

**Disaster Preparedness for Ebola Virus Disease:
Perspective on National Public Health
Policies and Case Study of North Carolina and UNC Hospital**

By

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ABSTRACT

The outbreak of Ebola virus disease (EVD) in West Africa from 2013 to 2015 illustrates the most recent example of the United States' growing need for domestic preparations for emerging infectious diseases. One case of Ebola presenting in the U.S. exposed weaknesses in federal and state level hospital preparations, employee protections, and screening, prevention, and surveillance protocols. In disaster preparedness federal entities such as the Centers for Disease Control (CDC) and key leaders of health care organizations are expected to strike a balance between disseminating timely information to train and protect workers and patients with appropriate resource utilization; a difficult task especially in the current national health care climate that demands value and cost effectiveness. Around the nation hospitals took various approaches for Ebola preparedness, often in a non-systematic or un-regulated manner. Late in the Ebola outbreak, regional tiered response systems called Ebola Treatment Facilities or Centers (hereafter called ETFs) were introduced as a federal policy for the emergency response.

This study used interviews with key decision makers or stakeholders from the UNC Health Care System (Chapel Hill, NC) and the Public Health Department of North Carolina to identify key themes in system leaders' thinking about Ebola preparation and also about the opportunity to pursue ETF status. Stakeholders emphasized that the experience of preparing for Ebola was expensive but protecting the public and employees was a priority worth the resources it cost. Ultimately, leaders in North Carolina declined ETF status mostly due to lack of federal planning around the designation and lack of funding at the time. ETF designation did not roll out clearly and went relatively untested as the outbreak overseas declined and screening domestically increased.

A triangulation of careful review of the policy documents, interviews with key stakeholders, a survey of health care workers, and a limited systematic review of the literature

permits me to conclude that capitalizing on national and local Ebola preparations will require that future federal disease preparedness policy better define the regionalized approach and strengthen local collaboration; promote ongoing training and adaptable communicable disease plans; and provide more and more consistently distributed funding for public health infrastructure and hospital preparedness programs.

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INTRODUCTION

The outbreak of Ebola virus disease (EVD) in West Africa from 2013 to 2015 illustrates the most recent example of the United States' growing need for domestic preparations for emerging infectious diseases. One case of Ebola presenting in the U.S. exposed weaknesses in federal to state level hospital preparations, employee protections, and issues in screening, prevention, and surveillance (Gostin, Waxman, & Foege, 2014).

As seen in prior infectious disease outbreaks, front line health care workers (HCWs) occupy key roles and take on special risks associated with those duties in response to infectious disease control. Many variables contribute to employees' willingness and readiness to respond to infectious disease outbreaks such as SARS or influenza. Health care and public health workers' perceptions of their ability to recognize and treat disease can be affected by the atmosphere of the employing organization. Well-functioning health care teams are important for managing disease outbreak successfully. Organizations such as hospitals and federal entities such as the Centers for Disease Control (CDC) can do their best to disseminate timely information to train and protect these workers.

Certain stakeholders' decisions in health care organizations influence the deployment of preparedness training to employees, which is then translated into care provided to patients. Major decisions in health care arise out of a complex interplay of social, political, and financial climates. For disease outbreaks such as Ebola, early information may not be peer-reviewed, established as best practice, or evidence-based (Love, Arnesen, Phillips, 2014). Common themes in regional reviews of disaster planning include education, training, and communication within the health care system as well as practice with "operationalized" training, drills, and community emergency responder engagement (Duley, 2005). However, these activities can be

very time intensive and costly. System leaders must choose the appropriate level of resources to devote to preemptive action on specific diseases or other threats.

Ultimately, even when disasters are averted, and preparation for them goes unused or untested, those preparations can still have considerable value. A difficult balance must be struck in disaster preparedness especially in the current national health care climate of demands for value and cost effectiveness. Disaster preparedness lags in moving away from the reactionary response that our \$2.9 trillion health care system still favors and toward a future goal of prevention and preparation readiness (Koenig and Schultz, 2014; McGill, 2014; Reeve, Wizemann, Eckert, Altevogt, 2014). Identifying key themes in stakeholder thought processes as well as probing employee perceptions can inform how reproducible or appropriate these actions might be for future disaster or outbreak scenarios. Recent Ebola preparations are a test of the system, and analysis of that test can be parlayed into improved response and safety for employees and the public the next time we are faced with an emerging infectious disease outbreak. This study provides such an analysis.

Research Aim and Hypotheses

AIM 1: Evaluate the degree to which HCWs consider training and attention to a specific disease to be an effective use of the organization's time and resources.

Hypothesis 1: The organizational communication and emphasis on training HCWs on basic Ebola facts, safety precautions, and hospital plan for suspected Ebola will improve the HCWs' understanding of the disease and their effectiveness and readiness to respond.

AIM 2: Interview stakeholders who made key decisions for UNC Hospitals' organizational plan to respond to Ebola to clarify what influenced the organization's choices in preparing for a potential infectious disease outbreak. Questions to address include:

1. Was there a clear top-down message about preparation strategies from federal to state to the local site?
2. Was this disease treated any differently than were other emerging infectious diseases in the past and, if so, why?
3. How does dwindling funding for public health and disaster preparedness affect the organization's willingness to respond?
4. How much does funding determine the level at which to stop preparations?
5. What benefit does the organization get from engaging in disease specific preparations?
6. Has this preparation had drawbacks for the organization's other priority needs and resource constraints?
7. Can stakeholders identify why ETF designation did not make sense for their organization in North Carolina while it made sense for others?

Hypothesis 2: Key stakeholders at the organizational level will identify certain points of effectiveness and contention in the preparations for Ebola at their site. They will mention differences in federal recommendations and ability to provide assistance in preparing for Ebola. Organizations will likely have taken a proactive but site-specific approach in their preparations because of the high profile nature of the disease. Stakeholders will emphasize weighing the benefits of preparing for Ebola. For example, we predict that stakeholders will emphasize that the experience has likely been expensive for the organization but that protecting the public and employees will be seen as a priority worth the resources it cost.

BACKGROUND

Setting the Local U.S. Stage

On October 27, 2014, Thomas Duncan presented to a Texas hospital in the United States, bringing with him the first in-country diagnosed case of Ebola. His arrival, though a surprise to Dallas Presbyterian Hospital, was not entirely unanticipated, as the United States (mainly from the CDC) had deployed information about Ebola virus disease since the summer of 2014. However, despite dissemination of information, the hospital and the nation were not ready to provide the safest and most effective care to both him and the staff who took care of him. The fallout from Duncan's hospitalization included his death and the infection of two nurses from his care team, as well as consequences to the hospital's reputation and finances.

Misinformation swirled in the national media with contradictory statements about appropriate safety techniques employed by the hospital, the infectious condition of the nurses, and whether one of the nurses could travel in the incubatory stage of her disease. The first nurse infected with Ebola from Duncan's case, Nina Pham, cited improper safety protocols and a breach in her privacy while she cared for Duncan and contracted Ebola. She sued Texas Presbyterian hospital describing her case as "a symbol of corporate neglect - a casualty of a hospital system's failure to prepare for a known impending medical crisis," while officials called her infection "a breach in protocol" rather than explaining problems with the protocols (Emily, 2015). The second infected nurse, Amber Vinson, called the CDC before she took a commercial flight and before she exhibited any fever or signs of disease. She had been cleared to fly but after developing a fever and testing positive for Ebola CDC director Tom Frieden made a statement that she should not have traveled. The CDC later acknowledged that she had done nothing wrong, but not before alarming the public that a plane-load of people could have been exposed because of the nurse's presence in the cabin (CBS, 2014).

RoseAnn DeMoro Executive Director of the National Nursing Union, and Kristin Stevens, a health care emergency management expert, in separate interviews, both felt the hospital and the CDC reacted first to blame the HCWs rather than own up to deficient protocols and training (National Nurses United, 2014; Moskowitz, 2014). The fear ratcheted upward, for both laypeople and HCWs concerned for their safety. The Ebola epidemic demanded that health systems and hospitals plan for how they would deliver safe and effective care.

HCWs on the front lines closely tuned into the Ebola coverage knowing they might encounter a suspect or confirmed case in their daily job. The African outbreak dramatically illustrated the risk of caring for Ebola patients, with more than 50% of infected HCWs (494 of the 853, as of March 25th, 2015) dying from the disease (World Health Organization, 2015). A survey of 1,058 U.S. clinician visitors to the website Medscape in September and October reported 49% of the visitors worried about contracting Ebola at work. A majority of clinicians, 63%, felt their clinical site had prepared to treat a patient presenting with Ebola symptoms. However, 55% felt the nation was not prepared to respond to an outbreak of Ebola. Clinicians felt more confidence about their site preparations than the nation's preparations (Goodman, 2014). From September to October, the Registered Nurses Response Network, part of the National Nurses United union, surveyed nearly 3,000 registered nurses in 1,000 facilities in all 50 states and Washington DC to find 84% said they had not received education about Ebola including how to interact with and question a suspected case, and 76% had not received any communication about their hospital's policy for admitting Ebola patients. Many reported concerns about safety controls such as personal protective equipment (PPE) availability, isolation rooms, and disposal of contaminated items (National Nurses United, 2014). Though major differences exist between the health care systems in Africa and the United States, U.S. HCWs recognized that their safety was not assured against the virus despite working for advanced health care institutions.

Decision Makers' Ability to Promote Safety

A positive safety climate, for both patients and HCWs, helps health systems provide safe care. These themes can then be elaborated upon during more advanced epidemic planning. Gershon et al. established six fundamental dimensions for positive safety climate in the health care system: (1) supportive senior management for safety programs; (2) absence of barriers in the workplace to facilitate safe work practices; (3) cleanliness and orderliness of the work environment; (4) minimal conflict and good communication between staff and team members; (5) supervisors providing frequent safety-related feedback and training; and (6) access to PPE and engineering controls such as appropriate isolation spaces (2000). All in all, achievement in each of these domains showed positive effects on HCWs' rate of exposure incidents and improved HCWs' compliance to blood borne safety protocols (Gershon et al., 2000). These fundamental dimensions are not new or unusual: they are the basic tenets of typical every day hospital operations that create a foundation of safety for patients and HCWs.

As seen with Gershon's safety dimensions, senior hospital officials and health care leaders play important roles in fostering safety for their workers and their patient clientele. The risks and costs of preparation for and treatment of Ebola weighed even heavier than usual safety operations. Capturing local hospital system decision making and then zooming out to the national level proves an interesting exercise in how these systems work together and what types of policies work best to promote preparedness. In the case of Ebola, system leaders had to decide what level of resources to dedicate to training and purchasing of supplies at the institutional level in collaboration with their surrounding public health departments, and judge the risk to the populations in their catchment areas. The tradeoff for a deadly, unique viral disease was between over-preparing which required more money, time, capacity, and staff morale, and underpreparing, thereby risking the safety of patients and employees, as seen in the Dallas Presbyterian case. The costs of both are huge to health care systems and health departments

strapped for resources. Ultimately, the decision point was reframed for hospital and state decision makers by somewhat diffuse federal policy, when the US Department of Health and Human Services (HHS) charged the Centers for Disease Control and Prevention (CDC) with creating an "Ebola Treatment Facilities" designation and invited health systems to seek such a designation. Health system leaders then had to decide either to pursue the next level of emergency response for Ebola, or remain where they were, capable of screening or assessment of Ebola.

Ebola Treatment Facilities: A New Model for Emerging Infectious Disease Care in the U.S.?

In October 2014, the Department of Homeland Security's Customs and Border Protection and the CDC determined that 94% of travelers from Guinea, Sierra Leone, and Liberia would arrive through the five international airports: New York's JFK, Washington-Dulles, Newark, Chicago-O'Hare, and Atlanta, so these locations initiated additional screening measures for Ebola (CDC, 2014). At the outset, this policy appeared to strengthen the riskiest entry points at which travelers from Ebola endemic countries might appear first. On December 2, 2014 the HHS declared 35 hospitals had been designated as Ebola Treatment Facilities (ETFs) to better serve these areas of screening for Ebola (U.S. Department of Health and Human Services, 2014). To date (July 1, 2015) a total of 55 ETF's have been designated, not representing all states, often times overlapping with multiple centers in the same state or city (CDC, 2015b).

Figure 2 about here

How were these ETFs in such quantity and distribution intended to fill the needs of the nation in preparing and caring for the Ebola epidemic? As the epidemic has evolved and slowly declined, is designating specific hospitals as disease specific treatment facilities the best way of

approaching disease outbreaks, and what will this mean for future outbreak planning? As I analyze the policy to determine whether it will be the right guide for future preparation, how facilities received these ETF designations, what motivations spurred the hospitals or various agencies to pursue such notice, and how this entire process compared to infectious disease responses of the past must be asked.

What Sets an ETF Apart

A special assessment team from the CDC began visiting hospitals around the country in the fall of 2014. The team was meant to evaluate and provide recommendations about hospitals' Ebola specific operations and plans (U.S. Dept. HHS, 2014). Voluntariness was central to this process; hospitals and state health officials both had to invite the CDC team and consequently decide whether they would pursue ETF status following the CDC site visit. The CDC did not designate ETFs but merely assessed them: even hospitals who had prepared adequately for Ebola and received positive assessments of their preparations by the CDC, had, in collaboration with state health officials, to deliberate on whether to become an ETF. How these joint decisions played out across different states is not widely reported, since it happened in institutional- and state-level discussions rather than in a systematic national forum. Messages from federal bodies about where these ETFs "should" occur were not public either because there was no such plan or because any plan was intended for a specialized audience of hospital and state decision makers only. For the most part the record contains only press releases when hospitals and states agreed to declare ETF status. Less is published or discussed about why institutions would not want to become ETFs, though a myriad of reasons such as limited resources, uncertainty, risk, and higher priorities are probably at work.

Not having ETF designation does not relieve hospitals from expectations to prepare for Ebola, however. The CDC strongly urged all hospitals to implement plans and policies for

encountering a suspect Ebola case and in January it published an interim guide for a “tiered response” illustrating three tiers. Specialized biocontainment units, Biosafety Level 4 Labs (BSL-4), consist of the most trained, experienced units and are located in Maryland, Emory, Nebraska, and Montana. These have been in existence for more than a decade and are specialized laboratories for defense and military research. Interestingly, the Montana St. Patrick’s biocontainment unit declined to be included as a transfer facility for Ebola patients. Their Care and Isolation Unit (CIU) was contracted with the National Institutes of Health to care for employees who might be exposed to deadly pathogens at the nearby Rocky Mountain Labs. The St. Patrick’s spokeswoman stated “Nothing in the contract indicates that by having a CIU St. Pat’s would serve as a component of a national emergency response network” adding that “we stand ready to take and fully treat a patient from the communities we serve in the event it is deemed appropriate to do so by all parties involved” (Chaney, 2014). The other biocontainment units did appear on the CDC ETF list and did receive transferred patients.

On the CDC’s health care infographic, as seen in Figure 1, ETFs exist at the top of the tier (though implicitly located below biocontainment units) with capabilities to receive, isolate, confirm, and care for a patient with Ebola. Additionally, ETFs must have enough personal protective equipment (PPE) available to provide seven days of full patient care and have staffing models capable of providing dedicated Ebola care for several weeks. The level below an ETF, an Ebola Assessment Hospital, provides the same services as an ETF, however, has only five available days of PPE stocked, and is not expected to provide definitive, intensive care but must be able to provide care in the several days it takes to diagnose or rule out Ebola. The Frontline Healthcare Facility represents the lowest tier; essentially these hospitals are expected to identify, isolate, and notify other facilities of potential cases and manage 12-24 hours of the patient’s care with their PPE stocks (CDC, 2015a).

It should be apparent that Ebola Assessment Hospitals take on significant expectations to provide care, just short of those of ETFs. While the guidelines suggest transfers be in place between tiers, the length of time before transfer can be initiated and which facility will take the transferred patient is not specified and left to local negotiation. “Local” may be relative and the distribution of higher tier facilities, which will be discussed in a later section, means transferred patients may be crossing state lines. No jurisdiction exists to keep hospitals from attempting to “dump” a patient quickly from lower tiers to higher tiers. The stratification of hospitals based on PPE availability is another interesting change in guidance by the CDC: it likely stemmed from hospitals’ budgetary and supply chain issues acquiring gear through the fall. Based on this information, the status of becoming an ETF must be weighed against the extra level of responsibility, responsibility which is not clearly defined or bounded.

ETF Hospitals: Volunteering Nobly or With Favors in Mind

Scrutinizing the distribution of ETF units raises questions beyond those about the HHS initial logic of co-locating these facilities near international travel centers (seen in Figure 2 and listed in Table 1). The 55 ETFs, which include 3 of the 4 biocontainment units, are in 19 states. Sixteen hospitals are located within 50 miles of the five most likely international airports to receive travelers from West Africa. Twenty-nine ETFs are co-located in a city with at least one or more other ETFs. Nine hospitals appear to be specifically pediatric hospitals. Fairly low volume international travel states like West Virginia, Pennsylvania, and Wisconsin have ETFs, and the latter two have multiple sites. Dallas, Texas which suffered the only traveler to present de novo with Ebola to a hospital does not have an ETF; the 2 Texas ETFs are in Houston and Galveston. However, entire regions such as the South below Virginia and East of Texas, rely on just one ETF, in this case, Atlanta, home of both CDC headquarters and the Emory biocontainment unit.

