

Preparing the Health System to Respond to Ebola Virus Disease in New York City, 2014

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ABSTRACT

The world's largest outbreak of Ebola virus disease began in West Africa in 2014. Although few cases were identified in the United States, the possibility of imported cases led US public health systems and health care facilities to focus on preparing the health care system to quickly and safely identify and respond to emerging infectious diseases. In New York City, early, coordinated planning among city and state agencies and the health care delivery system led to a successful response to a single case diagnosed in a returned health care worker. In this article we describe public health and health care system preparedness efforts in New York City to respond to Ebola and conclude that coordinated public health emergency response relies on joint planning and sustained resources for public health emergency response, epidemiology and laboratory capacity, and health care emergency management. (*Disaster Med Public Health Preparedness*. 2016;page 1 of 5).

Key Words: infectious disease medicine, health services, health policy, disaster planning, emergency preparedness

On the morning of October 23, 2014, the New York City (NYC) Department of Health and Mental Hygiene (DOHMH) spoke with a 33-year-old man who reported the sudden onset of low-grade fever and loose stool 9 days after departing Guinea, where he had been working as a physician in an Ebola treatment unit. Within 8 hours, the patient had been transferred from his home to NYC Health + Hospitals/Bellevue, placed in a specially equipped Ebola treatment unit at the hospital, and confirmed to have Ebola virus infection. Moreover, his close physical contacts in the community had been identified, evaluated, and placed under health monitoring. Within 6 weeks, the patient had fully recovered, and both his personal and health care worker contacts were deemed at no risk of Ebola. While the circumstances were fortuitous—a physician speaking from his home directly with DOHMH at the first onset of fever—the outcome was foretold by months of careful planning and collaboration between many components of the NYC health system. To help other jurisdictions enhance their ability to respond to Ebola and other emerging infectious diseases, we describe here how we prepared the NYC health system.

PREPARING FIRST RESPONDERS TO TRANSPORT PATIENTS SUSPECTED OF HAVING EBOLA

To provide emergency response, prehospital care and transport of any patient with suspected Ebola, the Fire

Department of the City of New York (FDNY) Emergency Medical Services (EMS) developed and implemented a plan that built upon existing disaster preparedness plans for chemical, biological, or nuclear (CBN) exposures. Planning began in August 2014, then accelerated in October 2014 after the first case of Ebola was diagnosed in the United States. FDNY determined at the outset that it would rely on Haz-Tac units, which had developed expertise caring for patients while wearing personal protective equipment (PPE) during CBN training and responses. Because poor visibility, extreme weather, and other environmental conditions can make doffing PPE in the field extremely difficult, FDNY also decided that, for all possible Ebola cases, doffing would be performed by a specially trained 2 person “valet” Haz-Mat team under field supervision. At the same time, FDNY began developing surge capacity by outfitting and training all FDNY EMS personnel and developing plans to do the same for firefighter certified first responders in case patient volume increased. From December 2014 through February 2015, a total of 3090 EMS personnel had been sized and trained in PPE, including donning and doffing practice drills.

To identify which responses required a specially trained unit, FDNY also modified its “911” medical triage/dispatch system. Beginning October 4, 2014, for every 911 medical call identified as a patient reporting a fever, a triage question was added to ascertain

if there was recent travel to Ebola-affected countries. If so, the call type was designated “fever/travel” (F/T), and FDNY dispatched a specially trained Haz-Tac unit rather than the nearest available EMS or certified first responder unit. The Haz-Tac response for F/T call types was fully implemented systemwide on October 14. FDNY was able to rapidly implement this system, because its call dispatchers had already been trained on a similar protocol to alert first responders to possible smallpox, measles, SARS, and H1N1 cases using “fever/rash” (F/R) and “fever/cough” (F/C) call types and because Haz-Tac units were already trained and available. In a city that averages nearly 4000 emergency medical 911 calls per day, the total number of F/T call types assigned in the 5 months from October 2014 through February 2015 was 42, with most occurring during the first month when there was a learning curve for dispatchers as to which countries were actually located in West Africa.

