Disaster Evaluation:
Why Use A Comprehensive "Eight-Step Approach"

by

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Bachelor of Philosophy, University of Pittsburgh, 2017

Submitted to the Graduate Faculty of the

Graduate School of Public Health in partial fulfillment

of the requirements for the degree of

Master of Public Health

University of Pittsburgh

2021

UNIVERSITY OF PITTSBURGH

GRADUATE SCHOOL OF PUBLIC HEALTH

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Abstract

This thesis focuses on the potential for comprehensive, scientific, public health evaluations to affect policy development by conducting a retrospective literature investigation of studies and evaluations published in the aftermath of Hurricane Katrina. Using Ricci et al.'s *Disaster Evaluation Research: A field guide* as a model of comprehensive evaluation, 161 articles were winnowed down to 73 that were then reviewed in three ways. The articles were categorized based on time-frame of focus (more or less than two weeks after Hurricane Katrina's landfall); and their topic within Ricci et al.'s "List of Emergency Public Health Activities." To identify the comprehensiveness of the articles, four core components of the "Eight-Step Approach" were highlighted and used as a comparison measure. Ultimately, eight articles met the criteria for comprehensiveness. This exercise demonstrates the lack of comprehensive evaluations following one of the most significant disasters in US history and discusses its effects on policy development and the disaster cycle.

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Preface

This work is one small piece in the history of scientific disaster evaluation studies, which would not be what it is without the pioneering work of the Task Force on Quality Control on Disaster Management and its partners. I am immensely lucky and grateful to have worked with Dr. Ricci throughout this thesis process, not only learning about the "Eight-Step Approach" in great detail, but also gaining other pieces of wisdom in our conversations over the years, starting with, "You should consider public health…" Thank you for everything.

I extend a special thank you to the members of my committee with whom I have had the pleasure of studying during my time at Pitt and once more during this thesis project.

Finally, thank you to my family, friends, and loved ones who have supported me over the years in countless ways. Thank you for your endless consideration and thoughtfulness.

1.0 Introduction

In the aftermath of Hurricane Katrina, America questioned the effectiveness of the disaster relief effort within local, state, and federal levels of government. Personal testimonies from survivors and responders, news articles from national syndicates, governmental reports, and academic research from a myriad of universities have commented on Katrina's effects on individuals and communities. The current narratives and reports do not effectively or comprehensively identify systematic gaps in preparation and response. This ultimately affects the response, recovery, and preparedness for future disasters (the disaster cycle). Amidst the multitude of theories, conjecture, and opinions, there is a scientific framework and process that can guide scientific assessment of the medical and public health response and then lead to suggestions for procedures of preparedness and response. This method is evaluation.

By using scientific methods to evaluate social programs, scientific evaluation gained traction in the 1960s with the passage of the Great Society programs (Patton, 2015) due to the scarcity of funds and a plethora of social problems (Patton, 1997). While evaluation is typically focused on programmatic interventions, its principles can apply to much larger systems and events like disasters.

Comprehensive evaluations are difficult to design and carry out in the aftermath of largescale disasters. However, such evaluations can be very useful to inform future preparedness and response efforts. Comprehensive scientific evaluation is based upon a broad conceptual frame (structure, process, and outcomes) and objective methods to collect and analyze data. One example of a comprehensive scientific evaluation approach that can be applied to disaster response is

described in Ricci et al. *Disaster Evaluation Research: A field guide*. The approach provides detailed guidance for the design and conduct of comprehensive evaluations, following large scale disasters.

Within the Ricci et al. "Eight-Step Approach" I have identified four main components critical for comprehensive scientific evaluation: (1) inclusion and collaboration with stakeholders, (2) a discussion of the theory underlying the intervention program (ideally displayed as a logic model), (3) a sampling method to guide the collection of medical and public health data, and (4) a scientific design (usually based on a mixed-method approach). The "Eight-Step Approach" details steps tailored for the difficult conditions evaluators face when applying scientific evaluation methods following large scale disasters (such as an interdisciplinary team, scout surveys, etc.—and will be discussed later in more detail).

The "Eight-Step Approach" (since its quite recent publication in 2019) has not yet been applied to any recent disasters; however, it can provide a useful lens for examining past disaster evaluation studies. The infamous 2005 Hurricane Katrina destroyed the city of New Orleans, caused a mass exodus, and left a lasting mark on US geographic, economic, cultural, and political history. Katrina—both a man-made disaster and a natural disaster—is a remarkable opportunity to "back test" this method. The response to Katrina has been subject to many academic studies and discussions, claiming an evaluative perspective. In these academic investigations, scientists seek to perform some type of scientific evaluation that assesses intervention and response success or failure and provide commentary on the recovery process or lack thereof. Within the medical and public health field, these evaluations are narrowly focused on a small aspect of the totality of the disaster event, creating a fragmented picture of a larger event. However, amid these narrowly

focused ‘spirit of evaluation’ studies, a few contain the four main evaluation core components demonstrated in the Ricci et al. method.

However, the lack of comprehensive evaluations following large disasters has the unfortunate consequence of sowing uncertainty regarding the success or failure of the disaster response. While the resultant devastation and destruction leaves many assuming that more should have been done, it does not identify if more *could* have been done. This failure to measure the effectiveness of the disaster response and recovery effort results in decision making about future disaster preparation and response that is grounded in speculation and specious judgement, rather than scientific methods and findings. Ultimately, the aim for comprehensive evaluation is to find its home in the domain of lawmakers who can use it to create policy, minimizing the arbitrary personal, structural, and cultural destruction from such catastrophes that will only continue over time.

1.1 Summary of Thesis

Evaluation science, in the form of a broad, comprehensive, framework, looks—both individually and collectively—at structure, process, and outcome variables. Such a framework has not yet been used in disaster evaluation studies. The purpose of this thesis is to describe one complex disaster, Hurricane Katrina, report and assess the studies that have been done, and then, compare the methods and design used in those studies to the “Eight-Step Approach” to assess what more could have been learned had a comprehensive evaluation approach been applied.

This thesis is divided into three main parts: Background, Methods, and Results and Discussion. 1) An extensive background section describes the disaster (Section 2.1), and the history and relationship of disaster research and public health (Section 2.2). In addition, the evaluation section (Section 2.3) contains a brief history of evaluation (Section 2.3.1), discusses the general evaluation guidelines and application (Section 2.3.2), and finally focuses on Ricci et al.'s work *Disaster Evaluation Research: A field guide* (Section 2.4).

2) The methods section discusses the inclusion of the "Eight-Step Approach" in the design of this literature investigation of 161 articles related to Hurricane Katrina that potentially employed evaluation principles. 3) A results and discussion section follows in which I examine the significance of the results and attempt to illustrate how research and policy gaps may have been avoided had a comprehensive disaster evaluation been conducted.

2.0 Background

Section 2.1 (Hurricane Katrina) provides the history and context surrounding Hurricane Katrina utilizing the disaster cycle as a guide. Following the terrorist attacks on September 11, 2001, several disaster preparedness plans and initiatives were implemented in the United States: these were put to the test during the response to Hurricane Katrina. The results of these policies and actions are described briefly to provide some context for the lessons learned and subsequent policies passed. This discussion provides background for a description of the role of comprehensive scientific evaluation in the examination of the preparation and response to future disasters.

