions. To try to maintain attendance while balancing parents' concerns that going to school was exposing their children to a severe illness, some schools began to require a doctor's note for children staying home with an illness. This resulted in both sick and healthy children flooding clinics and hospitals seeking doctors' notes for school absences. The schools quickly organized an informal coalition under the coordination of the county superintendent of schools to address the lack of centralized information and uniform school closure policies. This coalition worked closely with PHS on developing recommendations and consistent messages for public release. The group realized access to localized information was critical.

"As you know, this was a very localized kind of need for information. Some communities didn't even have it … we tried to really stay focused and made attempts to stay focused on the San Diego health department's information rather than the national information going to the state and then coming down to us …"

Lack of engagement of two closely related sectors not part of this coordinated effort, private schools and childcare facilities, was noted as a major gap.

Broad strategies for addressing response challenges. All sectors involved in the response shared challenges in similar areas: organization, situational awareness, resource management and communication. Several common strategies across sectors that proved successful to addressing these challenges in the San Diego County H1N1 outbreak are described below.

Establishment of ICS and EOC. The use of ICS and EOC provided structures through which to organize, carry out response activities and manage resources. The more complex the response engagement, the more essential these structures became. Even less formal coordination structures used by decentralized organizations such the CHCs and schools facilitated actions by individual members. Individuals who were trained and comfortable in ICS and EOC environments found them most helpful; those with less training tended to find ICS and EOC daunting.

Planning and preparation. While the H1N1 outbreak scenario differed from avian flu, anthrax attacks and other previously exercised plans, enough generalizability existed that staff involved in those efforts were able to adapt to the particular environment and requirements of the H1N1 outbreak. Situational awareness and just-in-time training facilitated adaption for personnel who were new to emergency response. Knowledge of ICS provided a common language across organizations for those involved in the response.

Staff, infrastructure investments and relationship development. In the six years prior to the H1N1 outbreak, significant investment was made in public health emergency response staff and infrastructure. Many of these staff and much infrastructure including the EOC, information technology, surveillance systems, laboratory equipment and medical supply caches were used during the outbreak. Established formal and informal relationships were critical in the management of the incident and provision of public health and health services to those affected.

Flexibility and adaptability. While formal planning and preparedness efforts were essential to incident management, aspects of the informal response should be noted. Responding agencies found ways to adapt in order to provide necessary services. Whereas the formal planning and training created a sense of ability and provided a framework, the established collegial public health environment fostered a sense of creativity and dedication in times of urgency that facilitated response actions:

"Some clinics … didn't have any formal plans [and] created their own surge, they set stuff up out in the parking lot with some tables and some makeshift umbrellas and ran people through … but you know people see a need and they just step up and they make it happen."

Discussion

The primary objectives of this study were to explore the use of ICS and EOC in the 2009 H1N1 influenza outbreak in San Diego County and understand how ICS and EOC affected the response. Our analysis focused on the gaps between planning and preparation and the actual response, including the impact of the gaps, the ways these gaps were overcome during response, and issues related to functioning as the lead response agency. Undertaking this analysis was supported by purposive critical case methodology. As noted by Keen and Packwood, this methodology is "valuable where broad, complex questions have to be addressed in complex circumstances," and is flexible enough to provide "a way of thinking about complex situations which takes the conditions into account, but is nevertheless rigorous."[9]

Public health, unlike traditional response agencies, does not engage in emergency response on a routine basis.[10] Rather, it intensifies by several factors its day-to-day activities and restructures in an ICS framework to "surge up" and meet crisis demands. Several broad elements emerged as key to ensuring effective and efficient public health response in the role of a lead agency during a major outbreak response: (1) developing a plan for emergency response, as well as a pandemic influenza plan; (2) establishing the framework for an ICS; (3) creating the infrastructure to support response including an EOC, electronic information systems for epidemiologic activities, laboratory capacity, and materiel caches; (4) supporting an adequate workforce trained on emergency response roles, responsibilities and equipment; and (5) conducting regular preparedness exercises, including involvement of potential response partners to further relationships among responding community sectors. These elements are expressed in the National Response Framework Preparedness Cycle (see **Fig. 1**).

The primary differences between the plan and the actual response arose in three areas: PHS functioning as the lead agency, the nature of the H1N1 outbreak with the first US cases in San Diego and neighboring Imperial County and external decisions and actions that drove the local response. While improvisation is an inherent part of emergency response, pre-incident planning can help enable ICS and EOC structures adapt to non-routine tasks.[11]

Recommendations

Based on the case study, after action reports, and other study resources, recommendations for actions that can be undertaken pre-incident and during an incident to improve public health's use of ICS and EOC are identified below. Pre-incident actions focus on readiness (e.g., having surge capacity in terms of the workforce's ability to mobilize and function effectively). Incident response-related recommendations center on strengthening operational capability when the organization is stressed.

Pre-incident preparedness

Exercises: Epidemiology and laboratory. The SNS has been a major focus of public health exercises due to federal grant requirements.[12] Exercises that specifically challenge and test epidemiologic and laboratory capacity, particularly handling large numbers of case reports and investigations and laboratory throughput, are isolated and conducted infrequently. For public health to realize full capacity for epidemiological surveillance and investigation, it is critical to conduct tabletop, functional, and full-scale exercises that test epidemiology and the laboratory's ability to work with relevant partners.

