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RISK, POLITICS, AND MONEY: THE NEED FOR A VALUE-BASED MODEL FOR FINANCING PUBLIC HEALTH PREPAREDNESS AND RESPONSE

by

William F. Pilkington

December 2014

Thesis Advisor: Robert Josefek
Second Reader: Christopher Bellavita

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Our federal, state, and local governments are not investing in the design and improvement of strategies for evaluating the costs associated with natural and man-made disasters and events. In this era of fiscal conservatism, one of the biggest challenges in designing and funding public health preparedness is deciding exactly how much to invest and determining the impact of those investments.

This thesis developed a rigorous scientific model to evaluate the benefit of using value-based tools to enhance the effectiveness of public health preparedness programs. The key question that framed this research was: Are public health departments that use value-based decision-making more likely to demonstrate and document higher levels of preparedness competencies?

Although this research failed to demonstrate a statistically significant relationship between preparedness competency and value-based decision-making, there were some findings to indicate that VBDM may be useful in decisions that determine the financing of public health preparedness. The ability to analytically demonstrate the benefit of public health preparedness might prove beneficial in attracting additional public funding as well as private funding.

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William F. Pilkington
B.A., University of North Carolina at Charlotte, 1973
M.P.A., North Carolina State University, 1974
M.P.A., University of Southern California, 1987
D.P.A., University of Southern California, 1988

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December 2014**

Author: William F. Pilkington

Approved by: Robert Josefek, Ph.D.
Thesis Advisor

Christopher Bellavita, Ph.D.
Second Reader

Mohammed Hafez, Ph.D.
Chair, Department of National Security Affairs

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ABSTRACT

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This thesis developed a rigorous scientific model to evaluate the benefit of using value-based tools to enhance the effectiveness of public health preparedness programs. The key question that framed this research was: Are public health departments that use value-based decision-making more likely to demonstrate and document higher levels of preparedness competencies?

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LIST OF ACRONYMS AND ABBREVIATIONS

CBA	cost-benefit analysis
CCP	Citizen Corp Program
CDC	Centers for Disease Control and Prevention
CEA	cost-effectiveness analysis
DHHS	Department of Health and Human Services
DHS	Department of Homeland Security
DOJ	Department of Justice
EMPG	Emergency Management Performance Grant
FEMA	Federal Emergency Management Agency
FTE	full-time equivalent
FY	Fiscal Year
HPP	Hospital Preparedness Program
HSEEP	Homeland Security Exercise and Evaluation Program
HVA	Hazard Vulnerability Analysis
IOM	Institute of Medicine
LETPP	Law Enforcement Terrorism Prevention Program
LHDs	local health departments
MBVA	model-based vulnerability analysis
MMRS	Metropolitan Medical Response System
NACCHO	National Association of County and City Health Officials
PHEP	Public Health Emergency Preparedness
PPHR	Project Public Health Ready
RA	risk analysis
ROI	return on investment
SDPP	State Domestic Preparedness Program
SHSP	State Homeland Security Program
UASI	Urban Areas Security Initiative
VSL	value statistical life
VBDM	value-based decision-making

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EXECUTIVE SUMMARY

This research pointed to significant problems in the public health preparedness system for which there are no easy solutions. Budgets are extremely tight and staffs are strained. Most of the public health preparedness funding comes from one federal grant (PHEP) that has been declining every year for the last seven years. There is only one national program that recognizes preparedness competency and very few LHDs have received recognition. During the past several years, a number of public health emergencies ranging from pandemics to hurricanes have seriously challenges the preparedness capacity of LHDs. A persistent theme in the literature review was the need for local health departments to be better prepared to respond to both natural and man-made events.

Since 9/11, political considerations have dominated homeland security decisions. The political model does not consider risk, benefit, or even effectiveness. Instead, large sums of public money have been appropriated and spent on homeland projects, equipment, and programs without any concrete evidence that they improve our security. Very little consideration has been given to using analytical or economic tools that can be used to demonstrate effectiveness.

In the absence of any analytical processes, it is likely that the expenditure of public dollars will continue to be determined mostly within the framework of the political model. Furthermore, unless an acceptable alternative appears, it is likely that the willingness to change to a more innovative rational decision-making model will be overshadowed by the coalitions that control homeland security funding policies.

In contrast to the political model, this thesis developed a value-based model for financing public health preparedness. This model is the antithesis of the political model because it is built upon the foundations of analytical decision-making. The essential tools of value-based decision-making (VBDM), for the purposes of this research, are risk assessment, cost-benefit analysis, cost-effectiveness analysis, return on investment, and hazard vulnerability analysis. These tools are “value-based” because they provide a

rational basis for evaluating the cost, consequence, and utility of specific funding decisions.

In an effort to understand the relationship between value-based decision-making and public health preparedness competency, 500 local health departments were randomly drawn using strata to randomly generate numbers.

This research project was unable to confirm the idea that value-based analytics improve the decision-making process for financing public health preparedness. The essential components of a new value-based model are national preparedness standards, use of common analytics, and political buy-in. Each of these components must overcome implementation hurdles before value-based decision-making can be deemed a successful alternative to the existing political model.

This research corroborated the need for system level change but emphasized individual departmental programmatic changes related to the investment in the public health preparedness infrastructure, the need for a budget and outcome tool, and the use of value-based decision-making as an analytical tool for prioritizing spending decisions. These changes can be viewed as recommendations that provide the foundation for developing a new value-based model for financing public health preparedness.

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I. INTRODUCTION

Despite the fact that there has been only one significant terrorist attack since 9/11, homeland security spending in the United States has increased by over $1 trillion in the last 13 years.[1] Why would the United States, its state and local governments, and the private sector spend so much money to achieve what risk analyst Howard Kunreuther called "only a small reduction in the probability of a terrorist attack?"[2]

Since 9/11, political considerations have dominated homeland security decisions. The political model does not consider risk, benefit, or even effectiveness. Instead, large sums of public money have been appropriated and spent on homeland projects, equipment, and programs without any concrete evidence that they improve our security. Very little consideration has been given to using analytical or economic tools that can be used to demonstrate effectiveness.

In the absence of any analytical processes, it is likely that the expenditure of public dollars will continue to be determined mostly within the framework of the political model. Furthermore, unless an acceptable alternative appears, it is likely that the willingness to change to a more innovative rational decision-making model will be overshadowed by the coalitions that control homeland security funding policies. In his book, "The Innovator's Dilemma," Clayton Christensen noted that innovation requires a new skill set and a new concept of the relevant value network.[3] Within the context of homeland security, a new concept of a relevant value network would include a different approach to analyzing homeland security needs, allocating homeland security dollars, and rewarding the coalition that is the homeland security enterprise. Christensen would label terrorism as a disruptive innovation that cannot be controlled by sustaining traditional decision-making practices.

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[1] John E.Mueller and Mark G. Stewart, *Terror, Security, and Money: Balancing the Risks, Benefits, and Costs of Homeland Security* (Oxford: Oxford University Press, 2011).

[2] Howard Kunreuther, "Risk Analysis and Risk Management in an Uncertain World," *Risk Analysis* 22 (2002): 662–663.

[3] Clayton M. Christensen, *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail* (Boston, Mass: Harvard Business School Press, 2000), 842.

In *The Dictator's Handbook*, Mesquita and Smith identified three groups of people who are the power brokers in any given political situation.[4] The most important group is the actors who make up the "winning coalition." In the on-going debate concerning the funding homeland security, the winning coalition consists of powerful members of the U.S. Congress, Governors of our larger states, key federal, state, and local officials, and lobbyists for the homeland security industry. All of these parties benefit from an irrational funding model that is built upon the premise of high risk and an infinite number of potential targets.

According to Mesquita and Smith, there are three subgroups essential to the political dynamic: the "interchangeables," the "influentials," and the "essentials." In the battle for homeland security funds, the interchangeables are the upper level administrative types, including the department secretary and other politically appointed senior executives. The influentials are the President, Governors, and members of Congress who hold key leadership positions. The essentials are the staff that implement homeland security policies and depend upon continuing appropriations to maintain their jobs.

The interchangeables are conduits of information to the influentials. Within the political decision-making model, the interchangeables have divided political loyalties but a shared commitment to maintaining or increasing funding for homeland security programs. Any change in funding policy is potentially a threat unless the interchangeables maintain control of communications. A rational model could enhance their political power but that would mean that the influentials would defer to a rational process for funding homeland security, hardly a likely scenario.

The influentials are the ultimate power brokers in the winning coalition. Through seniority and expert knowledge, they become recognized as the gatekeepers of all appropriation and policy decisions regarding homeland security. Key influentials include the President and members of Congress who hold important leadership positions. Because homeland security has become one of our highest priority areas, these political

[4] Bruce Bueno de Mesquita and Alastair Smith, *The Dictator's Handbook: Why Bad Behavior Is Almost Always Good Politics* (New York: Public Affairs, 2011), 4–6.

influentials are vested in an appropriations process that distributes resources according to a purely political process. Another set of powerful influentials is lobbyists for the numerous companies that profit from the massive public dollars spent on homeland security. Literally hundreds of companies employ lobbyists to ensure that the billions of dollars in homeland security funding remain intact. These lobbyists are very effective in a political process controlled by politicians. A more rational decision-making process would negatively impact both the politicians and the lobbyists who function well in an environment of pork barrel political decision-making.

The essentials are important to the homeland security funding process because they are the line staff that work in career service and implement the policies crafted and shaped by the influentials and the interchangeables. These essentials often have many years in career service and their collective institutional memories provide the base information that influentials and interchangeables need to maintain support for homeland security programs. Essentials can be found in the Departments of Homeland Security and Health and Human Services, GAO, and the Congressional Research Services.

In the absence of any analytical processes, it is likely that the expenditure of public dollars will continue to be determined mostly within the framework of the political model. Furthermore, unless an acceptable alternative gains political favor, it is likely that the willingness to change to a more innovative rational decision-making model will be overshadowed by the coalitions that control homeland security funding policies.

Given the predominance of politics in homeland security funding decisions, is there a role for what Christensen called value-based strategies? Some work has demonstrated the potential of evidence-based quality metrics to improve public response to a public health emergency, but it also argued that more investment in improved measurement was needed to apply these concepts more broadly.[5] More generally, as long as policy makers lack the ability to demonstrate a positive return on investment from expenditures on emergency preparedness efforts, public health preparedness funding will be at risk.

[5] Debra Lotstein et al., "Using Quality Improvement Methods to Improve Public Health Emergency Preparedness: Prepare for Pandemic influenza," *Health Affairs* 27 (2008): 328.

This thesis proposes to develop a value-based model for financing public health preparedness. This model is the antithesis of the political model because it is built upon the foundations of analytical decision-making. The predominance of the political model will ensure the continued downward spiral of public health funding because public health preparedness has not demonstrated a rational basis for funding support. As funding for homeland security has decreased, local public health departments have been hard hit and forced lay-offs have become the new normal. Resources for funding public health preparedness are scarce, always and everywhere. Accordingly, prioritization of expenditures is unavoidable. What criteria should be used to determine the proper investment in public health preparedness to assure value for money spent?

A. PROBLEM STATEMENT

Our federal, state, and local governments are not investing in the design and improvement of strategies for evaluating the costs associated with natural and man-made disasters and events. In this era of fiscal conservatism, one of the biggest challenges in designing and funding public health preparedness is deciding exactly how much to invest and determining the impact of those investments. In an ideal budget world, investments in public health preparedness should be analogous to any other public investment in an activity that purports to increase public security. According to a recent publication by the Institute of Medicine (IOM), "The optimal amount of investment in safety would be driven by a rigorous assessment of the expected cost of an event and the effectiveness of the prevention activity compared to the cost associated with the activity."[6]

Pines, Pilkington, and Seabury argued that the most fundamental challenge of measuring the costs and benefits of public health preparedness is simply agreeing on a definition of what it means to be prepared.[7] Part of the definition problem is deciding which public health activities fall within a definition of "preparedness." For example,

[6] Jesse Pines, William Pilkington, and Seth Seabury, "Value-Based Models for Sustaining Emergency Preparedness Capacity and Capability in the United States," (paper presented at the Institute of Medicine Forum on Medical and Public Health Preparedness for Catastrophic Events, Washington, DC, October 30, 2013), 9.