Section 2.2 (Disaster Research & Public Health) illustrates that public health has always been involved and concerned about disaster preparation, response, and recovery focusing on a variety of indicators to determine the effectiveness of a response—hence the plethora of research studies. As researchers determine the best way to improve the disaster cycle, there are important ethical implications to be considered that should remain at the center of comprehensive scientific public health evaluation while evaluators ultimately work to improve outcomes.

Section 2.3 (Evaluation) describes the History (2.3.1) and development of evaluation to create effective measurement guidelines. In describing the history and Evaluation Guidelines and Application (2.3.2), the evaluation process, theories, and methodology become clearer and provide a context for Ricci et al.'s "Eight-Step Approach" for comprehensive disaster evaluation.

Section 2.4 (Disaster Evaluation Research: A field guide) summarizes Ricci et al.'s method, highlights and describes the eight key steps, and concludes the background section by providing needed context for the following Methods section.

2.1 Hurricane Katrina

Hurricane Katrina made landfall in the morning of August 29, 2005, which triggered the breach of several levees, led to severe flooding, and ultimately submerged 80% of New Orleans. The recovery took years. (Fussell, Sastry, & Vanlandingham, 2010). Prior to Katrina's arrival, United States Northern Command (USNORTHCOM) [1] initiated alerts and began coordinating the disaster response. The Department of Defense (DOD) began troop and supply deployment preparations and President Bush declared a State of Emergency on August 30th. On August 31st, he declared Hurricane Katrina an Incident of National Significance[2] (Kochems, 2005). By September 14th, an estimated 41,000 people had evacuated to 133 American Red Cross shelters in Louisiana (Greenough et al., 2008). 23,000 of those were later evacuated to the Reliant Astrodome Complex (RAC) in Houston, Texas. The coast guard saved 24,000 lives and medically evacuated 9,000 people (Carafano & Keith, 2006). More than 1,800 people died and over 200,000 homes were destroyed, leaving 800,000 homeless (Nemeth et al., 2012).

Many public health concerns ensued during the disaster response: sanitation, illness, injury, and death from exposure (Lister, 2005), increasing numbers of disease vectors (Rabkin, 2005), and

[1] USNORTHCOM coordinates the response of the DOD and civil authorities in homeland defense.
[2] A procedure necessary for the Department of Homeland Security (DHS) and DOD to activate (Kochems, 2005).

mental health issues (Rowe & Liddle, 2008). Citywide infrastructure was destroyed, including electrical and transportation systems, hospitals, communication services, schools, sewage treatment plants, police and fire departments, and mortuary services (Weeks, 2007). Approximately 950,000 people became eligible for the Federal Emergency Management Agency's (FEMA) disaster assistance programs, with 120,000 residing in emergency FEMA trailers and mobile housing (Norris & Rosen, 2009). Louisiana was devastated and the economic effects were seen nationwide as gasoline prices fluctuated due to port damage in the Gulf (Rabkin, 2005).

However, Hurricane Katrina did provide one service: it exposed the weaknesses contained in the Department of Homeland Security's (DHS) (established in 2002) National Response Plan (NRP) (passed in 2004), and other policies like the Robert T. Stafford Disaster Relief and Emergency Assistance Act (passed in 1998) (Lister, 2005)[3]. Governmental reports following the Hurricane Katrina response identified systematic problems in several agencies, specifically, the management of international financial aid and in-kind donations (Office, 2006b), the lack of comprehensive training plans for the military (Office, 2006a), incomplete disaster response policies and plans, and conflicting leadership roles (W. O. Jenkins, Jr., 2009). One report, *The federal response to Hurricane Katrina: lessons learned* identifies 17 lessons and describes necessary systematic and programmatic changes for future disaster response preparedness[4]

[3] Although, early disaster reports indicate some processes were streamlined during the national response due to these pre-existing plans. Inter-state communications and specimen surveillance systems communicated effectively throughout the response. The military (DOD) had taken preemptive precautions which contributed to its life-saving response (Office, 2006a).

[4] (1) National Preparedness (2) Integrated Use of Military Capabilities (3) Communications (4) Logistics and Evacuations (5) Search and Rescue 6) Public safety and security (7) public health and medical support (8) human services (9) Mass Care and Housing (10) public communications (11) critical infrastructure and impact assessment (12) environmental hazards and debris removal (13) foreign assistance (14) non-governmental aid (15) training,

(Townsend, 2006). To address the limitations noted in the governmental reports, Congress passed the Post-Katrina Emergency Management Reform Act of 2006 (the Post-Katrina Act), which reorganized FEMA, clarifying the agency's responsibilities, and establishing its organizational autonomy[5] (Bea et al., 2006). In 2008, FEMA published the National Response Framework (NRF), and Congress passed the National Disaster Housing Strategy in 2009 (W. O. Jenkins, 2010) contributing to effective disaster preparation and response roles (Sapat, Yanmei, Mitchell, & Esnard, 2011).

2.2 Disaster Research & Public Health

An accurate object model of a disaster affects the disaster preparation, recovery, and response and explicit disaster definitions help determine recovery methods and research validity. There are five different disaster categories: natural, epidemic, technologic, famine, and violent conflicts (Quarantelli, 2001). The crisis of sudden natural and technological events (i.e., hurricanes, earthquakes, structural collapse, radiation fallout, etc.) create a need for social and public health interventions (Quarantelli, 2001). This is primarily seen in emergency response where undamaged sectors provide needed support when the affected area does not have enough supplies to mitigate the effects of the disaster (Sudnes, 2014).

exercises, and lessons learned (16) homeland security professional development and education (17) citizen and community preparedness (Townsend, 2006)

[5] By 2015, FEMA still had yet to adopt four of the proposed criteria (Currie, 2015).

With a hurricane (and its subsequent flooding), maintaining safe water, food, and sanitation systems, while instituting protective measures against exposed toxic substances and vectors, is crucial throughout disaster recovery. Public health assessment and surveillance helps ensure the safety of the water, food, and sanitation systems until the area becomes stable. When the area is stable, focus is placed on disaster assessment and preparation, where lessons learned from the previous disaster are implemented (Noji, 1997). Hospital surveillance, using morbidity and mortality measures, can be one way of assessing disaster preparedness plans (Bourque L.B., 2007). Academic research studies can also provide a disaster assessment using a scientific intervention. All disaster interventions need to be reassessed before implementation because of the ever-changing response statuses and community needs (Sudnes, 2014).

Disaster intervention design and assessment should involve local stakeholders: research partners, experts, and lay persons (such as survivors and their families) as members of advisory boards (Mezinska, Kakuk, Mijaljica, Waligóra, & O'Mathúna, 2016; Fleishman, Collogan, & Tuma, 2014). Collaboration and research coordination with these stakeholders, humanitarian organizations, and non-profits ease participant burden, reduce research duplication, and maintain the research agenda post-disaster (Fleishman et al., 2014) Additionally, these humanitarian and nonprofit organizations could ensure the proper stakeholders are involved in research and provide insight on ethical matters (Mezinska et al., 2016).

