THE EFFECTS OF STATE GOVERNANCE STRUCTURE AND FEDERAL PUBLIC HEALTH EMERGENCY PREPAREDNESS FUNDING ON DISASTER RESPONSE TIME IN THE US: 2007-2010

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ABSTRACT

THE EFFECTS OF STATE GOVERNANCE STRUCTURE
AND FEDERAL PUBLIC HEALTH EMERGENCY PREPAREDNESS FUNDING
ON DISASTER RESPONSE TIME IN THE US: 2007-2010

by Jean Popiak Goodwin

The ability to notify and assemble staff quickly in order to begin the decision-making process is critical when faced with a public health emergency. This study examined state infrastructure factors that affect response time during a public health incident, specifically, the effect of federal public health emergency preparedness (PHEP) funding and state governance structure on staff response time.

A retrospective cross-sectional mixed methods study design utilized data from the Centers for Disease Control and Prevention's (CDC) Preparedness Emergency Response System for Oversight, Reporting and Management Services (PERFORMS) and the Association of State and Territorial Health Officials (ASTHO) for all 50 states between 2007 and 2010. Quantitative analysis showed that, after removing outliers, PHEP funding did not significantly reduce response time for staff notifications $R = -.008$, $F(_{1,577}) = .039$, $p = .422$ or staff assemblies $R = -.039$, $F(_{1,441}) = .661$, $p = .208$. However, the type of state governance structure significantly reduced response time for staff notifications $t(_{577}) = -2.02$, $p = .022$ and staff assemblies $t(_{441}) = -2.96$, $p = .02$. When compared to states with other forms of governance structure, states with a centralized form of governance structure took longer to notify ($M = 23.44$ minutes vs. $M = 27.54$

minutes) and to assemble staff (M = 32.36 minutes vs. M = 41.74 minutes). Other factors, including the number of staff responding, the type of incident, whether the incident was announced or unannounced and whether the incident was during normal business hours or outside normal business hours did not explain the observed response time.

For states that exceeded CDC-recommended response times, qualitative analysis identified barriers to a timely response. Three themes emerged, related to individual staff members, the organization itself and channels of communication. Once barriers related to the organization and channels of communication were identified within a state, these barriers were reduced or eliminated. An individual barrier - assuring individual staff members were continually monitoring telecommunications devices and trained to respond appropriately – was ongoing and hard to reduce or eliminate.

In an attempt to understand the circumstances surrounding each incident, the survey questionnaire was changed in 2009 and two additional survey modules were added, which had a negative effect on mean response times and response rates. State governance structure, increased reporting burden and staff burnout may explain some of the lack of improvement in response time over the four year study period.

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ACRONYMS

AAR – After Action Report

ASTHO – Association of State and Territorial Health Officials

CDC – Centers for Disease Control and Prevention

DHHS – Department of Health and Human Services

EOC – Emergency Operations Center

GAO – General Accounting Office

HPPG – High Priority Performance Goal

HSEEP – Homeland Security Exercise and Evaluation Program

HSPD – Homeland Security Presidential Directive

ICS – Incident Command System

IOM – Institute of Medicine

LHA – Local Health Agency

MRC – Medical Reserve Corp

NACCHO – National Association of County and City Health Officials

NGA – National Governors Association

NIMS – National Emergency Management System

PAHPA – Pandemic and All-Hazards Preparedness Act

PHEP - Public Health Emergency Preparedness

SHA – State Health Agency

TFAH – Trust For America's Health

CHAPTER I

INTRODUCTION

Public health emergency preparedness (PHEP) is a relatively new field in the public health arena. With the discovery of the Iraqi biological weapons program and the release of sarin nerve gas in a Tokyo subway system in the late 1990s, the need to improve public health infrastructure to respond to biologic terrorism and national public health emergencies was identified (Institute of Medicine, 2002; Shipp, Dickson, Quinlisk, Lohff, & Franklin, 2003). After the terrorist attacks in New York City on September 11, 2001 and the anthrax attacks a month later, Congress passed the Public Health Security and Bioterrorism Preparedness Response Act of 2002 providing almost $1 billion to state, local and territorial health agencies to enhance their PHEP infrastructure (Department of Defense, 2002). Since then, almost $8 billion has been awarded to state and local health agencies through the Centers for Disease Control and Prevention (CDC) to enhance the infrastructure of public health agencies and assist those health agencies in preparing for or responding to a terrorist event, natural disaster, or emerging infectious disease (see Appendix A) (Centers for Disease Control and Prevention, 2010).

Historically, state health agencies (SHAs) and local health agencies (LHAs) were considered the community-based stewards of public health but were not intended to coordinate the health security of the nation (Gursky, 2005, Meyer & Weiselberg, 2009). With the threat of biologic terrorism looming, public health agencies became the cornerstones of emergency preparedness programs. Public health's new responsibilities in emergency preparedness and response planning rested on past accomplishments;

namely, public health's capacity to investigate reports and conduct disease surveillance. However, the large introduction of funding in a short period of time did not compensate for competing priorities between PHEP and core public health services, workforce issues and lack of evidence-based research in PHEP. Planning for and development of the capacities and capabilities needed to respond "adequately" to a real event of any size were lacking and the term "adequately" was never defined. States were at a disadvantage to spend the funding received or target their efforts effectively (Avery & Wright, 2010). In this early phase of funding, all states were required to develop a long-term, five year bioterrorism framework targeting six focus areas: (a) preparedness planning and readiness assessment; (b) surveillance and epidemiology capacity; (c) laboratory capacity for biological agents; (d) communications and information technology; (e) risk communications and health information; and (f) education and training. Although this bioterrorism framework was developed by most states, 88% of state health officials in one study readily acknowledged that many short-term initiatives were funded (Gursky, 2003).

After 9/11, there was a large infusion of PHEP funding to the states; since then, federal and state funding has decreased for public health and PHEP (Trust for America's Health, 2008, 2009b). Federal, state and local public health funding continue to dwindle (Trust for America's Health, 2009a). In 2010, 40 states reduced funding for population-based public health core services and PHEP activities. Few states continue to allocate funds directly to public health preparedness (Trust for America's Health, 2011).

With a decrease in overall federal funding, there is a concern that SHAs are rebuilding their public health infrastructure under the guise of emergency preparedness, rather than using PHEP funding to build public health emergency preparedness capacity (Watson-Alvan & Alves-Dunderson, 2007). The reduction of federal funding at the state level has triggered SHAs to reduce funding to LHAs; it appears that PHEP funding is replacing this loss. Gursky (2003) interviewed 34 LHA PHEP program directors and found that federal funding financed 100% of the PHEP program for almost all study participants. There have also been calls to integrate PHEP with the public health system for "dual use", providing gains to traditional public health capacities such as surveillance and disease detection, with bioterrorism applications (Lurie, Wasserman, & Nelson, 2006; Pestronk, 2005).

A state's governance structure influences how public health carries out their public health responsibilities (Turnock, 2009). Some states are centralized wherein the state agency has direct control and authority over LHAs. In other states, LHAs are decentralized and independent of the state, are run directly by the county or the township and are governed by local boards of health, a health commissioner or a cooperative agreement (Association of State and Territorial Health Officials, 2009). Other states have a mixed model of centralized and decentralized and still others have no LHAs; the state runs all LHA-type functions (Association of State and Territorial Health Officials, 2009).

There are 2,794 LHAs in the United States (National Association of County and City Health Officials, 2008). The number of LHAs range from zero in Delaware, Hawaii and Rhode Island to 351 in Massachusetts. While each type of state governance structure

has its strengths and weaknesses, no particular structure is considered the gold standard. Since there is no standard state governance structure, differences in structure dictate how a state allocates funding and declares health emergencies (Association of State and Territorial Health Officials, 2009).

While there is anecdotal evidence that increased PHEP funding has improved the ability of a state to be prepared for a real event, there is no empirical evidence to support this assertion. Billions of dollars in funding and the lack of well-defined, well-accepted, evidence-based standardized metrics of outcomes have led policymakers seek better indicators to quantify success. In response to these challenges, the Pandemic and All Hazards Preparedness Act (PAHPA) was mandated by Congress in 2006, requiring states to meet evidence-based benchmarks (Pandemic and All-Hazards Preparedness Act, 2006). CDC developed measures for public health capacity and operational capabilities defined by PAHPA and Homeland Security Presidential Directive 21 (HSPD-21) (Department of Homeland Security, 2007). HSPD-21 defined a national strategy for public health and medical preparedness, with the highest priorities identified as: (a) incident management; (b) crisis and emergency risk communication with the public; (c) biosurveillance, including laboratory, epidemiological investigation and surveillance; (d) countermeasure delivery, including distribution, dispensing and mass prophylaxis; and (e) community mitigation strategies, such as isolation and quarantine.

CDC brought together workgroups comprised of representatives from federal agencies, state and local public health agencies, national partner organizations and non-profit organizations. These subject matter experts identified the topic "incident management" as one of the top priorities for which performance measures should be

developed. The workgroup identified key performance indicators that were considered important, measurable, achievable and relevant to incident management capabilities. Bringing these stakeholders together to assist in the development of performance measures also increased the likelihood that the measures would be accepted and supported and brought a temporary consensus around the initial standards developed. The first performance measures, supporting data elements and reporting requirements were developed and released to all states and the survey was piloted in 2006. Quantifiable incidents were determined to be a priority, including the number of incidents and the timeliness of notifying and assembling staff for incidents. For the purpose of this study, the term 'incident' is defined as drills, exercises and real events.

One incident management performance measure developed was the *CDC Staff Notification Performance Measure*. Staff notification involved alerting staff members to prepare for an incident and the acknowledgement by the staff member confirming the receipt of the notification. CDC recommended an acknowledgement of the notification in 60 minutes or less. A second incident management performance measure was the *CDC Staff Assembly Performance Measure*. Staff assembly involved alerting staff members to report for immediate duty and the reporting for immediate duty either in-person, virtually, or a combination of the two. CDC recommended a staff assembly time of 2.5 hours or less. In 2009, two new incident management performance measures were added. The third incident performance measure was the reporting of the *Best Demonstration* of an incident conducted that year. Also in 2009, another incident management performance measure added was the *HHS/OMB High Priority Performance*

Goal (HPPG). In 2009, the baseline for all states was 70% (Centers for Disease Control and Prevention, 2009). This performance measure captured the same data as the *CDC Staff Assembly Performance Measure* but had a targeted assembly time of 60 minutes or less. Specifically, the target was defined as follows:

> By 2011, increase the percentage of state public health agencies that can convene within 60 minutes of notification a team of trained staff that can make decisions about appropriate response and interaction with partners to 90 percent (Centers for Disease Control and Prevention, 2009, p. 57).

Knowing the requirement for a staff assembly is 60 minutes, the question becomes: "How can states improve the timely assembly of staff within their state to meet this requirement?"

Study Purpose

The purpose of the study was to assess the relationship between elements of public health infrastructure and state health department response capabilities. Specifically the relationships among two infrastructure elements (state governance structure and PHEP funding) and two response-related outcomes (time to notify and time to assemble staff) were assessed (see Figure 1). An additional assessment of infrastructure-related factors to timely response was conducted based on narrative information describing barriers to timely staff notification and assembly.

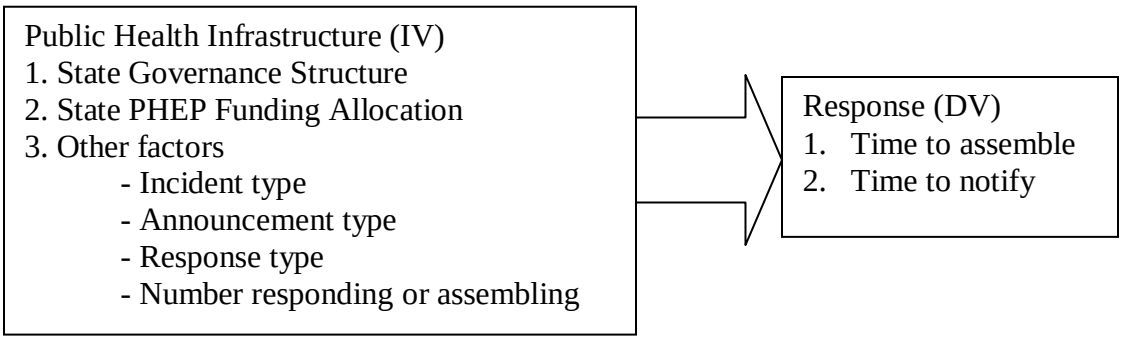


Figure 1. Public Health Infrastructure Independent Variables (IV) and Response Time Dependent Variables (DV)

Study Importance

This study's findings are important because the increase in man-made and natural incidents requires SHAs to respond in a timely and organized fashion to a perceived or real event. The ability to notify and assemble staff is related to improved preparedness by reducing a critical decision-making time period – the initial response. An effective and timely response can also prevent a threat from becoming more than a threat as well as decrease morbidity and mortality during a real event. By understanding what contributes to an effective response, the federal government can provide states with the needed resources to assist them in meeting the HPPG requirement, thereby reducing response time.

Study Significance

This study examined the relationship between state governance structure and the level of preparedness within a state, specifically the state's ability to notify and assemble staff for an incident. The study provides evidence that may support or refute the need to develop systems that support effective funding allocation methodology and state governance structures that factor into building and improving a state preparedness

program. The findings of this study have broad interest to federal, state and local government entities and may influence future policy decisions. By operationalizing the findings, public health managers can then make decisions using evidence-based research as they allocate PHEP funding to meet PAHPA requirements in an effort to decrease response time. Stakeholders, including the public, non-government organizations and other groups can better evaluate the influence federal funding has on state programs and quantify whether the public health system is better prepared to handle a large-scale public health emergency.

Research Questions

The study's primary research question was: "To what degree does state infrastructure predict a timely response to public health emergencies?"

The first step in mitigating an incident is bringing together key personnel to make decisions. It was noted during Hurricane Katrina that those individuals who made decisions with the information they had available to them saved lives, money and time whereas ineffective decision making delayed relief efforts (US House Select Bipartisan Committee, 2006).

Few question whether funding affects a state's ability to prepare for a real event. It costs money to conduct drills and exercises and train personnel to prepare for and respond to a disaster. Several studies concluded that federal PHEP funding supported increased improvement in local PHEP and had a significant impact on local public health system performance (Avery & Zabriskie-Timmerman, 2009; Bashir, Lafronza, Fraser, Brown, & Cope, 2003; Scutchfield, Knight, Kelly, Bhandari, & Vasilescu, 2004).

Studies have suggested the need for exercises that prepare for real events (Brand, Kerby, Elledge, Johnson, & Magas, 2006; General Accounting Office, 2007). The US House Select Bipartisan Committee concluded that reduced funding for training exercises contributed to FEMA's delay in the initial response to Hurricane Katrina (US House Select Bipartisan Committee, 2006).

Other factors could affect response time. The type of incident (defined as a drill, exercise or real event) could affect the time to notify or assemble staff. Drills and exercises are rehearsals to a real event. While drills and exercises mimic a real event, if individuals are informed that a drill or exercise is being conducted so as not to create a panic situation, the urgency associated with a timely notification and assembly may be reduced. If staff knows they are responding to a real event they may respond faster since lives may be at stake.

The type of announcement is a second factor that could affect response time. Announcement type was defined as announced or unannounced. If the incident is pre-announced, staff may have a heightened awareness that a notification will be conducted in the near future and may take additional steps to prepare for the notification, such as staying near the phone to await the call.

The type of response is a third factor that could affect response time. Response type was defined as a response conducted during normal business hours or outside normal business hours for staff notifications and immediate or delayed for staff assemblies. Notifications and assemblies conducted outside normal business hours may have a longer response time than notifications conducted during normal business hours, since staff are usually on-site and may alert other staff members who are unaware of the

need to respond. For immediate assemblies, staff must first receive the notification to assemble then travel to the designated location, increasing the time to assemble.

Finally, the number of staff contacted may affect the time to respond. Contacting eight staff members and requesting an acknowledgement to a notification or a request to assemble should, theoretically, take less time than making the same request of 80 staff members.

The first investigative question was: "To what degree do states receiving higher levels of PHEP funding report shorter staff notification and assembly response times than states receiving less funding?"