Table 1 about here

At least in publicly available and searchable information, I have found no reports that include an estimated number of cases of Ebola that might be treated in the United States, nor where hot spots for critical areas might be aside from the 5 international airports, nor why establishing numerous hospitals for treating children might be expected. Although we can generate reasonable hypotheses about why particular facilities overall sought and received the designation, no clear rationale appears for why certain states and hospitals would opt in or out of getting this special recognition. The outbreak may have been estimated to be large with significant local transmission within families or immigration of infected youth necessitating hospitals that could specialize in care for critically ill children. Federal funding and prestigious standing seem logical motivations for hospitals and state health officials to pursue ETF status which might be the alternative explanation for the pediatric powerhouses becoming ETFs. However, if those were clear motivators at the outset of ETF designation, the competition between states and regions would probably reflect this, and a more even geographical distribution might be achieved.

Given how much the public feared Ebola, hospitals might also have wished to capitalize on ETF designation to assure good public image. Following the mishaps of the Dallas Presbyterian case -- the infection of nurses and the eventual death of the patient -- many hospitals may have wished to assure their communities that they had done their due diligence. By having ETF status the hospital can claim the CDC had checked them and that they were seemingly superior in their preparations to other institutions. However, the hospital and state also must be so brave as to mark itself as a place that could receive Ebola patient transfers from other less well-prepared hospitals. This move obviously exposes the institutions to significant risk from the public, since many people in the general population do not like to imagine the possibility of encountering a rare, infectious disease while attending to their routine

health needs. The balance between public reward and public risk for a hospital seems a very delicate one, meaning that another strong variable like potential federal funding must have helped nudge institutions to take on that risk.

Deciphering the question of grants or funding enticements proves tricky. The time line of most hospital preparations occurred well in advance of any additional approval of funding and certainly well before promises and disbursements could be made. However, in a time span of several months funding valves were turned on, and only now are the results starting to trickle. Katie Schemm, the Senior Program Analyst of the National Association of County & City Health Officials Preparedness Division, broke down the various additional funding streams that had developed for Ebola by December to late January; that breakdown appears in Table 2. Congress approved the largest amount \$5.4 billion dollars, a portion that would go to domestic federal agencies. Additional funding released by the CDC will help health departments performing active monitoring, laboratory surveillance, and preparedness activities through supplemental Hospital Preparedness Programs (HPP) and Public Health Emergency Preparedness (PHEP) grants. Areas around the international enhanced screening airports and those health departments implementing tiered system response coordination receive extra allowances (Schemm, 2015).

Table 2 about here

The HHS confirms that all U.S. states will receive supplemental HPP grants, but those taking care of actual Ebola patients and those designated as ETFs will receive more (U.S. Dept. HHS, 2015). Meanwhile, Senators and hospital administrators alike expect that ETF designation regardless of actual disease deserves higher levels of funding (Almendrala, 2014). Hospitals and states who agreed to become ETFs must have had the foresight to predict that this would

happen and taken the risks of seeking designation accordingly. Now they must wait to see if the funding will be realized.

While Congress injected one-time emergency appropriations into the system to help support Ebola preparations, it hardly touches the budget cuts to baseline sustainment PHEP and HPP funding. Figure 3 shows how funding has waned for Public Health Emergency Preparedness Cooperative Agreement over the past decade which weakens the foundation of our responses in the future (CDC, 2015c). The Hospital Preparedness Program (HPP) grants have also dwindled to 50% of amounts approved in 2003, as seen in Figure 4, hurt even further by sequestration events that have kept appropriated funds from flowing to hospitals and states (Stein, 2014).

Figure 3 about here

Figure 4 about here

Centralized, Designated Facilities – A Different Idea

The approach of designating specific hospitals for Ebola treatment has little precedent in 21st century outbreaks of disease in the U.S. Current literature and news briefs do not explain the rationale for why it was deemed appropriate to designate special ETFs, but one can envision several reasons why this made sense to senior leadership at the time. The nation had expectations about how bad Ebola would be, though not always based on reality, and with such a strong reaction perhaps policymakers decided to respond strongly with clear signatory titles for Ebola-capable hospitals. Ebola got special attention from the media, including portrayal in a major film, *Outbreak*. As a filovirus and hemorrhagic disease, Ebola differs biologically from common North American viruses, which are usually spread via the respiratory system, so it has no native precedent. While the hemorrhagic aspect gets more attention, experts have pointed

out that in this epidemic massive fluid loss and dehydration from diarrhea and vomiting leading to organ failure have killed a majority of the victims (Lamontagne et al., 2014). No matter the mechanisms of harm, the imagery of Ebola proves far more compelling than how most Americans envision other typical, sometimes deadly, respiratory viruses.

Xenophobia and fear of a virus not endemic to North America and from the remote forests of Western Africa also played roles in national perception of the disease and perhaps motivated the desire to designate ETFs. Following public fear, politicians sometimes felt compelled to action, for example by mandating extra quarantine rules above federal guidelines such as those in New York and New Jersey (Gostin, 2014). This same logic might have induced certain state-level politicians to promote or resist local hospitals' ETF status. A hospital's ETF status can display readiness to the public, however, with an actual sick patient it also allows for the possibility for risk, failure, and "Not In My Backyard" public backlash given the fears about the African virus. Following the death of their patient and infection of two nurses, the Ebola scarlet letter affected Dallas Presbyterian's patient volume and revenues (Asbury Park Press, 2014; Moskowitz, 2014). Again, national funding probably could provide the requisite amount of incentive to get over the narrow margin between political and public support and opposition, but how these conversations or potential promises were conveyed to politicians is not clear.

New System Thinking for New Disease

The decision to approach Ebola preparedness by designating treatment in certain facilities departs from 21st century outbreaks and disaster planning but might resemble 19-20th century precedents like tuberculosis and polio hospitals. The drama of Ebola and early projections for the size of the epidemic might have instigated the epidemic and disaster planning world to make a large leap in response by pursuing this designated, isolation hospital plan. Following the terrorist attacks of September 11th, disaster planning committees saw the need for

greater preparation of the health care system for treating mass casualties, dealing with surge capacity, and identifying bioterrorism (Koenig and Schultz, 2014; Weber, Bottei, Cook, and O'Connor, 2004). Both outbreaks of pandemic respiratory viruses, Severe Acute Respiratory Syndrome in 2003 and H1N1 in 2009, spurred health care systems to start considering how to mitigate risk of potentially highly contagious disease in large volumes of patients. For SARS this entailed the establishment of special units within hospitals with special staff and special protective gear which was recommended by the CDC for use whenever possible (CDC, 2005). The establishment of off-site, somewhat isolated centers for providing vaccination and screening also took hold. This provides some background for the idea of advanced planning to separate certain epidemic diseases from normal populations in the hospital. However, there was no formal "designation" of hospitals that created these units, unlike the ETFs for Ebola.

Various system elements may be pushing toward approaches of consolidation and early identification of key players for response. Budget cuts in recent years to local health departments, public hospitals reliant on declining state support, and tightened NIH and CDC funding might make it desirable to broadcast which hospitals have stockpiled the supplies and trained staff to take care of resource-intensive Ebola. The question remains, however, why it was believed that biocontainment units would not be enough to treat and support confirmed, ill patients with Ebola, given their years of experience and specialist training in rare, highly contagious diseases. Instead of designations of new facilities as ETFs, could greater resources be spent in creating catchment and shoring up transfer plans to the biocontainment centers? Experts reported to national news outlets that the biocontainment units could provide care for up to 11 patients, though it was uncertain whether this number could be cared for concurrently (ABC News, 2014). Seasoned U.S. biodefence researchers like Dr. Mark Kortepeter suggest that the biocontainment center's limited number of beds and staff required to take care of patients with Ebola could be overwhelmed, and this provides a reason for developing units at

other major medical centers (Kortepeter, Smith, Hewlett, and Cieslak, 2015). He makes a point of saying these units should be developed as national resources not just for Ebola but for future outbreaks as well.

Preparing for Emerging Infectious Diseases: Through the Lens of Ebola

Around the nation hospitals took various approaches to deal with potential Ebola, but they did not do so in a systematic or regulated way. The absence of a systems approach has harms and benefits: not all hospitals had the same risk, the same resources, or the same culture of doing things. Biocontainment units and hospitals close to large international airports likely took their preparedness precautions seriously with training and drills. However, many hospitals around the rest of the United States may have only disseminated emails or flyers to alert staff to screening or risk of Ebola, based on their lower perceived risk. The test to the system in Texas proved a failure and could have presumably happened to many other hospital systems with the same results. Retrospective analysis of nationwide hospital preparations could prevent mistakes in the future. In general, we do not know how hospitals prepared nationally but we can analyze the deployment of federal policy designating ETF hospitals. Key stakeholders can provide insight into how local decisions were made as well as inform our understanding of their view of this ETF policy roll out. Information from study of policy and the published literature, the understanding of key stakeholders, and the perspectives of frontline health care workers as measured in surveys can help us understand how future epidemic preparedness decisions will unfold.

METHODS

Study Design and Participants:

The present study includes collection of data from two sources:

1. Web survey: Cross sectional, anonymous web-based survey distributed to UNC health care workers (HCWs) who are members of the Emergency Department staff, including physicians, nurses, nursing assistants, security personnel, and health unit coordinators (clerical staff). The web survey was conducted between March 25 and April 23, 2015.
2. Non-random, descriptive interviews conducted in person between April 16 and May 8, 2015 with key stakeholders and decision makers at UNC Health Care, a large, public academic medical center.

Respondents were two mutually exclusive groups: interview respondents did not complete the survey, and survey respondents were not interviewed:

1. Web-based survey respondents: Up to 260 HCWs working in the UNC Emergency Department were invited to participate in the web-based survey, and 151 participants fully completed the survey, with 159 completing at least part of the survey. See the Methods Appendix C for the survey questions and Table 3 for a description of survey respondents.
2. In-depth interviews with stakeholders/policymakers: Six key stakeholders representing UNC Hospital Systems leadership, UNC Disaster Planning, and the State Public Health and Disaster Planning sections were invited to participate, with one unable due to scheduling, and 5 completing in-depth interviews. Interview Protocol and Questions are in Appendix C.

Inclusion/Exclusion

1. Web survey inclusion criteria: Any employee of UNC Health Care System for any number of hours in one of the health care setting's emergency medicine divisions, working in any health care field, including support roles, security, and organizational staff, was eligible to participate. The only exclusion criteria were respondents not working for UNC Health Care or those unwilling to participate.
2. Key stakeholder in-depth interview inclusion criteria: respondents had to be identified by the investigators as a person in a system leadership position with organizational or expert knowledge. The only exclusion criterion was unwillingness to participate. Figure 5 shows UNC incident command operations table of key individuals and those interviewed for this project during the Ebola response.

Recruitment

1. Web Survey: The investigators distributed a link to the web survey to Emergency Department staff via work emails with the help of an "honest broker" with access to this email list so that respondents would remain unknown to the researchers. The email message explained the nature of the study briefly and noted that participation is voluntary. The first screen of the survey sought respondents' willingness to continue the survey. Clicking "I agree to participate" was accepted as consent. One week after the initial email message about the availability of the web survey, a reminder email was sent by the "honest broker" using the same email lists. The study was closed 3 weeks after the initial invitation email. A problem reaching a particular subset of participants required re-opening the survey and re-contacting the previous lists through another honest broker to give all participants equal opportunity for participation. The re-opened survey was left open for 10 days and then closed.

2. Stakeholder Interviews: Researchers identified and invited people who represented UNC and state public health leadership. Participants were emailed and if they agreed, they participated in a recorded in-person interview. Participants consented to be recorded and have their names included in any publications, with any use of quotes to be shared with them prior to submission. The in-depth interview protocol is presented in the Methods Appendix C.

Data Analysis

Survey Results:

We captured basic occupational demographic information in the survey (but no personal information), as well as answers to questions about respondents' perceptions of the amount and nature of their training. Because we had not had the opportunity to survey staff members before training began, we used a "post then pre" design to gather HCWs' attitudes about Ebola and their competence to care for Ebola patients before and after their training. These attitudinal questions tapped efficacy, threat, role responsibilities, willingness, organizational preparedness, respondents' assessment of contributions, and their general view of preparedness. In this study, we present collapsed agreement and disagreement summary measures of the attitudes, and we used Pearson Chi-square to compare respondent groups by occupation, years of experience, amount of training, and the recentness of training. Likert scale responses were averaged or summed to create a continuous variable which was then used in t-tests comparing different groupings of respondents as well as pre- to post- training attitudinal statements. Multinomial logistic regression analysis was performed to evaluate relationships between categorical variables and attitudinal responses (data not shown). Investigators used STATA software package version 13 (Stata Corporation College Station, TX) for this analysis. Only descriptive

results from attitudinal statements will be presented in this paper, as they are most relevant to stakeholder policy opinions.

Stakeholder responses:

We used standard policy analysis methods to evaluate stakeholder responses, including triangulating themes and interconnections from prior literature, current trends in news and public commentary, and expert opinion provided by multiple stakeholders representing different aspects of health care institution decision making. The first author transcribed all interviews then systematically coded them according to themes of policy decisions, disaster preparedness, and leadership concepts. Stakeholders' names, titles, and dates of interviews are included in Appendix B.

RESULTS

Survey Results

Of the Emergency Staff invited to participate, 58% participated and completed surveys (N=151). Their baseline demographic and Ebola training characteristics are shown in Table 3. Their perceptions of the Ebola threat and their preparedness for it, as well as their perceptions of their own attitude changes before and after their training, can be seen in Tables 4 through 7.

Interview Results

The list of invited institutional leaders included Dr. William L. Roper, UNC Health Care Chief Executive Officer; Dr. David Weber, UNC Medical Director of Hospital Epidemiology; Dr. Julie Casani, Medical Director of the North Carolina Department of Public Health's office of Preparedness and Disaster Planning; Dalton Sawyer, UNC Health Care director of emergency preparedness and continuity planning; Dr. Jane Brice, UNC Hospital Disaster Committee; and Dr. William Fischer II, UNC Health Care critical care physician and Ebola researcher. Dr. William Fischer II was unable to participate during the study period. The responses of all other five interviewees follow.

Federal or Local Responsibility to Lead Preparations

In summer 2014, hospitals started developing their own protocols and plans to deal with the threat of Ebola, often in advance of CDC recommendations. Whether this was due to the vacuum created by lagging federal guidelines or hospitals feeling compelled to create their own tailored plan for their individual risk and resources was not completely clear. All stakeholders seemed to support both feelings and believed disaster preparations must happen both at local levels and be augmented by federal entities.

However, some respondents felt federal authorities had more obligations to assist in the preparations for Ebola. Dr. Roper firmly stated “I believe it’s the role of national experts to distribute information in a timely fashion...they were slow to deal with Ebola and slow to offer any resources...specifically grants to leading institutions” (Roper interview, 2015). The lag in information was noted as being a major issue leading UNC and other hospitals to prepare in their own ways. Dr. Brice believed that when hospitals create variable plans to deal with Ebola, risky, fragmented care and endangered frontline workers could be more likely (Brice interview, 2015). Dr. Weber and Dr. Casani explained that the government can help by creating a minimum standardization and “connectivity of plans,” the drawback being that it rarely happens quickly because of the bureaucratic clearance process (Weber interview, 2015; Casani interview, 2015). Despite some frustration, Dr. Brice did say that the CDC appeared to be more responsive with disseminating information for Ebola than in previous epidemics like SARS (Brice interview, 2015).

Other stakeholders argued that public health emergency response to public health emergencies best originate at the local level. Hospitals feel responsible to their community and “will prepare on their own before guidance comes out because they know they have to” and luckily what makes sense to the hospital, logically tends to be close to the scientific guidelines put forth by federal entities (Casani interview, 2015). Dr. Weber seconded this sentiment: he said that at UNC “our goal was to always be weeks to months ahead of the CDC recommendations” (Weber interview, 2015). He added that sometimes top down recommendations even from the CDC do not make sense since those who create the recommendations are not actively providing patient care; their recommendations may actually be dangerous or un-implementable. For this reason experts at UNC reviewed everything rather than accepting them blindly (Weber interview, 2015). Furthermore, Mr. Sawyer said, federal entities “don't have the local knowledge, local background, and all the considerations of a

localized response. They can send resources to us but it's more of an augmentation as opposed to the whole local response" (Sawyer interview, 2015). Dr. Casani from her vantage point summed it up this way: federal responses must be strategic while local responses must be tactical, with hospitals being the most tactical and state public health services occupying the middle ground (Casani interview, 2015).