[7] Ibid., 9.

most local public health entities have an epidemiology function but how much of that function is devoted to bio-surveillance? Furthermore, there are some public health preparedness activities, including training, exercises, and infrastructure improvements that are not exclusively public health preparedness activities. For example, local public health departments must be ready to provide mass vaccinations on a routine basis as well as during a bioterrorism event. This definitional problem makes it difficult to distinguish between routine public health activities and activities that are uniquely public health preparedness.

Pines, Pilkington, and Seabury also point out that true public health emergencies are extremely rare and that the rarity provides limited opportunities for measuring the effectiveness of specific interventions.[8] With so few events for comparative analysis, an evaluative research model would have difficulty examining the effectiveness of investments in infrequent public health preparedness activities against established outcomes of more frequent disasters such as hurricanes, tornadoes, and floods. Consequently, there is little research that has provided evidence-based measures that could be used to impact public policy. Kaji, Langford, and Lewis found that where measures of emergency preparedness do exist and are used, these different measures provide highly inconsistent assessments of preparedness.[9] In order to establish some basic principles for evaluation of alternative funding proposals, it is important that there be some agreement on the component measures of an effective public health preparedness system. As Mueller and Stewart recognized, "policy discussions of homeland security are driven not by rigorous analysis but by fear, perception of past mistakes, pork-barrel politics, and insistence on an invulnerability that cannot be achieved."[10]

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[8] Ibid., 10.

[9] A.H. Kanji, V. Langford, and R.J. Lewis, "Assessing Hospital Disaster Preparedness: A Comparison of an On-Site Survey, Directly Observed Drill Performance, and Video Analysis of Teamwork," *Annals of Emergency Medicine 52 (2008): 195–201*.

[10] Mueller and Stewart, *Terror, Security, and Money: Balancing the Risks, Benefits, and Costs of Homeland Security*, 3.

There are at least four challenges in measuring the effective use of public health preparedness resources: evidence of effectiveness, evidence of method, evidence of smart practices, and the availability of locally generated data. Evidence of effectiveness for rare events is hard to come by. It is also difficult to capture all the benefits of any specific preparedness intervention. There is very little evidence available on best public health preparedness practices; and, locally generated data on preparedness outcomes plays a very limited role in the decision-making processes, which are driven by federal granting authorities.

However, there are several economic or value for money tools that can help decision-making when used and interpreted appropriately. These tools help with value judgments, explain costs and benefits and provide a rational choice among competing options. Economic tools seek to clarify the costs and benefits of alternative policy options and help decision-makers be more aware of the impact of their decisions. They also indicate the resources required to achieve a desired level of security. The process and discipline of developing economic measures helps to test the assumptions and value judgments associated with key financing decisions.

Value for money tools are both promising and concerning. The promise lies in their potential to analyze the impact of a specific intervention. The concern is that value for money tools will become the determining factor influencing the evaluation of competing options. No decision should be made on the basis of an economic measure alone. Similarly, an intervention should not be excluded simply because it is lacking measures or evidence of economic impact.

The issues that are described here arise intrinsically out of the nature of catastrophic risk and human behavior. Unfortunately, that means that there are no easy solutions. Ultimately, solving these issues requires both an investment in our ability to make accurate predictions about potential losses from an event, and educating the public about the need to remain vigilant and protect us. This will require the creation of additional knowledge in this area by developing a research agenda to address these measurement issues in public health preparedness to assess the right level of funding. Until this is accomplished, public health preparedness will always be vulnerable to

insufficient and misallocated funding, particularly in times when government revenues are low and there is strong competition for limited resources. With declining funding, it is vital to look to ways to make better use of the funds that are available, and to present potential ways for communities to develop public health preparedness programs that demonstrate cost effectiveness.

Finally, is it possible to measure effectiveness of public health preparedness and response grants? In a 2003 study, the General Accounting Office (GAO) concluded that there had been measurable improvement in one area, the management of first responders, but there remain significant challenges in measuring all other aspects of preparedness and response.[1112] To date, there has been no definitive study that measures the capability and capacity of communities to prevent, prepare, or respond to a terrorist event.

B. RESEARCH QUESTIONS

This thesis develops a rigorous scientific model to evaluate the benefit of using value-based tools to enhance the effectiveness of public health preparedness programs. The key question and sub-questions that frame the research that guides this thesis is: Are local public health departments that use value-based decision-making (VBDM) more likely to demonstrate and document higher levels of preparedness competencies; and

- What is VBDM and how is it defined within the context of public health preparedness?
- Does VBDM simply enhance preparedness competency or is it the deciding factor?

The assumption that value-based tools make a difference in preparedness effectiveness is neither proven nor tested. However, if these value-based tools can be demonstrated to show evidence of improving public health preparedness, it is possible that they could have substantial impact on changing the current political decision-making model.

[11]Government Accountability Office, Report to the Chairman, Committee on Appropriations, House of Representatives, *GAO-05-121 Homeland Security: Management of First Responder Grant Programs Has Improved, But Challenges Remain*, (Washington, DC: GAO, February, 2005).

[12] Paul L. Psner, *GAO-03-1146T Homeland Security Reforming Federal Grants to Better Meet Outstanding Needs,* (Washington, D.C.: General Accounting Office, 2003).

The first sub-question acknowledges that VBDM has different meanings depending upon context. For example, VBDM in social work considers the social values of both the clients and the service providers. In the field of public preparedness, VBDM will be defined within the construct of a process that uses analytical tools to improve measurable preparedness performance.

The second sub-question relates to the utility of VBDM in determining public health preparedness policy. If VBDM is only incidental to preparedness competency, what then are the critical factors that make one public health entity better prepared?

We know approximately how much money has been spent on public health preparedness and response before and after 9/11. What we do not know is if these expenditures have reduced our collective risk or improved preparedness and response capability and capacity. Would we have been better off by spending these dollars on education or foreign aid and assistance? Unfortunately, we will probably never know the answer because opportunity costs were not key considerations in preparedness budget decisions in the years following 9/11.

This research agenda supposes a deterministic causal relationship between the use of value-based assessments and improved levels of preparedness and response. In other words, if financing decisions are influenced by value-based risk assessments, then we would expect a measurable increase in levels of preparedness and response. We know this kind of cause/effect relationship is rarely exact though, so we must infer that certain conditions must exist for this causal relationship to work. For example, the use of value-based risk assessment methodologies requires a political environment that supports critical enquiry over political expediency. Because, human behavior is never certain, we begin with the assumption that these kinds of relationships are probable rather than likely.

II. LITERATURE REVIEW

With local public health budgets being ring-fenced, there is increased urgency to demonstrate return on investment in relation to public health preparedness interventions and explore methods of decision-support for public health preparedness priority setting. It is likely LHDs will continue to face significant reductions in federal grants for preparedness and as resources shrink, there will be an ever-increasing demand for more evidence-based interventions that demonstrably improve preparedness capacity and capability. This literature review will examine previous research on VBDM, provide a summary of the history of public health preparedness funding, explain the utility of VBDM tools such as cost-effectiveness analysis, cost-benefit analysis, and return on investment, and examine the use of VBDM in public health.

A. VBDM AS A RESEARCH TOPIC

VBDM is not a new concept. In the field of neurosciences, VBDM refers to a body of knowledge that attempts to explain the biological basis of human behaviors.[13] In the law profession, VBDM refers to decisions that are rule-based.[14] Health and medicine are somewhat recent in adopting VBDM. In order to augment their decision support systems, health care institutions have begun pursuing evidence-based decisions that enhance therapeutic and diagnostic patient outcomes.[15] At this time, there is no evidence in this literature review that local public health agencies have been eager to adopt VBDM and even less evidence that VBDM where used has resulted in the establishment of

[13] Antonio Rangel, Colin Camerer, and P. Read Montague, "A Framework for Studying the Neurobiology of Value-Based Decision Making," *Nature Reviews Neuroscience* 9 (2008), 545.

[14] Frederick F. Schauer, *Playing by the Rules: A Philosophical Examination of Rule-Based Decision-Making in Law and in Life* (Oxford: Oxford University Press, 1991).

[15] M. G. Myriam Hunink, *Decision Making in Health and Medicine*, (Cambridge: Cambridge University Press, 2004), 2.

thresholds that accurately demonstrate the relationship between costs and effects that an intervention must achieve to be considered successful.[16]

However, in 2013, IOM published a promising paper that laid the framework for how state and local public health agencies could implement value-based approaches to decisions regarding the financing of public health preparedness. The paper was entitled "Value-Based Models for Sustaining Emergency Preparedness Capacity and Capability in the United States," and made seven recommendations to provide "a roadmap for enhancing the sustainability of preparedness efforts in the United States."[17] The recommendations included a call for a national preparedness research agenda, alternative ways for distributing preparedness grant funding, clear metrics for determining preparedness grant effectiveness, and new mechanisms for financing local preparedness efforts. The paper concluded with the admonition that irrespective of successful financing models, "local, state, and federal governments still bear the ultimate responsibility to ensure that all communities in the United States are prepared for public health emergencies."[18]

B. PREPAREDNESS GRANT FUNDING

Prior to September 11, 2001, state and local governments received grants for emergency preparedness through three grant programs: the State Domestic Preparedness Program (SDPP) administered by the Department of Justice (DOJ), the Emergency Management Performance Grant (EMPG) administered by the Federal Emergency Management Agency (FEMA), and the Metropolitan Medical Response System (MMRS) administered by the Department of Health and Human Services (DHHS). SDPP, EMPG, and MMRS grants were brought under the control of the newly created Department of Homeland Security (DHS) in 2002. Four additional grant programs were established and also placed within the control of DHS. These four programs were the Urban Areas

[16] Hans-Georg Eichler et al., "Use of Cost-Effectiveness Analysis in Health-Care Resource Allocation Decision-Making: How Are Cost-Effectiveness Thresholds Expected to Emerge," V*alue in Health 7 (2004): 519.*

[17] Pines, Pilkington, and Seabury, "Value-Based Models for Sustaining Emergency Preparedness Capacity and Capability in the United States," 25-28.

[18] Ibid., 27-28.

Security Initiative (UASI), State Homeland Security Program (SHSP), Law Enforcement Terrorism Prevention Program (LETPP), and the Citizen Corps Program (CCP). In addition to these four programs, DHHS administered two key grant programs: the Public Health Emergency Preparedness (PHEP) funds and the ASPR Hospital Preparedness Program (HPP).

Immediately after 9/11, we saw huge increases in federal funds available to state and local governments for emergency preparedness. State and local governments built and equipped homeland security infrastructures with these monies and became almost totally dependent upon the federal government for funding their homeland security initiatives. The sharp increases occurred between the years 2002 and 2007. The Great Recession began in 2008 and resulted in drastic reductions in federal funding, forcing state and local governments to make draconian cuts in disaster and emergency preparedness programs.

DHS administered the five key grant programs to state and local governments during the period 2002–2007. These programs were: UASI, SHSP, LETPP, MMRS, and CCP. The total appropriation for these five programs increased from $315.7 million in FY 2002 to $1.66 billion in FY 2007. Table 1 displays the funding distribution and shows that the highest DHS funding occurred in FY 2004 at $2.9 billion. UASI targets eligible "high-threat, high-density" urban areas to help them prevent, protect, respond, and recover from acts of terrorism. Forty-five urban areas qualified in FY 2007 and six of our major cities received $441 million of the total $746.9 million allocated to UASI by DHS. From FY 2003 to FY 2007 UASI funding totaled 3.57 billion dollars.

Table 1. Homeland Security Grant Program Funding Distribution for FY 2002 to FY 2007 (in millions)

Grant Program	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007	Total
UASI	-	$596.4	$671.0	$854.7	$710.6	$746.9	$3,579.5
SHSP	*$315.7*	*$2,066.3*	*$1,675.1*	*$1,062.3*	*$528.2*	*$509.3*	*$6,156.8*
LETPP	-	-	$497.1	$386.3	$384.1	$363.8	$1,631.2
MMRS	-	-	$46.3	$28.2	$28,8	$32.0	$135.3
CCP	-	$37.5	$34.8	$13.5	$19.2	$14.6	$119.6
Total	$315.7	$2,700.2	$2,924.2	$2,344.9	$1,670.9	$1,666.5	$11,622.4

Source: Homeland Security Grant Program, U.S. Department of Homeland Security

SHSP are DHS grants to states, District of Columbia, and U.S. territories, to improve their homeland security capabilities. Awards are based on a risk analysis formula with each state guaranteed a minimum of 0.75 percent of the total funding available. SHSP dollars were $315.7 million in 2002 and peaked at $2.06 billion in 2003. From 2002–2007, the federal government awarded over $6.15 billion in SHSP grants.