Hypothesis 1: States receiving higher levels of PHEP funding will report shorter staff notification and assembly response times than states receiving lower levels of funding.

$H1a_0$: States receiving higher levels of PHEP funding will report the same or longer staff notification response times than states receiving lower levels of funding.

$H1a_1$: States receiving higher levels of PHEP funding will report shorter staff notification response times than states receiving lower levels of funding.

$H1b_0$: States receiving higher levels of PHEP funding will report the same or longer staff assembly response times than states receiving lower levels of funding.

$H1b_1$: States receiving higher levels of PHEP funding will report shorter staff assembly response times than states receiving lower levels of funding.

Additional analysis was conducted to determine if response time was influenced by incident type, announcement type, response type, or number of staff responding to a notification or assembling.

Another factor that could affect response time is state governance structure. State governance structure was defined by the location of the political and budgetary power within the state. No state governance structure is considered the gold standard; each has its strengths and limitations, particularly those related to disaster response. For the Hurricane Katrina response, the US. House Select Bipartisan Committee (2006) implied that a fully-functioning centralized command and control system would have worked better than a decentralized system. Provan and Milward agreed that a centralized structure provided more direct and complete control and facilitated coordination, integration and direct, non-fragmented external control (Provan & Milward, 1995). The second investigative question was: "To what degree do states with centralized state governance structure report shorter staff notification and assembly response times than states with other forms of state governance structures?"

Hypothesis 2: States with centralized state governance structure will report shorter staff notification and assembly response times than states with other forms of state governance structures.

$H2a_0$: States with a centralized state governance structure will report the same or longer staff notification response times than states with other forms of state governance structures.

$H2a_1$: States with a centralized state governance structure will report shorter staff notification response times than states with other forms of state governance structures.

$H2b_0$: States with a centralized state governance structure will report the same or longer staff assembly response times than states with other forms of state governance structures.

$H2b_1$: States with a centralized state governance structure will report shorter staff assembly response times than states with other forms of state governance structures.

Additional analysis was conducted to determine if response time is influenced by incident type, announcement type, by response type or number of staff responding to a notification or assembling.

In addition to state PHEP funding allocation and state governance structure, there may be other barriers to assuring a timely response to an incident. To elicit other potential factors that negatively affect public health infrastructure and response time, qualitative analysis of narrative data answered the third investigative question: "What additional infrastructure-related factors serve as barriers to a timely response?"

Summary

This study examined the relationship between state infrastructure and a timely response to public health emergencies. To do this, state PHEP funding allocations and state governance structure were used to assess the timely notification and assembly of staff for an incident. The information gained will assist states who have not yet been able to assemble staff within 60 minutes of being notified of an incident and identify factors that contribute to states meeting the HPPG requirement.

CHAPTER II

LITERATURE REVIEW

Although CDC's public health emergency preparedness program has been in existence at the state level since 1998, there has been little research establishing what effect state governance structure or state PHEP funding allocation has on a state's level of preparedness.

The literature review focuses on the topics: public health preparedness and the need to plan and train for real events; the advantages and challenges in the different forms of state governance structures within the US; and the history and current status of PHEP funding. For this study, "preparedness" was defined as the ability to notify and assemble staff for an event. "Incident" was defined as a drill, exercise or real event. "Real event" was defined as a factual occurrence that interrupts normal procedures.

Public Health Preparedness

Public health preparedness is "the ability of the *public health system, community, and individuals* to prevent, protect against, quickly respond to, and recover from health emergencies, particularly those in which scale, timing, or unpredictability threatens to overwhelm routine capabilities" (Centers for Disease Control and Prevention, 2011b). It is possible to prepare for unexpected incidents by strengthening response capabilities and providing resources to state and local agencies. Preparedness activities and real events occur on a daily basis, such as monitoring weather conditions or reacting to a suspicious

white powder. CDC's PHEP funding provides financial support to states to carry out planning and readiness assessments, infrastructure development and maintenance, workforce training and expansion, and communication (Garfield, 2005).

Incident management is defined as "a flexible and integrated system that provides a common framework for departments and agencies at all levels of government, the private sector and non-government organizations to work seamlessly to prepare for, prevent, respond to, recover from and mitigate the health effects of incidents, regardless of cause, size, location, or complexity in order to reduce the loss of life or property and harm to the environment" (Centers for Disease Control and Prevention, 2009). It is a capability required to direct and coordinate the implementation of other public health emergency capabilities and is therefore critical to public health emergency preparedness and response. Incident management allows public health agencies to make informed, timely, and effective decisions that direct resources and personnel to adaptively address ongoing and evolving health needs arising from emergencies.

One aspect of incident management is the need to notify and assemble staff in a timely and organized way. The National Incident Management System (NIMS) has been the established framework for incident management and unified chain of command since the 1970s. The Incident Command System (ICS) is a part of NIMS and consists of the policies, procedures and a standardized organizational structure used to bring people together to effectively collaborate, coordinate and communicate during a real event. ICS has a flexible and nimble construct. Once a decision is made to activate the incident management roles, notification and assembly of key personnel is integral to responding to an incident. Incident management roles are assigned during an incident; these roles are

shown in Appendix B. While the ICS organization chart shows eight roles, only the positions needed (based on the size and extent of the incident) are brought together at the beginning of the incident.

Decreasing the time to notify and assemble staff is critical to the preliminary identification of an incident and the swift response to contain it. The beginning of an incident is characterized by uncertainty, misinterpretation, indecisiveness and need to seek more information (Seattle Fire Department, 2011). The absence of an organized, timely staff assembly can confuse who is responsible for, has authority over and is accountable for the outcome of the incident. A delay in decision-making increases the likelihood of morbidity and mortality (Seattle Fire Department, 2011). At the beginning of an incident there may be uncertainties; notification puts staff on high alert to prepare. Staff notification is the predecessor to staff assembly. Once a decision is made to assemble and the staff assembles, a coordinated, swift response to the incident can be carried out.

Real events testing the public health system occur daily; however, they tend to be small in scope. There are few large real-world opportunities to test whether the resources, staff and processes are in place to maintain and restore a population's health status after a real event (Asch, Stoto, Mendes, Valdez, Gallagher, Halverson et al., 2005). Opportunities to test larger events can be accomplished through exercises. The Homeland Security Exercise and Evaluation Program (HSEEP) developed standards for exercising, including training facilitators and evaluators who monitor and observe exercises (Department of Homeland Security, 2010). HSEEP defines three types of

operations-based exercises: (a) drills; (b) functional exercises; and (c) full-scale exercises. Drills are a coordinated, supervised activity, testing a single function in a single agency and conducted in a low-stress environment. A functional exercise is a single or multi-agency activity designed to test capabilities and multiple functions using a simulated response in a moderately stressful environment. A full-scale exercise is a multi-agency, multi-jurisdictional activity, where resources are deployed, scenarios are scripted and the exercise environment is high stress, mimicking a real event. The aforementioned exercise types were included this study. Due to small sample size, functional exercises and full-scale exercises were combined.

The ability to train a workforce that is flexible, scalable and ready to respond to a public health threat safeguards health and saves lives. Training through exercises simulates activities conducted during a real emergency (General Accounting Office, 2007). Exercises are essential to determine the performance of the workforce, coordination with other agencies, decision pathways, and vulnerabilities in training, equipment and support (Federal Emergency Management Agency, 2010). Exercises clarify roles and responsibilities of personnel who could be involved in a real event, improve interagency coordination, find previously unknown gaps in equipment, personnel and other resources and provide opportunities to determine potential capacity and capability for preparedness (Roper, 2003). Emergency preparedness is an intangible goal; it is an ongoing process to build and maintain infrastructure, partnerships and plans needed to respond to atypical events. The gold standard is performance during a real event.

In the absence of real events, exercises are a critical tool for governments to create benchmarks for corrective actions (Federal Emergency Management Agency, 2010). Henstra identified 30 key elements in developing a framework for emergency management performance measures; conducting exercises was one of the key measures (Henstra, 2010). Other studies have also suggested the need for exercises that prepare staff for real events (Avery & Zabriskie-Timmerman, 2009; Brand, Kerby, Elledge, Johnson, & Magas, 2006; GAO, 2007). One study examined the activities conducted by LHAs to build capacity through exercises (Avery & Zabriskie-Timmerman, 2009). These activities included the hiring of an emergency preparedness coordinator, employment of an epidemiologist, whether the LHA had experience with an actual public health emergency, and whether the LHA had access to a public health laboratory. Each activity was reported as conducted or not conducted; one limitation to the study was the lack of quality metrics associated with each activity (Avery & Zabriskie-Timmerman, 2009). In another study, pre-test and post-test scores conducted before and after LHA exercises indicated 96% of staff showed improvement in all 13 core emergency preparedness competencies surveyed (Brand, et al., 2006).

Unfortunately, the concept of public health emergency preparedness is loosely defined, making operationalization difficult and the interpretation of outcomes confusing (Lurie, Wasserman & Nelson, 2006). Despite the declared benefits of exercises, evidence is scarce linking exercises to preparedness during a real event (Nelson, Lurie, & Wasserman, 2007). Avery and Zabriskie-Zimmerman found that LHAs experiencing real events had a significant positive relationship with an LHA's preparedness activities

(Avery & Zabriskie-Zimmerman, 2009). LHAs experiencing a real emergency were 48% more likely to conduct training and 52% more likely to assess staff competencies than LHAs who have not experienced a real emergency. Only one study was found in which an exercise was conducted measuring response times (Dausey, Lurie, & Diamond, 2005). The public health official responsible for responding to urgent case reports in 18 LHAs was contacted six to ten times over a four month period. Notifications were conducted during the workday, in the evening and on weekends. These unannounced tests revealed response times of under one minute to 2,470 minutes (mean time = 55 minutes). The longest response times occurred at the end of the workday, during the evenings and on weekends. The authors also reported that 91% of all notifications were responded to in less than 30 minutes.

The need to evaluate how states performed during an incident is important for several reasons. Comparing outcomes against objective criteria sets benchmarks and the ability to assess future efforts over a period of time. Evaluation over time can identify areas for improvement. Evaluating capacities and capabilities draws attention to previous improvements made and identifies further resources (financial and otherwise) needed to continue improving levels of preparedness. Finally, accountability of taxpayer dollars against measureable results demonstrates the effective use of public funding.

Studies by Biddinger et al. (2008), Gebbie et al. (2006) and Savoia et al. (2009) noted performance criteria utilized to assess preparedness have been inconsistent, with questionable levels of reliability and validity (Biddinger, Cadigan, Auerbach, Burnstein, Savoia, Stoto et al. 2008; Gebbie et al, 2006; Savoia, et al., 2009). Biddinger et al.

analyzed the content of After Action Reports (AARs) and defined challenges identified during exercises (Biddinger et al., 2008). The main themes extracted included: (a) leadership and management; (b) communication; (c) surveillance and epidemiology (d) disease control; and (e) mass care. While themes were identified, there was no discussion on how to improve on the themes (Biddinger et al., 2008). After identifying the lack of specific standards for exercises, Gebbie et al. brought together a group of 26 experts to develop criteria for evaluating performance (Gebbie et al, 2006). The criteria identified were: (a) initial response command and control; (b) communication; (c) early recognition/surveillance and epidemiology; (d) sample testing; (e) evidence management; (f) mass prophylaxis and immunization and pharmaceutical stockpiles; (g) mass-patient care; (h) mass fatality management and(i) environmental surety. One of the seven elements under the criteria "initial response and command and control" was the ability to identify and activate ICS positions within 30 minutes, regardless of time of day (Gebbie et al, 2006). The research did not note why the subject matter experts chose this time frame. The initial response command and control standard was defined as the notification and active communication with the individual notified, whether the individual was on site or virtually networked. To date, the criteria have not been adopted by a federal agency.

In 2008, Trust for America's Health (TFAH) defined parameters for meeting an "adequate" level of preparedness and surveyed all state health agencies (Trust for America's Health, 2008). These parameters included (a) state funding to public health programs at level funding or higher; (b) a public health laboratory system that had the ability to identify food-borne pathogens, the ability to pick up and deliver lab specimens

24/7 and meet the state's pandemic influenza planning expectations; (c) the purchasing and distribution of antivirals; (d) the provision of legal protection to health care volunteers and organizations providing relief services and care during a public health emergency; (e) the ability to track health threats through a disease surveillance system; and (f) have a state Medical Reserve Corps (MRC) Coordinator. States were re-surveyed in 2009; however, the indicators changed and only five of the ten key indicators were consistent so one-to-one comparisons could not be made (Trust for America's Health, 2009b). For example, in 2008, the MRC Readiness indicator was the hiring of a State Coordinator and the indicator for 2009 included not only the hiring of a State Coordinator, but added two other requirements: that the majority of the MRC units were in compliance with NIMS guidelines and the majority of the MRC units integrated with the state Emergency System for Advance Registration of Volunteer Health Professionals. A state that met the indicator in 2008 could fail to meet the indicator in 2009.

In addition to federal partners and other stakeholders, states themselves also saw the need to prepare for real events. After Hurricane Floyd in 1999, North Carolina public health emergency managers evaluated their disaster response performance to determine their level of hurricane preparedness (Davis, et al., 2004). They saw a need to create protocols that integrated ICS into emergency response, which defined how and when staff would be called to duty in an effort to reduce or eliminate delays prior to the start of the decision-making process. PHEP funds were used to implement these improvements (Davis, et al., 2004). In 2002, drills and exercises were conducted to test these protocols and additional changes were made (Davis, et al., 2004). After Hurricane Isabel in 2003,

staff re-evaluated their performance and concluded that the exercises conducted after Hurricane Floyd were beneficial to improved preparedness and response, particularly the ability to assemble staff quickly and efficiently (Davis, et al., 2004). It should be noted that additional information on how the state measured improvement was absent from the study.

In a second study, Lovelace et al. surveyed 84 LHAs in North Carolina on seven local public health preparedness indictors (Lovelace, Bibeau, Gansneder, Hernandez, & Cline, 2007). Indicators included (a) planning and exercises; (b) surveillance and epidemiology; (c) 24/7 response capability; (d) linkages with health systems; (e) emergency and risk communications; (f) workforce capacity; and (g) mass interventions. LHAs rated their level of preparedness using a four-point Lickert scale. The authors concluded that LHAs had higher levels of preparedness for outbreaks, natural disasters and bioterrorism events than for chemical, radiation or mass trauma disasters (Lovelace et al., 2007). These preparedness levels were perceived levels of preparedness and were not evaluated against a real event; since there was no event to evaluate, performance differences could be surmised but not measured.

AARs are a written improvement plan based on lessons learned from an exercise or real event and are used to improve performance. Seid and colleagues found that there was a failure to use lessons learned from previous exercises (Seid, Lotstein, Williams, Nelson, & Lurie, 2006). They noted that AARs often fail to include metrics to improve performance, such as the inclusion of the number of staff notified and assembled or the length of time it took to notify and assemble staff. Without this information,

improvements in performance over time cannot be calculated. One limitation of AARs is the lack of clarity in the use of common terms. Too often, definitions of common terms are absent, creating misunderstandings about what defines an exercise, including when an exercise begins and ends (Seid et al., 2003). Baseline data over time are key to determining the benefits of conducting exercises and improving performance. As noted earlier, only one study was found that analyzed a timely notification of staff. No studies were found that analyzed a timely assembly of staff against the type of incident that took place. No studies were found that assessed other factors or what affected a state's ability to assemble in 60 minutes or less.

State Governance Structure

State governance structure refers to the configuration of power and control within the state. In the US, state and local governments vary by size of population served, governance structure and statutory frameworks. Historically, state governance structure was centralized or decentralized. A centralized state has power and control within the state and activities are organized around a particular group or a small number of groups (Provan & Milward, 1995). States with a centralized governance structure have power consolidated in the state legislature; decisions are made and passed down to the local government with no additional layers of authority. Spending decisions are made by the central government and imply a high level of uniformity and gains through economies of scale. The SHA plays a major role in delivering health services and the entire state system is affected by decisions made. Improvements are made at the state level. One advantage of a centralized state governance structure is that the state can make policy and

administrative decisions that directly affect local public health, particularly in small rural counties where capacity is insufficient (Amodeo, Prentice & Woltring, 2002). Public health services at the state and local level are provided by the state staff and administered by the state or entities representing the state. One major drawback of a centralized governance structure is the notion that "one size fits all" for every county and city in the state. Centralization has been defined in unflattering terms, such as bureaucratic, rigid, complex, slow and unresponsive, with a need to enforce rules rather than respond to issues (Besley & Coate, 2003).