Dr. Weber also used UNC's local negotiations and discussions with the county water authority to illustrate local vs. federal politics. The CDC said Ebola liquid disposal simply needed to be disinfected with bleach prior to disposing into public sewer lines, however, the local county water authority disagreed, therefore, UNC had to comply with local guidelines. "Neither the CDC nor the federal government nor the state has any legal authority short of the president or the governor declaring a national emergency to compel [the local water authority] to do anything" (Weber interview, 2015).

Expert Knowledge for Initiating Preparations

Specifically at UNC, stakeholders felt they had the people and the experience as an institution to pursue their own path of preparations rather than wait. Most of the UNC stakeholders mentioned the strength of specific people who could expertly guide the system in the process. Dr. Roper noted that we had "in-house experts" with national reputations, like Dr. William Fischer II who had provided direct care for patients with Ebola in West Africa and Dr. David Weber, expert and author on infection control. These "in house experts" could provide superior guidance for the UNC preparations, he said (Roper interview, 2015). In emergency preparedness and planning, Mr. Dalton Sawyer was cited by Dr. Brice as someone who has been "embraced by hospital administration" for his "thoughtful preparedness efforts." This confidence on leadership's part allowed UNC to follow his lead on responding to Ebola (Brice interview, 2015). Dr. Brice also explained how supportive UNC systems has been since Sept.

11th in taking disaster preparedness training seriously – including, importantly, by providing consistent funding for it (Brice interview, 2015).

From Dr. Weber’s perspective, as a hospital “we like to always be ahead of the game not behind the game even now as an example, all our people have been trained.” He said that UNC went beyond CDC guidelines early on and still exceeds them for training staff on basic personal protective equipment (PPE), protocols for needle sticks or a breach of the PPE, and how to clean a spill in an Ebola situation (Weber interview, 2015). Additionally at UNC, Dr. Weber and his team had performed a study of contamination rates of PPE with a harmless tobacco virus, and he provided this illustration of efficacy of PPE to the CDC a few years prior. Knowing those results of high rates of contamination around hoods and hands, Dr. Weber implemented a PPE protocol and 3 step training program at UNC that went beyond guidelines. It included simulation lab work, educating and training workers on proper donning and doffing practices, and attending to extra issues like cleaning spills (Weber interview, 2015). These extra steps and expert knowledge put decision makers at ease that UNC could handle its preparations for Ebola correctly.

Additionally, the extra attention UNC leadership focused on training was felt beneficial by the front line health care workers in the Emergency Department who received it. All of these staff, from doctors to security staff, received at least one Ebola training session headed by Dr. Jane Brice and Dr. Emily Sickbert-Bennett of Hospital Epidemiology. The training sessions included Ebola’s epidemiology, the UNC Emergency Department plan, test scenarios, and practice donning and doffing in PPE gear to groups of 20-30 ED staff at a time.

The trained ED HCWs generally agreed in the web survey with the feeling that UNC was better prepared than other clinical sites, with a narrow margin agreeing that their site had well-tested disaster plans, seen in Table 4. HCWs may have been somewhat less likely to give

unqualified agreement because the question included other types of disasters as well as the key phrase “well-tested,” and some HCWs did note that a real test – a real case -- had not occurred.

Other Disease Comparisons

Ebola required highly specific, unique, and intense preparations, so one method of prior disease response did not provide a template protocol for responding to this disease. However, 4 of 5 respondents used a diverse set of diseases or situations in prior epidemic disease response to illustrate aspects of the Ebola response. Dr. Brice pointed to the way the CDC had been evolving in its management and dissemination of information for diseases, noting that the response to SARS seemed to not be well coordinated, H1N1 was “OK”, and Ebola was better (Brice interview, 2015). Dr. Brice also considered UNC’s institutional response to H1N1 successful, with strong laboratory and screening resources (Brice interview, 2015).

The 8th and last U.S. case of SARS which was confirmed at UNC, also came up in multiple conversations as an example of how disease can travel and providing justification to always be prepared (Sawyer interview, 2015; Weber interview, 2015). Additionally, Dr. Weber felt that SARS illustrated how “good public health, isolation, and diagnostic testing” could be the best approach since SARS was managed and eventually controlled worldwide without disease specific treatment or vaccines (Weber interview, 2015). Dr. Weber and Dr. Casani mentioned smallpox preparations that were undertaken nationally in the early 2000’s which involved extensive campaigns. These preparations were ultimately phased out, since smallpox never presented as a true problem. The government asked for volunteers to be “smallpox hospitals,” somewhat similar to current designation of specified destination hospitals for Ebola treatment (Casani interview, 2015). Dr. Weber mentioned how specific health care workers who volunteered to respond to potential smallpox cases received extensive team training and vaccinations (Weber interview, 2015).

HIV/AIDs was mentioned as an example of a disease where a similar “rapid epidemiologic investigation” was undertaken by federal bodies like the CDC (Roper interview, 2015). However, Dr. Weber also used HIV/AIDS to illustrate how the US’ national response to the outbreak in the 80’s was too slow, thus giving reason to seize the initiative in preparing for Ebola (Weber interview, 2015).

Finally, only Mr. Sawyer chose to illustrate just how different Ebola and this national response have been from other disease outbreaks. "Ebola is a disease that very few people know anything about, it originates from a land far away. And the only information that people have about Ebola unfortunately is from a science fiction movie" (Sawyer interview, 2015). Since nearly all cases of Ebola were tied to infection in Africa, the game is entirely different than diseases that spread easily in gathering places and airports, he said.

HCWs in the ED agreed that the institution’s response to Ebola was different than it had been for other diseases, as they received more education, training, and instruction specific to Ebola. More than half of HCWs had experience with past disease outbreaks to which they could compare this Ebola response, also seen in Table 4.

Media and Perceived Response to Ebola

None of the stakeholders seemed to feel preparations were driven heavily by media attention; however, it was not a variable without effect. Interviewers frequently appreciated the paradox of media wishing to provide information but sometimes sacrificing accuracy or choosing attention grabbing headlines that could stoke public fears. Overall, the stakeholders had mixed thoughts as to whether media attention helped or hampered the assessment of overall risk for Ebola. A slim majority of HCWs in the ED felt negatively towards the media for Ebola seeming excessive or exaggerated, seen in Table 5.

Most of these system leaders made the case that the greater responsibility lies on experts and organizations to produce accurate, clear statements during an epidemic, since the media markets information to the public's desires and the public tunes in more for the sensational. As Mr. Sawyer said, "The one thing in a crisis that you can control is your message" (Sawyer interview, 2015). Dr. Roper cited errors in public dissemination of knowledge during the fall when the CDC miscommunicated the Texas Presbyterian case. He felt strongly that "it is incumbent on experts and more specifically government officials to speak to the public with clarity with every step" (Roper interview, 2015). Dr. Brice felt that media attention was frenetic and wondered if the CDC had spent any special time communicating or educating journalists, which she felt had happened during SARS and H1N1 outbreaks (Brice interview, 2015). Dr. Casani, however, felt she witnessed mostly "responsible" media coverage with special attention to information from credible experts rather than outlandish, pseudo-experts seen in prior outbreaks (Casani interview, 2015).

Some reports by the media, however, contributed to a great deal of fear, making it harder for hospitals and health officials to have a rational "discussion" with the public (Weber interview, 2015, Sawyer interview, 2015). As Dr. Roper had done, Dr. Weber also mentioned the mistrials of Texas Presbyterian Hospital as a locus for problematic communication. Dr. Weber felt the media used this opportunity to prematurely assign blame in this case to the nurses, and that this had occurred again in the case of the doctor in New York (Weber interview, 2015).

Ebola fear created xenophobia. A few stakeholders expressed concern that fear of others was the message being conveyed to the American public either in the media or unofficially in social discourse. A few stakeholders encountered instances or anecdotes of discrimination toward people of certain ethnicities and toward health care workers who might care for cases of Ebola (Casani interview, 2015; Sawyer interview, 2015). Ebola fears also

began to enter debates about immigration and border closings, which Mr. Sawyer felt was not “an overly helpful national dialogue” since this xenophobia could hinder tracking and controlling the disease (Sawyer interview, 2015).

Stakeholders tended to the belief that media outlets serve a positive purpose in delivering news to inform the populace but a few stakeholders went further, with specific points of appreciation for coverage of Ebola. Dr. Casani expressed her surprise at and approval of the positive recognition created when TIME magazine named "Ebola fighters people of the year," recognizing “heroes of public health” both domestically and internationally (Casani interview, 2015). Dr. Weber made the point that media could have helped capture Congress’ attention to compel them to earmark funds specifically for Ebola response and research (Weber interview, 2015).

Ebola Treatment Facilities and North Carolina

Given that North Carolina has a thriving science and trade sector in the Raleigh Durham Triangle area, diverse multi-national residents, multiple universities associated with large academic hospitals, multiple active military installations, and substantial populations of livestock (a special factor in avian and swine influenza outbreaks) the state must always be prepared for infectious disease threats (Weber interview, 2015; Sawyer interview, 2015; Casani interview, 2015). Since public health departments, public health officials, hospitals, hospital systems, and others pursued exceptional levels of preparedness in order to feel ready should Ebola arrive in the state of North Carolina, it seems impossible not to ask why an Ebola Treatment Facility designation was not the next step in planning. Presumably, ETF status might warrant special funding or designate prestige or future leadership in disease preparedness. However, despite these presumed benefits, stakeholders readily identified many plausible reasons that UNC hospital system and North Carolina would not pursue Ebola Treatment Facility status.

The exact group of people who made decisions that resulted in North Carolina hospitals not pursuing any Ebola Treatment Facility designations was not named by any key stakeholders, though the interviewer did not ask explicitly, nor did she expect that all stakeholders would know with certainty. One stakeholder alluded to a political decision that could have been made beyond the boundaries of any one health care institution (Brice interview, 2015). Other stakeholders mentioned that UNC, being a public grant institution, would be unwilling or unable to say no if a state official decided it should be designated to receive Ebola patients, but as it turned out UNC did not have to make the decision (Weber interview, 2015; Sawyer interview, 2015). Mr. Sawyer conceded "it is noticeable that there are none in North Carolina" (Sawyer interview, 2015). On some level, collaboration certainly occurred between the multiple advanced academic institutions and public grant facilities in North Carolina to arrive at a decision that no one facility would either pursue the designation or be forced into this role for the State. Stakeholders were able to identify a large collaborative effort with Duke University and others made some mention of discussions with WakeMed in Raleigh, Wake Baptist in Winston-Salem, and Carolinas Medical Center in Charlotte (Weber interview, 2015; Sawyer interview, 2015; Roper interview, 2015). Mr. Sawyer explained "it wasn't just our experience, it was our collective experience as a state, we wanted these things, we needed these things before we in good conscience could say yes we will do this" alluding to what kinds of assurances would be necessary for North Carolina to have selected an ETF (Sawyer interview, 2015).

Funding stood out as a large question posited by all stakeholders. The timing of agreements was also a prominent obstacle to the UNC system not going further to seek designation. Specifically, UNC had to prepare and finalize its plans many months ahead of when any government support began to even be a remote possibility (Roper interview, 2015). Dr. Roper explained that "[UNC] made the decision – and in conversation with Duke – that we

would take it to the level of readiness to take care of any Ebola patient that came to our door but that we would not go out of our way to be the place where people were transferred from overseas or other hospitals” as the ETF might necessitate (Roper interview, 2015). Mr. Sawyer made the same points that designation would entail taking patients from far beyond our catchment area, which, without assurances, the systems in North Carolina would not be willing to accept (Sawyer interview, 2015).

How the federal government would deal with reimbursement of patient care was a major unknown for stakeholders as ETF decisions unfolded. The costs of caring for an Ebola patient and even conducting a “rule-out” of a suspect case are high and stakeholders like Dr. Weber and Mr. Sawyer concluded that the hospital would never be able to charge a patient or insurance and expect to be fully reimbursed, nor could the hospital shift those exorbitant costs to others (Sawyer interview, 2015; Weber interview, 2015). With patients traveling from Africa, many without insurance, or insurance simply unable to cover exorbitant costs, how hospitals would recoup losses was not addressed in the minds of stakeholders. Mr. Sawyer pointed out that hospitals know how the Refugee Act and NDMS reimbursement will take place (Sawyer interview, 2015). However, for the care of Ebola, federal entities did not provide a definite plan for whether ETF hospitals that began receiving transferred patients would receive payment, tax credits, deductions, or some other versions of reimbursement or would simply be expected to absorb the cost of care (Weber interview, 2015; Sawyer interview, 2015).

Ultimately, the problem was not simply that payment could not be expected, but that it would undermine the mission of many hospitals in North Carolina and the needs of the communities they serve. As Dr. Weber explained, “So while it's a good thing to do, and I applaud the hospitals that did it, it would cost us another umpteenth hundred thousand dollars of preparedness, do we then not do artificial hips on 40 patients who are charity patients because we spent the money on Ebola? It's a zero sum game.” (Weber interview, 2015). Dr. Weber's

example about providing total hip replacement surgery for NC citizens references UNC Hospitals' delivery of uncompensated care which directly changes the lives of many North Carolinians. Intensive Ebola preparations might not be able to achieve the same benefit to the community but could certainly hinder it by diverting dollars from charity care funds. Mr. Sawyer also raised the ethical issues behind taking care of Ebola patients at the cost to the institution, for those who seek care, but also for the staff who work there (Sawyer interview, 2015).

To protect staff, correct personal protective equipment (PPE) must be purchased and staff must be trained extensively to use it. This became an issue in the fall, mentioned by Mr. Sawyer and Dr. Weber, as hoods and supplies unique to Ebola exposure were on backorder for months. Both Mr. Sawyer and Dr. Weber said one qualm about being an ETF was getting the right supplies: though "earmarked" for UNC by the manufacturer, PPE gear were not located in house and if the PPE UNC did receive was not exactly the equipment on which staff had trained, they would have to retrain if they were to be completely safe (Sawyer interview, 2015; Weber interview, 2015).

Public pressure to become an ETF did not seem to be an important influence to stakeholders, though they mentioned how the effect of public perception might be both a negative and positive result of having special designation. Mr. Sawyer and Dr. Weber both mentioned a potential drop in census, such as patients canceling outpatient or elective procedures (Sawyer interview, 2015; Weber interview, 2015). "I presume they made a statement that the 'goodwill' of being named, and potential for future funding, outweighs the negative of being called an 'Ebola hospital'" with all that entails of the public nervously choosing to get their (non-Ebola) care elsewhere (Weber interview, 2015). Dr. Casani said that Duke's case of Ebola being ruled out for a patient was handled "incredibly well," meaning the hospital suffered no backlash (Casani interview, 2015). Mr. Sawyer also explained that if UNC became an ETF, the location of the biocontainment area for Ebola would have to be very clearly

conveyed and illustrated to the public without showing everyone a tour of “where Ebola is, and where it isn’t (Sawyer interview, 2015).

The Ebola Treatment Facility Designation Role in Response

Most stakeholders did not expound on too many specific reasons that Ebola Treatment Facility status was conferred to other hospitals. They could rationalize general reasons, however: that the locations of ETFs made sense, such as being on the East coast and located around major international airports (Casani interview, 2015; Weber interview, 2015; Sawyer interview, 2015). Additionally, many of the hospitals on the ETF list have prior experience or special funding for bioterrorism and infectious disease epidemics, noted Mr. Sawyer as he discussed Urban Area Security Initiative (UASI) jurisdiction and Bellevue hospital as the destination for treating the New York doctor’s case (Sawyer interview, 2015).

Three stakeholders discussed what they consider to be a similar system of designating hospitals in tiers, such as that for trauma centers (Casani interview, 2015; Weber interview, 2015; Sawyer interview, 2015). "in the hospital preparedness program out of the assistant secretary of preparedness and response up at HHS, they, Congress wanted a regional approach, they did not want 50 Ebola treatment centers because they thought that was just way too costly, not just in dollars but in people and time, perhaps not a good investment" (Casani interview, 2015). The current model, with 4 biocontainment units, 50-60 ETFs, and 288 assessment centers, makes sense (Sawyer interview, 2015).

The regionalization policy of designating ETF’s did not seem to roll out in a clearly defined or fully developed way in the fall when the CDC was making visits to assess preparedness. "The process of how to get on that list was basically people just raise their hands, so there was no plan. There was planning within the facilities but there was no plan," said Dr. Casani. She further explained that some states mandated certain hospitals step

forward, others did so for competition within their region, and many others hoped to get on that list but first wanted to have CDC visits completed, many of which were delayed due to volume, then the list abruptly closed. Deadlines were never originally discussed (Casani interview, 2015).

Government Funding

Funding was both the biggest carrot and the biggest stick. Money seemed a likely reason to join the ETF list but, as seen in stakeholder comments, the early lack of assurances of funding also provided the biggest barrier. Most stakeholders did not comment on whether they thought facilities who became ETFs had prior knowledge of eventual funding to motivate their decision. Dr. Casani, in her role as State Disaster Preparedness director, provided the most in-depth look at how funding may be distributed. She correctly confirmed what the HHS appears to intend: assessment hospitals should get some money, but ETCs will get more (Casani interview, 2015). However, in her assessment of the way plans were variably rolled out for selecting ETCs, hospitals likely did not receive guarantees about this funding up front when they made their decision. Mr. Sawyer expressed additional doubt that the amount of funding released domestically would come even close to cover all the preparations for all the hospitals and health departments that made them (Sawyer interview, 2015).