Because phone triage assignments may not always be accurate, all 911 system first responders were also instructed to ask patients about recent travel to West Africa. Responders asked this upon arriving for any medical call— before touching the patient and, to the extent possible, while standing 3 feet away. If symptoms were suggestive of Ebola and a positive travel history was obtained, EMS dispatch was notified, the call type reclassified as F/T, and EMS Haz-Tac units dispatched. If the patient was stable, patient care awaited the arrival of these units. If the patient was unstable, patient care was initiated and transferred to the specialized unit upon arrival. FDNY physicians were available 24/7 for consultation.

Practicing the handoff from EMS staff to hospital emergency department (ED) staff also proved important. Because NYC has 71 911-receiving EDs, there was the potential for large variability in how ED staff were trained in the use of PPE and other aspects of patient handling. A coalition of responsible agencies, including the DOHMH, the New York State Department of Health, NYC Health + Hospitals, the Greater NY Hospital Association, and FDNY instituted a multi-step process to verify that a hospital ED could safely receive a patient suspected of having Ebola from a FDNY Haz-Tac unit. While unstable patients would be transported to the nearest 911-receiving ED, all others would be brought to receiving facilities that had been approved by New York State and City health departments and FDNY to manage Ebola cases. Through nearly 20 tabletop and 5 full-scale exercises, most performed between October 2014 and February 2015, FDNY verified that a patient handoff location and doffing/decontamination location was available at these receiving facilities that would be safe for personnel, ensure optimal care of the patient, and not compromise care of other hospital patients. These drills proved useful not only for Ebola preparedness but also for fostering an all-hazards approach for future emergencies, not just biological but also chemical, radiologic, and nuclear. In all such emergencies, proper use of

PPE and decontamination protocols are essential for a health care system to operate safely and effectively.

PREPARING PROVIDERS AND FACILITIES TO IDENTIFY EBOLA VIRUS INFECTION

The NYC health care system is large and complex, with 55 acute care hospitals, 7 health care networks, 173 nursing homes, 77 adult care facilities, hundreds of primary care clinics, and numerous other settings where health care is delivered. Recognizing that a person ill with Ebola was most likely to present to a hospital ED, the efforts of the DOHMH to prepare the health care delivery system focused initially on educating health care providers about how to identify persons at risk, rapidly isolate those identified, and immediately contact the health department on-call medical epidemiologists for case review. Using its “Health Alert Network,” the DOHMH sent this guidance to 39,000 e-mail addresses, most of which are for medical providers, on August 11, 2014.¹ A subsequent Health Alert, released September 3, 2014, contained an algorithm providers could use to evaluate possible cases.² Guidance was updated several times.³⁻⁶ The DOHMH also issued guidance for specific health care settings, including ambulatory care sites and hospital EDs, through hospital emergency preparedness coordinators, ED directors, infection prevention and control professionals, laboratories, and health care coalitions.⁷ This guidance was discussed on regular conference calls starting in mid-August that were hosted by DOHMH and featured subject matter experts to answer questions about the ongoing situation in West Africa and evolving recommendations for NYC providers. Specific outreach to clinical laboratories through conference calls and contact with professional societies helped to identify preparedness gaps for handling of patient specimens in hospital laboratories and informed the development of guidance for clinical laboratories.⁷ Additional information for providers was progressively added to the DOHMH’s website, including a map of the impacted areas that proved particularly useful given that many providers seemed unaware of the names and locations of the Ebola-affected countries.⁸ The DOHMH also conducted specific outreach to aid organizations involved in the West Africa response to ensure that there were plans for identifying and reporting illness in returned workers. DOHMH physicians delivered lectures summarizing the epidemiology of the West Africa outbreak and providing recommendations for NYC providers on how to safely recognize, evaluate, and report suspect cases at venues throughout the city, including the Greater NY Hospital Association, local meetings of the infectious disease and infection control societies, and grand rounds at local medical centers.