In disaster research, there are ethical concerns about the trauma and burden of research when working with vulnerable populations. Women, children, the elderly, the impoverished, undocumented immigrants, and minorities are all negatively and diversely affected by disasters (Bourque L.B., 2007). These groups are considered vulnerable because are more likely to be taken advantage of or mistreated in research (Collogan, Tuma, Dolan-Sewell, Borja, & Fleischman,

2004) and they may not be able to protect themselves (Fleishman et al., 2014). The Institutional Review Board (IRB) may impose mitigating factors on disaster research studies to protect vulnerable research participants and limit their exposure to risk (Collogan et al., 2004) creating one IRB to oversee all disaster research may be one way to maintain research standards for vulnerable participants (Fleishman et al., 2014).

The ethical concerns surrounding mental health research of disaster victims is a prevalent discussion in disaster-based research. Following a disaster, many individuals face mental health issues, and researchers have worried about their research activities re-traumatizing a disaster victim and leading to more severe mental health illness. However, a person's mental health status after a disaster is determined more by pre-disaster characteristics than by the type of disaster experienced[6] (Bourque L.B., 2007). Study participation may result in emotional distress, but the cause of the distress is not a result of participation, nor does it traumatize people as the disaster itself would. A person may be aware of the emotional distress caused by past trauma which involves uncontrolled and unpredictable events, unlike the controlled and predictable environment of the study. Additionally, participants who experience this distress do not blame the research experience for their distress, indicating that the project is not seen as the source of the harm (Collogan et al., 2004). However, researchers should also make clear to participants that study participation is not a source of clinical care and participants should seek professional clinical help if they need it (Fleishman et al., 2014).

[6] Although, human-caused disasters (violence, war, etc.) usually result in higher results of negative mental health effects (Bourque L.B., 2007).

These ethical concerns must remain at the forefront of evaluation work. As researchers work to improve outcomes and save lives, failed ethical standards sabotage that mission at the outset, diminishing its value and undermining its applicability and contributions at the policy level: providing sound suggestions to save lives and minimize costs.

2.3 Evaluation

2.3.1 History

Preliminary evaluation efforts began in the early 20th century (1907-1927), where statistics were applied for evaluation purposes. The statistical measures of this time were then supplemented with additional information—such as program status updates, a list of activities performed, and indicators identified—for comparative ratings necessary for ranking public services. Before the 1930s, evaluation guides provided a historical perspective and the use of community appraisals contributed to advocates supporting the significance of evaluation (Suchman, 1967). One of the earliest disaster researchers was Samuel Henry Prince (1920). His sociology thesis at Columbia University, *Catastrophe and Social Change*, was the first systematic disaster study (Scanlon, 1988). Before World War I, evaluators looked at education and public health interventions for reducing morbidity and mortality from infectious diseases. Pioneering evaluation efforts began in the 1930s and expanded during and after World War II as the US army researched morale, personnel policies, and propaganda. After World War II, private and federal programs spent money

on international and domestic social support programs. With substantial funds contributed, lawmakers demanded proof of results (Rossi, Lipsey, & Freeman, 2004).

By the 1950s, evaluation grew worldwide, and in the 1960s, seminal evaluation works[7] on evaluation research methods indicated the growth of a specialty field (Rossi et al., 2004). In his text, Suchman identifies the purpose of evaluation as the ability to use science to solve social problems (Patton, 2015). However, evaluations from 1960 were mostly unused and poverty persisted despite the Great Society social programs (Patton, 1997). Historically, evaluations are most common among small intervention programs, though experimental designs can be used for complex systematic program evaluation (Weiss, 1993).

Program evaluation developed out of scarcity: If we know that there are not enough funds to solve every complex problem and that not every complex problem *can* be solved, then it needs to be clear which ones are worth solving (Patton, 1997). In evaluation for social programs, the frequent question " 'What are we getting for the money we are spending?' can be expanded into three: 'What is your program… trying to achieve?' 'How will its effectiveness be determined?' ... 'How did it perform?'" (Ricci & Nolan, 2009, p.2). When programs appeared ineffective, the focus on financial accountability and management increased, and skeptics questioned social science methods and initiated cutbacks (Rossi et al., 2004).

More books were published in the 1970s and the first journal was developed[8] (Rossi et al., 2004). During this decade, quantitative and qualitative methodologies became more prominent, using social science and professional skills (Newcomer, Hatry, & Wholey, 2015). However, less

[7] Suchman in 1967 and Campbell in 1969
[8] *Evaluation Review* (1977)

funds were dedicated to evaluation due to the Government Accountability Office (GAO) reporting that the evaluation results were inaccessible. This inaccessibility resulted in lack of use when distributed to congress and the public (Patton, 1997). Evaluators Carol Weiss, Peter Rossi, Susan Salasin and Howard Davis sought to rectify the perception of obscure evaluation results and their work has contributed to the use of evaluation in public policy (Patton, 2015).

In 1984, the Evaluation Research Society and the Practitioner-Oriented Evaluation Network combined to form the American Evaluation Society, establishing and refining evaluation standards throughout the 1990s (Patton, 1997). In 1997, Patton identified the need for a framework to create an accessible, comprehensive evaluation protocol called 'Utilization Focused Evaluation' (UFE) which has been part of evaluation discussions since its introduction to the field. Due to its emergence as a management measure, evaluation has grown into a professional field with university training and defined ethics, and practice principles established by the American Evaluation Association (Ricci & Nolan, 2009).

2.3.2 Evaluation Guidelines & Application

Evaluation research emerged from the needs of public agencies and legislatures to assess the value of public health programs and agencies (Suchman, 1967). Questions about the quality of program operations and their resulting impact can be systematically addressed through program evaluation studies. This process can involve data monitoring and/or a one-time study. Evaluation approaches are based on social science methodologies and a set of professional standards (Newcomer et al., 2015). Evaluation science and research involve using a scientific design and clear procedures for data collection and analysis to determine the worth of an intervention. As a

result, the value of a program is proven rather than asserted (Ricci & Nolan, 2009; Suchman, 1967).

There are three general types of evaluations: managerial, economic, and experimental. Managerial evaluations are used for monitoring performance on an ongoing basis to make sure the program is implemented as designed. Economic evaluations focus primarily on the costs of the program and the benefits received relative to the costs. Experimental evaluations attempt to measure cause and effect and are useful when a new program is being designed or to rigorously determine when an existing intervention is having the desired effect within the environment in which it is being applied (Ricci, 2019).

There are various methodologies and approaches that may be used in evaluation. A constructionist evaluation approach acknowledges and devotes attention to the various stakeholders in a program and their perceptions and experiences. Developmental evaluation is useful when designing new programs. Evaluation in this stage can guide new project creation, modification to current projects, and system alterations (Patton, 2015).

A logic model can be used to outline the most important parts of an evaluation: "… structure, process, outcomes, costs, and need" and demonstrates how project resources contribute to short, medium, and long-term outcomes (Ricci & Nolan, 2009, p.7). The logic model details a project plan, hypotheses, and ultimately program theory, providing a guideline for the evaluation. The extensive detail required makes it an important planning tool and should be developed before project implementation. In evaluation research, some studies incorporate scientific experimental principles to test the value and effects of an intervention (Ricci & Nolan, 2009).