Despite not having any ETC hospitals in North Carolina, Dr. Weber, Mr. Dalton, and Dr. Casani discussed how Ebola funding supplements like PHEP and HPP grants will reach the state. Here the three stakeholders also expressed their frustrations about using grant funding. Dr. Casani explained “it’s easier for Congress to appropriate categorically” and build the budget around Ebola rather than a “nebulous” concept like preparing for the next infectious disease epidemic or as Dr. Casani would like to term it “communicable diseases of consequence” (Casani interview, 2015). Despite these categorical restrictions, health officials will try to use

the money to build preparedness with general communicable diseases of consequence in mind (Casani interview, 2015). Dr. Weber, though pleased that this funding might help improve the state's plans, thought that none would flow to hospitals (Weber interview, 2015). In Mr. Sawyer's prior experience, while grant funding may help with specific items like purchasing PPE, it will "never be enough" especially when the biggest concerns to health care systems are operational needs, costs of training, and loss of revenues (Sawyer interview, 2015). Dr. Brice emphatically made the point that one time emergency grants like this would not undo the damage of budget cuts to public health or advance future national responses:

People will use those to recoup losses, because we are very shortsighted. There needs to be a consistent level of funding for all of those national bodies and local bodies when you talk about public health departments to be able to maintain a standard of preparedness. And I know it's really hard to see the benefits of that when nothing happens for 5 years, but that pays off when we have an Ebola event or a SARS event or an H1N1 event, it pays off with enormous benefits and rewards. But I don't think we learn our lessons well, so when we cut all those budgets, that's very short sighted, extremely short-sighted. And I think it leads to over-spending. (Brice interview, 2015).

Dr. Casani corroborated a "general erosion of services" in public health departments, especially in areas like the South where public health departments play many roles, from providing direct patient services to acting as safety nets for disadvantaged populations, in addition to their responsibility for local preparedness (Casani interview, 2015). Ebola acutely stressed the system as training took place and active monitoring and surveillance took away from other health department functions. Unfortunately, from her point of view, these Ebola grants also fall short since they are one time funding, not sustainable beyond the roughly 18 months of the award period (Casani interview, 2015).

Overspent, Overconsumed, Overtrained

Some vocal dissenters on the national scene like Dr. Susan Huang have said we have “overspent, overconsumed and overtrained” for Ebola, driven by an “abundance of caution driven by fear” (Almendrala, 2014). Stakeholders did not generally concede to this viewpoint, though they also recognized the drawbacks to the furious Ebola preparedness effort. Dr. Roper and Dr. Weber commented simply “we had to,” mainly to avoid potential mistakes like Dallas Presbyterian and because, as Dr. Weber illustrated, our political system does not force specific hospitals and states into what to do, so all hospitals had to prepare (Roper interview, 2015; Weber interview, 2015). Dr. Weber discussed our “pluralistic society” as a reason we do not plan everything and do not force everyone to do things a certain way, instead it is worked out on a smaller political theater, like the prior water authority example (Weber interview, 2015).

Dr. Casani, a Director of Preparedness, understandably, said “of course, I think we should prepare...preparedness is insurance” but she also said Ebola preparedness is only good if it is used to invest and prepare for other diseases also (Casani interview, 2015). Dr. Brice shared this idea that Ebola forced us to build a “foundation” of disease and disaster preparedness knowledge the benefit of which means we might only need “modest education and planning to move forward” (Brice interview, 2015). Dr. Brice did agree that over training, over spending, and over educating occurred for Ebola, but mainly because for the past ten years, disaster training had focused on terrorist attacks and mass casualty events. With “global pandemics...we were playing catchup,” during the SARS and H1N1 scares, and the nation did not spend the time, attention, or sustained necessary funding then that might have helped avoid overspending for Ebola (Brice interview, 2015).

Dr. Weber repeated the ethical question about Ebola spending’s opportunity costs, and he said that from a “cost-benefit analysis” point of view, a regional approach to designating

ETFs made sense, but that all hospitals pouring themselves into capabilities may have been a poor use of their resources (Weber interview, 2015).

Tables 4 and 5 show that HCWs in the ED seemed generally to approve of training, spending, and preparations for Ebola. They mostly felt approving of or ambivalent about the amount of money spent on Ebola. They supported the idea that all hospitals, not just special facilities, should be prepared to handle cases of Ebola, and that most hospital workers, not just specialized teams, should receive special education and training (with the caveat that some HCWs felt workers had the right to refuse care for a patient with Ebola, a topic hotly studied in previous outbreaks). HCWs showed less confidence, though they were still positive, in the international response for Ebola. Locally, the UNC HCWs felt strongly that UNC's preparations for Ebola were effective and appropriate and felt their own role was important in an emergency response.

These questions were not worded in such a way as to distinguish between HCWs' views of general preparedness or specific ETF level preparedness. The survey questions inevitably prevent HCWs from answering with as much depth or nuance as the elite stakeholders could provide in their in-depth interviews. However, it seems clear from these largely positive responses and from most of the free-text comments they offered that HCWs approved of UNC's preparations and could also have approved of the system becoming an ETF.

Unanimously, stakeholders felt that lack of ETF status would not prevent UNC or the state of North Carolina from being prepared for a potential Ebola test of the system, and that in the future, this designation would have no bearing on preparedness for future outbreaks. Words like "always ready", "comfortable," "willingness," "sufficient," "supportive," and "capable" were used by stakeholders to describe our level of readiness should we receive an Ebola patient in our catchment area (Weber interview, 2015; Roper interview, 2015; Brice interview, 2015;

Casani interview, 2015; Sawyer interview, 2015). Mr. Sawyer went the farthest in asserting how different Ebola is from what infectious threats we are likely to face in the future, specifically respiratory diseases that are easier to spread in country rather than by being imported. “We don’t have to be the go-to hospital for every single threat” (Sawyer interview, 2015).

Furthermore, he argued, theoretically the effort it might have taken to fulfil the role of ETF might have affected UNC’s ability to support its own leadership, like Dr. Weber’s and Dr. Fischer’s national and international work sharing expert knowledge with other institutions and conferences (Sawyer interview, 2015).

Additional Positives of Preparation

As previously mentioned, most stakeholders felt that plans and training for Ebola would be translated into developing better communicable disease plans. However, every stakeholder identified several additional positives to preparations done for Ebola. These included showing early initiative, creating more collaborative teams within and outside institutions, reworking communicable disease plans, and developing and improving capabilities.

Early, advanced preparations made a difference to UNC’s preparedness success. Populations at risk were identified, and the entire staff participated in extensive campus wide screening at all entry points to the health care system. The system implemented full-scale plans as if the disease were imminent in a worst-case scenario – as if UNC were alone, and no other specialized institution would be able to help (Roper interview, 2015; Casani interview, 2015; Weber interview, 2015; Dalton interview, 2015). Protecting other patients, the public, and especially health care workers took the foremost focus, according to Mr. Sawyer, which Dr. Roper believed showed our commitment, and Dr. Brice confirmed engendered trust and appreciation by the public and personnel alike (Dalton interview, 2015; Roper interview, 2015; Brice interview, 2015).

Dr. Weber emphasized just how responsive and supportive senior UNC leadership were, despite the resource intensity of the preparations. He noted that senior leadership allowed decision teams to implement and purchase whatever was deemed necessary (Weber interview, 2015). Dr. Brice echoed this perception of leadership support, something she said had been evident for years (Brice interview, 2015). Preparedness leadership meetings involved from 30 to 50 people representing teams from nursing, labs, respiratory, emergency, transport, amongst others. Getting 70 volunteers for direct patient care and training 300 Emergency staff for Ebola identification, isolation, and donning/doffing protocols was accomplished with surprisingly little resistance or dissension (Weber interview, 2015).

The survey of ED HCWs asked respondents to judge how the mixture of their own training, the passage of time, and media coverage all influenced their thoughts about Ebola. HCWs strongly identified training as most important to them. The survey's "post then pre" design captured their assessment of their own opinion change from what they recalled thinking prior to training to what they felt afterwards. The "post-training and now" answers allowed respondents to provide honest overall impressions, rather than artificially force them to isolate the influence of training as they answered. An index score calculated the absolute change in answer from pre to post listed by profession. The relationship between extent of training and opinion change was linear and positive, making it even more likely that training was the sentinel stimulant of HCWs' change in opinions about Ebola and its management, as seen in Table 6.

UNC Ebola training and time since the outbreak are strongly significantly associated with change in every measure of HCWs' opinions in a direction that might be thought of as the intended effect of training. The aggregate responses systematically reflect underlying individual-level responses; apparent aggregate change is not the result of dramatic movement in a few outliers but, rather, accurately depicts the entire collection of individual-level change. Workers had greatly increased confidence in their role and understanding their teammates' roles, their

understanding of the disease, their comfort with treating a case of Ebola and their organization's abilities to handle a case of Ebola. Their fear of exposure to Ebola, feeling that North Carolina would be threatened, that their PPE would protect them, and that the organization took their safety seriously also improved significantly but more modestly; see Table 7.

Confidence in the survey responses might be limited by the fact that HCWs' "pre" answers depend on their recall, and/or on some degree of social desirability, in the form of HCWs feeling that they should answer positively about the organization or their training. We also developed this survey without an opportunity to conduct extensive pre-tests of new indicators, although we did adapt most of the questions from other infectious disease HCW opinion surveys. The majority of research of this kind uses unstandardized questions.

While the HCWs identified positives about their training and roles as teams in responding to Ebola, stakeholders also practiced and built health care system coalitions on a broader scale during this epidemic. Stakeholders frequently mentioned renewed and strengthened collaborations between the CDC, the state Department of Public Health, county level health departments, many North Carolina hospitals such as UNC, Duke, Wake Forest, WakeMed, and the Carolinas system, and colleagues at other hospitals like the Emory and Nebraska biocontainment units (Brice interview, 2015; Roper interview, 2015; Casani interview, 2015; Weber interview, 2015; Sawyer interview, 2015). Dr. Roper has a particularly broad vantage point as CEO and Dean of the School of Medicine at UNC and a former HCFA and CDC leader. He said it "may not be apparent to the public, but within institutions this sharing of information and collaboration is very valuable" (Roper interview, 2015).

Stakeholders felt proud of how the state and health care institutions advanced capabilities with specialized team trainings and disease management spaces (and, as we have seen, their confidence appears to have been ratified by the HCWs). For example, one problem

UNC faced was designing where an Ebola patient would enter and receive care in a hospital that is used to 100% capacity. Decision makers in the Ebola Coordinating Group at UNC devised a unique contingency plan, using an affiliated critical access hospital, small enough to be cleared and isolated without endangering other patients and without necessitating building new space (Roper interview, 2015; Sawyer interview, 2015). By solving the issues of cross-training, cross-credentialing, delivering appropriate equipment, negotiating within systems, and logistics to use this hospital, UNC has created a methodology for “decompressing the ICU” at main campus in a situation of overcrowding, biological isolation, or mass casualty in the future (Sawyer interview, 2015). Dr. Brice, Dr. Casani, Dr. Weber, and Mr. Sawyer all saw translational potential in the training that health care personnel volunteers received for Ebola for infectious disease or even nuclear disaster responses, such as working in a high pressure situation, and donning/doffing special PPE (Brice interview, 2015; Casani interview, 2015; Weber interview, 2015; Sawyer interview, 2015).

Limitations in Power and Generalizability

This study is an investigative case study with a broad theme of quality improvement in infectious disease outbreak training and disaster preparedness. "Randomness" is not appropriate to such a focused study, because the central research question requires not responses of the general public who may or may not be informed but, instead, the responses of health care workers and health system leaders who are in a unique position to comment on, and evaluate, their training and the system's preparedness. The web survey's N of Cases is determined by the number of relevant emergency HCWs at UNC. We sought to reach not a sample, but the entire universe of such emergency HCWs. Because we examined the views of the universe of UNC Emergency HCWs, and because these views had not been studied before, "power calculations" are neither possible nor appropriate. A 58% response rate was achieved,

with all employment groups well represented, giving us confidence that we have an adequate number of responses for meaningful, reliable, and valid analysis.

The use of identified key informant stakeholders is a fundamental part of "process tracing" in policy research, whereby one deliberately seeks to identify those who have explicit knowledge about the policy processes in question. In such studies, a random design is inappropriate, since randomness would result in identifying people who have no knowledge of the policies in question, with a likely failure to identify those who actually know how the policy developed. In our case, we are identifying those UNC and NC health system and public health experts and leaders who have expert knowledge of UNC's Ebola preparations.

CONCLUDING RECOMMENDATIONS

This retrospective analysis of Ebola preparedness planning at the University of North Carolina Health Care System may tell us what was successful and what future progress must be made to prepare for new epidemics. Regardless of getting ETF designation, the reality is U.S. hospitals must stay ahead of the curve by continuing to monitor, train, and ready themselves for the next infectious disease wherever it arises. With designations like ETFs we might see a future trend of focusing extra training and resources on a few hospitals rather than on all. This makes sense in the environment of leaner spending in health care to achieve maximum quality. However, ETF designation did not confer clear cut responsibilities and roles in the overall national plan, as one might have thought. Despite the ambiguity of the lessons, we must be quick to learn from them if we are to be certain of the effectiveness of our capacity to confront a broad epidemic. The data I have presented here lead me to suggest some policy recommendations about how the national Ebola response and creation of ETFs can provide a better foundation for future infectious disease responses.

Policy Recommendations

1. Defined Regionalization Approach and Strengthened Local Collaboration

Stakeholders seemed to believe that regionalization of hospitals to be designated as Ebola treatment destinations was an appropriate use of resources. It allows tailoring to the unique operations of a locale, which stakeholders felt was an important corrective to the imposition of inflexible federal guidelines. In order for this to work, however, the federal government still needs to provide strategic planning and expectations for what the centers should provide. This appeared to be sorely lacking when the “list” of ETFs was generated: namely, when HHS would accept volunteer hospitals, and what goal would be an appropriate point at which to close the list. Additionally, up-front plans for how preparations and direct

patient care will be funded must be provided to allow hospitals to participate fully and knowingly. The argument goes beyond money, since many hospital systems do not want to jeopardize either their staff or their missions by taking on a complicated disease that they are not adequately supported to combat.

A seemingly better template for an ETF response exists in prior epidemics in Taiwan. Researchers and public health planners attributed some of their success to instituting Traffic Control Bundling and Six Sigma in their epidemic response to SARS. Using the concept of “zones of risk” and work groups, the Taiwanese created a tiered system to respond to the pandemic that designated special isolation hospitals to deal with possible influenza cases. Important to note in this process, other hospitals were designated “clean hospitals” to attend to normal system demands. In creating these zones the Taiwanese also created a network of transformed alternative sites, usually schools, to screen and vaccinate the rest of the public before transporting them to higher level care facilities (Yen et al., 2011).

Stakeholders repeatedly expressed gratitude for the collaborations that were created or strengthened between disparate emergency response systems, public health departments, and hospitals in the state as they prepared for Ebola. In fact, in North Carolina it seemed that hospitals unified around the idea that they could bolster their Ebola screening and assessment plans but not feel compelled to become ETFs. This tactic might represent very clear strategies for planned efficiency among the NC hospitals, or, considered another way, a unified, complicit message to federal disaster and disease preparedness authorities that assurances must be put in place before these hospitals participate in the future. Other states might not have experienced this environment of cooperation across health systems. Regardless, these regional networks of communication should be encouraged, stay intact where they already exist, and be bolstered since in a widespread epidemic they will be more important than ever.

2. Ongoing Training and Adaptable Communicable Disease Plans

During the fall of 2014, the highly specialized Nebraska Biocontainment Unit and the Emory Biocontainment Unit shared reports with the scientific community about their in-person training simulations and their process of reworking imperfect protocols. They thought these features were key to their success in training and handling patients with Ebola. In Nebraska, Ebola care team members and researchers Schwedhelm, Beam, Morris, and Sebastian provided a reflection on their high functioning team as an approach to high reliability during high risk situations (2014). They had the benefit of 9 years of experience but they also point out the quarterly to annual reviews and practices they did to maintain their skills and continually improve their methods. They claim to have created a “safe environment” and “what if” culture where all members of the team can equally challenge the status quo (Schwedhelm et al., 2014).

The disaster medicine researchers at Emory University, Isakov, Jamison, Miles, and Ribner, wrote a paper about their thorough handling of pre-hospital to hospital care of Ebola patients as way of highlighting what other non-CDC catchment hospitals should consider in their preparations (2014). The Emory researchers underscore that it takes “more than PPE,” citing the adoption of administrative policies, work practices, environmental controls, and focused education, training, and supervision to fully achieve safest care. They also address HCWs’ fear and apprehension, which can prevent them from providing the best and safest care, by providing plenty of simulation training and practice at the riskiest maneuvers like donning and doffing protective gear. The Emory unit has special practice in handling serious communicable diseases and over 12 years of training for such outbreaks due to their relationship with the CDC, but they claim that repeated practice has given them “new lessons” (Isakov et al., 2014).