Workforce capacity and capability. Emergency planning and response does not engage the majority of the public health workforce.[13] The role and responsibility of the overall public health workforce in the context of a response remains to be addressed, along with resource typing and the establishment and maintenance of a database so staff can be alerted and deployed as

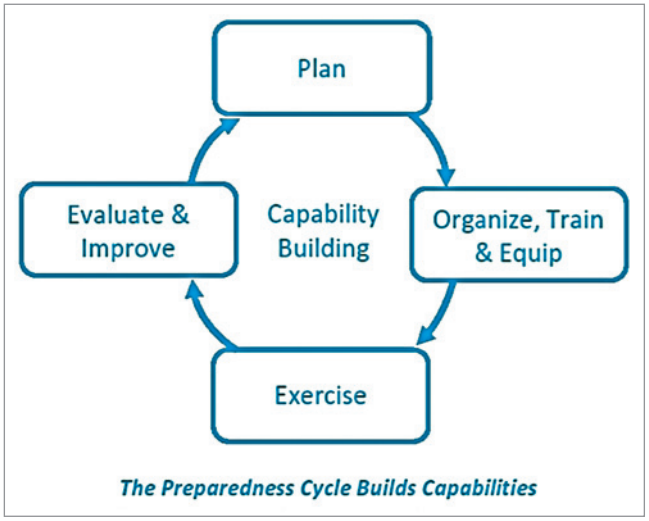

Figure 1. National Response Framework Preparedness Cycle.

needed. Database applications (such as the Emergency System for Advance Registration of Volunteer Health Professionals) have been developed and could be modified to meet the need to maintain a registry that facilitates typing of and alerting the public health workforce. Concomitant with establishment of a registry is implementation of a comprehensive training plan to ensure the workforce possesses core response knowledge and skills and necessary specialized capabilities to fulfill identified ICS and resource typing roles. Thus, the importance of a training focus on key competencies: knowledge, skills and abilities needed to respond effectively in real-world emergency situations[14]—and how to work together during such situations using the ICS and EOC framework gains additional import.

Incident command vs. incident management. Distinguishing the role differences between incident command and incident management is essential. In small-scale incidents these roles are often merged, but separate structures are required as an incident grows in size and complexity. Until the H1N1 outbreak, public health emergency preparedness planning and response had generally been based on playing a support role in large, complex incidents. Experience gained during the major 2003 and 2007 wildfires and 2008 measles outbreak helped the PHS gain the confidence and flexibility to respond to the H1N1 outbreak. However, H1N1 put PHS in the lead agency role and a national spotlight being "ground zero" without the broad experience, necessary resources, or overall support to assume responsibilities of this magnitude. The PHS rose to this challenge, as did other local public health agencies as H1N1 spread across the US

Looking forward, however, public health agencies need to develop plans and exercise scenarios in which they function as the lead agency. The jurisdictional emergency management agency needs to be engaged in and support such planning and exercise activities. Further, established trigger points with identified actions should be determined to facilitate the transition from incident command to incident management. Designation of staff roles and responsibilities in each of these capacities is essential, as is a clear delineation of a command post to support incident command and an EOC for incident management. Clarity related to the ICS planning section function can support this delineation.

Incident-response actions

Incident management team support. Given the limited public health agency staffing to support the ICS structure in a complex incident in which it is also functioning as the lead agency, augmented support for public health may be vital. At the national level, FEMA may provide an incident management team for an area experiencing an overwhelming incident. In a similar manner, the local jurisdiction emergency management agency may be able to provide support for the incident management functions for the public health agency.

Information management. Internal information management to establish situational awareness and support decision-making is paramount. This activity needs to be managed within the ICS structure with information flowing vertically and horizontally as appropriate. Designated people in each ICS unit should serve as the access, interpretation, and dissemination points within the unit. This will help ensure that staff resources are efficiently used and information is effectively directed to support decisions.

Joint information center (JIC). In a large-scale, complex incident, a JIC is critical to public information and directing public actions that can impact the outcome of the response. JIC establishment ensures that adequate staff and other resources are available, risk communication plans are activated, and all communication channels are functional. Moving from an agency-focused public information and risk management posture to a public risk communication strategy is essential to support response actions.

Limitations and strengths. The qualitative methods used in this study adhered to rigorous protocols for data collection, analyses, and interpretation. These case study interviews demonstrated the valued added of qualitative methods for preparedness research because the insights provided valuable social science evidence to the critical case, "if could happen here, it could happen anywhere."[15] This evidence included: historical recall, recommendations for logistical improvements and suggestions for policy change. Although this case study only occurred in one location and focused on one event, the recommendations from this study can lead to broader generalizations regarding policies and procedures on larger geographic scales or could form the bases of other research efforts.

Conclusions

Overall, this research demonstrates the value of investments made and that effective emergency preparedness requires sustained efforts to maintain personnel and material resources. By having this infrastructure and experience, PHS had the capability to "surge-up," to ramp up its day-to-day operations by several factors in a systematic and prolonged manner. None of these critical actions are possible without sustained funding for the public health infrastructure. This engagement requires on-going funding for specific public health preparedness infrastructure as this case study has demonstrated the importance of public health's role in emergency response.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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