LETPP is the third highest funding program administered by DHS and is intended to improve law enforcement's ability to prevent terrorism activities. Fusion Centers were created with this funding to improve coordination of emergency sector operations in major metropolitan areas. LETPP funding began in 2004 and has declined in every subsequent fiscal year budget. LETPP funds total over $1.63 billion dollars from FY 2004–FY 2007. The minimum allocation was 0.75 percent of the total funding available in the fiscal year.

MMRS is the only DHS program whose funding increased in FY 2007. MMRS is designed to help local emergency response to an "all-hazards mass casualty incident." MMRS funds totaled $135.32 million from FY 2004–FY 2007. Just 124 cities are eligible for MMRS funds and each city received $258,145.

CCP grants are the smallest program administered by DHS. Each state received 0.75 of the total funding available of $119.5 million in FY 2007. CCP is a program that provides funding to encourage public and private partnerships in addressing emergency preparedness, response, and resilience.

From 2002–2003, DHS funding for these five programs increased from $315.7 million to $ 2.1 billion, an amazing 554 percent growth in one year. This increase could be attributed to the events of 9/11 and a sense of urgency to prevent future terrorist attacks. Total funds available began declining in FY 2004 and by FY 2005; nearly all states had experienced a 22 percent decline in total DHS funds.[19]

The primary source of public health funding for state, local, tribal, and territorial health departments has been the PHEP funds that have been administered through the DHHS and the Centers for Disease Control and Prevention and Prevention (CDC). Since 2002, PHEP has granted almost $9 billion for health departments to strengthen their emergency preparedness and response capabilities.

In FY 2013, the fifty states and territories received $584.69 million in PHEP funding down from the $619.44 million received in FY2012. In 2008, PHEP funds totaled $704.86 million. The decline in funding from 2008 to 2013 has been slightly over 17 percent.

The consequences of the loss of PHEP funds have been immediate and measurable. The emergency preparedness capability of the public health sector has been severely impacted. In the *10th Annual Ready or Not? Protecting the Public from Diseases, Disasters*, 35 states and Washington, D.C., scored a six or lower on 10 key indicators of public health preparedness.[20] The report includes these findings:

- Twenty-nine states cut public health funding from fiscal years 2010–11 to 2011–12.
- Federal funds for state and local preparedness have been reduced 38 percent for the period 2005–2012.
- Twenty-three states have cut public health funding for two consecutive years and fourteen have cut public health funding for three years in a row.

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[19] Sujit CanagaRetna and Jeremy Williams, "Innovative Programs in Funding State Homeland Security Needs," *A Special Report of the Southern Legislative Conference, The Council of State Governments*, 2007, 8.

[20] Jeffrey Levi et al., *Ready or Not? Protecting the Public's Health from Diseases, Disasters, and Bioterrorism - 2012*, Washington, D.C.: Trust for America's Health, 2012. Accessed February 12, 2014, http://www.healthyamericans.org/assets/files/TFAH2012ReadyorNot10.pdf.

- Since 2008, state and local health departments have lost over 45,000 jobs

While there are fewer funds available for emergency preparedness, response and recovery, DHS did approve more than $1.3 billion for FY 2012 for preparedness grants to further enhance critical infrastructure protection activities. In addition, DHHS approved over $971 million in PHEP and HPP grants for this same fiscal year. Table 2 outlines several grant opportunities funded by DHS, DHHS and other federal agencies that are available to assist state, local, and tribal governments with preparedness, response and recovery efforts.

Table 2. Current Sources of Emergency Preparedness, Response, and Recovery

Federal Agency	Description	Further Information
Department of Homeland Security (DHS)	FEMA Grants Program Directorate provides a general overview on Preparedness (Non-Disaster Grants), Disaster Grants, Grants Management Toolkit, & State Administrative Agency Contacts List Specific programs include: ***DHS State Homeland Security Program (SHSP)*** State Administrative Agencies can apply for SHSP funds to address needs in planning, training, and evaluation to support protection, response, and recovery from acts of terrorism). ***DHS Urban Areas Security Initiative (UASI)*** State Administrative Agencies can apply for UASI funds to address similar needs as outlined in the SHSP, but are limited to high-threat, high-density urban areas specifically designated by DHS' risk methodology.	http://www.fema.gov/grants http://www.fema.gov/fy-2012-homeland-security-grant-program
Department of Health & Human Services (HHS)	***Grants.gov*** HHS is the managing partner for this website that provides all discretionary grants offered by the 26 federal grant-making agencies. ***Office of the Assistant Secretary for Preparedness and Response Hospital***	http://www.grants.gov http://www.phe.gov/preparedness/planning/hpp/pages/default.aspx http://www.cdc.gov/phpr/coopagreement.htm http://www.samhsa.gov/dtac/proguide.asp

	Preparedness Program Provides grants to assist states, territories, and four of the nation's largest metropolitan areas with improving surge and response capacity, improving preparedness plans, and enhancing capabilities of their healthcare systems; links to technical assistance guides and reports to further enhance disaster planning also available. ***Centers for Disease Control and Prevention Public Health Emergency Preparedness Cooperative Agreements*** Provides funding to state, local, tribal and territorial public health departments to enhance their ability to respond to public health threats, including natural disasters. **Substance Abuse and Mental Health Services Administration Crisis Counseling Assistance and Training Program** Implemented by FEMA and provides funding to states, U.S. territories, and federally recognized tribes to assist disaster survivors with mental health and counseling services.	
Department of Energy (DOE)	Manages several grant programs to protect and enhance the efficiency and resilience of the U.S. energy infrastructure; these grants include funds to improve technologies, methodologies, and state and regional energy emergency exercises to evaluate capabilities and assess current vulnerabilities to energy infrastructure and supply systems. Specific programs include: ***Global Threat Reduction Initiative*** This program administered by the National Nuclear Security Administration helps the Department of Energy prevent the acquisition of nuclear and radiological materials for use in weapons of mass destruction as outlined in the Nuclear Security Goal (2.2.44). The three subprograms, Convert, Remove, and Protect, further support the protection of nuclear and radiological materials to mitigate nuclear threats	http://energy.gov/oe/information-center/recovery-act http://www.science.doe.gov/grants/ http://1.usa.gov/r2pBo2
Department of Interior	The Bureau of Indian Affairs	http://www.bia.gov/

(DOI)	provides grants to Indian tribes and tribal organizations to maintain and manage critical infrastructure such as dams and power facilities; manages a grant program for the Irrigation, Power, and Safety of Dams.	
Department of Justice (DOJ)	Provides funding opportunities to help reduce crime and promote justice that address the needs of communities and criminal justice professionals, particularly at the state and local levels; previously managed the Domestic Anti-Terrorism Technology Development program to enhance counterterrorism technologies.	http://www.nij.gov/funding/welcome.htm
Department of Transportation (DOT)	Provides grants to State, local, territorial, and tribal entities to enhance hazardous materials emergency planning and training by conducting exercises and analyses; there are additional pipeline safety grant programs available.	http://www.phmsa.dot.gov/grants-state-programs

For more information on the DHS FY 2013 Budget and the National Preparedness Grant Program, visit http://www.dhs.gov/xlibrary/assets/mgmt/dhs-budget-in-brief-fy2013.pdf.

C. WHAT IS VBDM?

The essential tools of VBDM, for the purposes of this research, are risk assessment (RA), cost benefit analysis (CBA), cost effectiveness analysis (CEA), return on investment (ROI), and hazard vulnerability analysis (HVA). These tools are "value-based" because they provide a rational basis for evaluating the cost, consequence, and utility of specific funding decisions. This literature review examined these measures, their strengths and weaknesses, and made some estimates of which measures may be most useful in analytical decision-making. Figure 1 provides a visual representation of the concept of VBDM used in this thesis.

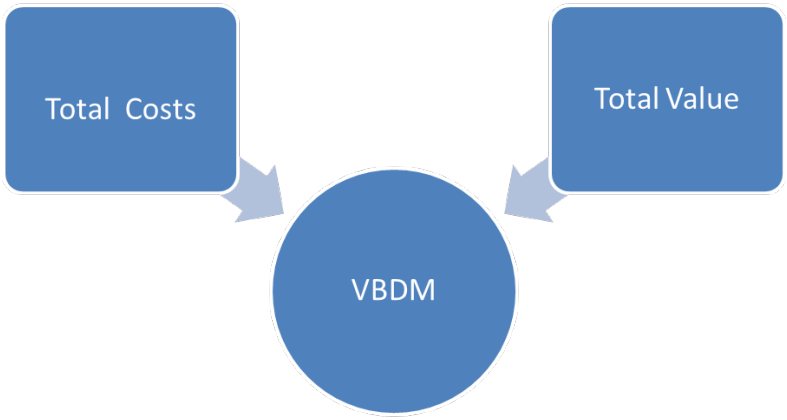

Figure 1. VBDM Framework

1. Risk Assessment

Within the scope of preparedness, risk assessment includes a combination of sequential actions that assess the threat likelihood, set level of acceptable risk, and establish limits of how much threat is likely to be reduced by a specific security measure.[21] Risk assessment tries to improve decision-making by using risk assessment methodology in place of an assumption that the only scenario is the worst possible outcome. Risk analyst Kip Viscusi cautions that using risk analysis in homeland security is difficult because "we don't have good numbers and if you can't assess the likelihood of a terrorist attack or how deadly it is going to be, it is really hard to say how much you should spend to try to prevent it."[22] Recently, DHS has begun using risk assessment methodology to estimated target vulnerability and attack consequences and likelihood of an attack to determine if a possible target should be protected.[23] The risk assessment equation can be modified as follows to fit into the realm of an analytical tool for examining public health preparedness:

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[21] Mueller and Stewart, *Terror, Security, and Money: Balancing the Risks, Benefits, and Costs of Homeland Security*, 13.

[22] Aaron Steelman, "Interview: W. Kip Viscusi," *Economic Focus, (Richmond: Federal Reserve Bank,* 2007), 40–45.

[23] Todd Masse, O'Neil Siobhan, and John Rollins, *The Department of Homeland Security's Risk Assessment Methodology: Evolution, Issues, and Options for Congress, (Washington, DC: Congressional Research Service, 2007), 6.*

- Risk = (probability of a successful manmade attack) x (losses sustained from a manmade attack)

Risk assessment is an alternative to worst case thinking because it includes both benefits and rewards.[24] Unlike worst case thinking, risk assessment does not assume all hazards are potentially possible and must be addressed. Such flawed thinking resulted in the huge increases in homeland security funding immediately after 9/11.

2. Cost-Benefit Analysis

On the other hand, CBA provides a vehicle for evaluating competing options. CBA seeks to compare the costs with doing something, to the benefits that derive from that something. The principle of cost-benefit analysis is rather simple and can be described as follows:

- If we must decide between options A and option B, A will be selected if the net benefits of A are greater than the net benefits of B.

However, calculating benefits is not always easy. For example, in considering whether or not to fund a new bioterrorism program, it is assumed that the benefit is the savings in lives and properties generated by implementing a specific intervention. The cost-benefit ratio requires these calculations:

- Benefits (gained by new terrorism prevention initiative)/Costs (new terrorism prevention initiative) = Benefit-to-Cost Ratio.

For example, if the benefit of the new initiative is $5 million and the cost is $1 million, the benefit to cost ratio is 5 to 1. Therefore, in this example, every dollar spent would generate five dollars in benefits.