Stakeholders in North Carolina felt that training gave their teams an advantage, and HCWs also placed great value on their training. The stakeholders, however, noted that such

training is time and resource intensive. During the threat, many hospitals around the U.S. likely held off on performing this final preparation step at all due to cost and time constraints. The ability of simulation training to address questions and develop skills was recognized by the Agency for Healthcare Research and Quality's Issue Brief about incorporating simulations into TeamSTEPPS training to address infectious diseases and Ebola (AHRQ, 2015). As the bar is set higher for safe and prepared emergency responses, the cost of simulation training may make its wider adoption a sticking point. Hospitals less focused on safety and more on revenues may skip these intensive processes altogether. It may take national guidelines, regulation, or funding for some of these best practices to be widely adopted. Furthermore, because of the cost of training and uniqueness of certain aspects of Ebola, stakeholders felt less certain about how they would pursue continued activity in the future as the threat of Ebola wanes.

Most stakeholders felt that they tried to construct Ebola preparations as adaptable communicable disease plans with future flexibility in mind for the next disease outbreak. Unfortunately, Ebola had unique requirements that may not translate completely to the next disease epidemic.

3. Consistent Funding for Public Health Infrastructure and Hospital Preparedness

The goal of being fast and preventive rather than slow and reactive in disasters would be best supported by consistent funding for preparedness. In December 2013, prior to the threat of Ebola in the United States, state preparedness levels were assessed by the Association of State and Territorial Health Officials in conjunction with the CDC and American Public Health Association. Their survey used five domains rated on 10 point scales: community planning and engagement, countermeasure management, health surveillance, incident and information management, and surge management. The national average score was 7.2 but consistently

states scored low in community planning and engagement and surge management. States' scores in preparedness suffered most because of inadequate funding for public health, with more than two-thirds receiving less funds and some health departments eliminating their preparedness programs altogether as a result of recent cuts (McGill, 2014).

Ebola provided a shock and bolus to the system. The missteps surrounding the first U.S. confirmed Ebola case would highlight weaknesses not exclusive to Texas Presbyterian hospital but present in the entire U.S. health care system and underfunded public health system. Congress' one time emergency funds in 2014 provided support for a four part strategy to attack Ebola globally by supporting source control abroad, domestically by strengthening the public health infrastructure, empirically through sped up vaccine and treatment research, and rapidly through emergency contingency funding for future surge capacity incidents (Gostin et al., 2014). The ease and speed at which modern-day travelers and their infections arrive in new places and on new continents make the threat of epidemics and pandemics inevitable. Therefore, to truly leverage the lessons learned from Ebola, the United States must recommit consistent funding to public health and preparedness to aid in disaster response, surveillance of disease, training of frontline health care workers, and better collaboration with global and public health systems.

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APPENDIX A. Systematic Review

I performed a systematic review of the literature to find surveys of health care workers (HCWs) about how prepared and how they perceived risk for epidemic and infectious diseases. I conducted the search using Web of Science to find articles of high quality and many disciplines. The initial search was constructed with four segments to address the research topic of finding: 1) a questionnaire or survey evaluating thoughts, attitudes, or perceptions of 2) health care workers, physicians, or nurses 3) about preparations, planning, and disaster planning specifically for 4) the threat of infectious disease, epidemics, or outbreaks. Severe acute respiratory syndrome (SARS) was included since this epidemic represents one of the largest novel outbreaks in the 21st century prior to Ebola which reached the worldwide stage. The search phrase was constructed as follows (((questionnaire OR survey OR attitude OR perception) AND (prepar* OR plan* OR disaster) AND ("health care worker*" OR physician OR nurse) AND (epidemic OR "infectious disease" OR SARS OR outbreak))). The product of this review would aid in the construction of a survey instrument to measure health care worker's perception about their risk and their preparedness for Ebola in the UNC Emergency department.

A search on May 4, 2015 resulted in 182 articles. By reviewing titles for relevance to the research question, I selected 45 articles for further abstract review. I analyzed abstracts for the population they addressed, whether it utilized a survey or questionnaire, and whether at least one goal of the evaluation determined worker's feelings of preparedness and risk related to disease in their current position. I disqualified many articles for focusing on patient or staff populations removed from clinical care, utilizing an open-ended interview format, a content focus on reviewing other papers or theories, focus on protective equipment, and focus on comparing multiple theoretical bioterror scenarios rather than mostly being related to infectious disease. This process left 12 articles for full review of the text. Two of the 12 articles' I reviewed

by abstract only to establish that they were precursors to subsequent publications already included in this review set, bringing the total list to 10 as seen in the following Table.

Study design for these papers was mainly cross-sectional surveys, six collected in paper mail form (Bell, Dake, Price, Jordan, & Rega, 2014; Martin, 2011; Alexander, Larkin, & Wynia, 2006; Jaakkimainen, Bondy, Parkovnick, & Barnsley, 2014; Tam, Lee, & Lee, 2007; Barnett et al., 2009). One cross-sectional survey “piggybacked” on a randomized control trial at several hospital sites and received a 99% response rate from in-person submission of the survey, far above the common less than 50% response rate many surveys collected, leading me to suspect bias or pressure on the part of respondents and researchers (Seale et al., 2012). The study population in 4 studies consisted of several different types of HCWs or emergency personnel (Seale et al., 2012; Tebruegge et al., 2010; Gershon et al., 2000; Imai, Takahashi, Hasegawa, Lim, & Koh, 2005). The rest of the studies focused on just one population such as nurses, doctors, or emergency medical services (Bell et al., 2014; Martin, 2011; Alexander et al., 2006; Jaakkimainen et al., 2014; Tam et al., 2007; Barnett et al., 2009).

I reviewed the literature for study question and design, to see what studies had in common and which added new interesting elements. Only two studies utilized a behavior model to explain the rationale to their questions and grouping answers. Barnett et al. used the Extended Parallel Process Model which reveals how efficacious workers feel and how threatened they feel about an issue (2009). Bell et al. used the Protection Motivation Theory and Social Responsibility Scale to assess workers’ perceptions of fear-based communications and health behavior as well as responsibility (2014). Five studies explicitly listed a section to query work factors, work safety, work environment, or employer policies (Martin, 2011; Gershon et al., 2000; Imai et al., 2005; Alexander et al., 2006; Jaakkimainen et al., 2014; Tam et al., 2007). Interestingly, only one study included “judgment of media, national, and international organizations” in questions, which can play a not insignificant role in workers’ perceptions of an

epidemic (Tebruegge et al., 2010). Five of the studies included willingness of employees to report to work in their main study question or outcome of interest (Bell et al., 2014; Seale et al., 2012; Martin, 2011; Gershon et al., 2000; Barnett et al., 2009). The validity of the questionnaires used often came from modeling or modifying a previous study's questions and piloting with small groups and experts. Results of each study differed significantly based off of the focus of questions.

Results of this review show that surveys of health care workers about epidemics tend to be designed on an individual basis, rather than using standardized behavior models or questionnaires. This might reflect that researchers prefer to customize their surveys to the disease, the setting, and the outcome of interest. In general, these surveys suffer from problems with generalizability and comparability to other studies since they have used different surveys, populations, and regions. Health care organizations likely worry about staffing during epidemics as reflected by half the studies focusing on "willingness to work." Half of the studies include elements to capture HCWs' perceptions of their work environment or organization which should interest health care organizations since they can plan to train, educate, and supply HCWs with information and assurances about safety. Common limitations to all of these studies are that intentions and theoretical risk differ than actual epidemic situations, so these results can only go so far to predict how HCWs will feel and behave. Additionally, these studies are cross-sectional surveys that can easily be biased by selection bias by participants' wishing to respond, bias to please researchers, and generally low response rates to generalize the results. Regardless, these surveys represent the desire to capture HCWs' perceptions and can hopefully inform employers about how to strategize and prepare their staff and organization for an epidemic.

Systematic Review Table

Include	Authors	Title	Year Pub.	Study Population	Study Question	Theory or Categories	Design	valid, generalizable?	results	address training or work?	y results	bias/scope	limitations	selection bias	measurement bias
yes	Bell, MA; Dake, JA; Price, JH; Jordan, TR; Rega, P	A NATIONAL SURVEY OF EMERGENCY NURSES AND AVIAN INFLUENZA THREAT	2014	332 emergency nurses (US National)	perceived likelihood to report to work during avian influenza outbreak	Protection Motivation Theory (fear-arousing communications for health behavior) and Social Responsibility Scale	cross-sectional. 8 weeks data collection by mailing surveys to randomly selected nurses. 46% response rate.	321 was number for generalizability. Validity of items in questionnaire included review by experts and prior surveys.	84% report they would report to work. Education level, information sources, and family are associated with likelihood to report to work.	identified formal training on the job as their source of information for Avian	Good	Good	unknown if this would mirror an actual pandemic event.	This sample came from the ENA professional database and they are likely different.	Validation was an expert panel of 7 people and Cronbach calculation of reliability with reported results.
yes	Seale, H; Wang, QY; Yang, P; Dwyer, DE; Zhang, Y; Wang, XL; Li, XY; MacIntyre, CR	Hospital Health Care Workers' Understanding of and Attitudes Toward Pandemic Influenza in Beijing	2012	1909 full-time nurses, doctors, pharmacists, ward clerks (Bei Jing)	perceptions on work attendance, quarantine, antiviral efficacy	(1) demographics, family situation, job description; (2) pandemic influenza knowledge and perceptions; (3) knowledge about methods of spread; (4) intended behavior in the event of a pandemic; and (5) confidence in infection control methods.	cross-sectional anonymous survey delivered in person by study investigators and immediately returned. 24 urban hospitals in Beijing 2009.	used modified questions about flu risk from Tam et al. Satisfied minimum level of participants for difference detection.	only 15% (n = 279) were able to correctly identify the meaning of pandemic influenza (an epidemic on a global scale), whereas 85% (n = 1614) incorrectly labeled a pandemic as being either "a large outbreak of influenza in a given country or geographic area" or "yearly cases of	found higher rates of reporting to work	Fair to Good	Fair to Good	This followed significant strengthening of system after SARs. Authors note differences in the Asian HCW population than Western findings.	An RCT had been initiated for these participants and they had a 99% voluntary response rate.	No validation of tool mentioned.
yes	Martin, SD	Nurses' ability and willingness to work during pandemic flu	2011	735 nurses re	affecting ability and willingness of nurses' to work during pandemic flu	testing willingness to work including: intention to work during PF, feeling knowledgeable about PF, feeling	sample of 1200 nurses. Voluntary anonymous survey mailed and collection via	3 experts reviewed and piloted on 16 nurses	(90.1%) reported willingness to work during pandemic flu and many (84.9%) felt confident in their	higher rates to work,	Good	Good	Followed mild H1N1 pandemic	Maine nurses only	some validation with limited expert review and practice
yes	Tebruegge, M; Pantazidou, A; Ritz, N; Connell, T; Bryant, P; Donath, S; Curtis, N	Perception, attitudes and knowledge regarding the 2009 swine-origin influenza A (H1N1) virus pandemic among health-care workers in Australia	2010	947 HCWs (in pandemic	perceptions, attitudes, and knowledge of Australian HCWs about H1N1 early in pandemic	demographics, sources for outbreak information, perceived risks for potential pandemic (including judgment of media, national, and international organizations), knowledge of mortality and antivirals	2 week web survey	denovo	convicted that Australia was sufficiently prepared for an influenza pandemic. Only 48.0% provided a realistic estimate of the mortality associated with an influenza pandemic at a population level.	expected access to antivirals including stockpiling	Fair	Good	2 week collection of survey coincided with 1st cases in Victoria, Australia	more heavy representation of pediatricians and one Australian state (with current outbreak)	minimal validation
yes	Gershon, RRM; Magda, LA; Qureshi, KA; Riley, HEM; Scanlon, E; Carney, MT; Richards, RJ; Sherman, MF	Factors Associated With the Ability and Willingness of Essential Workers to Report to Duty During a Pandemic	2010	1103 NY wor	what factors matter to essential workers' ability and willingness to report to duty during a pandemic	Demographics (inc prior experience), vaccination, attitudes and practices of protection, pandemic related risk perception, potential facilitators or barriers, workplace safety climate and trust, workplace pandemic planning	cross sectional anonymous survey between Nov. 2008-June 2009 distributed at meetings, with paychecks, bulk distribution by supervisors, and on site, returned in study envelopes	constructed from previously validated studies plus focus group. Survey pilot tested on 15 participants, revised to 9th grade reading level.	participants would be both able and willing to report to duty during a serious pandemic outbreak. Individual factors like adherence to respiratory protection and vaccination improved their ability/willingness, as did organizational factors like preparedness for respiratory protections	safety climate, organizational trust and shared values, respiratory protection program, employer pandemic planning	Excellent	Good	high risk area in New York, within range of the World Trade Center attack. Intentions may not actually predict behavior in real settings. The hypothetical pandemic presented in the outbreak	42% hospital workers, 49% health dept workers, to highest 76% of police officers returned surveys	prev validation
yes	Takahashi, K; Todoroki, M; Kunishima, H; Hoshuyama, T; Ide, R; Kawasaki, T; Koyama, N;	Perception in relation to a potential influenza			healthcare workers' perception of risk, knowledge of preventive measures, and perception of	preventive measures,	Cross-sectional but not noted means of survey delivery. July-Sept. 2003 at 7	international collaborative study developed at National University of	institutional measures was the most important predictor of individual perception of risk. 40% believed they had adequate training. High level of anxiety,	important institutional measures were predictors for			occurred in Japan so many administrative measures for infection control were hypothetical	cross-section does not assert	minimal validation

Continued. Systematic Review Table

Include	Authors	Title	Year Pub.	Study Population	Study Question	Theory or Categories	Design	valid, generalizable?	results	addresses training or work?	quality results	bias/sc	limitations	selection bias	measurement bias
yes	Alexander, GC; Larkin, GL; Wynia, MK	Physicians' preparedness for bioterrorism and other public health priorities	2006	744 physicians	assess physicians' general public health preparedness	organizational preparedness, specific education regarding event, likelihood of attack in community in 5	sectional, random-sample mailed survey in 3 waves in 2003 of 5 selected 600	pretested and content and construct validity were prospectively	of respondents believed that local health care systems need to be prepared for bioterrorism, and 92%	no	Good	Good	between perceived preparedness and actual preparedness	perceived readiness of the local systems was low for well prepared 23-46%	uncertain, also AMA selection of doctors, not reported what types of practices or locations these
yes	Jaakkimainen, RL; Bondy, SJ; Parkownik, M; Bamsley, J	How infectious disease outbreaks affect community-based primary care physicians Comparing the SARS and H1N1 epidemics	2014	183 general and family practitioners in the Toronto community	compare how infectious disease outbreaks H1N1 and SARS affected community based GPs and FPs	serious infectious disease outbreaks affected their clinical work and personal lives; their preparedness for a serious infectious	survey technique, post cards, multiple copies of questionnaires, with reminders over 6 wks sent to mailed	assessed among 30 staff and residents in Toronto with a re-test 3 weeks later.	confident or 48.1% somewhat confident that all levels of government would work well together to ensure the health care system	no	Fair	Fair	low response rate of 46%	limited area of survey, around Toronto where SARs outbreak occurred.	somewhat confident
yes	Tam, DKP; Lee, S; Lee, SS	Impact of SARS on avian influenza preparedness in healthcare workers	2007	999 nurses Hong Kong	attitude towards avian influenza, risk perception, and relationships with previous SARS exposure	community hygienic practice, attitudes towards avian influenza and SARS experiences. Perception of societal risk of avian influenza	anonymous survey to nurses in Hong Kong, identified by 3 nursing associations, mailings to 2929	developed with key stakeholders and healthcare workers, "field tested"	a personal risk of infection in the course of their work (72.7%), and prepared to take care of patients infected with avian	no	Good	Fair	low response rate of 36-39%	most experienced nurses replied 84.3% have 11+years of service. 17.8% worked in SARS	minimal validation but some adaptation of Imai survey
yes	Levine, R; Thompson, CB; Wijetunge, GU; Oliver, AL; Bentley, MA; Neubert, PD; Pirralo, RG; Links, JM; Balicer,	Gauging US Emergency Medical Services Workers' Willingness to Respond to Pandemic Influenza Using a Threat- and Efficacy-Based Assessment Framework	2010	586 EMS workers	EMS characteristics or demographics, Willingness to report if asked or if required, Willingness if Transmission possible to Family, Attitudes and Beliefs	Use Extended Parallel Process Model to reveal influences of perceived threat and efficacy on EMS' willingness to report to duty in an influenza pandemic	representative, stratified random sample of 1,537 EMS workers from May-June 2009. Mailed survey between May-June 2009.	Johns Hopkins Public Health Infrastructure Response Survey Tool (JH PHIRST) to assess respondents'	voluntarily report do duty in a pandemic flu emergency. Feeling prepared to perform responsibilities in a pandemic emergency were 3 times as likely to be willing,	yes	Excellent	Good	response rate 49%, does not actually predict behavior	conducted midway through announcement of H1N1 pandemic	validation thorough

APPENDIX B. Stakeholder Interviews

Dr. Jane Brice, MD, MPH

UNC Professor of Emergency Medicine, Chair UNC Hospital Disaster Committee, EMS Fellowship Program Director, Orange County EMS Medical Director

April 16, 2015

Dr. Julie Casani

Branch Head and Bioterrorism Coordinator, Director of Public Health Preparedness and Response, NC Dept. of Public Health and Human Services

Relevant Former Experience: Maryland Bioterrorism Coordinator

April 23, 2015

Dr. William Roper, MD, MPH

Dean of UNC School of Medicine and CEO UNC Health Care System

Relevant Former Experience: Director of CDC

April 20, 2015

Dalton Sawyer

Director of Emergency Preparedness and Continuity Planning at UNC Health Care

May 8, 2015

Dr. David Weber, MD, MPH

UNC Medical Director of Hospital Epidemiology, Chair of Ebola Coordinating Group, Division of Infectious Diseases

May 5, 2015

Dr. William Fischer II, MD

UNC Pulmonary and Critical Care Medicine, Co-Chair of Ebola Coordinating Group, Médecins Sans Frontières Volunteer to Guinea, Ebola Clinical Trial Researcher

Unable to schedule interview

APPENDIX C. Interview Protocol and HCW Survey

Information Sheet, Verbal or Telephone Consent

UNC Ebola Preparedness Study IRB #14-3203

Hello, my name is Jennica Siddle and I am a student in the Gillings School of Global Public Health at the University of North Carolina at Chapel Hill. I am also a medical student at UNC between my third and fourth years. Thank you for taking your time to speak with me today.

