

Review of Emerging Infectious Disease Preparedness Measures for the State of Delaware

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Abstract

Emerging infectious diseases (EIDs) are a growing global concern as more of these pathogens or their associated illnesses are identified, and human migration continues to increase. The state of Delaware has an intricate system to monitor, prepare for, and take action against these diseases. To effectively prepare for an outbreak of an infectious disease, there is a high level of inter- and intra-organizational communication, evolutions from previous situations, and cooperation with the public. EID preparedness plans are constantly changing to adapt to the situations at hand, making collaboration with all stakeholders crucial for a sufficient outbreak response.

Background

An emerging infectious disease (EID) is characterized as rapidly increasing incidences of an infectious disease over two decades, or those having the potential to proliferate exponentially in populations in the near future.¹ These diseases include new infections resulting from changes of existing pathogens, known infections spreading to new regions, newly recognized infections in areas undergoing ecologic transformation, and old infections re-emerging as a result of antimicrobial resistance or a lapse in public health measures. Each year, more diseases are added to the growing list of what are considered emerging or reemerging infectious diseases with the potential to cause epidemics or pandemics. In 2007, the World Health Organization reported that over 40 diseases had been newly identified since the 1970s, including Human Immunodeficiency Virus (HIV) and Severe Acute Respiratory Syndrome (SARS).² These diseases set an unprecedented rate of discovery at one more disease per year. This list of EIDs has also expanded to include diseases that have developed antibiotic resistance over time, such as *Streptococcus pneumoniae* and *Mycobacterium tuberculosis*. Many of these diseases are sensationalized through global media, especially in cases such as Ebola Hemorrhagic Fever, Middle East Respiratory Syndrome Coronavirus (MERS-CoV), and measles, while others, like health care-acquired infections spurred by antibiotic resistance, gain less attention. EIDs can be challenging to control as international travel continues to increase and populations interact. While humans have lived with emerging and re-emerging pathogens for centuries, in recent decades, EID incidences have increased exponentially. This is likely due to a number of factors, including changes in human demographics and behavior, international travel and commerce, climate and weather; a breakdown of public health measures; and poverty and social inequality, in addition to other complex global components.³

EIDs place a significant burden on global economies, public health resources, and health care facilities. Worldwide, infectious diseases are the cause of 25 percent of overall annual deaths.⁴ Even with the availability of safe and cost-effective vaccinations, vaccine preventable diseases (VPDs) such as mumps and measles are becoming more prevalent in the United States after being curtailed for decades.⁵ Complications from infectious diseases can also lead to chronic

disability or have psychological impacts. With the number of EID cases rising, the potential for an outbreak is also increasing. Fortunately, the health care community and the general public can prepare for potential outbreaks through strong collaborative efforts and prevention education.

Important prevention and preparedness measures begin with the individual. The general public should know how to access up-to-date and accurate information about EIDs. Knowing the signs and symptoms of a disease that is currently affecting or threatening to expand into one's region can lead to prompt recognition, treatment, and prevention of further transmission. Prevention tactics are good hand hygiene, social distancing, quarantine, and vaccination. Individuals should also keep a supply of food, medicine, and other basic needs stocked at their home in case they are quarantined due to an EID outbreak. These personal efforts can maintain a healthy community during the course of an escalating public health situation.

The Delaware Department of Health and Social Services, Division of Public Health (DPH) ensures EID preparedness through two data collection systems and/or provider reporting: the Delaware Electronic Surveillance System (DERSS) and the Electronic Surveillance System for the Early Notification of Community-Based Epidemics (ESSENCE). ESSENCE is licensed to Delaware and other states by Johns Hopkins University. DERSS receives case information and laboratory reporting for communicable diseases. Notifiable disease reporting requirements are guided by the Centers for Disease Control and Prevention (CDC) and Council for State and Territorial Epidemiologists, and health care providers must comply.^{6,7} EID preparedness is further maintained through syndromic surveillance, which relies on the reporting of health indicators, or *syndromes*, such as fever, rash, exposure, or injury, prior to a confirmed diagnosis.⁸ This epidemiological tool evolved in the early 2000s to respond to and mitigate potential agents of bioterrorism.⁹ Since then, syndromic surveillance expanded to an all-hazards approach, given the availability of data from electronic health records.¹⁰ While much of the data is not as specific as NNDSS reporting, it is timely and sensitive.