Steps/checklist procedures may guide evaluation implementation. For example, *Disaster Evaluation Research: A field guide* co-author Sudnes proposes a 22-step procedure for intervention

implementation. Only when all steps are complete is the intervention complete. Each of these 22 steps may be considered a benchmark in itself and can also be used as a guide for scaling down the project. Sudnes also identifies situational factors and background considerations surrounding project implementation such as:

> "(a) mission; (b) organisation of the project; (c) methods (projects, instruments, collaborating partners, etc.) that will be employed; (d) culture, religions, customs, and language of the affected population (beneficiaries of the intervention); (e) geography of the affected area into which they will be deployed; (f) public health specifics; (g) timelines; (h) monitoring systems; (i) other projects underway in the area; and (j) reporting mechanisms" (Sudnes, 2014, p.3).

When an organization requests an evaluation, they are responsible for implementing the project activities to complete the evaluation (Sudnes, 2014). Due to the number of organizations and stakeholders involved in a project, the goals may be broad to meet all stakeholder needs rather than the specific and measurable goals most useful in evaluation (Weiss, 1993). When programs and organizations do not have clearly identified goals or measures, the evaluator may be required to build the criteria to determine the outcomes (Newcomer et al., 2015). Because the development of the evaluation plan is created with stakeholders and could be integrated in a complex system, deviations from the plan require detailed explanation, resulting in additional administrative tasks (Sudnes, 2014).

Underlying these evaluation procedures and best practices are a set of professional standards that all scientific evaluation studies are expected to meet. Although they are not widely used in the field of public health, these four standards are nonetheless important as they contribute to the overall quality and utility of each evaluation study. The standards as described by Patton in

his Utilization Focused Evaluation (UFE) approach are: 1) utility, the extent to which people find the study useful and implement it; 2) feasibility, the ability to effectively carry out the evaluation; 3) propriety, following all ethical standards; and 4) accuracy, producing work according to professional quality control standards (1997). Evaluation standards remain the same across evaluation type and the power of an evaluation is determined by usefulness. Ensuring that stakeholders are part of the evaluation discussion and users are trained to utilize results leads to feelings of ownership and application of the evaluation results (Patton, 2015).

In complex systems, there is no central control, but rather the interaction of independent elements, contributing to emergent sophisticated behaviors and development (Patton, 2015). Unless an evaluator can decipher the important nuanced and hidden goals and priorities of a program, the evaluation criteria may very well be meaningless and lack the power necessary for change (Weiss, 1993). For evaluation to be the most effective, it needs to influence decisions, be in alignment with the goals of decision-makers, and encourage new and helpful perspectives (Weiss, 1993).

2.4 Disaster Evaluation Research: A field guide

Disasters are events that overwhelm a community, pushing it beyond its resilience limits, requiring outside assistance, and affects the community's health, safety, social networks, and infrastructure. Operating in a cyclical system (i.e., preparedness, response, and recovery), requires comprehensive scientific evaluations to improve future preparedness and response efforts. Combined cross-disciplinary approaches of engineering, medical, and public health research lead

to improvements in disaster related morbidity and mortality rates, seen in disaster epidemiology's focus on surveillance of casualty management and disease burden within a population over time. However, disaster evaluation focuses on the whole disaster response system and the function of each component. Ricci, Pretto, and Sudnes (2019), identify eight important steps for carrying out an effective comprehensive scientific disaster evaluation.

2.4.1 Overview of the Ricci et al. "Eight-Step Approach"

Step 1: Form the Stakeholder Group

In any evaluation, involving stakeholders is necessary for creating an evaluation useful to the participants. Because the disaster situation is complex and political, the stakeholder group should vary between professionals (system controllers/administrators), payers (organizations with concrete monetary investments), politicians, and the public, all of whom are identifiable from a variety of grey materials. Ideally, there would be three stakeholder meetings to create a comprehensive disaster evaluation plan and the group members would be articulate and dedicated individuals who believe in the value of the evaluation with the power to influence change (Ricci, 2019).

Step 2: Formulate Evaluation Questions

There are five basic categories of evaluation information[9] required to identify medical and public health issues. These questions match with a logic model as they focus

[9] "Structure (available resources for the Disaster response… Process (activities) followed in carrying out the response… Outcomes (effects of activities) that were achieved (or not)… Adequacy of the disaster response… Cost of the response" (Ricci, 2019 p.74).

on the available resources for disaster response, activities, and outcomes. In the end, these questions will guide judgements on the adequacy of the response and corresponding costs (Ricci, 2019).

Step 3: Construct the Logic Model and Research Design

While historical evaluations have operated in various experimental designs and models and modes of data collection, the "Eight-Step Approach" advocates for a logic model design to bridge the multi-disciplinary nature of a comprehensive evaluation. With a logic model guiding study design, mixed-methods are encouraged for a holistic approach. The four mixed-method designs are: convergence, data transformation, validating qualitative data, and multilevel mixed-methods (Ricci, 2019).

Step 4: Prepare Mixed-method Data Collection Instruments

Data collection should include the basic set of variables as seen in Ricci et al.'s Table 8.1. There are four main methods of disaster evaluation data collection: (1) Observations with checklists and guides, (2) Interviews with victims groups/ individuals, (3) Professional interviews with response and recovery stakeholders and, (4) Data from existing records and forms. Data collection may involve questionnaires and focus groups. Data questionnaires have a structured, semi-structured, or open-ended design. The focus groups, if conducted well, can be a very (cost-) effective method of data collection to gather differing viewpoints on a topic. As methods for concurrent data collection and recording disaster events unfold, data collection systems will likely evolve and be implemented into evaluation study designs (Ricci, 2019).

Step 5: Construct a Sampling plan

Sampling design is a significant component of the evaluation process, due to the broad scope of its effects and the inability to account for each person's experiences. Sampling will either be random or purposive for a variety of disaster data collection systems[10] and research participants[11] (Ricci, 2019).

Step 6: Conduct a Scout Survey

Due to the broad scope of the evaluation, a scout survey is necessary to test the field collection data plan to mitigate any emerging issues. A scout survey has the best results with a full week dedicated to it and concludes with a written report. The scouting report should be read by the entire evaluation team and orient the team to the site, making them aware of the work burden and potential barriers. When the report has been compiled, it is best to meet with the stakeholder groups and community leaders once more for further discussion (Ricci, 2019).

Step 7: Select and Train a Field Research Team and Collect Data

The evaluation team should include a multidisciplinary group of individuals prepared for the physical challenges of data collection in a disaster environment. Team members should demonstrate thoughtfulness and be willing to observe and follow the established protocol. To establish the team, initial contact should be made with the disaster site's emergency coordinators and designated leading public health and government officials. The timing of evaluation activities should be coordinated with these leaders. Team training should consist of familiarization with the project, and evaluation ethics, and

[10] Medical and construction records may be useful in this step (Ricci, 2019).

[11] Participants may include: victims, residents, professional/lay responders, police/military, public officials and response coordinators, NGO staff, and medical professionals (Ricci, 2019).

cultural dynamics of the disaster location. Due to the broad scope of disasters, it is possible to have several 'sub-studies' teams which focus on specific data areas like: public health response, hospital capacity, and overall morbidity and mortality. Strict professionalism and an above-board approach must be maintained for the sake of credibility (Ricci, 2019).