3. Cost-Effectiveness Analysis

Cost-effectiveness analysis (CEA) looks at spending decisions in terms of justifying expenses against demonstrated impact. In other words, if a dollar spent on homeland security has zero impact on improving security, it could be argued that the

[24] Mueller and Stewart, *Terror, Security, and Money: Balancing the Risks, Benefits, and Costs of Homeland Security*, 15.

expenditure is not cost effective. Maynard captures the value of CEA in this quote, "What is effective may not be cost effective, but what is cost effective is always effective."[25] The use of CEA in preparedness financing decisions could be beneficial in guiding budgeting decisions in response to rapidly increasing budgetary constraints. There are some excellent examples of using CEA in preparedness planning and resource allocation. Kaufmann, Meltzer, and Schmid used CEA to quantify the cost of a bioterrorist attack and concluded that a post attack prophylaxis program is the single most important means of reducing loss of lives.[26] Other research has assessed the cost-effectiveness of pre-attack and post attack strategies for dealing with a large-scale anthrax event and concluded that cost-effectiveness depended heavily on the probability of an attack and the potential number of people exposed during the attack.[27] Unlike CBA, CEA is not monetized and yields a cost-effectiveness ratio using the following formula:

Cost Effectiveness Ratio = Total Costs/Units of Effectiveness

For example, estimating the cost effectiveness ratio of a specific intervention intended to circumvent the effects of a terrorist attack would yield a ratio interpreted as dollars per life saved, injuries prevented, or reduced property damage. The cost-effectiveness ratio allows the analyst to rank order interventions on a scale from least effective to most effective. Unfortunately, it is difficult for policy makers to know whether differences in costs and effects are actually connected to differences in the efficiency of interventions.[28] Figure 2 is a pictorial description of the CEA process:

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[25] A. Maynard, "Evidence-Based Medicine: An Incomplete Method for Informing Treatment Choices," *Lancet* 349 (1997): 126.

[26] A.F. Kaufmann, M.I. Meltzer, and G.P.Schmid, "The Economic Impact of A Bioterrorist Attack: Are Prevention and Postattack Intervention Programs Justifiable?" *Emerging Infectious Disease* 3 (1997): 93.

[27] R.A. Fowler, "Cost-Effectiveness of Defending Against Bioterrorism: A Comparison of Vaccination and Antibiotic Prophylaxis Against Anthrax," *Annals of Internal Medicine* 142 (2005): 601.

[28] T. Tan-Torres Edejer, R. Baltussen, T. Adam, R. Hutubessy, A. Acharya, D.B. Evans, and C.J.L. Murray, eds. *Making Choices in Health: WHO Guide to Cost-Effectiveness Analysis*, Geneva: World Health Organization, 2003, 17.

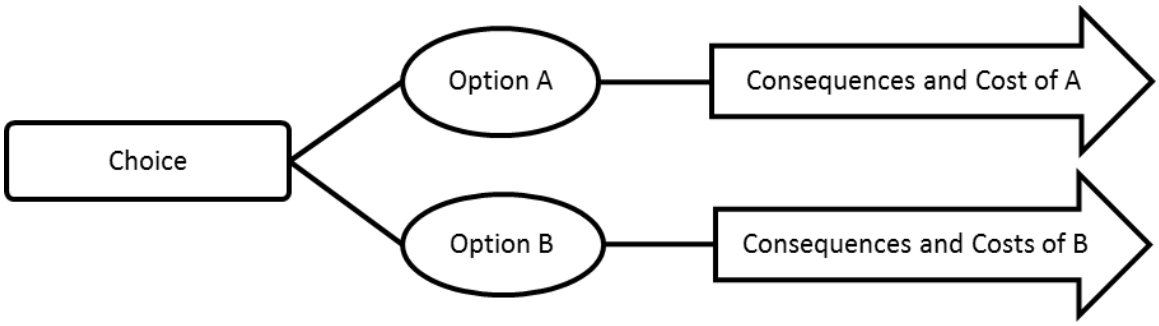

Figure 2. CEA Process

4. Return on Investment

ROI is more rigorous than CBA because it allows for the consideration of the time value of money and seeks to determine which costs and benefits produce a desirable financial outcome. To calculate simple ROI, the benefit of an investment is divided by the cost of the investment using the following formula:

$$\text{ROI} = \frac{(\text{Gain from Investment} - \text{Cost of Investment})}{\text{Cost of Investment}}$$

This simple ROI calculation is less accurate when the investments and/or benefits involve future years-as they do with homeland security funding decisions-because future dollars are worth less than current dollars. The general rule for greater accuracy is to use the discounted ROI calculation method when the investments and/or the benefits involve future years. First, the analyst must establish a baseline of current performance so before and after comparisons can be reliably calculated. The second step is to measure the change in performance from the baseline that resulted from the investment and the change that resulted from other factors other than the investment. The third step involves using present value data to calculate ROI.

To complete an ROI calculation where the objective is to reduce the number of deaths occurring from a terrorism event, a commonly used measure is the value of a statistical life (VSL). However, estimates of VSL are wide-ranging across federal agencies as well as by different economists and statisticians. For example, current Office of Management and Budget (OMB) guidance suggests that VSL estimates range from $1

million to $10 million. One DHS analysis suggested a VSL of $6.5 million (in 1990 dollars) be used in placing a monetary value on a human life.[29]

5. Hazard Vulnerability Analysis

Hazard vulnerability analysis (HVA) is very similar to what Ted Lewis calls model-based vulnerability analysis (MBVA).[30] According to Lewis, this model answers the questions, "What is worth protecting?" and "How much should be spent?"[31] HVA is an important analytical tool for understanding the risk and costs associated with a specific target of terrorism. Although the steps vary from one emergency responder to another, the basic HVA sequence follows a similar pattern beginning with determining probability and impact of hazard probability, then ranks impact on a scale from low to moderate to high.

For example, in Florida, hurricanes are a constant seasonal threat. An HVA for hurricanes would include a probability assessment, including but not limited to, known risk and historical data. The likelihood of a hurricane would be scored low, medium, or high. Other threats like wildfires, epidemics, and floods are also scored and the average score is used to determine which of the threats that are most likely. So, if the average score for hurricanes in a particular locale is highest in the month of September, and the average score for wildfires in the same month is lower, the analyst can predict that hurricanes are a much greater risk in September than are wildfires.

The formula for HVA is as follows: (Threat x Vulnerability) x Consequences = Risk.

Threat is defined as the probability of an event like a hurricane or wildfire impacting a specific locale. The potential human, property, and business impact of a specific hazardous event provides measures of vulnerability. Consequences are measured in terms of preparedness response, remediation, and recovery.

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29 Lisa A. Robinson, *Valuing Mortality Risk Reductions in Homeland Security Regulatory Analyses, Final Report*, U.S. Customs and Border Protection, Department of Homeland Security, June, 2008.

30 Ted Lewis, *Critical Infrastructure Protection in Homeland Security: Defending a Networked Nation* (Hoboken NJ: Wiley-Interscience, 2006), 145.

31 Ibid., 146.

Hospitals and community health centers are required to conduct an annual HVA. Public health departments are not required to do a HVA but the results of this research indicate that many LHDs include critical components of hazard vulnerability analysis in their preparedness planning.

Terry Cannon questions the viability of HVA noting that such analysis is suspect because of "vulnerability conditions of human systems."[32] Cannon is referring to the fact that disasters in low population areas have less impact than disasters affecting heavily populated areas. In other words, the population at risk, not the disaster itself, becomes the focal point of the analysis.

In the final analysis, all of these VBDM tools can give policy makers some concrete ways to measure preparedness, understand which data is most important, and make "business case" choices among competing alternatives. At the same time, the users of the data can manipulate these tools for political purposes. In addition, the adaptation of these tools for use in the public health preparedness context has produced mixed results. The next section describes how these decision-support tools have been applied to public health in general and specifically to public health preparedness.

D. VBDM AND PUBLIC HEALTH PREPAREDNESS

In June 1999, a meeting of national experts was convened to determine which biological agents posed the greatest risks to the public and to develop criteria for prioritizing public health preparedness efforts.[33] This report provided the foundation for the use of risk analysis in preparedness planning and identified the specific risk factors and weighting criteria that have become common VBDM tools. Why did public health become more interested in VBDM?

Achieving public health security in the 21st Century is suddenly much more complicated than it was in previous times. In the 1900s, public health used scientific and

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[32] Terry Cannon, "Vulnerability Analysis and the Explanation of 'Natural'Disasters," *Disasters, Development and Environment* (1994): 13–30.

[33] M. Meselson and J. Guillemin, "Public Health Assessment of Potential Biological Terrorism Agents," *Emerging Infectious Diseases,* 8 (2002): 225.

statistical approaches to eradicate smallpox and limit the broad population health effects of such dreaded diseases as polio, measles, whooping cough, and cholera. Cost-benefit analysis was the favored analytical tool and it was used as far back as the 19th century to "weigh the probability of disease outbreaks against the probability of adverse effects from immunizations."[34] CBA continues to prove invaluable in planning and executing responses to problems where historical information is readily available.

In this new millennium, the public health system is confronted with novel, incurable viruses like Ebola and HIV/AIDs, difficult to treat bacterium like MERSA, and the constant threat that bioterrorism may be used against civilian populations. Against this ominous backdrop, public health analysts have been experimenting with analytical tools that do not depend entirely on historical data.

The 2002–2003 Smallpox Vaccination Program clearly illustrates the difficulties encountered when using these new predictive analytical VBDM tools. The program was initiated without a cost-benefit analysis because no historical data existed to support the decision. Instead, the decision was supported by a combination of CEA and HVA. The implementation of the plan was plagued almost immediately by adverse medical reactions and overwhelming public resistance. Critics were quick to point out that the risk of smallpox was less than the risk of the smallpox vaccine. As a result, the vaccination program became a monumental failure.

The Smallpox Vaccination Program failed because it was an attempt to disrupt the prevailing public health values through innovative thinking. This new paradigm relied on metrics that provided solutions to problems that had not yet appeared, in this case a vaccination program for a disease that was eradicated almost 40 years ago.

Although this literature review did not uncover an abundance of examples using the new metrics, there are some relatively recent examples that have been applied to both public health and preparedness issues. Beginning in the 1990s, Paalman and her research

[34] Stephen J.Collier and Andrew Lakeoff, "The Problem of Securing Health," *Biosecurity Interventions: Global Health and Security In Question* (2008): 13.

partners argued that economic analysis be used to establish priorities for spending public health dollars.[35] More recently, Chretien and others suggested that new public health surveillance systems might replace the old query systems with dynamic real time response systems.[36] A 2007 publication illustrated the utility of using CEA in determining the relative value of using travel restrictions to control pandemic flu.[37] The authors concluded that air travel restrictions might delay the spread of a pandemic at minimal cost to the economy. Barnett and her colleagues took a systematic analytic approach to pandemic influenza preparedness planning using a Haddon matrix to demonstrate opportunities for prevention and mitigation prior to a global outbreak.[38]

Therefore, the new VBDM tools are being employed and even succeeding to varying degrees. The new public health problems, especially those associated with certain diseases and terrorism, have created innovative disruptions that cannot wait for historical analytical data. Consequently, public health is beginning to realize that novel public health threats require novel analytical approaches.

This literature review demonstrated that VBDM tools have been used in analyzing the viability of various vaccination programs. Hopefully, this research may encourage public health analysts to explore additional opportunities for using VBDM in preparedness decision-making.

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[35] Maria Paalman, Henk Bekedam, Laura Hawken, and David Nyheim, "Critical Review of Priority Setting in the Health Sector: The Methodology of the 1993 World Development Report," *Health Policy and Planning* 13 (1998): 13–31.

[36] Jean-Paul Chretien, Nancy E.Tomich, Joel C. Gaydos, Patrick Kelley, "Real-Time Public Health Surveillance for Emergency Preparedness," *American Journal of Public Health* 99 (2009): 1361.

[37] Joshua M. Epstein et al., "Controlling Pandemic Flu: The Value of International Air Travel Restrictions," *Plos One* 5 (2007): 1.

[38] Daniel J.Barnett et al., "A Systematic Analytic Approach to Pandemic Influenza Preparedness Planning," *Plos Medicine,* 2 (2005): 1240.

III. HYPOTHESES AND PROPOSITIONS

A. RESEARCH QUESTIONS

The primary research question is: Are local public health departments that use value-based decision-making (VBDM) more likely to demonstrate and document higher levels of preparedness competencies? This research includes the following sub-questions:

- What is VBDM and how is it defined within the context of public health preparedness?
- Does VBDM simply enhance preparedness competency or is it the deciding factor?