The 2014 Ebola outbreak in Africa led to Delaware's adoption of the One Health concept, a strategy recognizing that the health and well-being of the human population, animals, and the environment are directly connected and call for expanding interdisciplinary collaborations and communications. The One Health approach gathers critical stakeholders and decision makers to forge programs and policies to prevent unintended consequences of decisions made in isolation. Enhancing communications leads to greater coordination of disease surveillance and prevention activities, which enhances public health efficacy, expands scientific knowledge, and improves medical education and clinical care. Collaborative efforts across the professions can have a profound impact on the speed of decision-making and improved overall communications and care for the patient.

The One Health approach in Delaware has also been used to address other public health concerns such as food safety, antibiotic resistance, and zoonotic diseases through its multi-sectorial, multi-disciplinary standpoint. Disease surveillance activities performed across multiple disciplines within human, animal, and environmental health lead to effective detection, response, and mitigation of disease, including EIDs with the threats of cross-species transmission and pandemics. Preventative measures are principal for EID, but it is implausible to assume complete eradication is attainable given current socioeconomic, environmental, and ecological factors. Furthermore, infectious diseases are constantly adapting and evolving in hosts. Vaccines and antimicrobials have revolutionized prevention and control, and led to overall human health protection, but the unpredictability of infectious diseases continuously challenges health care and

public health providers. While the goal of public health prevention is key, effective countermeasures and preparedness are equally crucial and require effective leadership, structure, and resource prioritization.

Methods

If an EID outbreak detected through routine surveillance or provider reporting reaches either statewide or local emergency status, the DPH director will collaborate with the Emergency Medical Services and Preparedness Section (EMSPS) to activate the State Health Operations Center (SHOC) for medical response.¹¹ The intended purpose of SHOC is to yield an organized response with a central management structure. SHOC follows the Incident Command Structure (ICS) and is activated at levels based on the severity of the emergency. ICSs were revised to an all-hazards approach following lessons learned from Hurricane Katrina in 2005 and the 2009 novel influenza A/H1N1 pandemic.¹²

Inter- and Intra-agency coordination is essential for managing responses to EID.¹³ For general public health detection and response to EID, routine surveillance is ongoing through DPH's Office of Preparedness and the Office of Infectious Disease Epidemiology. In the event of an EID outbreak, such as the 2009 H1N1 pandemic, active surveillance immediately replaces passive surveillance, and SHOC is activated for severe instances. When SHOC is activated for an EID, DPH works with additional state and federal stakeholders, including the CDC, the Delaware Emergency Management Agency (DEMA), Delaware Medical Reserve Corps (DMRC), and Delaware Department of Safety and Homeland Security (DSHS) in the same facility for continuous, streamlined operations. Capitalizing on its small geographic size, state-level stakeholders as well as laboratories, hospitals, and long-term care facilities form a collaborative approach to EID preparedness. The readiness of all stakeholders must be frequently tested during exercises.

Detailed preparedness plans within DPH take an all-hazards approach to emergencies; however, EID-specific plans are also in place.¹⁴ The High Consequence Infectious Disease Surveillance and Response Plan (HCID) is used for any EID from an infectious organism or a biological toxin that usually causes an illness of low-incidence and high morbidity and/or mortality rates.¹⁵ Use of this plan would be appropriate for incidences involving the Ebola virus or MERS-CoV. Generalized outbreak response plans are applied to EIDs of low consequence, and a VPD outbreak response plan is critical to address resurgence throughout the U.S. DPH's Mass Fatality Management Plan, Contagious Disease Containment Measures Plan, Pandemic Influenza Plan, and Medication and Medical Supplies Management Plan supportive overall response to an EID, and they are routinely exercised and revised. In Delaware, judicial orders authorize isolation and quarantine measures and public health officials decide the length of isolation and quarantine under Titles 16 and 20 of the Delaware Code.¹⁶