Step 8: Analyze Data and Prepare a Final Report

There are four levels to data analysis for the final report: 1) description, 2) interpretation, 3) reporting findings, and 4) recommendations. Ultimately, the mixed-methods qualitative and quantitative data should match up, indicating a valid conclusion. When mixed-methods data does not match, new data can be gathered and clarified with the original sources and/or the differences may be discussed, highlighting the limitations the discrepancy presents in the study. The final report should contain the following: 1) Executive summary, 2) Project introduction, 3) Background of the event, 4) Study design, 5) Explanation of data collection, 6) Findings, 7) Recommendations, and 8) Appendices. (Ricci, 2019).

3.0 Methods

I reviewed 161 academic research articles related to Hurricane Katrina which potentially involved evaluation methods. These articles were compared to the "Eight-Step Approach", using the eight steps as a checklist. This exercise identified if an article that claimed to be evaluative truly followed a comprehensive evaluation framework such as the "Eight-Step Approach" by Ricci et al. and the principles and methods identified in Section 2.3.1 ("Evaluation History"). Because the "Eight-Step Approach" was created for comprehensive evaluation, this thesis argues that if more of the eight steps are followed, the more likely the study will be comprehensive, and therefore be more useful and effective in programmatic and policy decisions.

A convenience sample of 73 articles was curated from 161 articles in a PubMed search performed on January 21, 2021. (See Appendix A for search terms.) This search returned the 161 research articles on Hurricane Katrina from 2005-2020 on topics pertaining to medical and public health response and initiatives. From this search, articles were handpicked based on titles, key words, and abstracts for their potential relevance to evaluations performed on the Hurricane Katrina disaster response.

I gave special attention to articles that appeared to be comprehensive in nature. However, there were few broad comprehensive disaster evaluation studies. Therefore, the search expanded to include articles with the potential to meet evaluation standards, despite the fact their focus wase not broad and comprehensive among public health and emergency response activities. These disaster studies were more narrowly focused on a specific aspect of the disaster (see Figure 1 and

Table 1[12]). I screened the articles twice. In the first round of screening, I eliminated 88 articles based on their whose abstracts did not contain information about the public/medical health response to Hurricane Katrina. In the second round of screening, I excluded 34 articles that did not contain evaluation-related content. (See Figure 1.)

With the remaining 39 records, I first compared each article to the "Eight-Step Approach," questioning whether it contained the eight steps necessary for comprehensive evaluation. Steps One through Five ("Form the Stakeholder Group," "Formulate Evaluation Questions," "Construct the Logic Model and Research Design," "Prepare Mixed-method Data Collection Instruments," "Construct a Sampling Plan") were most often followed and I assumed Steps Seven ("Select and Train a Field Research Team and Collect Data") and Eight ("Analyze Data and Prepare a Final Report") were tacitly completed. Although, due to the page restrictions of the academic publication process, they were not described. However, Step Six ("Conduct a Scout Survey") was least often completed, due to the narrow topic choice and therefore, often not applicable. Additionally, few articles made concrete policy suggestions, instead making broad statements about the importance of continued research. For example, Quast writes: "However, the findings in this paper suggest that the care to some asthmatic children was interrupted and may have led to complications. Perhaps policymakers can build on the strengths of Medicaid emergency waivers to prevent similar disruptions following future disasters" (Quast, 2018, p. 6). From this surface review, no study fulfilled the "Eight-Step Approach", and in response, I reduced "Eight-Step Approach" to four

[12] Ricci et al. identifies categories in Box 4.1 "List of emergency public health activities at the community level in response to disasters" (Ricci, 2019, p.43).

fundamental evaluation components to determine the most comprehensive articles within their narrow fields of study.

These core components are: inclusion and collaboration with stakeholders (Step 1), a discussion of the theory underlying the intervention program, ideally displayed as a logic model (Step 2 and Step 3), a sampling method to guide the collection of medical and public health data (Step 3 and Step 4), and a scientific research design, usually based on a mixed-method approach (Step 5). Figure 2 demonstrates the conceptual progression of the "Eight-step Approach" to the four core components of comprehensive evaluation.

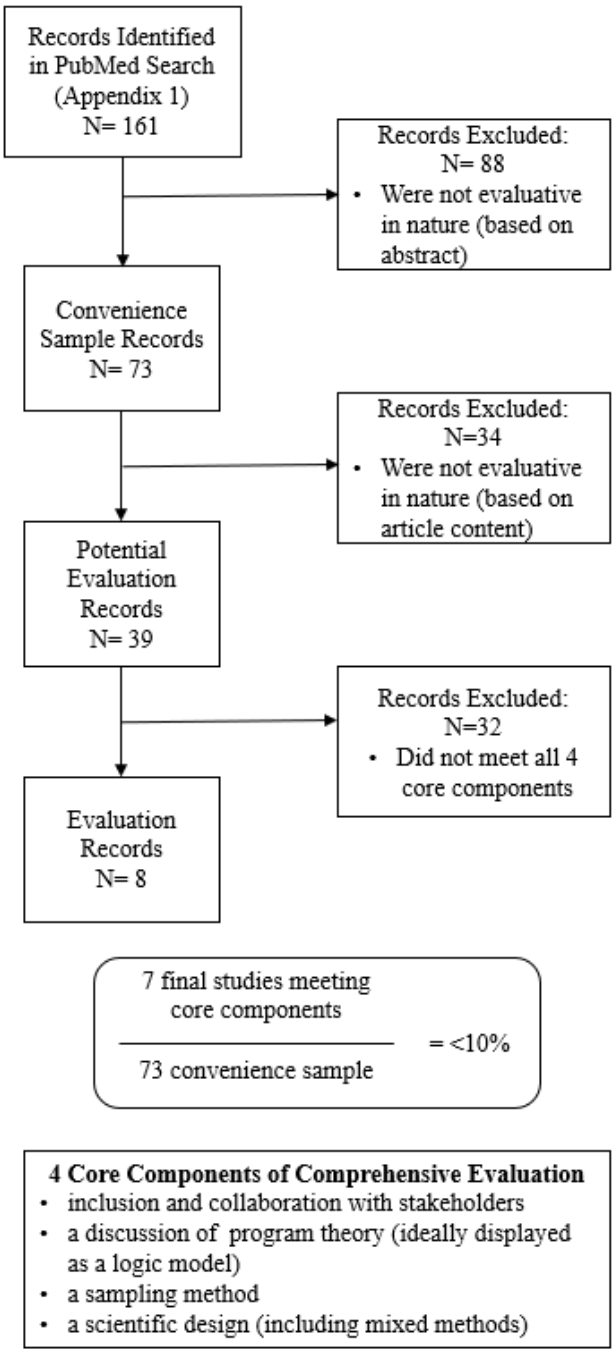

Figure 1: Screening process for Hurricane Katrina evaluation studies to identify comprehensive disaster evaluation studies