States with a decentralized governance structure tend to have a large system with many network links. One advantage to decentralized governance is that LHAs respond to local conditions and the community participates in the decision-making process (Amodeo, Prentice & Woltring, 2002). Decisions made in the locality are often financed by local representation (Provan & Milward, 1995). There are several drawbacks to a decentralized governance structure: it is more prone to political abuse; equity and consistency are more easily compromised; there is a greater difficulty in organizing and effectively managing; and depending on the wealth of the locality, services may be underprovided to those in need (Besley & Coate, 2003). For example, Massachusetts is a decentralized state with 351 governing bodies, each making independent decisions for its local health jurisdiction. While the state can make recommendations to the local level, the local level determines what is best for their jurisdiction and variations in decision-making are widespread.

Since the IOM's 1988 report that public health agencies were poorly managed and improperly structured, researchers have attempted to understand state governance structure (Centers for Disease Control and Prevention, 1991; Ford, Duncan, & Ginter, 2003). Efforts to classify state governance structure have been an ongoing process for many years with limited continuity from year to year (Association of State and Territorial Health Officials, 2005, 2009, 2011; DeFriese, et al. 1981; Ford, et al. 2003; National Association of County and City Health Officials, 1998, 2005, 2008; National Governors Association, 1997, 2008). DeFriese and colleagues (1981) discussed four types of organizational structures within states: centralized, decentralized, mixed and shared governance. For their study, state classification was self-reported by state health officials within each state (DeFriese, et al., 1981). Actual state statutes were compared against actual state organization charts to determine if the governance structure noted in the statutes were consistent with the governance structure depicted by the organization chart. State governance structures cited by the state health officials were inconsistent with the governance structure shown the organization chart, reducing the validity and reliability of the state health official's classification (DeFriese, et al. 1981).

Studies on state governance structure conducted by the same organization over several years have been inconsistent (Association of State and Territorial Health Officials 2005, 2007, 2011; National Association of County and City Health Officials, 1998, 2005, 2008; National Governors Association, 1997, 2004). The National Governors Association (NGA) (1997) conducted a study classifying state public health agencies by their location within the state's organization chart. The categorical definitions included terms such as a traditional public health agency, a super public health agency, a super

health agency or an umbrella agency (National Governors Association, 1997). NGA further defined health agencies by public health function based on specific health conditions, i.e., HIV/STD. In a subsequent study, NGA used the same categorical definitions based on location within the organization chart; however, they defined SHAs by cores services provided, public health functions, or special populations (National Governors Association, 2004).

In yet another study, NACCHO (1998) characterized public health agencies by which level of government delivered health care services and whether boards of health were involved in the line of authority. The five classifications used in the 1998 study were: (a) centralized; (b) decentralized; (c) mixed; (d) shared; and (e) other. In 2005, NACCHO asked the LHAs to categorize state governance structures using three typologies: whether all LHAs were units of the state health agency, all LHAs were units of the local government or all LHAs were a mixture of state health and local government (National Association of County and City Health Officials, 2005). The NACCHO 2008 survey used the same three typologies but noted that in practice there was a fourth typology in place (National Association of County and City Health Officials, 2008). NACCHO defined this typology as a shared governance structure, in which authority was shared by state and local government (p. 12).

ASTHO classified public health agencies by organizational structure in 2005, 2007 and again in 2011. In 2005, there were four state governance structures noted: (a) centralized; (b) decentralized; (c) mixed; and (d) shared with loose definitions for each

type of governance structure (Association of State and Territorial Health Officials, 2005). By 2011, ASTHO changed state governance structure definitions, emphasizing the percentage of the state's population governed by state or local agencies as a defining point; these definitions can be found in Appendix C.

Ford and colleagues (2003) defined public health agencies not by organizational structure as in previous studies but by strategic configuration based on environmental and managerial characteristics. These categories included agencies that were: (a) flexible in unpredictable environments; (b) centralized and stable; (c) looked for complex solutions in chaotic environments; (d) incrementally changed in bureaucratic environments; and (e) had scarce resources and were slow to change. While these were attention-grabbing classifications, they were controversial; the political will to adopt such labels and make substantial changes to state governance structure using these definitions was found lacking (Ford, et al., 2003).

In addition to the lack of a clear definition for a governance structure or classification system, there is no national coherent effort to develop standard definitions although for many years there have been calls to formulate a vision on the appropriate role and configuration of governmental public health (IOM, 1988, 2002; Salinsky & Gursky, 2006). Each state has public health autonomy, with differences in budgetary and appropriations processes and constraints, authorizing statutes and political culture. At this time, there is no clear vision on how national health protection activities should be operationalized or organized or how to strategically align resources across levels of government and geographic areas.

Provan and Milward conducted research in four community mental health networks, testing the effectiveness of centralized versus decentralized integration of services (Provan & Milward, 1995). The researchers found that a centralized structure provided more direct and complete control to clients and facilitated coordination and integration and concluded that networks are most effective under centralized integration and direct, non-fragmented external control in a stable system with stable funding (Provan & Milward, 1995). In another study, it was noted that monitoring and control over activities and outcomes were highly likely to achieve system-level goals in a centralized structure; decentralized programs tended to be ineffective and splintered and led to serious accountability problems (Kettl, 1995).

In the areas of emergency response and pandemic influenza, the need for a flexible, decentralized approach to organizing was called for (Gerberding, 2004; Waugh & Streib, 2006). Waugh and Streib envisioned a top-down, centralized structure being replaced by the flexible, decentralized structure (Waugh & Streib, 2006). But while Waugh and Streib noted the centralized, command-and-control approach was problematic during the Hurricane Katrina response in 2005, the US House Select Bipartisan Committee implied that a fully-functioning centralized command and control system would have worked better than a decentralized system (Waugh & Streib, 2006; US House Select Bipartisan Committee, 2006).

However, emergency preparedness differs from emergency response in several significant ways. Emergency preparedness is a strategic process for planning and preparing for a manmade or natural disaster and requires a high level of organization and collaboration prior to the incident. Emergency response is a tactical process for

responding to an event and limiting further damage. While emergency response also requires organization and collaboration, it must also be flexible and nimble to adapt to the changes occurring during the event. Since this study represents public health emergency preparedness, a centralized state governance structure was hypothesized as the most advantageous to states based on the findings from the House Select Bipartisan Committee.

Public Health Funding

Federal public health agencies are funded through Congressional committees that have jurisdiction over authorization of expenditures and appropriation of funding (Streeter, 2007). Federal funding is classified in two categories: mandatory funding and discretionary funding. Mandatory funding supports programs that are required by specific laws, such as Medicare and Medicaid. Programs that are funded with discretionary funding can be increased, decreased or eliminated each year, since funding is established annually by Congress. Once a budget has been submitted by the President to Congress, it is sent to the House and Senate Appropriations Committee. Within the House and Senate Appropriations Committee is the Subcommittee on Labor, Health and Human Services, Education, and Related Agencies who reviews and resolves budgetary discrepancies. The subcommittee also recommends funding for CDC's core programs, earmarking a percentage for specific initiatives, such as pandemic influenza or support for World Trade Center rescue and recovery workers (Families USA, 2008). Once the House and Senate agree on the funding level, legislation gives CDC the legal authority to

obligate funds. In turn, CDC allocates 85% of its funding to state, territorial, local and tribal entities through grants and cooperative agreements to increase public health capabilities Centers for Disease Control, 2011).

The heightened awareness of biologic and terrorism threats and the need to prepare for and fund these events became obvious after 9/11. After passage of the Public Health Security and Bioterrorism Preparedness Act of 2002, PHEP funding was increased from $50 million to $950 million to enhance state and local public health capacity and capability to prepare for a disaster. At that time the federal government required states to focus funding on all acts of terrorism, including chemical and radiologic events.

Unfortunately, with funding allocated by Congress to CDC on a yearly basis, planning at the federal level was short-sighted, unreliable and unsustainable. After 9/11, the focus of PHEP funding changed or was significantly modified yearly, which impeded local, state and federal long-term planning for emergency preparedness. With no robust, flexible spending stream for SHAs and LHAs to depend upon, long-term planning for public health and PHEP has continued to be inconsistent (Trust for America's Health, 2009a). At this time, there are no known initiatives or strategies to fund multi-year PHEP initiatives, stabilize funding at a sufficient level to support public health core activities or increase PHEP funding for PHEP activities.

When public health funding is reduced, PHEP funding is reduced. To assure some level of PHEP funding, a partial match of federal funding with state funding was required to force state legislatures to fund public health infrastructure activities (Centers for Disease Control and Prevention, 2007). Federal PHEP funding is intended to supplement, not supplant state funding. Supplantation is defined as the use of federal

PHEP funding in place of other funding streams that would normally be used to fund PHEP activities. Supplantation is strictly prohibited in the PHEP cooperative agreement; while hard to prove, supplantation appears to occur at both the state and local level (Turnock, 2004).

As noted, public health funding is discretionary and has decreased over the past several years (Hennessey, 2011). Twenty-seven states cut funding for public health from FY 2007-08 to 2008-09 (Trust for America's Health, 2009b). In 2009, public health programs were cut more than $392 million (Bowman, 2010). Sixteen states projected shortfalls to their 2010 budgets (Trust for America's Health, 2008). Specific data on the worse-hit states are readily available (Governing, 2004; Lav & McNichol, 2009; National Association of County and City Health Officials, 2009).

Just as there are two types of federal funding, there are two types of state funding. States can receive base and categorical PHEP funding. All states receive base funding, which is calculated by determining a minimum level of funding plus additional funding determined by the state's population; categorical funding is based on additional programs supported within the state. Examples of categorical funding include the number of cities located within the state that are targeted for readiness initiatives or whether the state has a Level 1 laboratory. The most recent Census population data are used to calculate funding above the base and this amount is added to the minimum base amount required by the Public Health Security and Bioterrorism Preparedness Response Act of 2002, deemed to be $5 million. Categorical funding for special initiatives is added to base funding. Funding amounts used for this study consist of base and categorical funds.

Over the years, there has been inconsistent assessment and monitoring of the financial situation in state and local governments, including activities to determine what financial resources and personnel SHAs have to carry out basic public health services, surveillance and public health monitoring. Assessing expenditures at the state level is problematic; not all revenue and expense data are sufficient for analysis in many states. Accounting systems differ from state to state and lack uniform classifications for expenses and revenues, standardized electronic data reporting and financial analyses or transparency in reporting results (Honore, Clarke, Mead, & Menditto, 2007). Assessing funding and expenditures at the local level is even more complex. A recent study revealed large numbers of missing or incomplete data for adjusted expenditures at the local level, which limited the data's usefulness (National Association of County and City Health Officials, 2008).

No published studies were found that analyzed state funding data at the national level (Fockler, 2005). There are few studies that used local funding data for analysis and evidence is mixed on whether federal funding has improved the PHEP performance of LHAs (Barry & Bialek, 2004; Bashir, et al., 2003; Scutchfield, et al., 2004).

No comprehensive studies could be found that analyzed state funding data against the number or quality of exercises conducted; however, evidence suggests federal funding affects the performance of LHAs. In one survey, Bashir et al. reported that LHAs perceived drills and exercises as an "excellent" way of assessing response capacities, identifying gaps and providing real-time experience (Bashir, Lafronza, Fraser, Brown, & Cope, 2003). The authors concluded that federal PHEP funding supported

increased improvement in local PHEP. The term "excellent" was not defined so there is no way of quantifying the increased improvement in local PHEP or what level of funding improved performance. Scutchfield and associates noted that funding had a "significant impact" on local public health system performance (Scutchfield, Knight, Kelly, Bhandari, & Vasilescu, 2004). Again, there was no discussion on what "significant impact" meant or its relationship to PHEP funding.

ASTHO conducted a study examining SHAs level of public health preparedness (Beitsch, et al., 2006). Forty-two of 45 SHAs surveyed noted that at least one tabletop exercise had been conducted in their state and 34 of 45 SHAs had conducted at least one full-scale exercise. The authors concluded there were no differences in levels of preparedness among states with regard to conducting exercises and drills based on state governance structure (Beitsch, et al., 2006). The time to notify and assemble staff for an incident was not captured in this study.

Avery et al. analyzed LHA preparedness activities and concluded there was a positive relationship between CDC funding and increased preparedness activities; the preparedness activities included the hiring of a preparedness director and an increase in full-time equivalent employees hired (Avery & Zabriskie-Timmerman, 2009). The most interesting finding was the linkage between state preparedness levels and local preparedness activities. Local preparedness activities appeared to be independent of state preparedness activities; there was no relationship between state and local preparedness levels.

Summary

This chapter presented literature which identified the condition of public health emergency preparedness funding and described the types of state governance structures in the United States. These two public health infrastructure elements may affect preparedness and response capabilities at the state level. The challenges in measuring public health preparedness were identified and explored and attempts to assess and measure preparedness levels were identified. The literature review specific to public health infrastructure revealed that there has been relatively little evidence-based metrics in public health preparedness, particularly in the area of a timely response to an incident.

CHAPTER III

METHODOLOGY

This chapter outlines the study methodology including study design, sample, procedure, variable definitions, data analysis and strategies for improving validity and reliability, focusing on the primary question of interest: "To what degree does state infrastructure predict a timely response to public health emergencies?" Quantitative data explored relationships among two infrastructure variables and two response-related variables and will be referred to as Study 1. Qualitative data were analyzed to determine what other factors inhibited states from notifying and assembling staff and will be referred to as Study 2.

Study 1

Design

This study utilized a retrospective cross-sectional, cross time study design analyzing secondary data collected by CDC. The study examined the perceived level of preparedness in the states' ability to notify and assemble staff for an incident. The time frame included data from 2007 through 2010, which will be referred to as Year 1 through Year 4.

Population

The group of interest was the 50 SHAs in the United States. Each state was funded by CDC through the PHEP cooperative agreement in Years 1-4. All states participated in the survey by completing mid-year and end-of-year reports.

Procedure

Data needed to answer the research questions were contained in two databases. The first database used was publicly available data from ASTHO's Profile of State Public Health (Association of State and Territorial Health Officials, 2011). This database provided findings from the most recent state governance structure survey conducted. Beginning April 2010, ASTHO surveyed state health agencies using an on-line survey, which was sent to the senior deputy in each state's public health agency. The survey collected information on state health agency organization and state governance structure, public health services provided, planning and quality improvement, and state health agency workforce composition. All data were self-reported; the senior deputy or his designee completed the survey and 100% of the states responded.

The second database used was the CDC's Preparedness Emergency Response System for Oversight, Reporting and Management Services (PERFORMS). PERFORMS has been used by CDC since 2003 to process approximately $1 billion in grant applications each year. One hundred percent of the states use PERFORMS. Data captured in PERFORMS is not accessible to the general public and can only be read or edited by pre-approved state and federal employees.

There are multiple modules in PERFORMS; the two modules used for this study were the Funding module and the Performance Measures module. States use the Funding module to submit and process grant applications, manage financial transactions and track progress. The system is automated; states cannot allocate more than the amount they are funded. Funding and allocation data are reviewed by CDC staff during application

submittal. Data are also reviewed throughout the grant year as modifications to the original allocations are requested by a state. Data collection is based on the funding cycle, availability of supplemental funding, new mandates and requirements or the need for additional data. The variable used for analysis from the Funding module was state PHEP funding allocation and is defined in greater detail in the Measures section below.

The Performance Measures module is made up of three distinct groupings: (a) staff notification; (b) staff assembly; and (c) incident action plan. Since the variables used for analysis were time to notify and time to assemble, only staff notification and staff assembly data were analyzed. After data were collected from the states, CDC staff examined each variable and its associated value in the database. If there appeared to be outliers within the data set, direct contact with the state's PHEP program director was made to validate the data and make corrections as needed. Both data sets and associated code books were provided to the researcher as Microsoft Excel databases containing survey results from CDC. The researcher extracted pertinent data from Excel and exported to IBM® SPSS® Graduate Pack 18.0 for analysis.