Gathering and disseminating credible information about EIDs and outbreak response actions is a central part of DPH's preparedness planning. During an active outbreak, DPH releases pertinent information to the public so they can take recommended actions for their own health and the health of their community. This information may include facts about the disease, avoidance of transmission, designated locations for treatment, prophylaxis, vaccination; and the disease's impact. Unfortunately, many websites and media channels rely on anecdotal evidence or provide unfounded information, leading to the spread of misinformation that can generate unnecessary fear of certain health care practices, such as vaccination. When searching for credible sources

pertaining to EIDs, it is essential to identify news sources and articles that cite peer-reviewed journals or official government public health organizations. Distinguishing these sources can stop the spread of misinformation and aid the public health response to an emergent outbreak situation.

Results

Two recent examples underline the importance of strong inter-agency collaboration, even in the absence of SHOC/ICS activation. In March 2018, mumps cases spread from a Mexican dance gathering (hereafter known as a *Baile*) in New Castle County, Delaware. A bilingual preparedness epidemiologist overcame an initial language barrier to obtain information from Baile participants and their close contacts. The EMSPS identified DMRC volunteers to meet language-specific needs, and an EMSPS planner position facilitated coordination between the two groups.¹⁷

In May 2019, the Delaware Public Health Laboratory (DPHL) received a presumptive positive test result for MERS-CoV, escalating an EID response involving SHOC. There was a strong suspicion for MERS-CoV, given the patient's symptoms, travel history to the Middle East, and close contact with camels. DPH notified CDC's Emergency Operations Center according to protocol, and DPHL initiated retesting. Within two hours of a presumptive positive result, DPH held a conference call between internal stakeholders, the hospital where the patient was seen, and the CDC. DPHL arranged for the specimen to be shipped to the CDC the following day for confirmatory testing, and the EMSPS was scaled to activate SHOC and implement the HCID plan, should the CDC confirm positivity. Subsequent testing the following day indicated that the initial result was deemed a "false positive."¹⁷

Public health education is a central part of being prepared for any EID situation. Education on intervention methods prepares the public for a communicable disease outbreak by teaching them safety measures that could be employed. Pharmaceutical interventions, such as vaccinations and antimicrobials, prevent transmission and limit the severity of illness; however, not all individuals have access to a health care provider or the finances to acquire medications.¹⁸ Non-pharmaceutical interventions are practicing proper hand hygiene and notifying health care providers of suspected contagious diseases at facilities prior to their arrival so they can take extra precautions. Other non-pharmaceutical measures are self-isolation or quarantine from one's family, cohabitants, and the public. Self-isolation may require telecommuting for work or staying home from social outings until the infectious period has passed.

By swiftly correcting misinformation about EIDs, vaccination, and other intervention methods, DPH avoids difficult resolutions that strain public health resources.

Conclusion

DPH maintains strong surveillance and planning for EID. Gaps between periods of routine surveillance and Emergency Operations activation can make escalation of capabilities difficult since large-scale outbreaks and high consequence infectious disease occur infrequently. Since EIDs will continue to present public health challenges, it is critical for DPH and health care, business, education, and non-profit sectors to exercise continuous preparedness practices for these scenarios.¹⁹ Incomplete plans, inadequate funding, and lack of trained personnel can thwart effective preparedness response. Proper and sustained funding is paramount. Effective EID

surveillance requires ongoing public health funding for personnel and materials, which is at times limited. Federal funding streams have significantly decreased on a national level, since 2001, with a 60 percent per-capita decrease between 2003 and 2016 (American Journal of Public Health, 2017). For DPH to maintain its EID readiness, all stakeholders must prioritize improvements in preparedness capabilities and identify gaps in workforce staffing and development.

Being prepared for an EID outbreak calls for a flexible system that can adapt as a situation evolves or develops as new lessons are learned. DPH's EID and resurgent VPD plans need public support, which can result from education about disease prevention and how to stay safe during an outbreak. With substantial collaboration and dedication to public health, the state can effectively prepare for and manage EID outbreaks.

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