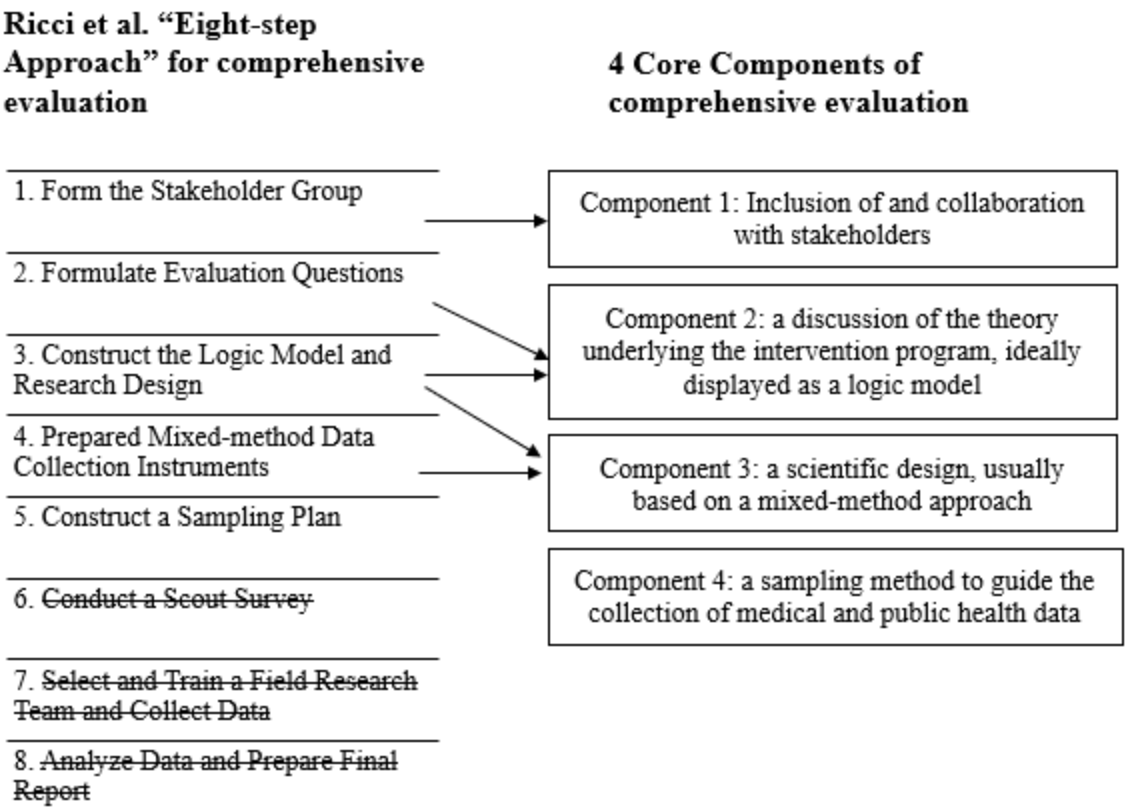

Figure 2: Developing the 4 Core Components for Comprehensive Evaluation from the "Eight-step Approach"

4.0 Results & Discussion

4.1 Academic Research Focus

I initially identified 73 articles for further review (seen in Table 1) which are divided into Short- and Long-term studies. Short-term studies focus on actions and information in the first two weeks of the disaster—the immediate disaster response. Long-term studies focus on the time two weeks after landfall, until the present day. These study topics, while varied and focused on different populations, are categorized according to Box 4.1 "List of emergency public health activities at the community level in response to disasters" (Ricci, 2019, p. 43).

Of these 73 articles, 15 were identified as 'Short-term studies.' These articles were primarily emergency response focused. The remaining 58 articles were 'Long-term studies' focusing on the months and years after Hurricane Katrina (Table 1). The lack of studies covering short-term effects (and its limit to immediate disaster response) again, is non-comprehensive. This may indicate unprepared surveillance systems, or a non-mobile system which was unable to be used in an emergency and may have contributed to the man-made disaster of Katrina.

The three categories with the most articles are 'Mental/Behavioral health care and social services' (28 articles), 'Mass casualty management' (14 articles), and 'Health (disease) surveillance (10 articles).' Aside from 'Mass casualty management', which focuses on the immediate response after the Hurricane (within two weeks of landfall), the other two categories are primarily long term focused. Of the 32 identified "Emergency public health activities" (Box 4.1) categories Ricci et al. provide only 13 are found in this convenience sample of 73 articles.

Table 1 shows the number of studies that are Short- or Long-term. As can be seen, there were far more Long-term studies than Short-term studies. This could be due to the timing of the longitudinal academic research process versus the shorter timeframe of epidemiological studies which can be performed from surveillance data. Additionally, the difference in topics between the Short- and Long-term studies in Table 1 is something to note. While some topics may seem to be more Short-term oriented than others, the topics are broad enough that they do not have a timebound application. 'Needs Identification (health and medical)' should occur in both the short-term response phase, but also in the long-term recovery phase. The few Short-term studies shows a lack of preparation for evaluation in the critical hours of disaster response—which FEMA has attempted to remedy in their NRF. Long-term studies are primarily focused on 'Mental/Behavioral health care and social services' and often covers the effects of interventions over time, speaking more to recovery than response efforts.

If disaster preparedness plans were based on comprehensive scientific disaster evaluations, there would be a wider array of Short-term and Long-term studies evenly distributed among categories of emergency public health and medical response activities which can occur in both the Short- and Long-term time frames.

Table 1 Reviewed studies categorized into Short-term and Long-term time frames with emergency public health and medical response intervention activities

Short Term (< 2 Weeks)		
Disaster Public Health Activities	**Year, Author**	
Sheltering	2012 Caillouet	
Mass casualty management	2009 Wahl 2008 McAteer 2007 Joy 2006 Franco 2006 Davis	2008 Brevard 2018 Becquart 2007 Greenough 2007 Sanford
Risk communication	2009 Cavey	
Evacuation public health emergency	2009 Broz	
Needs identification (health and medical)	2006 Rodriguez, Tocco	
Infectious disease identification, treatment, and control	2007 Yee	
Health (disease) surveillance	2005 CDC	

Table 1 Continued

Long Term (> 2 Weeks)		
Disaster Public Health Activities	**Year, Author**	
Sheltering	2011 Rendall	2015 Cheng
Mass casualty management	2013 Mack 2011 Berry 2018 Becquart	2006 Rodriguez, Aguirre 2009 Breaux
Needs identification (health and medical)	2015 King	
Infectious disease identification, treatment, and control	2007 Yee	
Health (disease) surveillance	2019 Moscona 2011 Jiao 2010 Thethi 2009 Gautam 2016 Shuler	2016 Moise 2014 Peters 2013 Peters 2011 Robinson
Mental/Behavioral health care and social services	2018 Quast, Gregory 2018 Mikolajewski 2011 Paxson 2012 Vu 2010 McLaughlin 2009 Norris, Bellamy 2012 Nemeth 2011 Legerski 2011 Olteanu 2010 Lajoie 2009 Wadsworth 2008 Kim 2013 Lowe 2011 Brown	2008 Rowe, Liddle 2010 Rowe, Liddle 2011 Tharp 2020 Lowe 2015 Oni 2007 Stephens 2008 Kessler 2012 Self-Brown 2009 Norris, Rosen 2011 Beaudoin 2010 Jaycox 2009 Potash 2008 Beaudoin 2019 Raker
Environmental hazard identification	2016 Mielke 2011 Mielke 2009 Chung	2020 Lichtveld 2009 Smith
Epidemiological services	2014 Joseph 2010 Fussell 2014 Arcaya	2012 Sastry 2010 Kanter
Restoration of public health programs, services, and infrastructure	2015 Weaver	
Environmental hazard identification	2018 Quast	
Vector control and pest management	2009 Edwards	

4.2 Spirit of Evaluation

This literature investigation sought to determine the extent to which these potential evaluation studies completed the "Eight-Step Approach" approach and therefore demonstrated characteristics of a comprehensive evaluation. While many of the steps were followed, no single study had a broad scope, followed all eight steps, or made concrete policy recommendations contributing to public health disaster preparedness and response.