We have already addressed the first sub-question in the literature review so the focus of the next two chapters will be on further addressing the primary question and sub-question two.

B. HYPOTHESES

The null hypothesis and the null hypothesis can be stated as follows:

- H_o: Any association between preparedness competency and VBDM occurs purely by chance.
- H_1: There is a non-random association between preparedness competency and VBDM.

C. PROPOSITIONS

If the theory that value-based decision-making (VBDM) improves public health preparedness is correct, the following propositions should be supported:

- Proposition 1: LHDs using VBDM should rank higher among respondents that are PPHR recognized.
- Proposition 2: LHDs that do not use VBDM should rank lower among respondents that are PPHR recognized.
- Proposition 3: LHDs that use VBDM should rank higher among non-PPHR respondents.

- Proposition 4: LHDs that do not use VBDM should rank lower among non-PPHR respondents.

The next step in this research design is to collect data to support or refute each of these propositions and the hypotheses. The data will then be analyzed against the four propositions and inferences will be drawn regarding the hypothesis that value-based financing improves preparedness and response.

IV. METHODOLOGY

A. SAMPLE SELECTION

The methodology chapter describes the essential components of a nation-wide survey designed to collect key information from 500 randomly selected local health departments. The survey respondents were drawn from a pool of over 2500 local health departments that are members of NACCHO. The survey was distributed in three ways to ensure the confidentiality and anonymity of the respondents. In larger states such as Virginia, Ohio and Florida, the statewide public health preparedness coordinator was contacted via email and asked to send the survey to the randomly selected departments in that state. In larger cities and counties, the survey link was sent directly to the attention of the public health officer. Finally, in the remaining departments, an email was sent directly to the department to the attention of the preparedness coordinator based upon contact information obtained from each department's website.

To achieve some confidence in the results of this research required a large sample of local public health departments due to the significant differences in these departments from state to state. For example, in some states, local public health departments (LHDs) are state government entities (Virginia, South Carolina, and Florida among others). In other states, local public health departments are autonomous units of local government (North Carolina). Hawaii and Rhode Island were excluded from this sample because the state and local health department are one and the same. A large sample was essential under these circumstances to control for the effects of organizational structure on performance and effectiveness. All 500 LHDs received the survey via email using Survey Monkey.

Because this researcher cannot observe cause, there must be valid inferences that support the causal relationship. In this case, there are several inferences that must be considered within this research design. First among these inferences is the idea that PPHR status provides demonstrated evidence of preparedness. Next, it is assumed that essential components of value-based analysis are CBA, RA, CEA, ROI, and HVA. It also

assumed that "the best prepared" public health entities have employed at least one or more of these components.

A 2x2 contingency table (Table 3) will be used to analyze the results. There are four cells, with the vertical axis measuring preparedness competency and the horizontal axis measuring the use/none use of VBDM.

Table 3. 2x2 Contingency Table

	Use VBDM	**Do Not Use VBDM**
PPHR Recognized	a	b
Not PPHR Recognized	c	d

B. SURVEY MEASURING USE OF VALUE-BASED STRATEGIES

The survey is the key component of this research. From the list of 2532 LHDs identified in NACCHO's Profile of Local Health Departments, the sample was selected using a random number generator. The sampling frame was placed into an Excel spreadsheet. The random selection was achieved using the following steps:

- Adding a new column within the spreadsheet and naming it random number
- Copying and pasting the first cell to other cells for this column of 2500 plus departments.
- Sorting the records by random number column.
- Choosing the first 500 departments. Those became the random 500 out of 2532 departments.

The survey was open from August 25 to September 25, 2014. One hundred thirty-eight respondents started and 130 completed the survey.

The on-line survey was comprised of the fourteen questions listed in Appendix A. During pretest on some likely users, the survey took an average of fifteen minutes from start to completion. The survey is divided into four sections, each with a specific purpose. Although the survey was carefully designed to protect the identity and confidentiality of

the respondents, it was intended that the surveys would be completed by a knowledgeable person within the department.

C. DATA COLLECTION

The data collection was driven by a deductive approach that tested the theory that preparedness can be enhanced by value-based decisions. The first question was actually not a question but an informed consent for participation in the survey. It assured the respondent that their identity would be protected and their responses remain anonymous and confidential.

Questions two through five were used for classification purposes so that departments might be compared and contrasted. Question six answered which departments have been PPHR recognized by NACCHO. PPHR recognition indicates a basic level of public health preparedness. Question seven attempted to measure the scope and nature of essential preparedness activities by respondent. Questions eight through thirteen provided information on which departments are using VBDM in their preparedness budget decision processes. The final question asked each respondent to subjectively rank his or her department's preparedness level.

D. DATA ANALYSIS

The Pearson Chi-square test was used to examine the significance of the association (contingency) between preparedness competency (PPHR certification) and the use of VBDM in financing public health preparedness. After testing for statistical significance using Chi-square, the null hypothesis will either be accepted or rejected.

E. BIAS CONCERNS

This survey has several potential points where human bias may affect the validity of the survey results. First of all, the selected respondents are departments not individuals. Because of the survey collection methods, there is no way to know which person in a department actually completed the survey. Because this survey depends upon a respondent's expert knowledge of local public health preparedness, not knowing the level of respondent qualifications may influence the credibility of the response. Second,

the design of the survey itself is affected by the survey designer's opinions, knowledge, and assumptions. Lastly, the researcher's understanding and interpretation of the data collected can be affected by inexperience and personal bias.

V. ANALYSIS

A. DESCRIPTIVE STATISTICS

1. Frequency

In order to analyze the data from the surveys it is helpful to view the data in frequency distributions. The survey is attempting to measure a number of variables and the frequency distribution shows all the values that a variable can take. For example, one of the variables being measured in the survey is the size of the preparedness staff in respondent departments. The first step is to list all the values this variable can take within a range of values. The number of observations is entered corresponding to a specific staffing range.

Table 4 illustrates a frequency distribution for preparedness staff among the 126 respondents. All the values for staffing size or any other variable are listed from lowest to highest even though there may be no values for a particular variable. Of the 126 responses to this question, 108 respondents had less than five full-time equivalent employees and all had less than 25 full-time equivalent preparedness employees. This could lead to a conclusion that most of the respondents represent small LHDs, but Table 6 reveals that well over half of the respondents represent populations over 100,000.

Table 4. Frequency Distribution for Preparedness Staffing Size

Staff Size		**Number of Departments**
< 5	FTEs	108
5–10	FTEs	16
11–-24	FTEs	2
25–99	FTEs	0
100–249	FTEs	0
250–499	FTEs	0
> 500	FTEs	0
Total Departments		**126**

Table 5 shows the frequency distribution of respondents that are PPHR recognized and includes several interesting observations. Most interesting is the fact that 12 of the respondents were unsure as to whether or not their LHDs were PPHR recognized. This could indicate that these 12 respondents were either new to the job or lacking basic knowledge about their own preparedness programs. Fortunately, these were a small number of total respondents and should not have adversely affected the survey results. The proportion of PPHR recognized versus not PPHR recognized respondents differs dramatically from the overall national results. This finding will be discussed later in this chapter.

Table 5. Frequency Distribution of Number of Local Health Departments PPHR Recognized

PPHR Status	Number of Departments	Proportions
Yes	44	0.35
No	70	0.56
Not Sure	12	0.09
Total	**126**	**1.00**

2. Central Tendency

Central Tendency measures where the distribution's most typical value is located. The three most used measures are the mode, median, and mean. Because the survey questions are categorical, the measurement scale is nominal and the best measure of the best measure of the most typical value is the mode. Ordinal, interval, and ratio measurement scales are better suited for mean and medium measures of central tendency. The mode is useful in dealing with categorical data because it allows the researcher to identify the most likely answer. For example, the survey question regarding population served allows the mode to be determined as follows:

Table 6. Population Served By Number of Responses

Population Served	Number of Respondents
< 25,000	8
25,000–49,999	20
50,000–99,999	18
100,000–249,999	34
250,000–499,999	20
500,000-999,999	20
1,000,000–2,499,999	8
2,500,000–4,999,999	2
>5,000,000	0
Total Respondents	**130**

The mode or most likely respondent serves a population between 100,000 and 249,999. This population served will be the tallest column on a histogram or the peak of a line chart. Since the same data is already in the frequency distribution, the numbers have already been counted. However, the mode is not the frequency of the number that occurs most often. The mode is the category that has the highest frequency. According to the 2013 National Profile, 72 percent of the LHDs in the nation serve populations under 25,000. The average respondent in the survey serves much larger populations. This difference is significant and indicates that the average respondent does not represent the typical LHD.

B. SURVEY SECTION: CLASSIFICATION

Survey questions two through five asked the respondents a series of questions to determine the type of public health jurisdiction, population served, size of preparedness budget, and number of employees dedicated to preparedness activities. Table 7 displays the various jurisdictions represented by the respondent health departments. The county health department was by far the most common (mode of 98) jurisdiction in almost the same distribution as represented in the 2013 National Profile of Local Health Departments.[39] Because county health departments are proportionally represented among

[39] "Project Public Health Ready Recognized Agencies," National Association of County and City Health Officials, accessed December 12, 2013, http://nacho.org/topics/emergency/PPHR/index.cfm.

the survey respondents, the survey results could adequately reflect the preparedness programs of county health departments, the majority of health jurisdictions in the country, even if they don't reflect the average population served by LHDs. City or town health departments were only a small number (6) of the total responses. City and town health departments do not typically provide a wide range of traditional public health services and in most cases would not be expected to be engaged in public health preparedness. Other data from the National Profile cannot be easily used because it is not related to the measures used in this survey.

Table 7. Survey Respondent Identification

Geopolitical Distribution	Survey Response Frequency (2013 National Profile)		Number of Respondents
County	77.78%	(68%)	98
City or Town	4.76%	(20%)	6
Multi-County	9.52%	(8%)	12
Borough	0.00%	(0%)	0
District	7.94%	(0%)	10
Other	0.00%	(4%)	0
Total Respondents			**126**

In question three, respondents were asked to provide the population served within nine population ranges. Table 8 displays the results and indicates-according to the NACCHO 2013 National Profile of Local Health Departments-that the survey underrepresented small LHDs and overrepresented larger LHDs. According to the National Profile, LHDs representing populations in excess of 100,000 totaled less than 25 percent. In the survey, almost 75 percent of the respondents represented populations in excess of 100,000. In addition, the very largest LHDs were not represented likely due to the survey not finding its way to the appropriate respondent. These very large departments are considered to be more sophisticated and would be expected to be making greater use of VBDM tools.

Table 8. Population By Response Frequency

Population Range	Survey Response Frequency V. (2013 National Profile)		Number of Respondents
< 25,000	6.25%	(41%)	8
25,000–49,999	15.63%	(20%)	20
50,000–99,999	14.06%	(16%)	18
100,000–249,999	26.56%	(10%)	34
250,000–499,999	14.06%	(8%)	20
500,000–999,999	14.06%	(4%)	20
1,000,000–2,499,999	6.25%	(2%)	8
2,500,000–4,999,999	1.56%	(0%)	2
>5,000,000	0.00%	(0%)	0
Total Respondents			**130**

Question four asked the respondents to estimate the size of the department's annual budget for public health preparedness. The request for estimated, not actual, data recognized that exact budget expenditures are often not available until required annual audits have been completed. Budget information is important because it is one possible indicator of how much priority the department places on public health preparedness. Table 9 shows that almost 50% of the respondents reported their annual preparedness budgets to be below $100,000. This is especially concerning given the underrepresentation of small departments among the respondents. If preparedness budgets are limited for larger departments, then it can be assumed that they are very negligible for the vast majority of smaller LHDs. Also of concern is the average budget of $250,000–$499,000. No comparable preparedness budget figures are available from the National Profile so it is difficult to know if these budget numbers are representative of all LHDs. The National Profile does indicate that per capita emergency preparedness spending for LHDs of all population sizes was approximately $2.00. This would indicate that larger health departments always have total budgets much larger than smaller departments.