PREPARING NYC HEALTH + HOSPITALS FOR MANAGING SCREENING AND TREATMENT OF EBOLA VIRUS DISEASE

NYC’s municipal health care system, NYC Health + Hospitals, began a comprehensive, emergency management-centered approach to managing Ebola across its 11 acute care

hospitals, 5 long-term care facilities, and 6 diagnostic and treatment centers in April 2014. The initial focus was on identifying and rapidly isolating possible Ebola virus disease patients on arrival at NYC Health + Hospitals' 11 EDs. By July 2014, protocols were developed for patient screening, and NYC Health + Hospitals made the decision that treating a confirmed or high-risk patient would be centralized at one hospital to minimize clinical and logistical challenges and to reduce risks to health care workers. Beginning in July 2014, an existing isolation facility at NYC Health + Hospitals/Bellevue was modified to allow for care of up to 2 patients in isolation, a point of care laboratory, and all necessary logistic, staff, and communication needs. Discussions with public health agencies and 2 of the country's national biocontainment units, Emory University Hospital and the University of Nebraska Medical Center, yielded important suggestions for the development of NYC Health + Hospitals/Bellevue's biocontainment unit.

By August 2014, training had commenced and NYC Health + Hospitals continued its central coordination and standardization of all protocols, PPE, waste management, communication tools, and training programs through the existing emergency management structure, supported by a standing team of senior staff overseeing clinical care, workforce, simulation and training, supply chain, communications, and operations. In September, NYC Health + Hospitals emergency management leaders began conducting Homeland Security Exercise and Evaluation Program-compliant tabletop exercises at the hospitals. By the end of October 2014, NYC Health + Hospitals' Institute for Simulation and Advanced Learning had conducted 25 no-notice drills with "simulated patients" presenting to the system's 11 EDs to test preparedness, with a focus on time from arrival to isolation and timely consultation with the DOHMH. Many valuable lessons were learned in this process, especially when accompanied by a formal, structured debriefing including senior hospital and system staff. Preparation of ambulatory clinics to identify at-risk patients relied on the lessons learned from preparing EDs.

Prompted by a New York State Health Commissioner order mandating minimum standards for Ebola preparedness in all health facilities on October 16, 2014,⁹ NYC Health + Hospitals engaged the services of an outside vendor to augment PPE training. Doing so provided a dedicated training team around the clock at NYC Health + Hospitals/Bellevue and rotating teams across the system's other 10 acute care hospitals. Through October 2014, "town hall" events indicated increasing anxiety among system staff regarding Ebola. Focused, expert PPE training helped to reduce this anxiety, ensuring that people came to work and followed protocols appropriately. To protect less experienced health care workers, NYC Health + Hospitals made the decision to limit the provision of care to highly skilled physicians, excluding students and other trainees, working closely with dedicated nursing staff during an inpatient stay.

PREPARING THE HEALTH DEPARTMENT TO INVESTIGATE AND CONFIRM EBOLA VIRUS INFECTIONS

From August to October 24, the DOHMH received 177 Ebola-related calls to its Provider Access Line from health care providers.¹⁰ The Provider Access Line is available 24 hours a day for clinicians to report immediately notifiable conditions and consult with medical epidemiologists. Of the 177 Ebola-related calls received before October 24, 157 were excluded from further evaluation, because persons did not have a travel history or illness consistent with Ebola. The remaining 20 were evaluated and subsequently found to have malaria (8 patients), an alternative severe illness (9 patients), or an undiagnosed mild illness that resolved (2 patients). Including the 1 confirmed case of Ebola, 2 patients were tested during this period. To manage these calls effectively, the DOHMH developed guidance documents and algorithms to train DOHMH physicians on how to assess the likelihood that a patient has Ebola and how to manage a patient suspected of having Ebola, including transport, testing, contact tracing, and infection control. The DOHMH added a physician specially trained in managing suspect Ebola cases to its preexisting physician on-call system to manage inquiries from clinicians on nights, weekends, and holidays.