The aim of my study is to use Ebola as an example to learn more about the public health and disaster planning preparation at a major academic hospital. I am interested in exploring the benefits and difficulties of preparing, delegating resources, and assessing risk that the hospital system has undertaken for Ebola from the viewpoint of a key stakeholder such as yourself.

My faculty advisor is Sue Tolleson-Rinehart, faculty member in the UNC Department of Pediatrics in the School of Medicine as well as the School of Public Health.

This interview will consist of several open-ended questions about your professional experience and opinion. It will last between 20 to 40 minutes depending on what you wish to tell me. The interview will be recorded with a digital recorder to make sure I have an accurate depiction of what is said during the interview. I will inform you when the recording is on and off, and you are welcome at any time during the interview to request to speak off record. If at any time before, during, or after our conversation you wish to end the interview early or withdrawal your responses altogether, I will honor your request and delete the recording. After our conversation I will transcribe the interview and delete the audio recording. Both the audio recording and the transcription will be stored on my password-protected computer and will be deleted upon completion of my research.

Your participation is completely voluntary and you may refuse to participate or withdrawal from my research at any time. If you are a UNC employee this study is not a University duty of yours to complete, refusing will not affect your job nor will agreeing to participate give you special job-related consideration. You can contact me at any time at jennica_siddle@med.unc.edu or (724)516-6543, or you can reach my faculty advisor Sue Tolleson-Rinehart at (919)843-9477.

This study # 14-3203 has been approved by the Institutional Review Board at UNC and you can reach them at 919-966-3113 or by email to IRB_subjects@unc.edu.

I will now ask your permission to interview and record your responses.

Do you wish to participate in the interview?

Yes No

Do you consent to be audio recorded during the interview? I will inform you when the audio recording begins and ends, and you may request to have the recorder stopped at any time during the interview.

Yes No

Because of the position you occupy and the expert knowledge you possess, I hope your feedback will clarify and share key decisions made for outbreak and preparedness planning with the scientific community. Do you consent to having your name included in the final results? If you choose to remain anonymous, you will only be identified in a way such as an “emergency or disaster planning or health policy expert”. Again, I plan to publish the results of my research in an academic journal in the future.

Yes No, I wish to remain anonymous

And do you consent to have direct quotes used along with your name (which I will share with you for your approval)?

Yes No

Name _____ Date _____

Thank you for your help!

Questions for Elite Stakeholder Interviews
UNC Ebola Preparedness Study IRB #14-3203

This interview will consist of several open-ended questions about your professional experience and opinion. It will last between 20 to 40 minutes depending on what you wish to tell me. The interview will be recorded with a digital recorder to make sure I have an accurate depiction of what is said during the interview. I will inform you when the recording is on and off, and you are welcome at any time during the interview to request to speak off record. If at any time before, during, or after our conversation you wish to end the interview early or withdrawal your responses altogether, I will honor your request and delete the recording. After our conversation I will transcribe the interview and delete the audio recording. Both the audio recording and the transcription will be stored on my password-protected computer and will be deleted upon completion of my research.

DECISION TO PREPARE

1. Last summer, it seemed that hospitals started developing their own protocols and plans to deal with the threat of Ebola, often in advance of CDC recommendations.

(Provide example if necessary): UNC developed a system wide campaign of “Ask Isolate Call” before the CDC released a similar recommendation.

1 a. Do you think it is the responsibility of local systems to plan their initial response taking into account their individual risk or resources? Or is it the responsibility of national experts, like the CDC, to move quickly to develop and distribute guidelines from the top-down?

(Follow-up if necessary): When things go wrong in these preparations who is most responsible?? A particular example might be the changes to PPE guidelines to cover the neck, following two nurses becoming infected at Texas Presbyterian.

1 b. In your experience, has this national response to Ebola been similar to responses to prior epidemics? (Follow-up) Like SARS?

MEDIA/POLITICAL

2. The media paid very close attention to the Ebola outbreak especially once infected people were being treated on U.S. soil. Even President Obama cautioned the public to avoid Ebola “hysteria.”

2.a. Do you think media attention helped or harmed efforts to assess risk and prepare for the disease?

(Probe if not already covered): did media attention force hospitals to prepare beyond a level that was appropriate?

3. As you know, there have been major budget cuts in recent years for the CDC, NIH, and most public health departments. On top of this, hospitals' costs for treating Ebola have been high. Hospitals have also spent a lot to rule out suspect cases, and to train and purchase gear.

3 a. How are hospital systems supposed to afford these preparations?

3 b. Congress approved an emergency appropriation to fight Ebola internationally and domestically. In your view, will these one-time emergency funds help with state & local preparations?

The CDC can distribute the Hospital Preparedness Program (HPP) or Public Health Emergency Preparedness (PHEP) funding.

3 c. Do you think these funds could help "repay" what's already been spent on Ebola or will they go towards building future capacity for the next infectious disease response?

DECISION WHERE TO STOP

4. Did UNC or the state create an initial plan about how far to go with preparations or was it evolving?

4b. I encountered thoughts of some vocal dissenters, like Dr. Susan Huang at UC Irvine, who said we "overspent, overconsumed and overtrained" for Ebola. But others feel we haven't done enough to invest in general preparedness for such things. How do you feel about the value or the risk of intensely preparing for a specific disease?

[5 AND 6 FOR PEOPLE PARTICIPATING IN CDC VISIT PLUS HEALTH SYSTEM LEADERS]

5. After the CDC visit, why would no hospitals in North Carolina pursue specific Ebola treatment facility designation?

(Probe if necessary for NEGATIVES) I can think of many reasons not to, from cost to the supply chain to public fears, to other policy debates.

(Probe if necessary for POSITIVES) Such as mitigating risk, academic standing, being a world player and increasing visibility/action to Ebola worldwide.

6. The HHS statement about the first 35 ETFs said they were in “priority areas ... served by the five international airports” for screening returning travelers for Ebola. Since then more ETF’s have been designated in mostly clustered areas.

6 a. What are your thoughts about hospitals that did pursue ETF status?

6 b. Without the ETF designation will UNC or NC hospitals be less likely to participate, be funded, or be recognized as a leader in future emerging outbreaks?

FUTURE

7 a. Hospitals devote a lot of effort to preparing for things we hope won’t happen. How does UNC or our state make the best of that need to prepare?

7 b. What if anything do you think UNC or our state can get out of showing leadership in Ebola preparation?

FOR EMERGENCY EXPERTS]

8. Ebola is not unique in terms of making us think about missing a potential diagnosis, protecting the safety of health care workers on the frontline, and triggering systems of surveillance & dissemination of public health knowledge.

8a. What happens next for Emergency Departments to lower their vulnerability to emerging infectious diseases?

9. Thank you – that concludes my questions! Is there anything else you think I should know?

Qualtrics Web Survey for ED HCWs

Default Question Block

Hello, and thank you for your willingness to take this survey about managing Ebola in our facility. We know it's been some time since you took the Ebola preparedness training. In this survey, we ask you to think back about that training. We hope that your feedback will improve training for disease outbreaks in the future.

The survey takes approximately 5 minutes. You may be more comfortable completing this survey on a computer, but you can also complete it on a smartphone or tablet.

Consent to Participate in a Research Study:

Disaster Preparedness for Ebola Virus Disease: Perspective on Public Health Policies and Case Study of UNC Hospital (IRB# 14-3203 approved 05/20/15 - 03/19/16)

Researchers:

Jennica P. Sidde, MS3 and MPH candidate - UNC School of Medicine & Gillings School of Global Public Health
Sue Tolleson-Rinehart, PhD - UNC Dept. Pediatrics & Gillings School of Global Public Health
Jane Brice, MD - UNC Dept. Emergency Medicine
Emily Siskbert-Bennett, PhD - UNC Dept. Hospital Epidemiology

Please direct questions to:

jennica_sidde@med.unc.edu

About research studies in general: You are being asked to take part in a research study because you work at UNC hospital. To join the study is voluntary. You may refuse to join, or you may withdraw your consent to be in the study, for any reason, without penalty and with no bearing on your job at UNC.

Purpose of study: The purpose of this research study is to collect viewpoints of health care workers about institutional preparedness and training related to the Ebola virus disease.

Participants in study: If you decide to be in this study, you will be one of approximately 400 people who are health care workers or medical staff in this research study.

What happens in study: Your part in this study will last approximately 5 minutes. You will complete an online questionnaire that asks you to describe your thoughts about Ebola and the training you received.

Benefits of study: Research is designed to benefit society by gaining new knowledge. You may not benefit personally from being in this research study.

Risks or discomforts of study: We anticipate few to no risks in this study. We encourage you to take this survey on your computer where you feel comfortable.

Protecting privacy: All of the data you provide will be stored anonymously. This means that there will be no way for anybody to ever link your data or the results of the study to your identity.

Stopping participation: You can withdraw from this study at any time, without penalty and skip any question for any reason.

What if you are a UNC employee: Taking part in this research is not a part of your University duties, and refusing will not affect your job. You will not be offered or receive any special job-related consideration if you take part in this research.

Rewards or costs of study: You will receive no monetary reward for participating in this study. There are no costs associated with being in the study.

Questions: You have the right to ask, and have answered, any questions you may have about this research. Contact the principal investigator listed above with any questions, complaints, or concerns you may have.

Your rights as a research participant: All research on human volunteers is reviewed by a committee that works to protect your rights and welfare. If you have questions or concerns, or if you would like to obtain information or offer input, please contact the Institutional Review Board at 919-988-3113 or by email to IRB_subjects@unc.edu.

If you are ready to begin, please click one of the responses below.

- I'm ready to take the survey. I consent.
- I'd rather not take the survey. I do not consent.

What is your job here at UNC? Please choose from the list below.

- Doctor (attending)
- Doctor (resident or intern)
- Nurse (RN, BSN, or LPN)
- Nursing Assistant
- Allied health professional
- House supervisor
- Unit coordinator
- Security staff
- Other (please describe)

And how long have you been working in your present field?

- less than a year
- between a year and 5 years
- more than 5 years
- I am a student in the field

And how long have you been at UNC?

- less than a year
- between a year and 5 years
- more than 5 years

Do you work at any other medical, clinical, or hospital sites other than UNC?

- Yes
- No

How many hours per week do you typically work at a clinical site other than UNC?

How many hours per week in a clinical setting do you typically work at UNC?

What age range do you fall into?

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65-74
- 75+

How many hours of training about Ebola have you received in your job(s)?

- less than 1 hour
- 1 to 5 hours
- 5 or more hours
- No training

When was your most recent Ebola training for your job?

- less than 1 month ago
- 1 to 3 months ago
- 3 to 6 months ago
- 6 months or more ago

We are interested in measuring attitude change to a possible Ebola outbreak with the following timeline in mind:

- ◆ **before you were trained**
- ◆ **after you were trained and now**

Use answers on the **left** for how you feel **before** receiving any training on Ebola.

Use answers on the **right** for how you feel **now** that you have received training on Ebola.

Before Training						Now: After Training & Now				
Strongly Disagree	Disagree	Nether Agree Nor Disagree	Agree	Strongly Agree		Strongly Disagree	Disagree	Nether Agree Nor Disagree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I would be exposed to Ebola	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I was afraid or concerned that we might mis-manage an Ebola case	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I had more questions than answers about Ebola	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	If we had a suspect Ebola case we could deal with it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I would be ready to play my role in responding to Ebola	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I would be comfortable with the idea of responding to a suspected Ebola case	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The same instructions apply for the next question:

Use answers on the *left* for how you felt *before* receiving any training on Ebola.

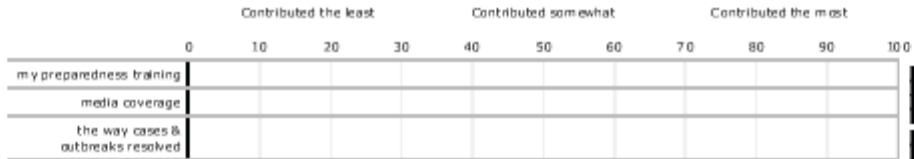
Use answers on the *right* for how you feel *now* that you have received training on Ebola.

Before Training						After Training & Now				
Strongly Disagree	Disagree	Nether Agree Nor Disagree	Agree	Strongly Agree		Strongly Disagree	Disagree	Nether Agree Nor Disagree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	The personal protective equipment would protect me from getting Ebola	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	My role was clear in responding to a suspected Ebola case	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	In the event of an outbreak I would be willing to care for or work around infected patients	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I generally understood the other team member's roles in responding to Ebola	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Ebola would not be a problem in North Carolina	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	UNC hospital system was well prepared to deal with a disease outbreak	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	UNC hospital system took my safety as an employee during an outbreak very seriously	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If your views have changed over time, what things have contributed the most and the least to that change?

Please use the slider bars to respond to each item, where 0 means "did not contribute to changing my views at all" and 100 means "contributed completely to changing my views."

Your answers do not have to "add up" to any particular total amount.



Last Questions

We'd like you to know your thoughts about preparedness. Please choose the response below that comes closest to your views.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
UNC hospital is probably better prepared for an Ebola outbreak than other local hospitals are	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am uncertain if UNC has well-tested plans for events like bioterrorism, disease outbreaks, or disasters	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It would be ok for staff to refuse care for a patient suspected of having Ebola	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My role is important in responding to an emergency situation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have prior experience dealing with other disease outbreaks	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have received more training about Ebola than other disease outbreaks (Influenza, H1N1, SARS, MERS etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
UNC hospital has done enough to prepare specifically for Ebola	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

We'd like to know your reactions to what's going on with Ebola in our country and in the world.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I think the media coverage of Ebola has been excessive, exaggerated, or too much.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The amount of money that has been spent on Ebola has been excessive, exaggerated, or too much.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All hospitals in the U.S. should be prepared to handle Ebola cases, rather than only special containment units.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
All hospital workers should receive education and training to deal with Ebola cases, rather than only special teams.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have confidence in the international response to Ebola	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Thank you for helping us understand this topic better! Please use the space below to write any additional thoughts or feedback that our survey didn't capture.