Question five asked the respondents to provide information on number of FTEs employed in public health preparedness. Even with the underrepresentation of small

departments, the overwhelming majority (over 85%) of respondents employed less than five FTEs in public health preparedness. These survey results support the findings in the literature review regarding the decline in public health staffing and raises serious questions about LHD preparedness capacity and capability.

Table 9. Annual Budget for Public Health Preparedness

Annual Budget	Response Frequency	Number of Respondents
<$50,000	17.74%	22
$50,000–99,999	25.81%	32
$100,000–199,999	20.97%	28
$200,000–499,999	25.81%	32
$500,000–999,999	4.84%	6
$1,000,000–1,999,999	4.84%	6
$2,000,000–-3,999,999	0%	0
$4,000,000–5,999,999	0%	0
>$6,000,000	0%	0
Total Respondents		**126**

C. SURVEY SECTION: PREPAREDNESS COMPETENCY

To assess preparedness competency, questions six through eight asked the respondents to indicate PPHR status, list participation in certain preparedness activities, and specify level of participation in VBDM. The collective responses to these three questions were intended to provide an overall picture of preparedness competency.

Question six proved to be the most important question in the survey. It asked the respondents to clarify whether or not their departments are PPHR recognized by NACCHO. PPHR recognition is currently the only established national indicator of LHD public health preparedness. Overall, about 14% of the local health departments have received PPHR recognition. Among the survey respondents over 30% have received PPHR recognition. These results may indicate that the survey respondents may represent larger, more sophisticated LHDs. However, Table 10 shows the percentage of PPHR and non-PPHR departments that responded to the survey and indicates that the average PPHR recognized departments had preparedness budgets less than $100,000, while the average

non-PPPHR recognized departments had budgets over $200,000. This survey result suggests that size of budget does not improve the likelihood that a LHD will be PPHR recognized.

Table 10. PPHR Recognition

LHD Budget	Yes	No	Don't Know	Number of Respondents
<$50,000	18.18% (4)	45.45% (10)	36.36% (8)	22
$50,000–$99,999	43.75% (14)	50.00% (16)	6.25% (2)	32
$100,000–$199,999	42.86% (12)	50.00% (14)	7.14% (2)	28
$200,00–0$499,999	25.00% (8)	75.00% (24)	0.00% (0)	32
$500,000–$999,999	66.67% (4)	33.33% (2)	0.00% (0)	6
$1,000,000–$1,999,999	33.33% (2)	66.67% (4)	0.00% (0)	6
$2,000,000–$3,999,999	0.00% (0)	0.00% (0)	0.00% (0)	0
Total Respondents	**44**	**70**	**12**	**126**

Question 7 (for responses see Table 11) asked the respondents to choose among a list of eight preparedness activities in which their departments are engaged. These activities represent essential LHD public health preparedness capacity in two key domain areas. The domains are surveillance and investigation and exercises and emergency events. The first four activities fall within the surveillance and investigation mode. The remaining four activities are included in the exercises and emergency events domain. Taken together these activities provide insight into the relationship between participation in essential preparedness activities and preparedness capacity. With the exception of participation in the National Electronic Disease Surveillance System (NEDDS), the majority of respondents are highly engaged in the nine essential preparedness activities, in percentages ranking as high as 85% for sending/receiving electronic health information. As such, these results are not dissimilar enough to be useful in

distinguishing between PPHR and non-PPHR respondents. The lack of response frequency with respect to NEDDS is not associated with jurisdiction, population served or size of preparedness budget. Without proper data, there is no clear explanation as to why NEDDS is so under-utilized throughout the variety of LHDs.

Table 11. Preparedness Capacity

Preparedness Activity	Response	Frequency
Participates in EPI-X	77.42%	96
Participates in NEDDS	32.26%	40
Sends/Receives EH Messages	85.48%	106
Electronic Surveillance System	77.41%	96
Capability to E Report/Receive Lab Info	74.19%	92
Participated in CRBN Exercise	62.90%	78
Rapid Method Send Messages to Community Partners	85.48%	106
Demonstrated Ability to Manage SNS	85.48%	106
Total Responses 124		

D. SURVEY SECTION: USE OF VBDM

Question eight asked respondents to specify their use of selected VBDM tools in budgeting for preparedness. Because over half of the respondents are using VBDM tools, VBDM may be more widespread than suggested in the literature review. This is significant because it indicates the possibility of some rapid change occurring in the use of VBDM among LHDs.

Tables 13 and 14 show the frequency with which both PPHR respondents and non-PPHR respondents used the five VBDM tools. In both categories, there are only a small number of respondents indicating they use VBDM. Even though the numbers are small, for each and every one of the five individual VBDM activities, PPHR respondents had higher participation rates indicating that PPHR respondents more frequently use VBDM tools.

In Table 12, the 44 PPHR respondents were most likely to use HVA (20 respondents of 71 total responses). RA and CEA are the next two most likely VBDM tools at 16 and 14 responses respectively. There were seven responses, presumably from seven respondents, indicating no VBDM tools are in use in these departments. This is where we derive the number of 37 PPHR recognized departments using VBDM tools.

Table 12. Use of VBDM in PPHR Respondent LHDs

VBDM Tools	**% PPHR Participating/Responses**	
CBA	22.73%	10
RA	36.36%	16
ROI	9.09%	4
CEA	31.82%	14
HVA	45.45%	20
None	31.82%	7
Total PPHR Respondents 44	**Total Responses 71**	

Table 13 provides similar results for non-PPHR respondents and indicates that VBDM is used by all but 16 of the 70 respondents. There were 132 responses for use of each of the VBDM tools and again HVA at 48 responses or 36.36% of all responses was the most popular tool used. Next most popular tools were RA, CEA, and CBA. These results track very closely with the results for PPHR recognized respondents.

Table 13. Use of VBDM in Non-PPHR Respondent LHDs

VBDM Tools	**% Non-PPHR Participating/ Responses**	
CBA	13.64%	18
RA	19.70%	26
ROI	4.55 %	6
CEA	13.64%	18
HVA	36.36%	48
None	12.11%	16
Total Respondents 70	**Total Responses 132**	

Questions 9–13 are specific to individual VBDM tools and asked the respondents to identify the role (percentage) that each tool plays in preparedness budget decisions. Table 14 shows the cumulative survey results for each question. Unfortunately, less than half of the 44 PPHR recognized departments and only 14 of the 70 non-PPHR respondents completed any of these five questions. In addition, if a respondent indicated that they are using a VBDM tool less than 10% of the time, the actual number could be zero. The survey instrument was not specific enough to determine what a response of less than 10% meant in actual numbers. Given the poor response to these questions, it is not possible to make predictions that will hold true for all LHDs in the country. Accordingly, the responses to these five questions cannot be meaningfully used in explaining any relationship between specific VBDM tools and how they are used in PPHR and Non-PPHR recognized LHDs.

Table 14. Use by PPHR Response

Preparedness Decisions Impacted/Responses										
PPHR										
% of Departments	**CBA**		**RA**		**ROI**		**CEA**		**HVA**	
	%	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**
< 10%	28.56%	4	33.33%	6	66.67%	8	55.56%	10	25.00%	6
10–25%	42.86%	6	11.11%	2	16.67%	2	0.00%	0	41.67%	10
26–50%	14.29%	2	44.44%	8	0.00%	0	33.33%	6	16.67%	4
51–75%	0.00%	0	11.10%	2	0.00%	0	0.00%	0	8.33%	2
>75%	14.29%	2	0.00%	0	16.67%	2	11.11%	2	8.33%	2
Non-PPHR										
% of Departments	**CBA**		**RA**		**ROI**		**CEA**		**HVA**	
	%	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**
< 10%	25.00%	2	42.86%	6	66.67%	4	50.00%	4	14.29%	4
10–25%	75.00%	6	42.86%	6	33.33%	2	50.00%	4	50.00%	14
26–50%	0.00%	0	14.29%	2	0.00%	0	0.00%	0	28.57%	8
51–75%	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
>75%	0.00%	0	0.00%	0	0.00%	0	0.00%	0	7.14%	2
Total Responses	**22**		**32**		**18**		**26**		**52**	

E. SURVEY SECTION: OPINION ON PREPAREDNESS CAPABILITY

The final survey question asked the respondents to estimate their department's preparedness level. The responses were not requested in a Likert Scale format but do provide some subjective assessments of preparedness capability related to use of VBDM tools and budget size. Table 15 looks at use of VBDM in relation to opinions on preparedness capability reveals that capable respondents were more likely to use VBDM tools than respondents who believed they were not preparedness capable. Although small, the numbers consistently indicate an association between capability and use of VBDM tools.

Table 15. Opinion of Preparedness Capability

VBDM Tool	Capable of Managing Any Man-made Disaster	Capable of Managing Any Natural Disaster	Capable of Managing Most Man-made Disasters	Capable of Managing Most Natural Disasters	Only Capable of Managing Small-Scale Man-made Disasters	Only Capable of Managing Small-Scale Natural Disasters	Not Capable of Managing Any Man-made Disasters	Not Capable of Managing Any Natural Disasters	Total Respondents
Q8: Cost-Benefit Analysis	**11.11%** (2)	**0.00%** (0)	**22.22%** (4)	**55.56%** (10)	**0.00%** (0)	**11.11%** (2)	**0.00%** (0)	**0.00%** (0)	18
Q8: Risk Analysis	**6.67%** (2)	**6.67%** (2)	**26.67%** (8)	**53.33%** (16)	**6.67%** (2)	**0.00%** (0)	**0.00%** (0)	**0.00%** (0)	30
Q8: Return on Investment Analysis (ROI)	**0.00%** (0)	**0.00%** (0)	**33.33%** (2)	**66.67%** (4)	**0.00%** (0)	**0.00%** (0)	**0.00%** (0)	**0.00%** (0)	6
Q8: Cost-Effectiveness Analysis	**10.00%** (2)	**0.00%** (0)	**20.00%** (4)	**60.00%** (12)	**0.00%** (0)	**10.00%** (2)	**0.00%** (0)	**0.00%** (0)	20
Q8: Hazard Vulnerability Analysis	**0.00%** (0)	**3.85%** (2)	**26.92%** (14)	**53.85%** (28)	**7.69%** (4)	**7.69%** (4)	**0.00%** (0)	**0.00%** (0)	52
Total Respondents	6	4	32	70	6	8	0	0	126

However, one of the respondents who chose not to answer the question commented, “No one is capable of managing any disaster only ‘mitigating’ them look at New Orleans or Joplin, Missouri.” This observation might be useful for continuing research beyond this thesis by addressing the “managing versus mitigating” question.

VI. SIGNIFICANT FINDINGS/IMPLICATIONS/A VBDM MODEL

A. SUMMARY OF ANALYSIS

Table 16 provides the following information: the observed cell totals, (the expected cell totals), and the (Chi square statistic for each cell). Examining each cell permits an assessment as to whether or not the four propositions supported.

Table 16. Relationship Between Preparedness Competency and VBDM

Preparedness Competency	**LHD Uses VBDM**		**Totals**
	YES	**NO**	
PPHR Recognized	37 (35.12) (0.1) (a)	7 (8.88) (0.4) (b)	44
Not PPHR Recognized	54 (55.88) (0.06) (c)	16 (14.12) (0.25) (d)	70
Totals	**91**	**23**	**114**

- Proposition 1: LHDs in situation (a) should rank higher in number of respondents that are PPHR recognized, because these departments also use VBDM. Proposition 1 is supported. Cell (a) indicates that 37 of the 44 respondents who are PPHR recognized use VBDM.

- Proposition 2: LHDs in situation (b) should rank lower in number of respondents that are PPHR recognized, because these departments do not use VBDM. Proposition 2 is supported. Cell (b) includes only 7 of the 44 PPHR recognized respondents.

- Proposition 3: LHDs in situation (c) should rank higher in number of respondents that are not PPHR recognized, because these department use VBDM. Proposition 3 is supported. The overwhelming majority of non-PPHR respondents, 54 of 70, are found in cell (c).

- Proposition 4: LHDs in situation (d) should have the lower number of departments among non-PPHR departments because they are not using VBDM. This proposition is supported. Only 16 of the 54 non-PPHR respondents indicate that they are not using VBDM tools.