Measures

Categorical variables with two levels were coded "0" and "1". The value "0" was assigned to the reference level for interpretation of the results. The value "1" was assigned to the level that was hypothesized to shorten the response time.

Dependent variables. The two outcome variables of interest for this study were the state's self-reported time to notify and time to assemble for an incident.

Time to notify. Time to notify was a continuous variable measuring the time from the beginning of the staff notification (when the first phone call or e-mail was sent) to when the last staff member acknowledged receipt of the notification. The beginning date and time and ending date and time were entered into the survey and PERFORMS automatically calculated the time to notify in minutes. For Year 1 and Year 2, the time to notify was ascertained by asking for: "Date and time the public health director or designated official began notifying pre-identified primary staff (secondary or tertiary staff as needed) [Reporting cycle: beginning reporting date to ending reporting date]" and "Date and time that the last primary staff person (secondary or tertiary staff as needed) to fill all 8 ICS functional roles acknowledged notification". The wording changed slightly in Year 3 and Year 4: "Date and time that a designated official began notification of pre-identified staff. [Reporting cycle: one year time frame]" and "Date and time that the last staff person needed to fill pre-identified functional roles acknowledged notification". Data for Year 3 and Year 4 were based on a reporting time frame of one year. For each of the four years, states provided data for up to 12 incidents. For analysis purposes, the number of notifications conducted from the beginning of the year through mid-year and the number of notifications conducted from mid-year through the end-of-year were merged to create a one year time frame for Year 1 and Year 2 to be consistent with Year 3 and Year 4.

Time to assemble. Time to assemble was a continuous variable measuring the time from the beginning of the staff notification to when the last staff member reported for immediate duty. The beginning date and time and ending date and time were entered into the survey and the system automatically calculated the time to notify in minutes. For

Year 1 and Year 2, the time to notify was ascertained by asking for: "Date and time the public health director or designated official began notifying pre-identified primary staff (secondary or tertiary staff as needed) that the public health agency's EOC [sic] was being activated [Reporting cycle: beginning reporting date to ending reporting date]" and "Date and time that the last primary staff person (secondary or tertiary staff as needed) to fill all eight ICS functional roles signed in at the EOC". Appendix D contains the survey questionnaire for the 2007 Mid-Year Performance Measures for Time to Assemble. The wording changed slightly in Year 3 and Year 4: "Date and time that a designated official began notification of pre-identified staff that they need to report for duty." and "Date and time that the last staff person needed to fill pre-identified incident management functional responsibilities reported for duty." Data for Year 3 and Year 4 is based on a one year time frame. For each of the four years, states provided data for up to 12 incidents. For analysis purposes, staff assemblies conducted from the beginning of the year through mid-year and staff assemblies conducted from mid-year through the end-of-year were merged to create a one year time frame for Year 1 and Year 2.

Independent variables. There were nine variables of interest. These included state governance structure; year; incident type; announcement type; response type; number of staff acknowledging the notification or assembling for the incident; state PHEP funding allocation; population; and per capita funding.

State governance structure. State governance structure was a dichotomous variable coded as 0 = all other types of state governance structure and 1 = centralized state governance structure. The variable was dichotomized due to the small sample size

of states with a shared or mixed state governance structure. The definition of each type of state governance structure is explained in Appendix C.

Year. Year was a discrete variable coded with four possible values. Year was coded as 2007 = 1; 2008 = 2; 2009 = 3; and 2010 = 4.

Incident type. Incident type was a discrete variable coded with three possible values. Incident type was coded as 1 = drill, 2 = exercise and 3 = real event. In addition, dummy variables were created so multiple regression analyses could be conducted. A drill was defined as a coordinated, supervised activity used to test a single function in a low stress environment. An exercise was defined as an activity used to test a single capability, multiple functions or a multi-agency, multi-jurisdictional activity testing many capabilities and functions in a high stress environment and mimics the conditions of a real event. A real event was defined as a natural or man-made disaster which requires action to protect life, property, the environment, public health or safety in a very high stress environment; examples include measles outbreaks, hurricane and tornado warnings and white powder incidents.

Announcement type. Announcement type was a dichotomous variable created for this analysis based on whether the staff was notified prior to the staff assembly or notification, coded as 0 = unannounced and 1 = announced. No data were collected in Year 1 for staff notifications or staff assemblies. In Year 2, staff notifications and staff assemblies were reported as announced or unannounced. Two questions were asked: "Was the notification unannounced?" and "Was the activation unannounced?" In Year 3

and Year 4, only unannounced staff notifications and staff assemblies could be reported. The wording of the questions changed slightly "Was this staff notification unannounced?" and "Was this staff assembly unannounced?"

Response type. Response type was dichotomous variable created for this analysis based on whether the staff was off duty at the time of the incident. For staff notifications, the variable was coded as 0 = outside normal business hours and 1 = during normal business hours. No data was collected in Year 1 for staff notifications. For staff notifications in Year 2, incidents that were conducted during normal business hours or outside normal business hours could be reported. The question asked: "Was the notification outside normal business hours?" In Year 3 and in Year 4, only staff notifications conducted outside normal business hours could be reported. The wording of the question was: "Did this staff notification occur outside of normal business hours?"

For staff assemblies, the variable was coded as 0 = delayed and 1 = immediate. There were no questions pertaining to response type for time to assemble in Year 1 or in Year 2. In Year 3 and in Year 4, only staff assemblies conducted outside normal business hours could be reported. The question asked: "Was this staff assembly immediate?"

Number of staff acknowledging a notification or assembling. The number of staff acknowledging a notification or assembling was a continuous variable that consists of the number of staff who were contacted during a notification and acknowledged the notification or the number of staff who were contacted to assemble and assembled for the incident. No data were collected in Year 1 or in Year 2. In Year 3 and in Year 4, the questions asked were: "How many staff was notified?" and "How many staff reported for duty to fulfill the pre-identified incident management functional responsibilities?"

State PHEP funding allocation. State PHEP funding allocation was a continuous variable that consists of the amount of PHEP funding the state allocated to preparedness activities in a given year.

Population. The population of each state was a continuous variable. Population estimates were taken from the Annual Estimates of the Resident Population of the United States for the years 2007 through 2010 (Census, 2010).

Per capita funding. Per capita funding was a continuous variable created by dividing state PHEP funding allocation by the population estimate.

Data Analysis

Originally, three sets of data were used for analysis. The first data set that was analyzed consisted of end-of-year data with the outcome variable "time to notify". The second data set that was analyzed also consisted of end-of-year data but with the outcome variable "time to assemble". For both data sets, states reported data for up to 12 incidents per year for all four years of the study. The third data set that was analyzed consisted of one incident which the state considered their best demonstration of a timely staff assembly. Best demonstration data was collected in Year 3 and in Year 4 and included the outcome variable "time to assemble". In Year 3 and in Year 4, a fourth data set containing High Priority Performance Goal (HPPG) data became available; it consisted of one incident and included the outcome variable "time to assemble". However, in Year 3 the question was asked whether the state could assemble staff in 60 minutes or less, with a yes/no answer. In Year 4, the state provided the actual time it took to assemble

staff in minutes. Only Year 4 data were used for analyzing end-of-year data, best demonstration data and HPPG data for time to assemble.

Each state provided data for up to 12 incidents. Some states provided information for one incident; others provided information for 12 incidents. It was unknown whether the survey responses were the population of incidents reported to CDC or an unknown sample of the true population of the incidents that were reported. It should be pointed out that a state reporting data on 12 incidents may have conducted more than 12; a state that reported one incident may have conducted only one or many more. There is no denominator for the number of incidents per year that occurred within a state; the data simply are not available. Analysis was conducted under the assumption the incidents reported were a sample of the population. One incident within a state was compared against another incident if the state reported information on more than one incident; while this may appear to violate the assumption of independence and create inter-subject correlation, each incident conducted within a state was an independent event conducted on a separate date with a specific start and stop time independent of any other incident. Therefore, independence was assumed.

Data was extracted from PERFORMS and provided to the researcher in Microsoft Excel data sets, with final export into IBM® SPSS® Graduate Pack 18.0 for analysis. Responses with missing data were excluded from analyses. It appeared that most of the responses with missing data had no values in any of the pre-determined variables targeted for analysis. This may have been due to PERFORMS itself. For example, a state PHEP program director could click on a button to add an incident to the data set. After adding an incident, a second incident could be added by clicking on the "Next" button. A new

screen would open up to add the second incident. If the state PHEP program director chose not to add another incident but clicked the "Save" button instead of the "Cancel" button, the record would be saved with no data in it. The survey instrument was changed in Year 4; all pertinent data elements required an input value before the response could be saved. Table 1 shows the number of responses that were missing data. These records were deleted from analysis.

Data analysis began by examining the frequency distributions and descriptive statistics of key variables to help guide analysis. Data exploration continued with comparisons of the variables by year. Strategies used for testing hypotheses are shown in Table 2.

While repeated measures ANOVA appeared to be the most appropriate statistical analysis for analyzing response time and state governance structure, univariate ANOVA was used because the data set had unequal group sizes. The data did not lend itself to repeated measures ANOVA analysis. For example, one state provided data points for twelve incidents in Year 1, five incidents in Year 2, one incident in Year 3 and two incidents in Year 4. A second state provided data points for two incidents in Year 1, four incidents in Year 2 and one incident in Year 3 and in Year 4.

Table 1. Responses and Missing Data for Time to Notify and Time to Assemble

Year	Notify			Assemble		
	Total Responses	Missing Data %	Final	Total Responses	Missing Data (%)	Final
Year 1	261	16 (6.1)	245	195	22 (11.3)	173
Year 2	226	9 (4.0)	217	177	18(10.2)	159
Year 3	90	2 (2.2)	88	78	1 (1.3)	77
Year 4	92	0	92	82	0	82

Table 2. Summary of Statistical Tests and Variables Used for Testing Hypotheses

Hypothesis	Independent Variable	Dependent Variable	Statistical Analyses
1 a	PHEP funding	Time to notify	Pearson's correlation coefficient Simple linear regression
1 b	PHEP funding	Time to assemble	Pearson's correlation coefficient Simple linear regression
2 a	State governance structure	Time to notify	Univariate ANOVA
2 b	State governance structure	Time to assemble	Univariate ANOVA
Other Variables	PHEP funding; state governance structure; incident type; announcement type; response type; number notified	Time to notify	Multiple linear regression
Other Variables	PHEP funding; state governance structure; incident type; announcement type; response type; number assembled	Time to assemble	Multiple linear regression

Analysis was conducted to assure the data met the standards of normality. Response times were skewed to the left and did not meet the standards of normality as shown in Table 3. Response times were transformed using log10 to bring the data closer to normal. To determine the best method for smoothing the data, outliers were identified using two methods: interquartile range and trimmed means. First, normality was attempted using the interquartile range methodology. The upper and lower quartiles were calculated. Data points that laid more than 3.0 times the interquartile range below the first quartile or above the third quartile were considered extreme outliers and removed from analyses. Since the data were skewed to the left, only extremely long response times and a small number of cases were removed from analyses (time to notify = 14 cases removed; time to

assemble = 11 cases removed). Second, normality was attempted using the trimmed means methodology. Five percent of the lowest and five percent of the highest values from each data set were removed then data analysis was conducted. Skewness and kurtosis of the raw data and outliers removed using the interquartile range and trimmed means methodology are also shown in Table 3. After further review of the results, all analyses in this study removed outliers using a trimmed means method, since skewness and kurtosis for both response times were between -1 and +1. Response time was computed using the transformed data, and then the transformation was reversed when discussing results.

Table 3. Computed Skewness and Kurtosis for Time to Notify and Time to Assemble, With Outliers and With Outliers Removed

	With Outliers		With Outliers Removed (log 10)	
Data Set	Raw Data	Log 10	Interquartile Range	Trimmed Means
Time to Notify	(n = 642)		(n = 628)	(n = 578)
Skew	10.02	1.84	0.05	0.07
Kurtosis	105.82	7.84	1.18	-0.48
Time to Assemble	(n = 491)		(n = 479)	(n = 442)
Skew	8.26	.412	0.26	-0.23
Kurtosis	80.14	2.28	0.09	-0.62

Validity and Reliability

The study sampled the total population of SHAs (n = 50), thus mitigating potential selection bias. States were surveyed every six months in Year 1 and in Year 2 then once a year in Year 3 and in Year 4. Data points were independent of each other; a staff assembly conducted in the first six months of the year was reported in that time frame only. Construct validity was assured; survey questions were developed by CDC subject matter experts in Year 1 and in Year 2 then re-assessed by state subject matter experts in Year 3 and in Year 4.

Study 2

Design

This study utilized qualitative semi-structured survey data collected by CDC in PHEP mid-year and end-of-year reports in Year 1 and in Year 2. Mid-year and end-of-year reports were a requirement and state PHEP program directors provided updates on work plan activities, budget expenditures and performance measures. The survey questions were part of a larger survey to examine a state's ability to notify and assemble staff (see Appendix D, Question 8 for an example of the qualitative survey question). The agency's goal in collecting the data was to ascertain the reasons states gave for failing to meet CDC's recommended time to notify and assemble. In Year 3 and in Year 4, responses from the HPPG questionnaire were used for analysis.

Sample

The group of interest was the 50 SHAs in the United States. State PHEP program directors provided data to CDC twice per year in Year 1 and in Year 2 and responded to the following questions: "Why did it take longer than 60 minutes for pre-identified staff to acknowledge notification?" and "Why did it take longer than 2.5 hours for all eight ICS functional roles to be covered?" The full survey for the end-of-year performance measure for time to assemble is shown in Appendix D. At the time, CDC recommended that states notify staff and receive an acknowledgement of a notification in 60 minutes or less and assemble staff in 2.5 hours or less. The sample was comprised of states that did not meet one or both of the recommendations. All states that did not meet the recommendation explained in free text format why the recommendation could not be met.

In Year 3 and in Year 4, the survey questions that were asked in Year 1 and Year 2 were omitted from the end-of-year reports. CDC removed these recommendations because PAHPA legislation required at least 90% of the states to assemble staff in 60 minutes or less. Instead, questions in the end-of-year report targeted the HPPG, asking state respondents to describe one incident that best demonstrated their ability to respond. One question and one statement were noted: "Which exercise or real incident reported represents the best demonstration of your agency's staff assembly capability?" and "Please provide a brief description of why this exercise or incident was chosen as the best demonstration of your agency's staff assembly capability." State respondents provided information in a free text format. The sample was comprised of states that did not meet the requirement of assembling staff in 60 minutes or less.

Data Analysis

CDC's PERFORMS system was used to capture the data in five data sets: end-of-year data for time to notify; end-of-year data for time to assemble; best demonstration data for time to notify; best demonstration data for time to assemble; and HPPG data for time to assemble. All data sets and associated code books were provided to the researcher in Microsoft Excel data sets containing results of the surveys from CDC. CDC recommendations in Year 1 and in Year 2 were significantly different from the PAHPA requirement in Year 3 and in Year 4, so information pertaining to CDC recommendations was analyzed separately from information pertaining to the PAHPA requirement.

Year 1 and Year 2 data consisted of short paragraphs, one to five sentences long. The unit of analysis was word phrases or sentences, depending on how the data were submitted by the state PHEP program director. There were 57 responses from 24 states. Mean word count for each response was 40 words (range = 7-110; median = 33).

Year 3 and Year 4 data also consisted of short paragraphs; the change in the wording of the survey questions changed the content of the information that the states provided. There were 20 responses from 19 states. The mean word count was 118 words (range = 41-230; median = 107). Manual analysis of the data was conducted; no qualitative software systems were used for analysis.

The objective of the analysis was to elicit themes and categories of barriers to a timely response. The original themes and associated code assignments were derived from those developed by NACCHO and supported by the Public Health Accreditation Board (see Appendix E) (National Association of County and City Health Officials, 2011; Public Health Accreditation Board, 2009). All identifiable information was removed prior to coding. The researcher read and re-read each response in the Year 1 and in the Year 2 questionnaire until fully immersed so as to understand the context as a whole. Once immersion was reached, open coding began. Multiple passes through a hard copy of the transcript using color coded markers highlighted and classified themes. Text segmentation was conducted and textual units were based on a priori codes, related to human, fiscal, informational, legal, organization and policy guidelines (see Appendix E for definitions and decision tree).