Figure 1. CDC Infographic of Tiered Response for Ebola (CDC, 2015b)

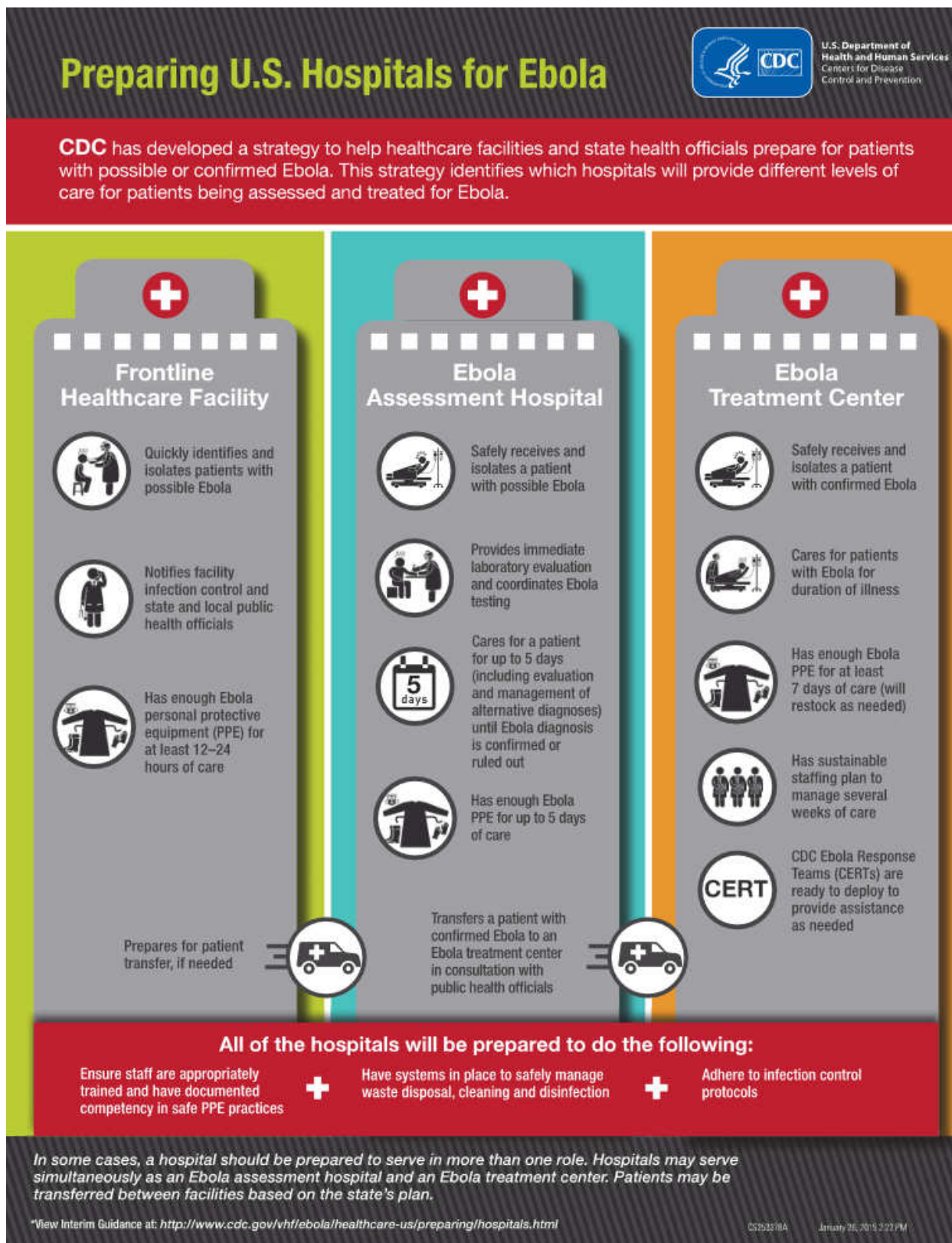


Figure 2. United States Map of 55 ETFs Designated as of Feb. 18, 2015

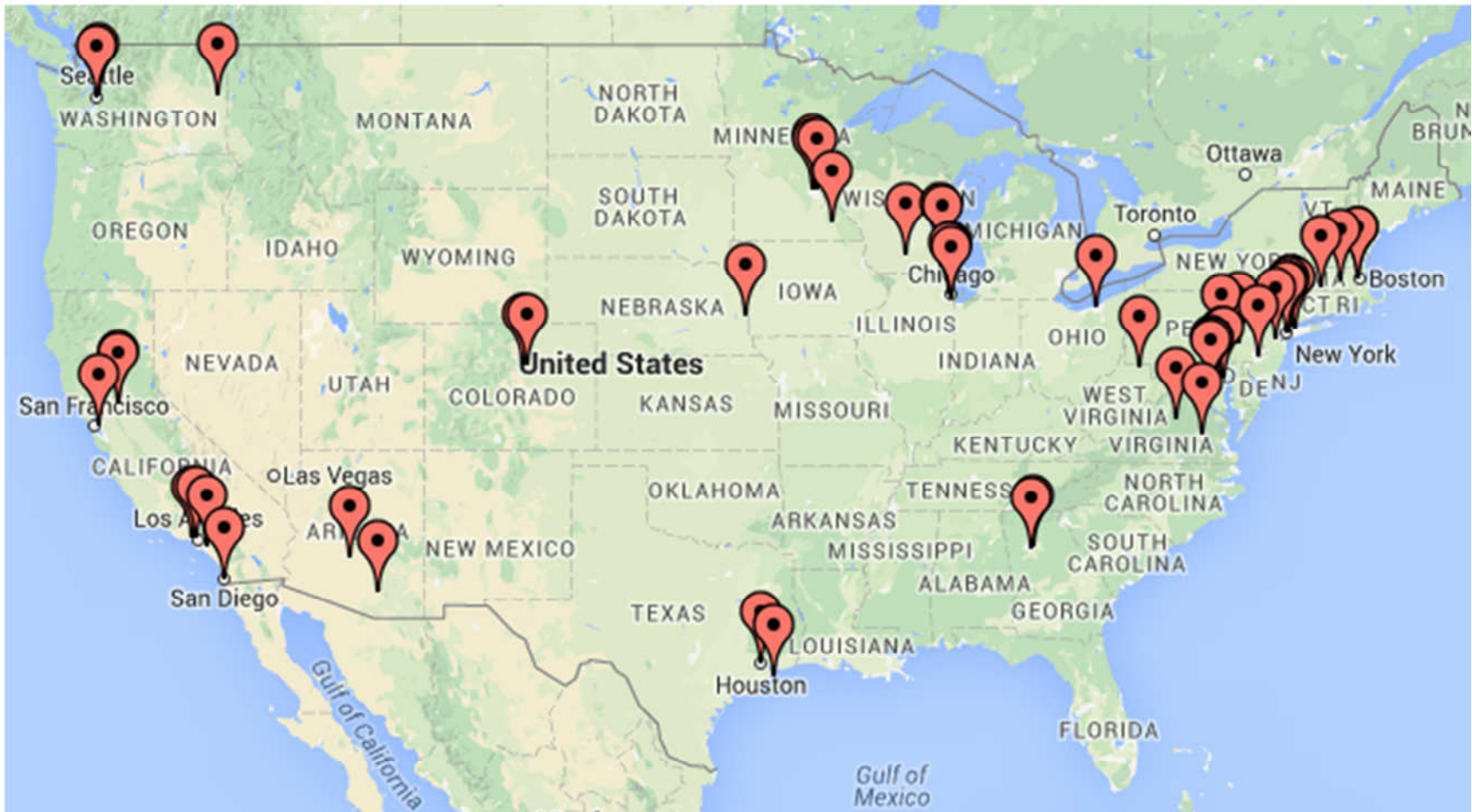


Figure 3. CDC Infographic Public Health Emergency Preparedness Funding (CDC, 2015c)

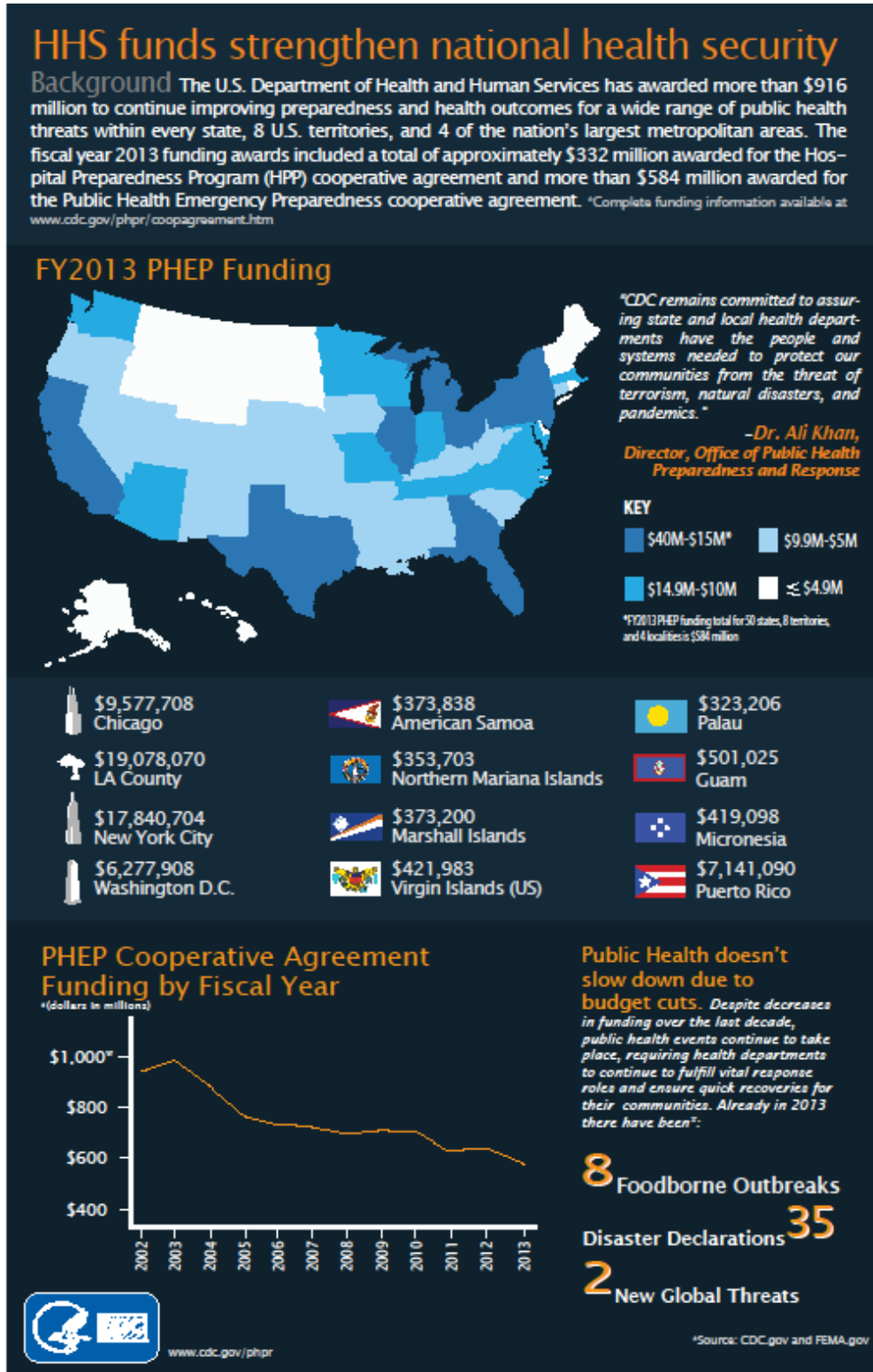
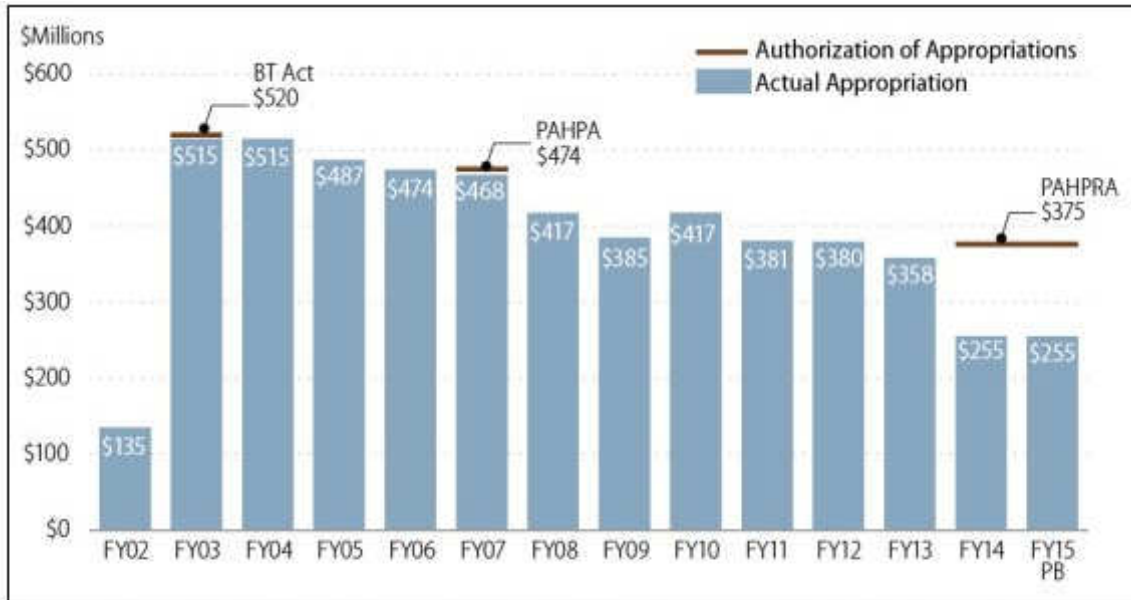


Figure 4. Hospital Preparedness Program Funding History from Huffington Post (Stein, 2014)



Sources: Compiled by CRS from HHS annual "Budget in Brief" and congressional budget justification documents, <http://dhhs.gov/asfr/ob/docbudget/>.

Notes: Amounts include funds for the Emergency System for Advance Registration of Health Professionals (ESAR-VHP). BT Act is the Public Health Security and Bioterrorism Preparedness and Response Act of 2002, P.L. 107-188. PAHPA is the

Figure 5. UNC Hospital System Organizational Chart for Ebola Response

Hospital Incident Management System (Ebola) Version 3 *

* Version altered slightly by J. Siddle 6/5/15 for use in Master's Paper

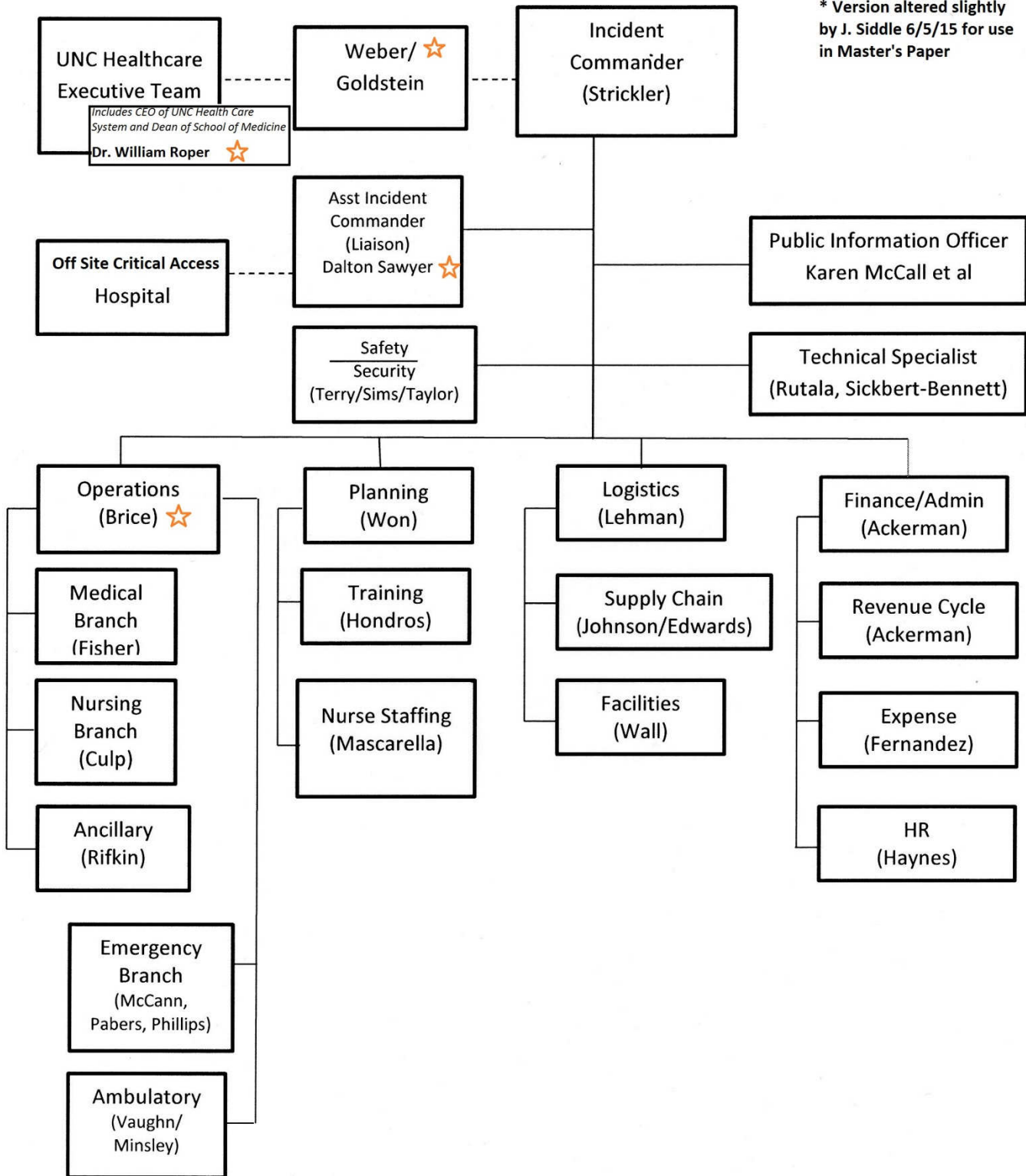


Table 1. 55 Nationally Designated Ebola Treatment Facilities as of Feb. 18, 2015

Gray Shading - 29 hospitals Located in Same City
 *INTL- 16 hospitals located within 50 miles of 5 International Screening Airports
 9 Exclusively Pediatric Hospitals Indicated
 3 Biocontainment Facilities Indicated and Bolded