DOHMH's Public Health Laboratory began working on August 7, 2014, through the Laboratory Response Network of the Centers for Disease Control and Prevention (CDC) to make testing for Ebola virus available in NYC. Until then, the only 2 laboratories available in the United States approved to test for the virus were at the US Army's Research Institute for Infectious Diseases and the CDC. On August 29, 2014, the Department's laboratory was officially approved by the CDC to conduct testing. Because specimens from a person with Ebola are considered highly infectious and pathogenic, federal regulations require that they be handled specially. The Department trained NYC Health + Hospitals/Bellevue staff how to safely handle a blood specimen from an Ebola patient, and both staff worked together on how to package a specimen for transport from the hospital to the Public Health Laboratory, which conveniently was across the street.

The DOHMH developed detailed procedures and data collection tools for investigating cases, and tracing and monitoring contacts of a confirmed Ebola case, and then further refined these after an Ebola case was identified in Dallas, Texas, and resulted in transmission of Ebola virus to 2 nurses.¹¹ The DOHMH extensively debated when to restrict the movement of exposed but non-ill persons. Before detailed guidance from state and federal governments was issued regarding movement and monitoring of high-risk persons, DOHMH had already consulted with ethicists to develop an interim policy on when a contact should be considered for quarantine and, even more important, the services that should be offered to ensure humane treatment during that period. Careful preparation of these services led to

close monitoring and services regarding physical health, mental health, and life needs for the 3 persons initially quarantined because of their contact with the first confirmed Ebola case in NYC. Monitoring for Ebola among health care workers involved in the care of the NYC patient proved particularly challenging.¹² On the basis of the experience gained during the management of the initial case, the DOHMH subsequently developed detailed facility-specific protocols for 4 Ebola treatment hospitals in NYC for health care worker monitoring, and provided on-site visits to ensure coordinated planning for health care worker monitoring programs in the event of another Ebola case.

DISCUSSION

The successful management of Ebola virus disease in NYC occurred because of several important features that could be applied to other public health emergencies. At the first recognition of a threat, close collaboration is beneficial between the local public health agency, leaders of the health care delivery system, the emergency management community, and first responder agencies. Such immediate and close collaboration is more likely to occur when there are both preexisting personal relationships between key leaders in those agencies and organizations, and preexisting formal institutional relationships. The DOHMH and NYC Health + Hospitals already had a long-standing financial agreement in which DOHMH used federal grant funds, such as CDC's Public Health Emergency Preparedness and the Assistant Secretary for Preparedness and Response's Hospital Preparedness Program grants, to support DOHMH emergency response personnel, training, and exercises with health care facilities, and isolation of persons with infectious diseases at NYC Health + Hospitals sites. The DOHMH, NYC Health + Hospitals, and FDNY/EMS personnel had previously worked closely together and with the health care delivery system at both the technical staff and leadership levels on other infectious disease emergencies, including H1N1, SARS, smallpox, and MERS.

Public health leaders benefit from looking immediately to outside experts and consulting, as a group, to learn from their experiences. Conference calls and e-mails with the staff at Emory University Hospital who were involved with transporting and treating the first US health care workers with Ebola played a critical role in making NYC agencies aware of the range of issues to be addressed and potential solutions. Similarly, early involvement of the local health care delivery system leadership in discussions and decision-making around development of novel health care system capabilities is essential to ensuring that the right services are available and ready when and where they are needed. Moreover, the occurrence of secondary infections in Dallas led city agencies involved in the response to reassess protocols and fill in gaps, particularly regarding health care worker contact tracing and PPE use. Repeated practice through the core emergency