However, upon first review, these codes did not capture essence of the response and many of the responses did not fit the pre-defined codes well. Several codes were not

used, including those pertaining to fiscal, information, legal and policy, and the "other" category became too large to consider the responses unique. Since the overall goals of the qualitative analysis were to identify a minimum set of themes without losing the meaning or idea behind the theme, to identify relationships and to note patterns, an alternative course of action to code the data was developed.

First, the researcher reviewed the themes developed by NACCHO and modified and merged several themes based on the narratives provided by the state PHEP program directors. The three themes that emerged from the data were related to the staff, to the organization itself and to the channels of communication. Second, two interns with a background in public health emergency preparedness reviewed each theme, category, scope and level of detail and amended the definition of the categories, the guidelines for use, the guidelines for exclusion and assisted in the development of a code book prior to analyzing the data (see Appendix F). Once the conditions associated with data analysis were agreed upon, the iterative process of coding a sample of the data, testing inter-rater reliability and revising the coding scheme began.

The interns independently coded a sample of 11 responses chosen randomly, segmenting the responses as needed based on the definitions. The results were compared for consistency of text segmentation and code application. Four inconsistencies were reviewed (36%) and minor modifications were made to the categorical definitions. The interns coded a second sample of ten responses and once again the team met to discuss issues in applying the codes; one problematic code was modified slightly. Most of the uncertainties in coding involved segmentation of the response; several responses had

multiple themes and categories. After each round of sample coding, consensus between the two interns led to an understanding of response segmentation and categorical coding. The final coding scheme consisted of 3 major themes divided into 11 categories (see Appendix F). The major themes related to staff, the organization or communication. For responses that did not provide enough information to categorize, the code "other" was applied. Mutually exclusive codes allowed for inter-rater reliability estimates using Cohen's Kappa, with the final sample's inter-rater reliability Kappa = 0.623.

Since a few of the states used the exact same verbiage in multiple responses, the full data set was randomized to assure each response was coded individually throughout the coding process. All identifiable information was removed prior to coding. In the first full round of coding, inter-rater reliability using Cohen's Kappa = 0.72; after a second round of coding, the interns came to full agreement.

One month after Year 1 and Year 2 data were analyzed, Year 3 and Year 4 data were analyzed by the same interns using the same themes and categories. As noted earlier, the wording of the questions changed beginning in Year 3. Once again, all identifiable information was removed prior to coding. On the first round of coding, Cohen's Kappa was so low it could not be computed; any level of agreement between the interns was by chance. After another round of coding and additional discussion, the interns determined the responses did not provide enough information to code appropriately based on the pre-determined categories. They felt that they could not come to any level of agreement; the researcher concurred and additional coding of the data ended.

Reliability

Reliability was established using several methods. The researcher has been engaged in public health emergency preparedness for over six years. Two CDC interns familiar with public health emergency preparedness reviewed themes, modified code definitions and coded the data. Interpretation and code definition was checked against raw data. The interns attended a comprehensive training program conducted by the researcher over several weeks. Sampling validity was assured since 100% of the states were included in the analysis.

Dependability and validity were addressed through extensive research notes, which recorded the process of decision-making and results, the code book and meeting notes. By referencing these materials, the researcher was able to audit personal inferences and interpretations and those of the interns. All documentation is available for review.

In 2009, 70% of the states were required to assemble within 60 minutes (Centers for Disease Control and Prevention, 2009). By 2010, the number of states targeted to meet the requirement was raised to 90%. Knowing the requirement for a staff assembly is 60 minutes, the question becomes: "How can states improve the timely assembly of staff within their state to meet this requirement?"

CHAPTER IV

RESULTS/FINDINGS

This study examined response data and funding allocation data collected by CDC for the Fiscal Years 2007-2010 and other variables that may be associated with response time performance. State governance structure data collected by ASTHO also examined. This chapter represents the results of the analyses for each hypothesis. All analyses were conducted using IBM® SPSS® Graduate Pack 18.0 for analysis.

The primary research question was: "To what degree does state infrastructure predict a timely response to public health emergencies?" The first investigative question was: "Do states receiving higher levels of PHEP funding report shorter staff notification and assembly response times than states receiving less funding?" The first hypothesis theorized that states receiving higher levels of PHEP funding would report shorter staff notification and assembly response times than states receiving lower levels of funding. Additional analysis was conducted to determine if response time was influenced by other variables, including incident type, announcement type, response type, or number of staff responding.

The second investigative question was: "Do states with centralized state governance structure report shorter staff notification and assembly response times than states with other forms of state governance structures?" The second hypothesis theorized that states with a centralized form of state governance structure would report shorter staff notification and assembly response times than states with other forms of governance

structures. Additional analysis was conducted to determine if response time was influenced by other variables, including incident type, announcement type, response type, or number of staff responding.

The third investigative question was: "What additional infrastructure-related factors serve as barriers to a timely response?" In addition to state PHEP funding allocation and state governance structure, other barriers to assuring a timely response to an incident were analyzed through qualitative analysis of narrative data.

In future references to the p-value, the symbol "p" will be used. Unless otherwise noted, α=.05. All hypotheses testing were one-tailed unless otherwise noted. Whether a notification or assembly was analyzed, time to respond was transformed using log 10. All analyses were conducted with outliers and with outliers removed using 10% trimmed means methodology discussed previously in this paper.

Study 1

Results of the Preliminary Analysis

Based on findings from the U.S. House Select Bipartisan Committee after Hurricane Kartrina that a centralized command and control structure may have had a better outcome than a decentralized system, it was hypothesized that centralized state governance structures had shorter response times than other forms of state governance structure. Using the ASTHO database, 13 states were categorized as having a centralized state governance structure (Association of State and Territorial Health Officials, 2011). With the small sample size of states with mixed and shared governance, decentralized, mixed and shared state governance structures were merged and categorized as "all other"

governance structures. Of the 37 states categorized as "all other" governance structures, 27 states had a decentralized form of state governance structure, five states had a mixed governance structure and five states had a shared governance structure. Governance structure did not change over the four years of the study (Association of State and Territorial Health Officials 2009, 2011).

Analysis was conducted to determine if the type of governance structure within a state affected the amount of funding a state received. Mean differences were computed between allocated funding to states with a centralized governance structure and states with other types of governance structures across a four year period. There was a significant difference between states with a centralized governance structure and states with other types of state governance structures $F_{(1,199)} = 21.47$, $p<0.001$. As shown in Table 4, states with a centralized governance structure consistently had less funding allocated throughout the four year period than states with other forms of governance structure. Since confidence intervals did not overlap, there was no spurious relationship between state governance structure and funding. As expected, states with a centralized governance structures had smaller populations than states with other types of governance structures. States with a centralized governance structure receive more funding per capita than states with other forms of governance structures and the difference was significant $F_{(1,199)} = 13.23$, $p<0.001$.

Table 5 and Table 6 show preliminary analysis for variables related to time to notify and time to assemble. The timeliness of notifications and assemblies varied widely. The longest notification time reported was 40,308 minutes and the longest

assembly time reported was 1,140 minutes. Removing outliers using the trimmed means method reduced these to 170 minutes for notifications and 142 minutes for staff assemblies. The number of incidents reported for time to notify decreased from a high of 245 incidents in Year 1 to a low of 88 incidents in Year 3; for time to assemble, the number of incidents reported also decreased, from a high of 173 incidents in Year 1 to 77 incidents in Year 3. PHEP funding allocations were based on the number of survey responses and remained stable with outliers and with outliers removed. The number of staff who acknowledged the notification or assembled was collected beginning in Year 3.

Table 4. PHEP Funding Allocations by State Governance Structure (n = 50)

State Governance		Funding[1]			Population[2]			Per Capita[3]		
Structure	n	M	SD	95%CI	M	SD	95% CI	M	SD	95% CI
Centralized	13	7.23	2.98	5.13, 9.33	2.69	2.06	0.95, 4.43	3.69	1.73	3.22, 4.16
All Others	37	12.96	8.62	11.72, 14.20	7.23	7.29	6.19, 8.26	2.68	1.71	2.41, 2.96

[1] In millions of dollars.
[2] In millions.
[3] In dollars.

Table 5. Descriptive Statistics for Response Time, PHEP Funding Allocation and Staff Response With Outliers and With Outliers Removed for Time to Notify

Time to Notify																
With Outliers (n = 642)																
	Year 1 n = 245				Year 2 n = 217				Year 3 n = 88				Year 4 n=92			
Variable	Min	Max	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max	M	SD
Time to Notify[1]	1	13996	104.74	905.16	1	14162	101.98	961.66	1	34624	1154.22	5431.80	1	40308	1239.75	6057.49
PHEP Funding[2]	4.70	45.04	13.14	9.23	4.35	40.95	12.44	8.95	4.63	41.35	12.00	9.34	4.50	41.11	10.58	7.78
Number Responding	*	*	*	*	*	*	*	*	5	1655	93.01	297.01	4	1711	86.22	314.38
With Outliers Removed (n = 578)																
	Year 1 n = 222				Year 2 n = 208				Year 3 n = 68				Year 4 n = 80			
Time to Notify[1]	5	126	32.05	25.88	5	145	28.41	23.07	5	170	47.6	43.52	5	142	40.51	33.77
PHEP Funding[2]	4.7	45.04	13.16	9.35	4.35	40.95	12.5	9.09	4.63	41.35	11.66	9.2	4.5	41.11	11	8.23
Number Responding	*	*	*	*	*	*	*	*	5	1334	43.78	159.68	4	87	20.43	15.34

[1] In minutes.
[2] In millions of dollars.
* Data not collected.

Table 6. Descriptive Statistics for Response Time, PHEP Funding Allocation and Staff Response With Outliers and With Outliers Removed for Time to Assemble

Time to Assemble																
With Outliers (n = 491)																
	Year 1 n = 173				Year 2 n = 159				Year 3 n = 77				Year 4 n = 82			
Variable	Min	Max	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max	M	SD
Time to Asssemble[1]	1	2430	109.8	309.14	1	160	40.13	29.98	3	1140	77.52	134.262	2	240	43.2	35.96
PHEP Funding[2]	4.7	45.04	13.09	8.89	4.35	40.95	12.87	9.67	4.63	41.35	11.88	9.08	4.5	41.11	12.34	9.93
Number Responding	*	*	*	*	*	*	*	*	2	140	17.61	20.46	4	97	14.93	12
With Outliers Removed (n = 442)																
	Year 1 n = 147				Year 2 n = 151				Year 3 n = 65				Year 4 n = 79			
Time to Asssemble[1]	7	142	41.03	28.56	7	135	39.06	25.46	7	139	57.25	35.15	7	142	41.72	28.33
PHEP Funding[2]	4.7	45.04	13.03	8.93	4.35	40.95	13.12	9.81	4.63	41.35	11.41	8.45	4.5	41.11	12.57	10.06
Number Responding	*	*	*	*	*	*	*	*	2	105	15.97	15.6	4	97	14.95	12.13

[1] In minutes.
[2] In millions of dollars.
* Data not collected.

Table 7. State Governance Structure, Incident Type, Announcement Type and Response Type With Outliers (n = 642) and With Outliers Removed for Time to Notify (n = 578)

Time to Notify	With Outliers					With Outliers Removed			
	Year 1	Year 2	Year 3	Year 4		Year 1	Year 2	Year 3	Year 4
State Governance Structure	n (%)	n (%)	n (%)	n (%)		n (%)	n (%)	n (%)	n (%)
Centralized	73 (29.8)	55 (25.3)	22 (25.0)	21 (22.8)		71 (32.0)	55 (26.4)	20 (29.4)	18 (22.5)
All Others	172 (70.2)	162 (74.7)	66 (75.0)	71 (77.2)		151 (68.0)	153 (73.6)	48 (70.1)	62 (77.5)
Incident Type									
Drill	124 (50.6)	107 (49.3)	48 (54.6)	61 (66.3)		116 (52.3)	101 (48.6)	39 (57.4)	52 (65.0)
Exercise	70 (28.6)	56 (25.8)	11 (12.5)	12 (13.0)		62 (27.9)	55 (26.4)	9 (13.2)	12 (15.0)
Real Event	51 (20.8)	54 (24.9)	29 (33.0)	19 (20.7)		44 (19.8)	52 (25.0)	20 (29.4)	16 (20.0)
Announcement Type									
Announced	*	42 (17.1)	**	**		*	42 (20.2)	**	**
Unannounced	*	203 (82.9)	88 (100)	92 (100)		*	166 (79.8)	68 (100)	80 (100)
Response Type									
DNBH	*	122 (56.2)	**	**		*	118 (56.7)	**	**
ONBH	*	95 (47.8)	88 (100)	92 (100)		*	90 (43.3)	68 (100)	80 (100)

* Data not collected.
**Type not permitted due to requirement change.
DNBH: during normal business hours.
ONBH: outside normal business hours.

Table 8. State Governance Structure, Incident Type, Announcement Type and Response Type With Outliers (n = 491) and With Outliers Removed for Time to Assemble (n = 442)

Time to Assemble	With Outliers (n = 491)					With Outliers Removed (n = 442)			
	Year 1	Year 2	Year 3	Year 4		Year 1	Year 2	Year 3	Year 4
State Governance Structure									
Centralized	37 (21.4)	33 (20.8)	21 (27.3)	16 (19.5)		32 (21.8)	28 (18.5)	19 (29.2)	15 (19.0)
All Others	136 (78.6)	126 (79.2)	56 (72.7)	66 (80.5)		115 (78.2)	123 (81.5)	46 (70.8)	64 (81.0)
Incident Type									
Drill	50 (28.9)	54 (34.0)	33 (42.9)	51 (62.2)		47 (32.0)	50 (33.1)	27 (14.5)	49 (62.0)
Exercise	68 (39.3)	55 (34.6)	15 (19.5)	16 (19.5)		58 (39.5)	54 (35.8)	14 (21.5)	16 (20.3)
Real Event	55 (31.8)	50 (31.4)	29 (37.7)	15 (18.3)		42 (31.1)	47 (31.1)	24 (36.9)	14 (17.7)
Announcement Type									
Announced	*	115 (72.3)	**	**		*	108 (71.5)	**	**
Unannounced	*	44 (27.7)	77 (100)	82 (100)		*	43 (28.5)	65 (100)	79 (100)
Response Type									
Immediate	*	*	77 (100)	82 (100)		*	*	65 (100)	79 (100)
Delayed	*	*	**	**		*	*	**	**

* Data not collected.
** Type not permitted due to requirement change.

mean number of staff who were involved in notifications and assemblies decreased slightly from Year 3 to Year 4 although the difference was not significant ($p = 0.882$ and $p = 0.311$ respectively).

Table 7 and Table 8 show frequency distributions for time to notify and time to assemble variables for the four year study period. As the number of incidents reported decreased over time for notifications, the type of incident reported also changed. In Year 1, 51% of the incidents reported were drills; by Year 4, the number had increased to 66%. The number of exercises decreased from 29% to 13% over the same period of time, while the number of real events reported fluctuated over the four years but stabilized between Year 1 and Year 4. The same trend could be seen for drills and exercises for time to assemble. Drills increased from 29% to 62% over the four year period and exercises decreased from 39% to 20%. The number of real events reported decreased over the four year period.

In Year 2, state PHEP program directors were required to provide additional information on the incidents reported. Incidents were classified as announced or unannounced. In Year 2 for time to notify, most of the reported incidents (83%) were unannounced. The opposite was true for time to assemble; most of the reported incidents (78%) were announced. However, in successive years CDC reporting requirements changed and all incidents reported had to be unannounced whether they were staff notifications or assemblies.

Also in Year 2, state PHEP program directors were required to provide information on whether the notification occurred during normal business hours or outside normal business hours. In Year 2, 56% of all notifications were conducted during normal

business hours; no data were collected for time to assemble. In Year 3 and in Year 4, the requirement changed again for both staff notifications and assemblies. All notifications reported had to be unannounced and conducted outside normal business hours; all staff assemblies reported had to be unannounced and immediate.