During the review process, it became evident that some steps were always completed by each study. For example, Steps Seven and Eight were always completed as a properly trained research team and result dissemination is an inherent part of the academic research and publishing process. Likewise, Step Two ('Formulate Evaluation Questions') was always performed as studies attempted to answer a specific question—even if it was as broad as commenting on lessons learned.

Because very few surveys were broad in scope and primarily consisted of research in a narrow field, Step Six, ('Perform a of Scout Survey') was not applicable or mentioned in these articles. For comprehensive scientific disaster evaluations, the scout survey is necessary to test the disaster evaluation program theory and data collection systems for future evaluation application and subsequent recommendations.

With these commonalities in the article set, I thus highlighted four components as the core of comprehensive evaluation. These four categories are: 1) inclusion of and collaboration with stakeholders, 2) a discussion of programmatic theory (ideally displayed as a logic model), 3) a scientific mixed-method design, and 4) a sampling method. In the Ricci et al. "Eight-Step Approach," they correspond with Steps One, Three, and Five—"Form the Stakeholder Group,"

"Construct the Logic Model and Research Design," and "Construct a Sampling Plan." Table 2 identifies the studies that meet all four core components.

With 38 potential evaluations, the winnowing process resulted in a final count of eight studies: Franco 2006; Brevard 2008; Rowe, Liddle 2008 & 2010;[13] Berry 2011; Vu 2012; Cheng 2015; Weaver 2015; Lichtveld 2020. Weaver 2015 is the only article containing a logic model (though not in a public health format). However, because the scope of this article pertains to federal interdepartmental relationships, it remains relevant and listed with the other studies in Table 2. The remaining articles contain information about the program theory that can be extrapolated into a logic model, though they did not provide one. Due to the significance of a logic model's display of evaluation program theory, and the lack of logic models provided in the 73 article sample, an extrapolated program theory was accepted as a qualifier in my four-step core component comparison method.

While none of the 73 academic articles are based upon a broad comprehensive evaluation of Hurricane Katrina, these eight disaster evaluation studies approach what I believe to be the core of the "Eight-Step Approach." This indicates that while their research questions may not span the totality of the public health and medical preparation and response, these studies nonetheless contain key core elements of a comprehensive evaluation framework and may be applicable in the narrow focus of the study.

If less than 10 percent of the studies in this literature investigation contain the four core elements of a comprehensive evaluation, and are narrow in scope, then the larger purpose of

[13] The 2008 and 2010 Rowe & Liddle articles are counted as one study because the topic is the same: the 2008 study provides stakeholder while the 2010 article provides study results. Together the two articles fulfill the 4 requirements.

disaster evaluation research is called into question. While these studies can help form and assess interventions and methods in their own field, comprehensive scientific evaluation is necessary to effectively manage the disaster cycle and improve the medical and public health response, resulting in more lives saved while minimizing costs.

Table 2: Extent to which Studies met the four core evaluation components of the "Eight-Step Approach"

Year, Author	Title	Core 1: Stakeholders named?	Core 2: Program theory provided?	Core 3: Scientific research mixed-method design used?	Core 4: Sampling plan used?		
Ricci et al. "Eight-Step Approach"		*Step 1: Form the Stakeholder Group*	*Step 2: Formulate Evaluation Questions Step 3a: Logic Model included?*	*Step 3b: Was a Mixed-Method design used ? Step 4: Prepared Mixed-method Data Collection Instruments*	*Step 5: Construct a Sampling Plan*	*Timing*	*Topic*
1. 2006, Franco et al.	Systemic Collapse: Medical Care in the Aftermath of Hurricane Katrina	• Health Care Professionals • Hospital Administrators • Public Health & Gov't Officials • Academic Medical Center Staff	What are the key institutional and systemic responses that attempted to provide medical care for Hurricane Katrina? How can we improve these responses in future disasters? *Indicators:* • *Supply availability* • *Hospital response plans* LM not included	Multi-Level Mixed-Methods • Interviews • Literature review	Purposive	Short-term	Mass casualty management
2. 2008, Brevard et al.	Analysis of Disaster Response Plans and the Aftermath of Hurricane Katrina: Lessons Learned From a Level I Trauma Center	• Emergency Medicine Residents • Surgery Residents • Hospital Staff	How does the disaster preparedness of a Level I Trauma Center compare with their performance in an actual disaster? *Indicators:* • *Hospital master disaster plan* • *Code gray annex* LM not included	Convergence • Observations • Checklists	Purposive	Short-term	Mass casualty management
3. 2008 & 2010 Rowe, Liddle et al.	When the Levee Breaks: Treating Adolescents and Families in the Aftermath of Hurricane Katrina	• Communities • Families & Children • Clinical Providers • School Systems	How do family risk factors relate to PTS and substance use in teens post disaster? *Indicators:* • *Hurricane impact* • *Pre-disaster risk factors* • *Post-disaster risk factors* LM not included	Convergence • Adolescent Diagnostic Interview-Light • Diagnostic Interview Schedule for Children Predictive Scales • Additional questionnaires • PTSD Checklist • PTSD Reaction Index	Systematic Random Sample	Long- term	Mental/Behavioral health care and social services
4. 2011, Berry et al.	Care Coordination in a Medical Home in Post-Katrina New Orleans: Lessons Learned	• Health care professionals • Clinical providers • Clinic Faulty and staff	How can a nurse care coordinator improve Medical Home criteria to meet the needs of families in New Orleans post-Katrina vs. pre-Katrina? *Indicators:*	Data Transformation	Cluster Random Sampling	Long-term	Mass casualty management

Table 2 continued

			• Patients & families	• *Medical Home rating* • *Faculty training* • *Family inclusion criteria* • *Case complexity* • *Care coordination activity* • *Family receipt of services*				
				LM not included	• Observation • Data in existing records and forms			
5.	**2012, Vu et al.**	Physical and Mental Health Consequences of Katrina on Vietnamese Immigrants in New Orleans: A Pre- and Post-Disaster Assessment	• Vietnamese Americans • Immigrants • Community leaders • Health providers	What are the health impacts of a natural disaster on a major immigrant community? *Indicators:* • *Impact of Event Scale-Revised*	Validating Quantitative Data	Systematic Random Sampling	Long- term	Mental/Behavioral health care and social services
				LM not included	Pre/post data from records			
6.	**2015, Weaver et al.**	The Department of Defense and Homeland Security relationship: Hurricane Katrina through Hurricane Irene	• DOD • DHS • NORTHCOM • FEMA	How did a collaborative relationship between the DOD and DHS result in greater efficiency between departments (NORTHCOM & FEMA) in preparing and responding to Hurricane Katrina? *Indicators:* • *Communication*	Multi-Level Mixed-Methods	N/A	Long- term	Restoration of public health programs, services, and infrastructure
				• *Planning* • *Coordination* • *Number of deaths* • *Days to return to normalcy*				
				LM included	• Exercise drills • Case Study Triangulation			
7.	**2020, Lichtveld et al.**	A Community-Based Participatory Research Approach to Hurricane Katrina: When Disasters, Environmental Health Threats, and Disparities Collide	• Community members & leaders • public health officials • research scientists from academia and private firms • federal and local government	Does an intervention evidence-based intervention (from previous trials tailored to families with an exposure-reduction component and an asthma counseling component) reduce asthma morbidity? *Indicators:* • *Clinical Evaluation* • *Environmental Assessment*	Multi-Level Mixed-Methods	Systematic Random Sample	Long-term	Environmental hazard identification
				LM not included	• Two clinical evaluations • Three home assessments • Asthma symptom monitoring • Home Inspection (Visual, temperature, moisture, air and dust sampling)			