State	ETCs per State	Hospital System and Location
Arizona	1	Maricopa Integrated Health Systems; Phoenix, Arizona
	2	University of Arizona Health Network; Tucson, Arizona
California	1	Kaiser Los Angeles Medical Center; Los Angeles, California
	2	University of California Los Angeles Medical Center; Los Angeles, California
	3	Kaiser Oakland Medical Center; Oakland, California
	4	Kaiser South Sacramento Medical Center; Sacramento, California
	5	University of California Davis Medical Center; Sacramento, California
	6	University of California Irvine Medical Center; Orange, California
	7	University of California San Diego Medical Center; San Diego, California
	8	University of California San Francisco Medical Center; San Francisco, California
Colorado	1	Children's Hospital Colorado; Aurora, Colorado (Pediatric 1/9)
	2	Denver Health Medical Center; Denver, Colorado
Georgia	1 *INTL	Emory University Hospital; Atlanta, Georgia (Biocontainment 1/3)
	2 *INTL	Grady Memorial Hospital; Atlanta, Georgia
Illinois	1 *INTL	Ann & Robert H. Lurie Children's Hospital of Chicago; Chicago, Illinois (Pediatric 2/9)
	2 *INTL	Northwestern Memorial Hospital; Chicago, Illinois
	3 *INTL	Rush University Medical Center; Chicago, Illinois
	4 *INTL	University of Chicago Medical Center; Chicago, Illinois
Maryland	1	Johns Hopkins Hospital; Baltimore, Maryland
	2	University of Maryland Medical Center; Baltimore, Maryland
	3 *INTL	National Institutes of Health Clinical Center; Bethesda, Maryland (Biocontainment 2/3)
Massachusetts	1	Baystate Medical Center; Springfield, Massachusetts
	2	Boston Children's Hospital; Boston, Massachusetts (Pediatric 3/9)
	3	Massachusetts General Hospital; Boston, Massachusetts
	4	UMass Memorial Medical Center; Worcester, Massachusetts

Table 1 Continued. 55 Nationally Designated Ebola Treatment Facilities as of Feb. 18, 2015

Minnesota	1	Allina Health's Unity Hospital; Fridley, Minnesota
	2	Children's Hospitals and Clinics of Minnesota - Saint Paul campus; St. Paul, Minnesota (Pediatric 4/9)
	3	University of Minnesota Medical Center, West Bank campus, Minneapolis, Minnesota
	4	Mayo Clinic Hospital - Rochester, Saint Marys Campus; Rochester, Minnesota
Nebraska	1	Nebraska Medicine - Nebraska Medical Center; Omaha, Nebraska (Biocontainment 3/3)
New York	1 *INTL	North Shore System LIJ/Glen Cove Hospital; Glen Cove, New York
	2 *INTL	Montefiore Health System; New York City, New York
	3 *INTL	New York-Presbyterian/Allen Hospital; New York City, New York
	4 *INTL	NYC Health and Hospitals Corporation/HHC Bellevue Hospital Center; New York City, New York
	5 *INTL	The Mount Sinai Hospital; New York City, New York
New Jersey	1 *INTL	Robert Wood Johnson University Hospital; New Brunswick, New Jersey
Ohio	1	MetroHealth Medical Center; Cleveland, Ohio
Pennsylvania	1	Children's Hospital of Philadelphia; Philadelphia, Pennsylvania (Pediatric 5/9)
	2	Hospital of the University of Pennsylvania; Philadelphia, Pennsylvania
	3	Lehigh Valley Health Network - Muhlenberg Campus; Muhlenberg, Pennsylvania
	4	Penn State Milton S. Hershey Medical Center; Hershey, Pennsylvania
Texas	1	University of Texas Medical Branch at Galveston; Galveston, Texas
	2	Texas Children's Hospital; Houston, Texas (Pediatric 6/9)
Virginia	1	University of Virginia Medical Center; Charlottesville, Virginia
	2	Virginia Commonwealth University Medical Center; Richmond, Virginia
Wisconsin	1	Children's Hospital of Wisconsin, Milwaukee; Milwaukee, Wisconsin (Pediatric 7/9)
	2	Froedtert & the Medical College of Wisconsin – Froedtert Hospital, Milwaukee; Milwaukee, Wisconsin
	3	UW Health – University of Wisconsin Hospital, Madison, and the American Family Children's Hospital, Madison; Madison, Wisconsin
Washington, D.C.	1 *INTL	MedStar Washington Hospital Center; Washington, D.C.
	2 *INTL	Children's National Medical Center; Washington, D.C. (Pediatric 8/9)
	3 *INTL	George Washington University Hospital; Washington, D.C.
Washington	1	Harborview Medical Center; Seattle, Washington
	2	Seattle Children's Hospital; Seattle, Washington (Pediatric 9/9)
	3	Providence Sacred Heart Medical Center; Spokane, Washington
West Virginia	1	West Virginia University Hospital; Morgantown, West Virginia

Table 2. Ebola Funding Streams from ASPR and CDC (Schemm, 2015)

Funding Source	Funding Amount	Funding Distribution	Eligible Awardees	Funding Purpose
ASPR FY 2014 Appropriations – Hospital Preparedness Program Supplemental	\$1 million	\$50,000 – \$1,000,000 per eligible applicant based on need, subject to availability	State and local public health departments serving five enhanced screening airports	Personal protective equipment procurement and training, implementation of laboratory testing for Ebola, minor retrofitting of healthcare facilities, planning with waste management
ASPR FY 2015 Ebola Funding Appropriations	<i>\$576 million (appropriated amount)</i>	<i>To Be Determined</i>	<i>To Be Determined</i>	<i>To Be Determined</i>
CDC FY 2014 Appropriations – PHEP Supplemental	Approximately \$4.7 million	Base + Allocation percentage based on volume of travelers from Ebola-infected countries	PHEP Awardees	Support state and local health departments with active monitoring and direct active monitoring (AM/DAM)
CDC FY 2015 Ebola Funding Appropriation – PHEP Supplemental	Approximately \$145 million	Base + allocation percentage based on volume of travelers from Ebola-infected countries	PHEP Awardees	Public health preparedness planning, coordination with healthcare for implementation of tiered strategy, contact investigation, AM/DAM
CDC National Center for Emerging and Zoonotic Infectious Diseases FY 2015 Ebola Funding – Epidemiology and Laboratory Capacity (ELC) Supplemental	Approximately \$106 million	Competitive	Current ELC grantees	Healthcare infection control assessment and response; enhanced laboratory biosafety and biosecurity capacity; global migration, border interventions, and migrant health

Table 3. Emergency Department HCW Demographics and Ebola Training

OCCUPATION		Response	%
Doctor (attending, resident, or intern)		48	30%
Nurse (RN, BSN, MSN, LPN or NP)		51	35%
Nursing Assistant		15	9%
Allied health professional		4	3%
House supervisor		10	6%
Unit coordinator		14	9%
Security staff		11	7%
Total		158	
EXPERIENCE in FIELD			
< 1 year		16	10%
1 - 5 years		47	30%
5 + years		94	59%
Total		158	
EXPERIENCE at UNC			
< 1 year		12	8%
1 - 5 years		65	41%
5 + years		81	51%
Total		158	
OTHER WORK SITE			
Yes		42	27%
No		116	73%
Total		158	
WEEKLY HOURS UNC			
0-20 hours		23	23%
21-39 hours		34	34%
40 hours		37	37%
40-80 hours		7	7%
Total		101	
AGE RANGE			
18-34		50	31%
35-54		89	55%
65-74		20	13%
Total		159	
TIME TRAINED for SPECIFICALLY EBOLA		Response	%
< 1 hour		4	3%
1 - 5 hours		126	80%
5 + hours		26	17%
No training		1	1%
Total		157	
RECENTNESS of TRAINING			
Less than 3 months ago (Jan-April 2015)		34	22%
3 to 6 months ago (Oct 2014-Jan 2015)		107	68%
+ 6 months ago (earlier than Sept. Oct. 2014)		16	10%
Total		157	

Table 4. Emergency Department HCWs Attitudinal Agreement to UNC Site Ebola Preparations



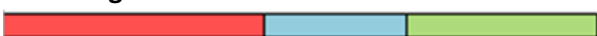




<p>I have received more training about Ebola than other disease outbreaks (influenza, H1N1, SARS, MERS etc.). (n=150)</p> <p>7% 14% Agree 79%</p> 
<p>UNC hospital is probably better prepared for an Ebola outbreak than other local hospitals are. (n=150)</p> <p>4% 30% Agree 66%</p> 
<p>I am uncertain if UNC has well-tested plans for events like bioterrorism, disease outbreaks, or disasters. (n=149)</p> <p>Disagree 44% 24% 32%</p> 
<p>It would be ok for staff to refuse care for a patient suspected of having Ebola. (n=149)</p> <p>37% 19% Agree 44%</p> 
<p>I have prior experience dealing with other disease outbreaks. (n=150)</p> <p>Disagree 58% 9% 33%</p> 
<p>My role is important in responding to an emergency situation. (n=149)</p> <p>6% 7% Agree 87%</p> 
<p>UNC hospital has done enough to prepare specifically for Ebola. (n=147)</p> <p>7% 27% Agree 66%</p> 

Table 5. Emergency Department HCWs Attitudinal Agreement to Broader National and International Ebola Preparation

Questions & Responses	Disagree (red)	Neither (blue)	Agree (green)
I think the media coverage of Ebola has been excessive, exaggerated, or too much. (n=145)	23%	26%	Agree 51%
The amount of money that has been spent on Ebola has been excessive, exaggerated, or too much. (n=149)	Disagree 48%	34%	18%
All hospitals in the U.S. should be prepared to handle Ebola cases, rather than only special containment units. (n=149)	28%	13%	Agree 60%
All hospital workers should receive education and training to deal with Ebola cases, rather than only special teams. (n=149)	16%	11%	Agree 73%
I have confidence in the international response to Ebola. (n=149)	23%	33%	Agree 44%

Table 6. Rating of Variables in viewpoint change, Training Level, and Index of change scores by occupation

Contributors to View Change over Time	Average Value and Range	Standard Deviation
My preparedness training	63.56 (0-100)	36.42
Media coverage	28.17 (0-100)	30.13
The way cases & outbreaks resolved	44.01 (0-100)	32.31
Hours of Training	Average Index Change	Standard Deviation
Less than 1 hour	4.75	7.63
Between 1 and 5 hours	17.29	9.48
More than 5 hours	20.74	10.50
Occupation	Average Index Change	Standard Deviation
Allied health professional (n=3)	17.33	0.58
House supervisor (n=7)	19.43	5.26
Health unit coordinator (n=13)	14.38	9.79
Security staff (n=7)	16.43	16.67
Advanced Nurse (MSN, LPN or NP) (n=5)	24.00	16.73
Senior Doctor (attending) (n=29)	21.14	9.21
Junior Doctor (resident or intern) (n=10)	13.20	7.83
Nurse (RN, BSN) (n=44)	15.52	8.57
Nursing Assistant (n=13)	18.92	11.12
Total	17.45	9.89

Table 7. ED HCWs opinion changes and directions from before they were trained to after

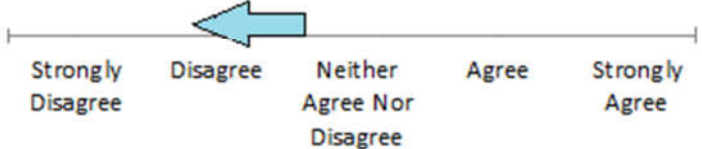
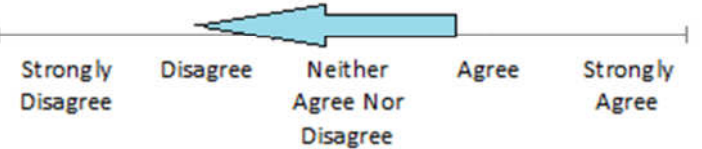
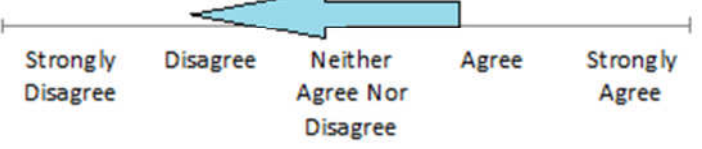
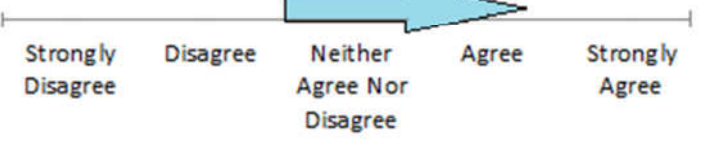
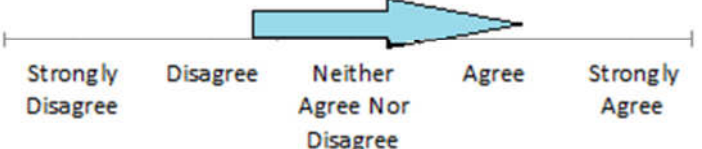

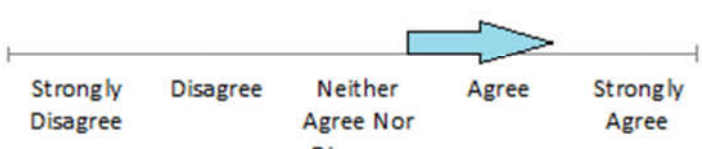
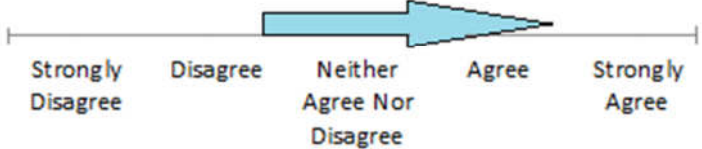
Variable Opinion	Pre to Post Mean Score
<p>I would be exposed to Ebola</p> <p>1 2 3 4 5</p>  <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>2.56 to 2.11 ($p=0.0000$) Ambivalent to Disagree</p>
<p>I was afraid or concerned that we might mismanage an Ebola case</p> <p>1 2 3 4 5</p>  <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>3.59 to 2.22 ($p=0.0000$) Agree to Disagree</p>
<p>I had more questions than answers about Ebola</p> <p>1 2 3 4 5</p>  <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>3.58 to 2.08 ($p=0.0000$) Agree to Disagree</p>
<p>If we had a suspect Ebola case we could deal with it</p> <p>1 2 3 4 5</p>  <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>2.79 to 4.08 ($p=0.0000$) Ambivalent to Agree</p>
<p>I would be ready to play my role in responding to Ebola</p> <p>1 2 3 4 5</p>  <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>2.54 to 4.03 ($p=0.0000$) Disagree to Agree</p>

Table 7 Continued. ED HCWs opinion changes and directions from before they were trained to after

<p>I would be comfortable with the idea of responding to a suspected Ebola case</p> <p>1 2 3 4 5</p> <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>2.09 to 3.60 ($p=0.0000$) Disagree to Agree</p>
<p>The personal protective equipment would protect me from getting Ebola</p> <p>1 2 3 4 5</p> <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>2.94 to 3.78 ($p=0.0000$) Ambivalent to Agree</p>
<p>My role was clear in responding to a suspected Ebola case</p> <p>1 2 3 4 5</p> <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>2.39 to 4.23 ($p=0.0000$) Disagree to Agree</p>
<p>In the event of an outbreak I would be willing to care for or work around infected patients</p> <p>1 2 3 4 5</p> <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>2.65 to 3.52 ($p=0.0000$) Ambivalent to Agree</p>
<p>Ebola would not be a problem in North Carolina</p> <p>1 2 3 4 5</p> <p>Strongly Disagree Disagree Neither Agree Nor Disagree Agree Strongly Agree</p>	<p>2.86 to 3.15 ($p=0.0001$) Ambivalent to Less Ambivalent/More Agree</p>

Table 7 Continued. ED HCWs opinion changes and directions from before they were trained to after

<p>UNC hospital system was well prepared to deal with a disease outbreak</p> <p>1 2 3 4 5</p> 	<p>2.59 to 3.88 (p=0.0000) Disagree to Agree</p>
<p>UNC hospital system took my safety as an employee during an outbreak very seriously</p> <p>1 2 3 4 5</p> 	<p>3.22 to 4.11 (p=0.0000) Ambivalent to Agree</p>
<p>I generally understood the other team member's roles in responding to Ebola</p> <p>1 2 3 4 5</p> 	<p>2.46 to 4.18 (p=0.0000) Disagree to Agree</p>