B. STATISTICAL SIGNIFICANCE

Even if all four propositions are supported, are the results statistically significant? The responses listed in Tables 10 were filtered by yes and no answers to PPHR recognition and derived a total of seven out of 44 PPHR recognized respondents that did not use VBDM and 16 of 70 non-PPHR recognized respondents that did not use VBDM. Applying the Pearson Chi-square formula to above, we get:

$$\text{Chi-square} = 114\,[(37)(16) - (7)(54)]^2 / (44)(70)(23)(91) = 0.8715$$

In order to refine the calculations, we need to know how many degrees of freedom we have. When a comparison is made between one sample and another, a simple rule is that the degrees of freedom equal (number of columns minus one) x (number of rows minus one) not counting the totals for rows or columns. For our data this gives (2-1) x (2-1) = 1.

We now have our chi square statistic ($x^2 = 0.8715$), our predetermined alpha level of significance (0.05), and our degrees of freedom (df = 1). Using a Chi square distribution table with 1 degree of freedom, we read find our value of x^2 (0.8715) lies between 0.455 and 2.706. The corresponding probability is between the 0.5 and 0.10 probability levels. That means that the p-value is above 0.05 (it is actually 0.35054). Since a p-value of 0.35054 is greater than the conventionally accepted significance level of 0.05 (i.e., $p > 0.05$) we fail to reject the null hypothesis. In other words, there is no statistically significant difference in the proportion of PPHR recognized LHDs that utilize VBDM.

C. IMPLICATIONS

Even though the results are not statistically significant at either the 0.05 or 0.10 level, it is still important to look at themes that have emerged from this research and their implications for shaping a new model for financing public health preparedness. These emerging trends are contained in Table 17 and are grouped around four themes: impact, focus, enhance, and inform.

The “impact” theme highlights the continued financial woes that have plagued LHDs over the past several years. The stagnant economy and fiscal austerity have ring-

fenced public health preparedness budgets. Almost half of the respondents are protecting their publics with preparedness budgets totaling less than $100,000. Almost 85% of the responding LHDs have fewer than five FTE employees dedicated to public health preparedness. Diminished budgets and staff are a direct result of decreased PHEP funding, which provide the majority of local preparedness funding.

As a result, LHDs have had to explore alternative models for addressing preparedness needs. One option is regionalization and another is enhanced public-private partnership. Nebraska regionalized its local public health system and improved preparedness by spreading specialized human resources all over the state.[40] California also adopted a regional approach, shifting personnel previously dedicated to preparedness activities to traditional public health services.[41] In collaboration with the local health department, Milwaukee hospitals established a regional emergency medicine Internet system to securely share real-time ambulance diversion information.[42]

Another emerging "impact" item was the need for increased flexibility in developing preparedness programs specific to a need or a locale. Some respondents commented that they were frustrated by the "one-size fits all" mentality embodied in the current PHEP grants.

The second distinct theme emerging from the survey is the need to "focus" on expanding the number of LHDs that have received PPHR recognition. Nationally, NACCHO reports that 394 of the 2532 LHDs (15.6%) in 26 states have voluntarily sought and received PPHR recognition. Within the survey, over one-third (44) of the responding departments are PPHR recognized. PPHR recognition is criteria-based and

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[40] David Palm and Colleen Svoboda, "A Regional Approach to Organizing Local Public Health Systems and the Impact on Emergency Preparedness: The Nebraska Experience," *Public Health Reports* 123 (2008).

[41] "Regionalization in Local Public Health Systems," California Public Health Policy Forum, September 2007, accessed December 8, 2013, http://www.cahpf.org/GoDocUserFiles/412.RegionalizationIssueBriefFinal.pdf, accessed December 8, 2013.

[42] "Public Health Surveillance and Communications Using Regional Emergency Medicine Internet," (2005), accessed December 8, 2013http://www.sfhip.org/modules.php?controller=index&module=PromisePractice&action=view&pid=287.

has three components: all-hazards preparedness planning; workforce capacity development; and readiness demonstrated through exercises and real events. The PPHR criteria incorporate the latest federal preparedness recommendations, including the National Incident Management System (NIMS), Homeland Security Exercise and Evaluation Program (HSEEP), and current PHEP guidance.[43]

Table 17. Emergent Findings

Impact	***Focus***
Economic Conditions/Austerity Preparedness Budgets Are Ring-Fenced Program Flexibility Limited	PPHR Recognition Broader Determinants of Public Health Preparedness Longer Term Impacts
Enhance	**Inform**
LHD Analytical Capability and Use of Priority-Setting Tools	Political Values Shaping Decisions on Investment/Disinvestment

As such, the PPHR criteria constitute the only set of comprehensive national public health preparedness standards. It is imperative that more local public health departments achieve PPHR recognition to demonstrate readiness capability.

The "focus" theme also includes the need to develop broader determinants of public health preparedness. Several of the survey respondents commented that traditional public health activities like disease surveillance encompassed and surpassed many of the PPHR criteria and should be considered in any definition of preparedness.

[43] Project Public Health Ready Webpage, NACCHO, accessed December 12, 2013, http://naccho.org/topics/emergency/PPHR/index.cfm.

In addition, survey respondents also commented on the need to focus on longer term evidence-based results instead of one-time low impact interventions. Implementing this idea would require the PHEP funding program to develop longitudinal measures that change the funding cycles from annual grants to multi-year grants.

The "enhance" theme relates to LHD need to be more analytical in setting priority spending goals. The survey results indicated that most LHDs use VBDM. Comments like, "the state bureau determines our funding amount from federal funds and sets spending constraints," illustrate the feeling of helplessness that many LHDs feel regarding their role in determining financing decisions. However, as federal funds continue to decline, the use of VBDM will become increasingly important as LHDs seek support and funding from public and private sources.

The fourth and final theme emerging from the survey is the "inform" theme. Ultimately, all public policy decisions are political decisions. The survey respondents frequently commented they did not use VBDM because it was futile, or as one respondent said, "politicians don't want objective information." The survey confirmed that only a small number of the responding LHDs indicated that they regularly used VBDM. In order to increase the use of VBDM it is imperative that policymakers understand and use analytical information in making investment/disinvestment decisions.

D. ESTABLISHING A VALUE-BASED MODEL FOR FINANCING PUBLIC HEALTH PREPAREDNESS

This research project has confirmed the idea that VBDM holds substantial promise for improving the methods for financing public health preparedness. The essential components of such a model are national preparedness standards, use of common analytics, and political buy-in. Each of these components must overcome implementation hurdles before VBDM can be deemed a successful alternative to the existing political model. Figure 3 depicts one potential VBDM model for financing public health preparedness.

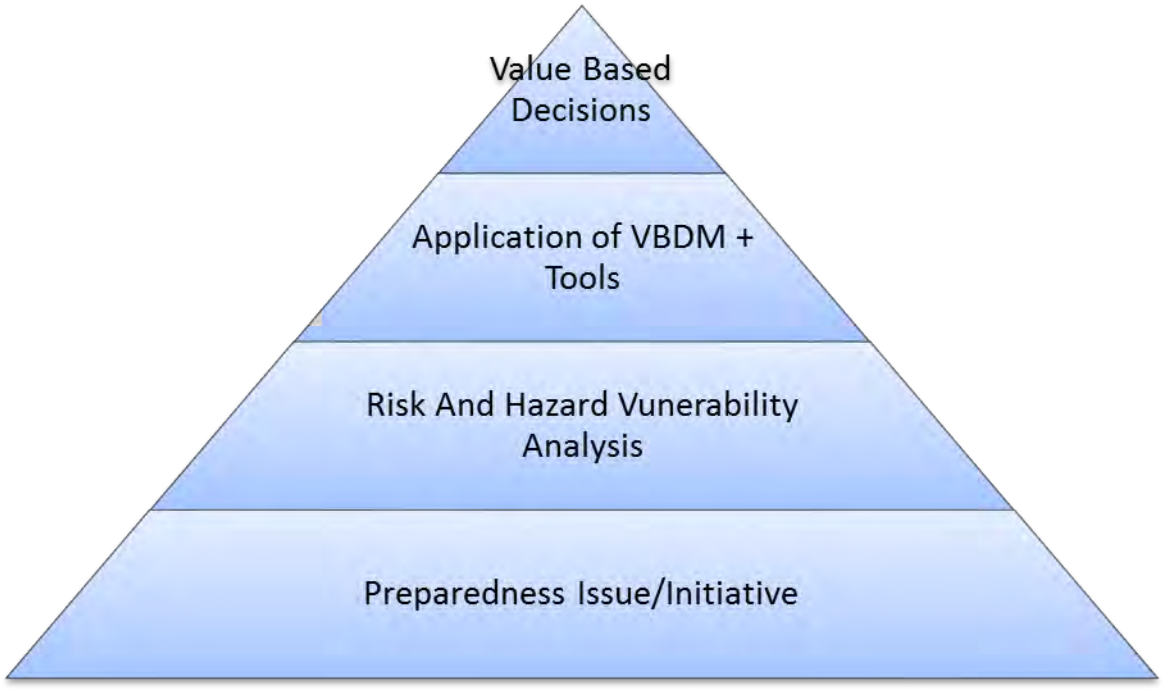

Figure 3. The VBDM Model

The VBDM model starts with a public health preparedness issue or initiative. Next, the LHD analyzes the issue/initiative using RA, HVA and one or more of the value-based tools such as CBA. The model requires a RA and HVA in every analytical process because knowing risk is essential to calculating benefits, effectiveness, and ROI. The completed analysis results in a value-based decision grounded in objective measures of success.

VII. RECOMMENDATIONS

The survey responses pointed out significant problems in the public health preparedness system for which there are no easy solutions. Budgets are extremely tight and staffs are strained. Most of the public health preparedness funding comes from one federal grant (PHEP) that has been declining every year for the last seven years. There is only one national program that recognizes preparedness capacity and very few LHDs have received recognition. In addition, only a small number of LHDs make use of more than one VBDM tool and survey comments like "the state determines our priorities" suggest a LHD reluctance to taking strategic approaches to financing public health preparedness. Given this environment, it is not surprising that a number of the survey respondents seriously questioned their internal capability to handle both natural and manmade disasters.

In their groundbreaking work on VBDM, Pines, Pilkington, and Seabury made seven recommendations "to provide a roadmap for enhancing the sustainability of preparedness efforts in the United States":[44]

- The federal government should develop measures of emergency preparedness both at the community-level and nationally.
- Measures developed should be used to conduct a nation-wide gap analysis of community preparedness.
- Alternative ways of distributing funding should be considered to ensure all communities can build and sustain local coalitions that can support sufficient infrastructure.
- When monies are released for specific projects, there should be clear metrics of grant effectiveness.
- There should be better coordination at the federal level, including funding and grant guidance.
- Local communities should build coalitions or use existing coalitions to building public-private partnerships with local hospitals and other businesses with a stake in preparedness.

[44] Pines, Pilkington, and Seabury, 3.

- Communities should be encouraged to engage in creative ways to finance local preparedness efforts.

These recommendations are focused on changes at the system level and aim to correct deficiencies that hamper public health preparedness and response efforts. This thesis corroborated the need for system level change but emphasized programmatic changes related to using VBDM as an analytical tool for prioritizing spending decisions.

VIII. IDEAS FOR FUTURE RESEARCH

During the past several years, a number of public health emergencies ranging from pandemics to hurricanes have seriously challenges the preparedness capacity of LHDs. A persistent theme in the literature review was the need to be better prepared to respond to both natural and man-made events. Preparation requires adequate budget and staff to perform at a base level. Overall, the U.S. has 50,000 fewer public health employees than it did in 1990.[45]

While survey respondents expressed frustration with diminished budgets, they also offered some recommendations that may be helpful in strengthening the LHD preparedness infrastructure. Not surprisingly, the respondents called for stable and sustained preparedness funding. They also recommended separate grant funding for "personnel to perform investigations on diseases and epidemics to leverage staff availability for emergency operations."

In this time of fiscal austerity, it is critical that LHDs spend their preparedness funds efficiently and effectively. PHEP guidelines mandate that their funds be spent in strict accordance with grant requirements. These requirements ensure and promote efficiency but do not help LHDs understand the relationship between budgets and outcomes. For the most part, these guidelines do not identify areas where significant gaps require additional capability analysis. In addition, PHEP does not require a risk assessment at the local level as a condition of receiving funds.