Hypothesis 1

Hypothesis 1 proposed that states receiving higher levels of PHEP funding would report shorter staff notification and assembly response times than states receiving lower levels of funding. Hypothesis 1a asserted that states with higher levels of PHEP funding would report shorter staff notification response times than states with lower levels of PHEP funding. Specifically, the hypotheses were:

$H1a_0$: States receiving higher levels of PHEP funding will report the same or longer staff notification response times than states receiving lower levels of funding.

$H1a_1$: States receiving higher levels of PHEP funding will report shorter staff notification response times than states receiving lower levels of funding.

Pearson's correlation coefficient and simple linear regression were computed to assess the relationship between time to notify and PHEP funding. There was no significant difference with outliers $R = -.016$, $F_{(1,641)} = .155$, $p = .347$ or with outliers removed $R = -.008$, $F_{(1,577)} = .039$, $p = .422$ between time to notify and funding amount. The results suggest that increasing funding levels do not decrease staff notification time.

Hypothesis 1b asserted that states with higher levels of PHEP funding would report shorter staff assembly response times than states with lower levels of PHEP funding. Specifically, the hypotheses were:

$H1b_0$: States receiving higher levels of PHEP funding will report the same or longer staff assembly response times than states receiving lower levels of funding.

$H1b_1$: States receiving higher levels of PHEP funding will report shorter staff assembly response times than states receiving lower levels of funding.

Pearson's correlation coefficient and simple linear regression were computed to assess the relationship between time to assemble and PHEP funding. There was a significant difference with outliers R=.762, $F_{(1,491)}$=678.82, $p \leq .001$; however, with outliers removed R=-.039, $F_{(1,441)}$=.661, p=.208. The results suggest that increased funding levels do not decrease staff assembly time. Overall, the findings suggest that PHEP funding allocation is not useful in predicting response time for an incident.

Hypothesis 2

Hypothesis 2 proposed that states with a centralized form of state governance structure would report shorter staff notification and assembly response times than states with other forms of state governance structures. Hypothesis 2a asserted that states with a centralized state governance structure would report shorter staff notification response times than states with other forms of state governance structures. Specifically, the hypotheses were:

$H2a_0$: States with a centralized state governance structure will report the same or longer staff notification response times than states with other forms of state governance structures.

$H2a_1$: States with a centralized state governance structure will report shorter staff notification response times than states with other forms of state governance structures.

An independent samples t-test was computed to assess the relationship between time to notify and state governance structure. There was no significant difference $t_{(641)}$ = -.092, p = .464 between time to notify and state governance structure with outliers; after removing outliers, there was a significant difference between time to notify and state governance structure $t_{(577)}$ = -2.02, p = .011; however, the results were in the opposite direction than predicted. With outliers removed, states with a centralized governance structure took longer to notify staff (M = 27.54 SD = 2.29) than states with other forms of state governance structures (M = 23.44 SD = 2.18).

Hypothesis 2b asserted that states with a centralized state governance structure would report shorter staff assembly response times than states with other forms of state governance structures. Specifically, the hypotheses were:

$H2b_0$: States with a centralized state governance structure will report the same or longer staff assembly response times than states with other forms of state governance structures.

$H2b_1$: States with a centralized state governance structure will report shorter staff assembly response times than states with other forms of state governance structures.

With outliers, there was a significant difference between time to assemble and state governance structure $t_{(490)}$ = -2.30, p = .011 and with outliers were removed $t_{(441)}$ = -2.96, p = .02; however, the results were in the opposite direction predicted. With outliers removed, states with a centralized governance took longer to assemble staff (M = 41.74 SD = 2.01) than states with other forms of governance structures (M = 32.36 SD =

2.03). The results indicate that states with a centralized governance structure take longer to assemble staff than states with other types of governance structures and the difference was significant $p = .003$.

Other Factors

Multiple regression analysis assigned time to respond as the dependent variable and all other variables were independent. Each independent variable was used to evaluate the effect upon the dependent variable. Stepwise backward elimination was used to remove variables with p-value $\geq .10$ from the model (two-tailed). Results of the analyses are provided in Table 9.

Table 9. Final Regression Analyses, Backward Entry With Outliers and With Outliers Removed for Variables Predicting Time to Notify and Time to Assemble

Response Type		Drill	Exercise	Real Event	State Governance Structure	Funding	Announce[1]	Response[1]	# Acknow[2]	Final Model R-Sq	Final Model F	*p*
		n = 642					n = 217	n = 217	n = 180			
Notify	With Outliers	-	β = -.059 *p* = .153	β = .027 *p* = .527	β = -.003 *p* = .941	β = -.021 *p* = .623	β = 0.006 *p* = .941	β = -.026 *p* = .714	β = .633 *p* ≤ .001	0.005	0.869	0.482
		n = 578					n = 180	n = 180	n = 148			
	With Outliers Removed	β = .033 *p* = .515	-	β = .050 *p* = .331	β = .089 *p* = .043	β = .018 *p* = .675	β = .020 *p* = .798	β = -.084 *p* = .247	β = -.069 *p* = .408	0.009	1.315	0.263
		n = 491					n = 159		n = 159			
Assemble	With Outliers	-	β = .085 *p* = .092	β = .061 *p* = .234	β = .088 *p* = .064	β = -.051 *p* = .286	β = .093 *p* = .288	-	β = .19 *p* = .018	0.019	2.36	0.053
		n = 442					n = 151		n = 144			
	With Outliers Removed	β = .009 *p* = .870	-	β = .104 *p* = .062	β = .125 *p* = .012	B = -.017 *p* = .735	β = .096 *p* = .288	-	β = .061 *p* = .462	0.029	3.279	0.012

[1] Year 2 only.
[2] Year 3 and Year 4 only.
"-" Variable was eliminated due to the model (p≥.10).
β refers to the standardized regression coefficient.

65

For time to notify with outliers, the model $R^2 = .005$, $F_{(4, 641)} = .869$, $p = .482$ retained the variables exercise, real event, centralized state governance structure and PHEP funding allocation, suggesting little association among the variables. Announcement type and response type were added to the analysis in Year 2; this did not change the relationship among the variables. The number of staff acknowledging the response was added to the analysis in Year 3 and in Year 4; there was a significant positive association between number of staff acknowledging the response and time to notify with outliers $\beta = .633$, $p \leq .001$. With outliers removed, there was a negative non-significant association between and the number of staff acknowledging the response and time to notify $\beta = -.069$, $p = .408$. There was also a positive significant relationship between state governance structure and time to notify with outliers removed $\beta = .089$, $p = .043$; this relationship was discussed in Hypothesis 2a.

For time to assemble time with outliers, the model $R^2 = .019$, $F_{(4, 490)} = 2.36$, $p = .053$ retained the variables exercise, real event, centralized state governance structure and PHEP funding allocation, once again suggesting little association among the variables. Announcement type was added in Year 2; this did not change the relationship among the variables. The number of staff assembling was added in Year 3 and in Year 4; there was a significant positive association between number of staff assembling and time to assemble $\beta = .190$, $p = .018$; this association weakened significantly with outliers removed $\beta = .061$, $p = .462$. There was also a positive significant relationship between state governance structure and time to assemble with outliers removed, $\beta = .125$, $p = .012$; this relationship was discussed in Hypothesis 2b.

Table 10. Pearson's Correlation Between End-of-Year Data and Best Demonstration Data in Year 3 and in Year 4 for Time to Notify (n = 100)

Variable	EOY[1] Time	EOY[1] Incident Type	BD Time	BD Incident Type
EOY[1] Time	1.00	-	.962	-
EOY[1] Incident Type	-	1.00	-	.969
BD[2] Time	.962	-	1.00	-
BD[2] Incident Type	-	.969	-	1.00

[1] End-of-Year Data.
[2] Best Demonstration Data.

End-of-Year, Best Demonstration and HPPG Data

Each state PHEP program director provided information on one incident they considered the state's best demonstration of a staff notification. It should be noted that the best demonstration time that was submitted was not always the shortest incident they reported throughout the year. Several state PHEP program directors submitted their best demonstration data for time to notify, even though it was not their shortest time to notify based on all incidents reported in their end-of-year reports. In Year 3, three state PHEP program directors reported their best demonstration notification time was longer than their shortest end-of-year notification time and no state reported a shorter best demonstration time than an end-of-year notification time. In Year 4, no state reported a longer notification time as their best demonstration and one state reported a shorter demonstration time than was submitted throughout the year. A partial Pearson's correlation coefficient was calculated using time to notify and incident type by year; results showed there was a high correlation between end-of-year data for time to notify and best demonstration data for time to notify (see Table 10). It was found that one of the incidents reported throughout the year was also considered to be the best

demonstration of a staff notification. Based on the extremely high correlations obtained, no additional analysis was conducted.

Since there was a high correlation between end-of-year data and best demonstration data for staff notification, analysis was conducted to determine if time to assemble was highly correlated between end-of-year data and best demonstration data. Six states provided information on their best demonstration that had longer assembly times than were submitted for the end-of-year report in Year 3. Four states reported longer assembly times and four states reported shorter assembly times than were submitted for the end-of-year report in Year 4. A partial Pearson's correlation coefficient was computed using the variables state ID, time to assemble and incident type by year in Year 3 and in Year 4. As Table 11 shows, extremely high correlations between the variables were obtained. Once again, results showed that one of the incidents reported throughout the year was also considered the best demonstration of a staff assembly. No additional analysis was conducted.

Finally, analysis was conducted to determine if time to assemble was highly correlated among end-of-year data, best demonstration data and HPPG data in Year 4. Pearson's correlation coefficient was computed using the variables state, time to assemble and incident type. As expected, there was an extremely high correlation among the data sets as shown in Table 12. An incident reported throughout the year was considered the best demonstration of a staff assembly and was submitted to fulfill the PAHPA reporting requirements. No additional analysis on response times was conducted.

These results support the reliability of state reporting. It enhances the confidence that state PHEP directors are consistently reporting staff notifications throughout the year, then choosing one of these incidents as their best demonstration. This was also true for staff assemblies. State PHEP directors reported staff assemblies throughout the year then chose the same incident as their best demonstration and to meet PAHPA requirements. This finding shows a clear pattern of uniformity in reporting incidents and related response times. It also reduces the uncertainty that data submitted to meet PAHPA benchmarks is contrived.

Table 11. Pearson's Correlation Between End-of-Year Data and Best Demonstration Data in Year 3 and Year 4 for Time to Assemble (n = 100)

Variable	EOY[1] Time	EOY[1] Incident Type	BD Time	BD Incident Type
EOY[1] Time	1.00	-	.951	-
EOY[1] Incident Type	-	1.00	-	.916
BD[2] Time	.951	-	1.00	-
BD[2] Incident Type	-	.916	-	1.00

[1] End-of-Year Data.
[2] Best Demonstration Data.

Table 12. Pearson's Correlation Among End-of-Year Data, Best Demonstration Data and HPPG Data in Year 4 for Time to Assemble (n = 50)

Variable	EOY[1] Time	EOY[1] Incident Type	BD[2] Time	BD[2] Incident Type	HPPG[3] Time	HPPG[3] Incident Type
EOY[1] Time	1.000	-	0.847	-	0.755	-
EOY[1] Incident Type	-	1.000	-	0.875	-	0.927
BD[2] Time	0.847	-	1.000	-	0.844	-
BD[2] Incident Type	-	0.875	-	1.000	-	0.944
HPPG[3] Time	0.755	-	0.844	-	1.000	-
HPPG[3] Incident Type	-	0.927	-	0.944	-	1.000

[1] End-of-Year Data.
[2] Best Demonstration Data.
[3]High Performance Priority Goal.

Study 2

Descriptive Statistics

There were three themes developed for data coding and analysis; these themes were related to the organization, the staff and channels of communication. Each theme was defined by who or what controlled the ability to meet the recommended time for notification or assembly and were further segmented into three to four categories (see Appendix F). In Year 1 and in Year 2, a total of 24 states (48%) reported at least one incident (notification or staff assembly) in which they did not meet the recommended time to notify or assemble for a total of 57 responses (see Table 13). After data segmentation, these responses were coded into 69 segments. For instance, one response included: "User errors, technical issues, and people were out of the office and unable to respond within the required time limit." The phrase "user errors" was coded as "staff – training", "technical issues" was coded as "communication – hardware/software issues" and "people were out of the office and unable to respond within the required time limit" was coded as " staff – response time".

Twenty-four states reported at least one incident in which they did not meet the recommended response time. There were five states that were unable to meet the time to notify recommendation for two years in a row; one state did not meet the recommended time to notify or assemble. The other 18 states had varying levels of success: a state may not have met the recommended time to assemble in Year 1 but succeeded in meeting the recommendation in Year 2; however, the same state may have met the recommended time to notify in Year 1 but did not meet the recommendation in Year 2. Seven states

(29%) accounted for 41 (59%) incidents that did not meet the CDC recommendations. One state accounted for 12 (17%) of the incidents. For that particular state, 11 incidents were reported in Year 1 and one incident was reported in Year 2.

Table 13. Response Times Outside CDC Recommendations for Time to Notify and Time to Assemble

Variable	Year	Total Incidents Reported	Met Recommendation (%)	Did Not Meet Recommendation (%)
Notify[1]	Year 1	245	221 (90.2)	24 (9.8)
	Year 2	217	199 (91.7)	18 (8.3)
Assemble[2]	Year 1	173	159 (91.9)	14 (8.1)
	Year 2	159	158 (99.4)	1 (0.6)

[1] Recommendation for time to notify was ≤ 60 minutes.
[2] Recommendation for time to assemble was ≤ 2.5 hours.

Table 14. Barriers to a Timely Response by Theme and Category (n = 69)

		Organization				Staff			Communications		
Type	Year	Extended Timeframe	Confirmation	Information	Other	Staff Response	Training	Other	Audit Trail	Hardware/ Software	Compatibility
Notify	Year 1	4	4	1	0	8	3	1	6	5	2
	Year 2	4	0	0	2	10	2	0	0	2	0
Notify Subtotal		8	4	1	2	18	5	1	6	7	2
Assemble	Year 1	8	2	0	2	0	0	0	0	2	0
	Year 2	0	0	0	0	1	0	0	0	0	0
Assemble Subtotal		8	2	0	2	1	0	0	0	2	0
Total		16	6	1	4	19	5	1	6	9	2

Frequency response rates were determined by adding the number of times each response was applied to a theme and category. Table 14 summarizes the barriers to a timely response. The theme "organization" accounted for the most infrastructure-related barriers to a timely response with a total of 27 responses, followed by staff (25 responses) and communications issues (17 responses). It should be pointed out that in Year 1, there were 14 staff assemblies in which state PHEP program directors reported the inability to respond within 2.5 hours; in Year 2, only one staff assembly did not meet the recommended time to assemble. The ability to receive an acknowledgement after notifying staff did not change between Year 1 and Year 2 and the number of times the staff was noted as the reason for the longer response time increased from 8 instances to 10 instances. The number of communication barriers decreased from 15 instances in Year 1 to two instances in Year 2 for notifications and assemblies. Between Year 1 and Year 2, state PHEP program directors reported a decrease in the number of instances notifications and staff assemblies did not meet the recommendations set by CDC.

The results for each theme (organization, staff and communications) will be discussed in detail, beginning with the theme "organization". This theme was chosen first, since it was mentioned more than the other two themes: 21 times in Year 1 and 6 times in Year 2.

Theme: Organization

The infrastructure-related theme that emerged as the largest barrier with the most number of responses was the organization itself. The theme "organization" was related to leadership and process management efficacy. The ability to meet the recommendation

was controlled by managerial decisions. Four categories defined the organizational themes: the organization requested an assembly or notification longer than the CDC recommendations, coded as "extended timeframes"; the organization did not request a confirmation of the notification, coded as "confirmation"; the organization's rosters were not current, coded as "information"; and responses that were under the organization's control but could not be clearly classified in the categories "extended timeframes", "confirmation" or "information", coded as "other".