management tenets of training, drills, simulations, and exercises allowed decision-makers to refine protocols and ensured that health care workers developed both proficiency and confidence in their abilities. We found that health care worker confidence was particularly important given the high risk perception and resulting fear associated with Ebola. For FDNY and for workers on NYC Health + Hospitals/Bellevue's isolation unit, confidence was developed and maintained through regular practice of specific new skills (such as donning and doffing complex PPE ensembles) and of otherwise routine patient handoffs and procedural skills in an unusual setting with additional challenges for patient care. NYC Health + Hospitals' experience demonstrated that a large, public, urban US health care delivery system, in collaboration with its external partners, could safely and effectively treat an Ebola patient and manage the evaluation of possible Ebola cases directly from its community. The experience was a paradox: managing a low patient count, coupled with high resource demand, low resource capacity, and high risk perception illustrated the value of taking a coordinated, comprehensive emergency management approach.

The public health laboratory proved to be a critical resource. Although large-volume clinical and academic centers are available to perform clinical laboratory testing, public health laboratories remain vital community resources. Public health laboratories are able to perform tests that are important for public health decision-making but are not necessarily patient care and can test pathogens that are both rare and potentially lethal. The support of this specialized testing requires sophisticated instruments, highly trained technical staff, and essential infrastructure. During the emergence of HIV, West Nile virus, SARS, pandemic H1N1 influenza, MERS, and now Ebola, public health laboratories have been the first to adopt these tests, make them available to clinicians, and provide training and support for their eventual adoption by clinical laboratories.

The successful response described here should not be seen as evidence that NYC's system cannot be improved. The response depended on factors that might not be easily replicated: the case occurred in a knowledgeable, cooperative patient; the first imported case in the United States occurred a few weeks earlier, giving NYC additional time to plan, train staff, and implement protocols; and the number of contacts was small. The response could have been more challenging or even exposed gaps in preparedness had the presenting case been more complex or the number of confirmed cases been much greater. Indeed, numerous other suspected cases have been identified and evaluated in NYC, and, though none were confirmed to have Ebola virus disease, each of these events offered opportunities for learning, identifying gaps, and improving response. As concern about Ebola virus disease waned with the end of the West Africa outbreak in 2015, NYC's public health and medical response partners have sought ways to sustain the capabilities developed during the

intense initial period of planning and response. We are working with our partners to extend planning for a network of special pathogens treatment hospitals within NYC and the region; have continued unannounced drills to test screening and isolation protocols, utilizing non-Ebola infectious disease scenarios; and continue to partner with the health care delivery system to advance preparedness capabilities for all hazards. By continuing and extending these activities, we are working to maintain the relationships, skills, and day-to-day practices that will be critical for responding to the next public health threat, regardless whether it is chemical, biologic, radiologic, nuclear, or other.

The successful management of the first Ebola case in NYC also depended on a large amount of work outside of the health care system, including community outreach, public education through mass media, and collaboration with elected officials and other government agencies to prevent a secondary epidemic of panic. Nevertheless, challenges emerged that we were not prepared for. Making policy and incorporating these policies into practice in NYC was complicated, because guidelines from the state and federal level were either initially unavailable or changed midresponse, including those related to PPE and the monitoring and movement restrictions of health care workers caring for Ebola patients both in the United States and in West Africa. Perhaps most important, decisions about health and safety were inevitably influenced by public discourse suggesting zero risk as the only acceptable target. In that environment, to ensure that the health sector's policies and practices reflect what is known rather than what is feared, local jurisdictions can benefit from coordinated efforts across public health, government agencies, and the health care delivery system well before an incident occurs, and from maintaining effective capacity for public health emergency preparedness, infectious disease epidemiology and laboratory capacity, and health care emergency management.

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Disclaimer

The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention or the Agency for Toxic Substances and Disease Registry.

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