In the smaller and less sophisticated LHDs, there appeared to be little enthusiasm and support for VBDM. Some survey respondents expressed the feeling that analytical tools "would not improve their decision-making process."

Here are some ideas that could link expenditures to outcomes:

- LHDs could develop decision support systems for guiding preparedness funding decisions.

[45] Trust for America's Health, *Ready or Not? Protecting the Public's Health from Diseases, Disasters, and Bioterrorism 2010.*

- LHDs could conduct comparative analyses that identify gaps in essential preparedness capability areas.
- LHDs could develop performance-based preparedness plans containing clearly defined outcome objectives.
- PHEP grants might be made competitive and based on which LHDs can demonstrate success in achieving outcomes.
- LHDs could develop benchmarks to facilitate peer agency comparisons.

IX. CONCLUSIONS

Although this research failed to demonstrate a statistically significant relationship between VBDM and preparedness competency. The ability to analytically demonstrate the benefit of public health preparedness could be beneficial in attracting additional funding for public health preparedness. Widespread use of VBDM might also facilitate political buy-in as well as enhance the capability of LHDs to implement evidence-based preparedness strategies. If the downward funding trend is to be reversed, the use of a VBDM may be the only alternative to a much politicized appropriations process.

In the final analysis, most public health preparedness funding is determined within a political environment. The product of this political process is the annual appropriation for the PHEP grant. Policymakers have a vested interest in public health preparedness programs that improve security and protect the health of all citizens.

While PHEP funds have dramatically decreased over the last six years, LHDs have struggled to find a strategy that will stabilize funding. The survey results demonstrated that LHDs that use VBDM have higher preparedness scores than departments that do not use VBDM. If VBDM does indeed improve public health preparedness capabilities, it is imperative that policymakers be helped to understand how to use VBDM to improve the appropriations process. To enhance the credibility and use of VBDM the following messages must be communicated to and understood by key decision makers:

- Risks, effectiveness, and benefits-can be accurately measured and associated with costs.
- Grant allocation formulas should be directly linked to threat, vulnerability, and consequences of terrorist acts.
- Create a local public health security preparedness index to provide a basis for preparedness comparisons and funding allocations among local health departments.

While this thesis did not demonstrate a statistically significant relationship between value-based decision-making and preparedness competency, the findings indicate that a large number of local health departments are using value-based decision-making in their preparedness financing decision process. This is important research that has demonstrated future directions for how we may allocate scarce financial resources while improving performance. Policy makers at all levels of government should pay attention to the findings and the opportunities for enhancing preparedness competencies through enhanced analytical capabilities.

APPENDIX A. SURVEY QUESTIONS

MEASURING PUBLIC HEALTH PREPAREDNESS COMPETENCY SURVEY RESULTS

Q1. Informed Consent. I understand that no information provided in this survey will identify me or any other person who may assist me in completing this survey. I further understand that the results of this survey will be used in a graduate level thesis at the Naval Postgraduate School. I understand that taking this survey involves no risks or hazards greater than those encountered in normal living activities. I understand that I will receive no compensation or benefits will be derived by me personally as a result of completing this survey. I understand that a copy of the research results will be available at the conclusion of this research through the Homeland Security Digital Library. I understand that all records of this study will be kept confidential and that my privacy will be protected. No information will be accessible by any person that could identify me as a participant. I understand that my participation is strictly voluntary, and if I agree to participate, I am free to withdraw at any time without prejudice. I understand that if I have any questions or concerns about this survey upon the completion of my participation, I should contact Dr. William Pilkington,wfpilkington@cabarrushealth.org or the Principal Investigator, Dr. Robert Josefek, rjosefek@gmail.com. Any medical questions should be addressed to LTC Eric Morgan, MC, USA, (CO, POM Medical Clinic), eric.morgan@nw.amedd.army.mil. Any other questions or concerns may be addressed to the IRB Chair, LT Brent Olde, baolde@nps.edu. I have been provided with a full explanation of the purpose, procedures, and duration of my participation in this research project. I understand that by agreeing to participate in this research, I do not waive any of my legal rights.

Answered: 138
Skipped: 0

Answer Choices	Responses/Response Count	
I consent	100.00%	138
I do not consent	0.00%	0
Total Respondents:		**138**

Q2. Please describe the geographic jurisdiction served by your department.

Answered: 124
Skipped: 10

Answer Choices	Response Percent/Response Count	
County	79.03%	98
City or Town	4.84%	6
Multi-County	8.06%	10
Borough	0.00%	0
District	8.06%	10
Other	0.00%	0

Q3. What is the population served by your department?

Answered: 128
Skipped: 10

Answer Choices	Response Percent/Response Count	
< 25,000	6.25%	8
25,000–49,999	15.63%	20
50,000–99,999	14.06%	18
100,000–249,999	26.56%	34
250,000–499,999	14.06%	18
500,000–999,999	15.63%	20
1,000,000–2,499,000	6.25%	8
2,500,000–4,999,000	1.56%	2
>5,000,000	0.00%	0

Q4: Estimate you annual budget for preparedness related programs for the most recent Fiscal Year.

Answered: 124
Skipped: 10

Answer Choices	Response Percent/Response Count	
<$50,000	17.74%	22
$50,000–$99,999	25.81%	32
$100,000–$199,999	20.97%	26
$200,000–-$499,999	25.81%	32
$500,000–$999,999	4.84%	6
$1,000,000–$1,999,999	4.84%	6
$2,000,000–$3,999,999	0.00%	0
$4,000,000-$5,999,999	0.00%	0
>$6,000,000	0.00%	0

Q5: Number of FTEs employed in preparedness activities.

Answered: 124
Skipped: 10

Answer Choices	Response Percent/Response Count	
<5 FTEs	85.48%	106
5–10 FTEs	12.90%	16
11–24 FTEs	1.61%	2
25–99 FTEs	0.00%	0
100–249 FTEs	0.00%	0
250–499 FTEs	0.00%	0
>500 FTEs	0.00%	0

Q6: Is your department recognized by NACCHO as being Project Public Health Ready (PPHR)?

Answered: 124
Skipped: 10

Answer Choices	Responses Percent/Response Count	
Yes	33.87%	42
No	56.45%	70
Don’t Know	9.68%	12

Q7: Please check all preparedness activities conducted by your department.

Answered: 122
Skipped: 12

Answer Choices	Responses Percent/Response Count	
Participates in EPI-X	77.05%	94
Participates in NEDSS	31.15%	38
Sends and Receive Electronic Health Messages	85.25%	104
Electronic Syndromic Surveillance System	77.05%	94
Capability to Electronically Receive and Report Laboratory Information	73.77%	90
Participated in A CBRN Exercise	62.30%	76
Rapid Method to Send Messages to Partners in the Community	85.25%	104
Demonstrated Ability to Manage the Strategic National Stockpile (SNS)	85.25%	104

Q8: In budgeting for preparedness, does your department use any of the following?

Answered: 124
Skipped: 10

Answer Choices	Responses Percent/Response Count	
Cost-Benefit Analysis	12.90%	16
Risk Analysis	22.58%	28
Return on Investment Analysis (ROI)	4.84%	6
Cost-Effectiveness Analysis	14.52%	18
Strategic Planning	19.35%	24
Hazard Vulnerability Analysis	41.94%	52
If None, Please Go to Question 14.	43.55%	54

Q9: If your department uses cost-benefit analysis in developing and evaluating preparedness budget decisions, please estimate the percentage of preparedness budget decisions impacted by cost-benefit analysis.

Answered: 24
Skipped: 114

Answer Choices	Responses Percent/Response Count	
<10%	25.00%	6
10%–25%	58.33%	14
26%–50%	8.33%	2
51%–75%	0.00%	0
76%–100%	8.33%	2
Total Respondents		**24**

Q10: If your department uses risk analysis in developing and evaluating preparedness budget decisions, please estimate the percentage of preparedness budget decisions impacted by risk analysis.

Answered: 36
Skipped: 102

Answer Choices	Responses Percent/Response Count	
<10%	38.89 %	14
10%–25%	22.22%	8
26%–50%	33.33%	12
51%–75%	5.56%	2
>75%	0.00%	0
Total Respondents		**36**

Q11: If your department uses ROI analysis in developing and evaluating preparedness budget decisions, please estimate the percentage of preparedness budget decisions impacted by ROI analysis.

Answered: 18
Skipped: 120

Answer Choices	Responses Percent/Response Count	
<10%	66.67%	12
10%–25%	22.22%	4
26%–50%	0.00%	0
51%–75%	0.00%	0
>75%	11.11%	2
Total Respondents		**18**

A12: If your department uses cost-effectiveness analysis in developing and evaluating preparedness budget decisions, please estimate percentage of the preparedness budget decisions impacted by cost-effectiveness analysis.

Answered: 28
Skipped: 55

Answer Choices	Responses Percent/Response Count	
<10%	50.00%	14
10%–25%	21.43%	6
26%–50%	21.43%	6
51%–75%	0.00%	0
>75%	7.14%	2
Total Respondents		**28**

Q13: If your department uses hazard vulnerability analysis in developing and evaluating preparedness budget decisions, please estimate the percentage of preparedness budget decisions impacted by hazard vulnerability analysis.

Answered: 52
Skipped: 86

Answer Choices	Responses Percent/Response Count	
<10%	19.23%	10
10%–25%	46.12%	24
26%–-50%	23.08%	12
51%–75%	3.85%	2
>75%	7.69%	4
Total Respondents		**52**

Q14: Finally, how would you rank your department's preparedness level on the following scale? Choose the one that best describes your situation.

Answered: 126
Skipped: 6

Answer Choices	Responses Percent/Response Count	
Capable of Managing Any Man-made Disaster	4.76%	6
Capable of Managing Any Natural Disaster	9.52%	12
Capable of Managing Most Man-made Disasters	14.29%	18
Capable of Managing Most Natural Disasters	57.14%	72
Only Capable of Managing Small-Scale Man-made Disasters	4.76%	6
Only Capable of Managing Small-Scale Natural Disasters	7.94%	10
Not Capable of Managing Any Man-made Disasters	1.59%	2
Not Capable of Managing Any Natural Disasters	0.00%	0
Total Respondents		**126**

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APPENDIX B. COMMENTS FROM RESPONDENTS

Q6: Is your department recognized by NACCHO as being Project Public Health Ready (PPHR)?

- Waiting for approval by NACCHO
- Applying this year

Q7: Please check all preparedness activities conducted by your department.

- Currently taking another look at our security for SNS
- Planning, training, exercising, responding, participating in preparedness activities with partner agencies, and more
- EPI-X and NEDSS would be through FDOH Central Office and view only for this health department.
- Member of the local EOC

Q8: In budgeting for preparedness, does your department use any of the following?

- Funding received is for 4 FTEs only, not projects
- The state bureau determines our funding amount from federal funds and sets spending constraints
- Staffing and activities to meet grant deliverables
- Planning around PHEP Capabilities, etc.
- We strive to meet the benchmarks established in the agreement with the state. We also strive to be a convener and active partner with our three counties in emergency preparedness planning and exercises.
- State of Michigan dictates what level of revenue we receive.
- Politicians don't want objective information.

Q14: Finally, how would you rank your department's preparedness level on the following scale? Choose the one that best describes your situation.

- Capable with partners of managing most natural disasters (exception: major earthquake)
- Capable of also handling most man-made disasters
- Equal ability to manage most man-made and natural disasters.
- Also capable of managing most man-made disasters, but not given option to select more than one.
- Capable of managing small scale man-made disasters and most natural disasters, we just don't have the depth of staffing.
- Can handle natural and man-made disasters, however could not handle nuclear or catastrophic natural
- Capable of managing BOTH Most man-made and natural disasters
- Also could manage most natural disasters
- No one is Capable of Managing any Disaster only "Mitigating" them look at New Orleans or Joplin MO

- Most natural and some man made. No option here for any or some of both?
- This all depends on scale so difficult to answer question as posed
- Cannot ck more than 1 but could add most manmade disasters also
- We can handle the flu

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