Extending the timeframes for the staff to respond to the incident was a barrier to notifying or assembling within the recommended time frame. Interestingly, some states provided detailed information on the incident which they extended the time frame, knowing the incident did not meet the recommended time to respond. One respondent noted:

> On 1/16/07, 20 were [sic] Staff with public health agency ICS functional responsibilities were notified to report to the Command Center at 7.00 AM on 1/18/07. All 20 staff reported to the Command Center before 7.15 AM on 1/18/07 (All staff reported to the Command Center within 0 to 15 minutes of the requested time).

Other state respondents provided minimal information citing, "warm start to the full scale exercise" or explained the extension by noting that "there is no doubt that individuals would have reported sooner during a real event. Since this was an exercise, the time to report was extended to allow staff the additional time."

Barriers related to the request for a confirmation of the notification or assembly decreased from six in Year 1 to zero in Year 2. In Year 1, respondents documented that the "confirmation of notification receipt was not required or obtained" or "this was a low level - email only alert sent to regional health office personnel to provide information regarding a nationwide FDA report. An immediate response was not requested…" There was one response noting that pertinent information needed to assure a timely response was not updated.

The "other" category was comprised of responses that resembled the following: "this delay was due to the artificiality of the functional exercise." Since the organization conducted the exercise, the response was coded under the theme "organization"; however, it was unclear what the respondent meant by this statement.

There were 21 incidents that were coded as organizational barriers in Year 1; in Year 2, the number decreased to 6 (see Table 14). Under the category "extended timeframes", there were 12 incidents where notification or assembly times were extended; in Year 2 there were four. Confirming and assuring accurate information (in the way of updated rosters) also decreased from Year 1 to Year 2, with no states reporting confirmation or inaccurate information barriers. This reduction may have been due to additional training conducted with the states by CDC to clarify the intent of the performance measure.

While the organization theme was mentioned 27 times by state PHEP program directors as a major barrier with a decrease from 21 responses to 6 responses over the two year study period, the next theme, staff, was mentioned 25 times. The difference between the two themes was that, while staff issues were a barrier in Year 1, they continued to be a barrier and increased slightly in Year 2, from 12 to 13 instances.

Theme: Staff

The theme "staff" was related to the workforce and staff. The ability to meet the recommendation was controlled by the individual staff member. Staff themes were classified into three categories: not all staff responding to the notification or assembly within the required time frame, coded as "staff response"; staff response was hampered by inadequate training, coded as "training"; and responses that the staff had the ability to control but could not be clearly classified in the categories "staff response" or "training", coded as "other".

The category contributing most to the inability to meet the recommendation was "staff response". Staff response seemed to be an important barrier yet was perceived as a common barrier by states and warranted further examination of the data. After further review of the text, the responses fell into two groupings: (a) respondents who provided a reason why staff could not respond within the recommended time frame; and (b) respondents who described the late acknowledgement of one or two employees as an anomaly. Most respondents gave reasons why staff was not able to respond. These respondents noted that staff was traveling, in meetings without their Blackberry, or out of the office; a few pointed out the late response was due to extenuating circumstances. One respondent cited:

> The last individual to confirm notification was the incident commander, (IC) who initiated the notification process. The delay was due to the fact that the IC was managing the event and was not able to electronically verify notification until time was available."

Another respondent reasoned that "notification was on a Sunday on Father's Day and many staff was out and in the middle of family activities."

The majority of respondents who explained the late acknowledgement of one or two employees as an anomaly were consistent in their explanation of what the response would have looked like if the outlier was omitted. One respondent reported that "one staff member took 107 minutes to respond to the notification. This outlier skewed the data. All other staff responded within 60 minutes with a total mean response time of 18 minutes." Another stated, "twenty-two people responded to the call down (92%) within 87 minutes. Two individuals did not respond to the alert until the next morning. The average response time excluding two individuals was 24 minutes." A third respondent did not give an explanation but simply said, "only one staff person failed to acknowledge the notification within 60 minutes."

Staff training was another factor in a state's ability to respond in a timely fashion. States that reported longer response times due to the need for additional staff training in Year 1 did not report the need for additional staff training in Year 2. Staff training included user issues and user errors; it should be noted that respondents were specific about which software programs would require additional training by staff. Barriers related to staff training were reported three times in Year 1; this was reduced to two reports in Year 2. Confusion on the correct use of GROOVE workgroup software used as the virtual Emergency Operations Center (EOC) and staff members learning how to confirm alerts on the Health Alert Network (HAN) system were illustrated as training issues. One respondent described their training issue and stated the problem was corrected:

This was the first time we conducted this type of drill and some people were not

familiar with how the notification worked. When the PIN is sent, instead of a person's name or email address showing, a number (the PIN number of the person sending the message) is shown instead. Since most people didn't know what this number meant the message was ignored. This problem was corrected prior to our next drill.

The only theme that increased between Year 1 and Year 2 (albeit slightly) pertained to staff. While there were eight incidents reported involving staff response in Year 1, these were attributed to four states. The 10 incidents involving staff response in Year 2 were attributed to eight states, with only two states having reoccurring staff response issues from Year 1. Staff training was a factor in a state's ability to respond in a timely fashion in Year 1 and continued to be a factor in Year 2. While the number of times staff issues as a barrier increased between Year 1 and Year 2 overall, communications barriers decreased from 15 responses in Year 1 to two responses in Year 2 as described in the next section.

Theme: Communications

The theme "communications" related to the communication of knowledge and the act of informing. Channels of communication (software and hardware) that were used to transmit information controlled whether or not the recommendation was met. Communications were classified into four categories: barriers in tracking the acknowledgement of the notification or assembly, coded as "audit trail"; hardware, software or other technical issues that impeded the notification, coded as "hardware/software"; lack of compatibility between computer systems, coded as

"compatibility" and responses that did not clearly fit in the categories "audit trail" "hardware/software" or "compatibility", coded as "other". All responses fit one of the pre-defined categories and the "other" category was not used.

Under communications, the lack of a robust audit trail was the biggest barrier to a timely response (see Table 14). One respondent cited limitations to the software system that audited the beginning and ending time of the notification. The communications system could only document that the notification occurred within a two hour period from initiation. Since the recommended time for an acknowledgement of a notification was 60 minutes or less, this state noted 120 minutes for all notifications, although it may have taken longer than 120 minutes. In Year 2, no state reported incidents involving problems linked to an audit trail.

The hardware and software barriers that were identified appeared to be corrected immediately after identification. One respondent described his inability to meet the recommendation and also described steps the state had taken to reduce or eliminate this barrier from arising in the future, stating:

> This was during a widespread tornadic [sic] event in the state and there were many lines and communication methods temporarily not working. The system was used again several times during Gustav and IKE and worked much better. We continue efforts to have a redundant communication system so that when one method fails we have several others that do not. This was an excellant [sic] learning experience and we will test communication methods several times this year and ensure that we have a back up method for communicating with all of our ICS functions.

A second respondent mimicked the first:

> A large number of people were not contacted or the system could not verify that they were contacted--628 of 1172 people were not contacted. The system vendor reported that their T1 circuits were experiencing problems with their telecom vendors and they are in the process of switching vendors due to this. This lack of data skewed our mean for the drill, allowing the outlier to be more prominent in the final results.

Both compatibility issues were reported by one state, noting that "several Blackberry browsers have not been updated to be compatible with the Health Alert Network (HAN) system." Barriers due to compatibility were reported in Year 1 only. It should also be noted that the same states that reported overall communication barriers in Year 1 did not report communication barriers in Year 2; a new set of states experienced communication barriers.

Under the communications theme, hardware and/or software issues were a barrier in the states' ability to respond in Year 1 and continued to be a barrier in Year 2. Six states attributed hardware or software issues to their inability to meet the recommendation; two states noted more than one incident. Technical issues were coded as hardware/software; one state reported five communications issues, three related to hardware/software issues and two related to compatibility. While there were six responses that were attributed to lack of a robust audit trail, one state reported five of these responses in Year 1. In Year 2, no state reported responses involving barriers linked to an audit trail.

As noted earlier, the questions asked in the end-of-year report changed significantly in Year 3. States were not explicitly asked to identity their barriers to a timely response. The updated question: "Which exercise or real incident reported represents the best demonstration of your agency's staff assembly capability?" elicited responses such as: "We conducted staff assembly operations as we stood up our Emergency Operations Center as part of our state response to the A(H1N1) swine flu virus ourbreak [sic].--105 Minutes". Another responded:

> Center for Emergency Preparedness and ICS were notified about a hurricane in the Gulf of Mexico. The ICS was activated along with EOC and call center. Medical needs shelters were opened. The state coordinated with (another state) to provide cross-jurisdictional response. EOC and call center remained activated until shelters were closed.--94 Minutes

And still another noted:

> All functional leads were alerted by Health Alert Network (HAN) and instructed to report to the Agency Emergency Coordination Center to assume their ICS responsibilities within an hour in response to non-specific indicators threats and warnings. HAN alerts are launched by landline, cell, web--68 Minutes----68 Minutes [sic]

While all responses pointed out that it took over 60 minutes to respond, the responses could not be coded into organization, staff or communications themes. Additional analysis was conducted to determine if any consistent themes emerged; the

data did not support the development of themes or a coding schema. Data could not be coded into the themes used to code Year 1 and Year 2 data.

A follow-up response was required to the original question: "Please provide a brief description of why this exercise or incident was chosen as the best demonstration of your agency's staff assembly capability." Responses included: "Our response for spring and summer Year 3 has been focused on H1N1 and our response to that event and ongoing response with duty officer assigned 24/7 (90 minutes)", "This required a large activation of staff, unexpectedly and quickly (94 minutes)", and "This drill was chosen because it was our best demonstration of our agency's staff assembly capability. It was also chosen over the real event because the real event was slow moving during activation and did not require full and quick activation of all staff (139 minutes)." Again, additional analysis was conducted to determine if any consistent themes emerged; these comments were not detailed enough to categorize into existing themes or the development of new themes. Data analysis was discontinued.

CHAPTER V

DISCUSSION

Main Findings

The purpose of this study was to assess the relationship between public health infrastructure and state health department response capabilities, specifically, the relationships among two infrastructure elements and two response-related outcomes. Public health emergency preparedness (PHEP) is a relatively new field of study and metrics to monitor success continue to be developed. The study of state governance structure and PHEP funding allocation and its relationship to response times is the first known attempt to capture the dynamics between these variables. As such, no historical comparisons could be made to verify or refute the findings of this study.

The study sought to answer the research question, "To what degree does state infrastructure predict a timely response to public health emergencies?" The first objective was to determine if PHEP funding allocation affected response time. The second objective was to determine if state governance structure affected response time. The third objective was to identify infrastructure-related barriers to a timely response. The research question was answered and each of the objectives was accomplished.

A mixed methods approach using quantitative and qualitative analysis was employed for this study. One of the strengths of this study was that all 50 state PHEP program directors or their representatives provided data to CDC through mid-year and end-of-year reports from 2007 through 2010. The findings of this study may have practical implications for states in improving their response times during an emergency.

Quantitative analyses were used to meet the first two objectives. The results of this study did not support the hypothesis that increased levels of PHEP funding allocation would reduce response times. The findings show that states with higher levels of PHEP funding did not respond to incidents faster than states with lower levels of funding; in fact, states with lower levels of PHEP funding responded slightly faster, although the results were not statistically significant. It should be pointed out that all states receive a minimum $5 million in base funding plus additional funding determined by their population. States with lower levels of funding tended to have smaller populations. Minimum funding levels affected per capita levels; states with smaller populations had higher per capita spending than states with larger populations. The results suggest that the base funding of $5 million provided to all states has a greater effect on dollars spent per capita in less-populated states.

The analysis between state governance structure and response time was based on the US House Select Bipartisan Committee's conclusion that Louisiana's decentralized response to Hurricane Katrina may have been improved through a centralized command and control system (US House Select Bipartisan Committee, 2006). This study's findings do not support that hypothesis. The results suggest that a decentralized form of state governance structure has a positive effect on response time. States with decentralized, mixed or shared state governance structures notify and assemble their staff significantly faster than states with a centralized form of state governance. As noted earlier, states with a centralized governance structure tend to have smaller populations than states with other forms of governance, receive less funding and therefore are able to hire less staff.

States with a decentralized, mixed or shared form of governance structure tend to have larger populations, receive more funding and, in turn, can hire more staff. Also, major reductions in public health staffing due to the economic downturn may be affecting smaller, less populated, centralized states more than states with other forms of governance structure (Trust for America's Health, 2011); with less staff available to respond to emergencies, fatigue and burnout may be affecting time to respond.

Another explanation why states with a centralized governance structure may take longer to notify and assemble staff may be the unintended consequences of funding core infrastructure needs for dual use over funding response needs targeted toward disaster preparedness and response. While funding for dual use has been strongly encouraged by CDC, it may take its toll on states with centralized governance structures.

Funding comes from state and federal sources; there is little to no funding at the local level; there are fewer staff at the state level to rely on to respond and few to no locals,

There may also be other inherent differences in the organization and management of the different types of governance structures that affect the ability of staff to respond to an emergency.

The researcher was unable to explain what other factors could have affected response time. While multiple regression analysis supported the initial findings related to funding and state governance structure and indicated that these results were not chance findings, the variables associated with incident type, announcement type, response type and number of staff responding did not support a reduction in response time for staff

notifications or assemblies. The findings also did not support the underlying expectation that, with practice, staff response times would decrease year after year. This may be due to the changes in data collection and reporting and the effect the survey modification had on response times when the questionnaire was changed. In an effort to gather additional information to better assess the activities surrounding the incidents reported, additional questions were added to the survey in Year 3, increasing the number of questions the state PHEP program directors were required to answer from 8 to 14 (see Appendix D and Appendix G). This was detrimental to the number of incidents reported and the response times submitted to CDC. Between those two years, mean response times almost doubled while the number of incidents reported decreased by more than half. Also, eight questions relating to the best demonstration of an incident and twelve questions meant to assess the achievement of the PAHPA benchmark were added to the survey. After analyzing all the data sets, the results suggest that response times submitted for a state's best demonstration and those submitted to meet PAHPA requirements accurately represent the incidents conducted throughout the year. For data submitted for their best demonstration and to satisfy the PAHPA requirement, state PHEP program directors did not appear to single out the shortest incident time submitted in their end-of-year report but rather submitted the incident that best displayed their ability to respond per CDC guidance. These additional questions, which were meant to help understand the circumstances surrounding each incident reported, actually appeared to place an undue reporting burden on the state and suggest that survey fatigue may have played a factor in reducing the response rate and response time over the four year study period. Response

time may have increased because states, while conducting incidents that had shorter response times, did not have answers to all the questions asked in the survey and therefore could not report on that particular incident. Taken together, considerations should be made for reducing the burden of reporting staff notifications and assemblies on the states. If a state can demonstrate staff response times within the required time frame, CDC should consider extending the time frame for reporting best demonstration data or end-of-year data from once per year to once every three years. And, since PAHPA requirements must be met for states to receive full funding, CDC should consider requiring states to report the one incident that reflects the PAHPA requirement only, thus reducing the reporting burden on the states.

The final objective was met through qualitative analysis. Three barriers were identified as impeding response time. These barriers were associated with individual staff members, the organization itself and channels of communication. The ongoing barrier between Year 1 and Year 2 was related to the staff; specifically, individual staff response. Having staff wired and monitoring their cell phones and Blackberries 24/7 was the biggest barrier to a timely response. Training staff on the proper use of software was also a barrier; however, states that reported longer response times due to lack of adequate staff training in Year 1 did not report this barrier in Year 2. The findings also suggest that, once training on the use of software systems to respond to a notification was identified as a problem, states may have upgraded their systems to make responding to an alert easier or they may have conducted more trainings for employees. Both these findings, the need to monitor communication devices for emergencies and the need to

understand how to respond to a notification, may suggest that, with the high turnover rate in public health staff (Association of State and Territorial Health Officials, 2011), employees need higher levels of training to become proficient in their organization's expectations and learn the software systems used to respond. Changes in policy to require yearly training for all employees on the expectations surrounding a response and practice how to adequately respond may be needed to improve the likelihood that all staff will respond within 60 minutes of notification of an incident.

While the total number of responses relating to organizational barriers was higher than barriers related to staff, the outcome after identification was different. Once the organizational barriers were identified, they were reduced or eliminated within a state the following year. The organizational barriers were classified as extending the time frame for reporting, the lack of consistent messaging for confirming the notification, and messages sent for information purposes only. For instance, in the first year of the study, some states extended CDC's recommended timeframe for a response; this immediately caused the state to be out of compliance with the recommendation. Lack of consistent messaging and updating employee information were eliminated as barriers in the second year; states learned and made changes as barriers were identified. CDC should consider requiring states to provide examples of the barriers that were faced and what processes and procedures were put in place to reduce or eliminate the barrier so as to assist other states in reducing similar barriers within their organizational structure.

The last barrier identified was related to channels of communication. These were identified as the lack of a robust audit trail, hardware and software issues and lack of

compatibility between communication systems. It should be noted that the same states that reported overall communication barriers in Year 1 did not report communication barriers in Year 2; a new set of states experienced communication barriers. Once again, states appeared to implement lessons learned. Between Year 1 and Year 2, barriers related to an audit trail and the compatibility between communications systems were reduced to zero. This reduction may have been due to an improvement in the notification system that recorded the time to notify, they may have upgraded hardware and software systems, assured compatibility between communication systems or the state chose to provide information on incidents that did not involve compatibility issues.

In Year 3, the questionnaire's wording changed and all states were asked to describe the incident rather than asking states who did not meet the requirement to describe the barrier encountered. Responses could not be segmented appropriately. Overall, states changed their practices once the barrier was identified. To reduce response time, barriers need to be isolated. Consideration should be made to change the questionnaire wording back to the original verbiage which specifically asks what barriers increased response time. As shown, these barriers can then be reduced or eliminated in the future.

While over $8 billion has been spent on PHEP activities, the question still remains: Is the US better prepared to respond to a terrorist event, natural disaster, or emerging infectious disease? This study highlights the importance of conducting research using quantitative and qualitative methodologies to answer this question. Comparing the findings of both studies suggests the answer is "yes". While the

quantitative results are mixed, the qualitative results clearly suggest that, as states identified barriers while responding to incidents, these barriers were corrected. These findings point to the need for additional qualitative research to highlight lessons learned and disseminate the findings to other states in an effort to continuing improving response activities.

Limitations

There are several potential limitations inherent to the data used for this study. All CDC data are self-reported and no data are validated through other means. The results may be biased if the accuracy of the self-report is suspect. All data were presumed accurate. Some states may provide data that clearly represents their response time; other states may report shorter response times, suggesting the state is performing well. Still other states may report longer response times, suggesting the need for additional technical assistance or funding to improve this measure. There was no control group.

A second limitation of this study was the number of incidents reported. As the years progressed, fewer incidents were reported, resulting in a small sample size. Additional analysis on other variables by funding year could not be conducted because of the limitations of the data. Making generalizations about these findings to the larger population of incidents could be considered questionable.

A third limitation was that only federally-appropriated public health emergency preparedness funding allocations were used as a variable. The state provided CDC with information on the funding they allocate; however, there is no comprehensive check and balance system to assure the funding is spent. Audits are conducted; the PERFORMS

system is not updated with the audit's findings. Other federal agencies may have used some of their funding to assist in a public health incident, thereby skewing the actual amount of funding available to public health. During 2009, a widespread pandemic was declared and funding was made available to specific programs, including state and local PHEP and immunization programs. While over 95% of the funding went to the local level, any funding which was spent at the state level was not included in the study Centers for Disease Control, 2011).

Also, the population of incidents could not be calculated. States provided information on one to twelve incidents per year, whether they conducted one or 100. Public health agencies participate in incidents with other agencies and these incidents are not reflected in the survey. The reported incidents were considered a sample of the total population of incidents conducted.

Finally, this study was limited by the change in the survey questionnaire. In Year 1 and in Year 2, the survey questionnaire's wording was the same. In Year 3, the wording changed, additional questions were added to the survey and two additional surveys were added. Also in Year 3, state personnel were provided with a guidance document defining terms and measurement specifications, which may have changed the way they answered the survey questions.

Areas for Further Study

Further research should be conducted to elucidate the non-financial determinants that may affect public health emergency response time. These determinants can then be used to enhance public health program performance, while leveraging the available

funding. Any infrastructure-related factors that are identified may take years to operationalize within a state. Conducting interviews with state PHEP program directors could help identify these factors. Conducting case studies in states with centralized, decentralized, mixed and shared governance structures could also shed light on what improves response time within a state.

Public health preparedness does not operate in a vacuum; emergency management, and healthcare systems must work together to develop a high level of community preparedness. Additional research should focus on preparedness as a whole with public health as one component to the picture. As federal funding shrinks and federal programs align to utilize fewer funds, research into the most effective, evidence-based funding formula should be expanded. This formula may be risk-based rather than population-based for states and include preparedness funding in the areas of law enforcement, transportation, emergency management and hospital preparedness. The findings from this research can then be used to develop evidence-based performance metrics that measure the improvement of preparedness as a whole.

APPENDICES

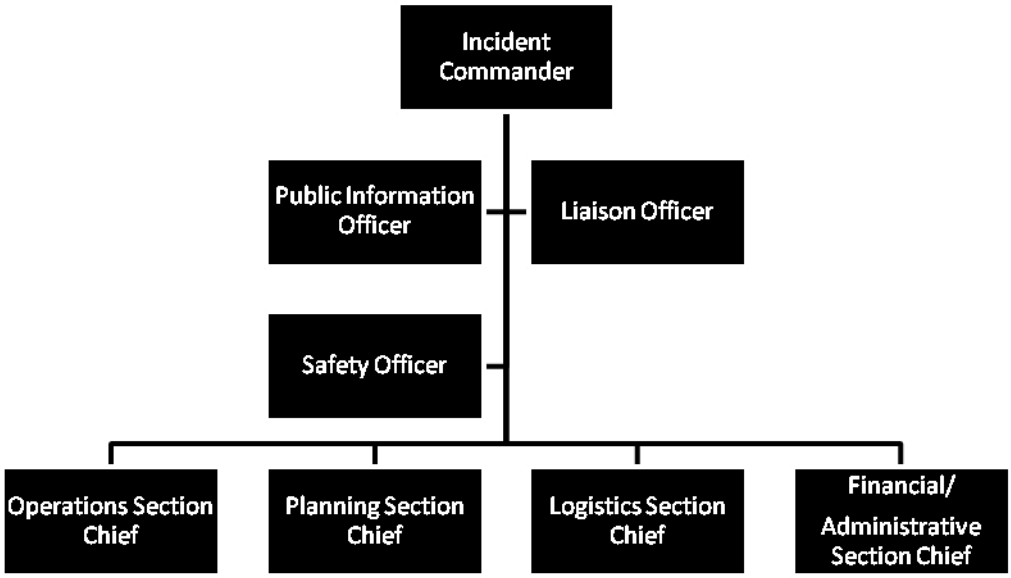
APPENDIX A

FEDERAL PUBLIC HEALTH EMERGENCY PREPAREDNESS FUNDING, 1999 - 2010 (IN MILLIONS)

Year	Total PHEP Funding
1999	$40.7
2000	$41.8
2001	$49.9
2002	$949.7
2003	$1,045.7
2004	$849.6
2005	$962.8
2006	$991.4
2007	$971.7
2008	$704.8
2009	$688.9
2010	$688.3
Grand total	$7,985.3

APPENDIX B

INCIDENT COMMAND STRUCTURE



APPENDIX C

STATE GOVERNANCE STRUCTURE DEFINITIONS

Centralized

The state is classified as having "centralized/largely centralized" state governance if local health agencies do not serve at least 75% of the state's population. The "centralized" classification is designated to the state if 100% of the state's population is served by the state agency; the "largely centralized" classification is designated to the state if 75%-99% of the population is served by the state agency. States could also be classified as having "centralized/largely centralized" state governance if local health agencies serve at least 75% of the state's population, the LHA is led by a state employee, and the state does not meet three or more of the criteria for having shared authority with the local government. Criteria for having shared authority with local government include: a) budgetary decisions are made by local government; b) local government establishes taxes for public health and the revenue goes to the local government; c) the state health agency provides less than 50% of the LHA's budget; d) public health orders can be issued by the local health government agency; e) local chief executives are approved by local officials; and f) local chief executives are appointed by local officials. "Centralized/largely centralized" states will be classified together as "centralized".

Shared

The state is classified as having "shared/largely shared" state governance if the local health agencies serve at least 75% of the state's population, the LHA is led by a state employee, and the state meets three or more of the criteria for having shared

authority with the local government (as noted above). States could also be classified as having "shared/largely shared" state governance if local health agencies serve at least 75% of the state's population, the LHA is led by a local employee and the state does not meet three or more of the criteria for having shared authority (noted above) with the state government. Criteria for having shared authority with the state government include: a) budgetary decisions are made by state government; b) local government cannot establishes taxes for public health or this revenue goes to the state government; c) the state health agency provides more than 50% of the LHA's budget; d) public health orders cannot be issued by the local health governmental agency; e) local chief executives are approved by state officials; and f) local chief executives are appointed by state officials.

The state is classified as having "shared/largely shared" state governance if the local health agencies serve at least 75% of the state's population, the LHA is not led by a local employee, and meets three or more of the criteria for having shared authority with the local government (noted above). "Shared/largely shared" states will be classified together as "shared".

Decentralized

The state is classified as having "decentralized/largely decentralized" state governance if the local health agencies serve at least 75% of the state's population, the LHA is led by a local employee, and the state did not met three or more of the criteria for having shared authority with the state government (as noted above).

"Decentralized/largely decentralized" states will be classified as "decentralized".

Mixed

The state is classified as having "mixed" state governance if less than 75% of the state's population is served by a LHA that is not led by a local employee. A mixed state government has a combination of centralized, decentralized and/or shared governance throughout the state.

APPENDIX D

YEAR 2 END-OF-YEAR QUESTIONNAIRE FOR TIME TO ASSEMBLE

Year 2 Question Text

1. Was the public health agency s EOC activated due to a drill, exercise, or real incident from 03/01/2008 to 08/09/2008? If no: Why was the public health agency s EOC not activated?
2. How many times was the public health agency's EOC activated due to a drill, exercise, or real incident from 03/01/2008 to 08/09/2008?
3. Was the activation the result of a drill, exercise, or real incident?
4. Was the activation unannounced?
5. Provide a description of the scenario or real incident that led to the public health agency's EOC activation.
6. Date and time the public health director or designated official began notifying pre-identified primary staff (secondary or tertiary staff as needed) that the public health agency s EOC was being activated (Reporting cycle: 03/01/2008 to 08/09/2008)
7. Date and time that the last primary staff person (secondary or tertiary staff as needed) to fill all eight ICS functional roles signed in at the EOC (Reporting cycle: 03/01/2008 to 08/09/2008)
8. Click the button to calculate and display the time for primary staff (secondary or tertiary staff as needed) with public health agency ICS functional responsibilities to report for duty at the public health agency s Emergency Operation Center (EOC): If over 2.5 hours: Why did it take longer than 2.5 hours for all eight ICS functional roles to be covered?

APPENDIX E

DEFINITIONS OF PUBLIC HEALTH INFRASTRUCTURE-RELATED CATEGORIES AND DECISION TREE FOR ASSIGNING CODES

Definitions

Human: related to the workforce and staff. The action is controlled by the individual staff member and he controls whether or not the recommendation is met.

Fiscal resources: related to funding or money. Accessibility and timeliness of funding control whether or not the recommendation is met.

Informational: related to communicating knowledge and the act of informing. The channels of communication (software and hardware) that are used to transmit the information controls whether or not the recommendation is met

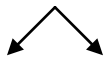
Legal: related to and recognized by the law. A law or statute controls whether or not the recommendation is met.

Organizational: related to leadership and process management efficacy. Managerial decisions control whether or not the recommendation is met.

Policy: related to plans, principles or guidelines. Plans, principles and guidelines control whether or not the recommendation is met.

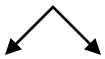
Decision Tree

Does the response note a hardware or software communication issue?



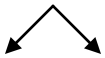
No Yes – Informational

Does the response contain information that is controlled by the individual employee?



No Yes – Human

Does the response note a process or system controlled by management?

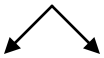


No Yes – Organizational

Does the response note a plan, policy or guideline was not adequate or omitted?

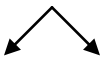
No Yes – Policy

Does the response pertain to issues recognized by the law?



No Yes – Legal

Does the response relate to financial matters?



No Yes – Fiscal resources

Define as “other”.

APPENDIX F

DEFINITIONS OF PUBLIC HEALTH INFRASTRUCTURE-RELATED THEMES AND CATEGORIES

Theme	Code	Full description	Guidelines for use	Guidelines for non-use
Staff	Response time	Staff member did not respond or responded late	If staff had control over the ability to respond and did not respond or responded late. This includes not having their cell phones/blackberries with them, not checking them, or time of drill/exercise was inconvenient.	If the equipment did not work; the cause of the lack of response was something the staff member could not control.
	Training	Additional training was needed on the hardware/software; lack of experience with software	If staff training can correct the issue; additional training needed on the hardware/software; lack of experience with software. Staff attempted to respond; due to their understanding of the system or message, they were unable to respond.	Staff training cannot correct the issue; if the hardware/software issue is out of their control.
	Other	Unique to staff	The issue pertains to individual staff members but the response is unclear and the reason for the lack of response cannot be clearly identified.	
Communication	Audit trail	Poor audit trail/lack of audit trail	Technical issues outside staff or organization that pertain to tracking the response time of the incident; the response time was not recorded or recorded incorrectly.	Confirmation of receipt was not requested; staff was notified prior to the event and were given more than the recommended time to notify or assemble.

Theme	Code	Full description	Guidelines for use	Guidelines for non-use
	Hardware/ software	Hardware/software issues	Channels that were used to transmit the information controlled whether or not the recommendation could be met, including internal and external to the communication channel; the hardware or software is not functional. This includes power, T-1 lines and other types of hardware needed to communicate between systems.	System compatibility issues.
	Brief descrip-tion	Full description	Guidelines for use	Guidelines for non-use
	Compat-ability	Incomplete staff information	Hardware or software do not "talk" to each other, conflict with each other.	Does not include systems that conflict with each other and are out of the purview of the staff member or organization; user issues; staff roster issues.
	Other	Unique to communication efforts	Pertaining to the ability to communicate; unable to classify by the categories noted.	
Organ-ization	Extended timeframe	Staff were given longer than the recommended time to notify or assemble	The organization had control over time to assemble or time to notify; the staff were given longer than the prescribed time to notify or assemble; staff were notified prior to the event.	Staff has control over the ability to notify or assemble or control over the time to notify or assemble.

Theme	Code	Full description	Guidelines for use	Guidelines for non-use
	Confirmation	No confirmation of receipt requested	Information was sent out; verification of receipt of the response was not requested.	A response was requested.
	Information	Incomplete staff information	Rosters or information needed to contact the staff were not updated.	If it is noted that the staff had responsibility for updating the rosters.
	Other	Unique to the organization	The organization has the control; unable to classify by the categories noted.	

APPENDIX G

YEAR 3 END-OF-YEAR QUESTIONNAIRE FOR TIME TO ASSEMBLE

Year 3 Question Text

1. Did you have any unannounced and immediate staff assembly occur either during operations-based exercises or real incidents from 08/10/2008 to 08/09/2009?
2. Was this staff assembly part of a drill, functional exercise, full-scale exercise, or real incident?
3. What was the incident type?
4. Was this staff assembly unannounced?
5. Was this staff assembly immediate?
6. Please provide a brief description of the real incident or event / incident upon which the exercise scenario was based.
7. Was the staff assembly virtual, physical, or a combination?
8. Was the Department Operations Center (DOC) activated?
9. How many incident management functional responsibilities were required to be fulfilled by the notification to report for duty?
10. How many staff were notified?
11. How many staff reported for duty to fulfill the pre-identified incident management functional responsibilities?
12. Date and time that a designated official began notification of pre-identified staff that they need to report for duty.
13. Date and time that the last staff person needed to fill pre-identified incident management functional responsibilities reported for duty.

14. Click the button to calculate and display the time for staff with public health agency incident management functional responsibilities to report for duty.

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