4.3 Ricci et al.'s "Eight-Step Approach," Disaster Evaluation, & Policy

In completing this literature investigation, it is clear that while scientific evaluation is a defined field, the interpretation and application of evaluation principles to disaster research is not consistent throughout the Hurricane Katrina literature. To date, there has been no comprehensive public health evaluation. Amongst narrowly focused studies (which alone would be the cause for exclusion), few met the Ricci et al. approach, or even the four core components of scientific evaluation studies. While the four core components may be helpful in their simplicity, claims of 'evaluation' in scientific academic studies (despite not meeting the four core components) weakens the evaluation field due to an inconsistent application of evaluation principles. Had a comprehensive evaluation model been developed, established, and implemented (probably through a FEMA initiative) prior to the Hurricane Katrina, it is likely a comprehensive evaluation following the disaster would have been completed—analyzing the disaster response from various entities: governmental, military, non-profit, and the public health and private sectors.

As evaluation ultimately seeks to find its place and application in policy, Ricci et al.'s "Eight-Step Approach" currently lacks guidance to link evaluation to policy. A recommendation to suggest policy is mentioned in Step Eight, but the clarity of a 'Policy Recommendation' (versus a general recommendation) requirement would encourage application of comprehensive evaluation with politicians as relevant and key stakeholders.

Additionally, I conducted a surface level policy review, looking at governmental reports and policies passed in the subsequent years following Katrina. The Post-Katrina Act established new law and amended both the Homeland Security Act and the Stafford Act. FEMA was reconfigured and its autonomy was enhanced, making it a distinct entity within the DHS (Bea,

2006). FEMA is responsible for developing the national preparedness system (Jenkins, 2010) and the FEMA Administrator (after reporting to the Secretary) can provide direct recommendations to Congress. The Post-Katrina Act also prohibits substantial limitations of FEMA and most transfers of FEMA functions or assets to other parts of the DHS (Bea, 2006).

Governmental reports primarily discussed interagency coordination and communication, any systematic issues that arose during disaster response, and primarily cited other governmental reports.[14] While governmental reports identify systematic shortcomings and suggestions for inter-agency efficiency and collaboration, systematic inclusion of comprehensive public health evaluation procedures would provide more clarity to future response and recovery processes. Between the governmental reports (focused on the federal level agency operation) and the academic articles (focused on community and geographic locations), evidence of a relationship between the two is lacking.

So, while policies and suggestions developed from 'lessons learned,' the lack of a comprehensive evaluation spanning local, state, and federal levels of government may have resulted in the missed potential for maximum effectiveness.

Application of a comprehensive method, like the "Eight-Step Approach," in the next disaster would improve the community's recovery process with multi-level stakeholder buy-in and accurate, tailored information to provide valuable contributions to disaster preparedness and response systems.

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[14] Perhaps the reason for citing other governmental reports is due to the requirements of governmental deadlines. Academic research and the journal submission process may be too long for the immediate demands of Congress and the President. While academic articles are not cited in governmental reports, this does not mean that research findings do not influence policy makers.

Comprehensive evaluation should lead to comprehensive policy recommendations. In a crisis when people are searching for effective policy, evaluation provides scientifically grounded guidelines. A comprehensive evaluation would be funded through a political process and its results would be primed for utilization among law-makers (Weiss, 1993). Without comprehensive evaluation it is difficult to devise a set of policy recommendations that are comprehensive, coordinated, interrelated, and scientifically based (all which form the basis of good policy). The inability to find a comprehensive evaluation when examining one of the largest disasters in US history leads to the belief that policy positions taken may be chosen without solid scientific support, leading to ineffective, piecemeal conclusions that may address one systematic aspect and without taking others into account.

4.4 Limitations

This work is neither a systematic review nor a critical analysis, though it has the spirit of the two in its thoughtful approach to reviewing the literature on Hurricane Katrina. Therefore, initial searches were not broad enough to ensure all relevant articles and governmental reports were part of the screening and review process. It is possible relevant articles are missing. Additionally, this work focuses primarily on academic articles and governmental reports and not on other grey materials which may have demonstrated some level of matching with the "Eight-Step Approach." Searching for Hurricane Katrina-focused governmental reports was done at a surface level. Though the reports themselves are in-depth, there are possibly others that match the criteria which were not reviewed in this study. While applied to a concrete 8-step theoretical

model, inclusion and exclusion decisions were ultimately subjective and judgement based, and study comments are observational.

5.0 Conclusion

In this thesis I have attempted to show the existence and importance of comprehensive, scientific disaster evaluation principles and its potential to aid in solid and effective policy formation. The background section provided a brief context for the effects Hurricane Katrina and the subsequent policy response to the disaster. The following discussion of disasters, public health, and evaluation provided context for the emergence and significance of comprehensive disaster evaluation and the role of Ricci et al.'s "Eight-Step Approach." I applied Ricci et al.'s comprehensive "Eight-Step Approach" to 73 relevant articles (out of 161 articles) in a literature investigation. These 73 studies were narrowly focused and investigated only one aspect of the medical and public health response to Hurricane Katrina, rather than interactions between various emergency public health activities.

Due to this narrow focus, I proposed four components to be the core of comprehensive evaluation as: 1) inclusion of and collaboration with stakeholders, 2) a discussion of programmatic theory (ideally displayed as a logic model), 3) a scientific mixed-method design, and 4) a sampling method. Among these narrow studies, only 7 studies met the four core components out of the 73 studies in the convenience sample. Because less than ten percent of the 73 studies in the convenience meet the four components of comprehensive evaluation, this leads to questions about the effectiveness of post-Katrina policies implemented throughout the country and the policies' effects on the disaster cycle.

Despite being one of the largest disasters in US history, it is clear a comprehensive evaluation framework was not applied in disaster response and recovery work, due to the inability

to find a comprehensive public health evaluation study among academic research and governmental reports (illustrated in the tables above). The "Eight-Step Approach" from Ricci et al.'s *Disaster Evaluation Research: A field guide* is one model for comprehensive disaster evaluation and could be utilized in future disaster evaluations for improving the disaster cycle. Next steps for the model would include adding a policy recommendation requirement in Step 8 of the approach, which would maximize its effectiveness by linking comprehensive disaster evaluations to policy development. With this addition in mind, the model's ultimate test is to be applied to a disaster in the field, providing key insights to the methods of comprehensive disaster evaluation.

To create effective policy, scientific evidence is necessary to support policy recommendations. Due to interrelated systems in disaster preparation, response, and recovery throughout the country, a systems perspective is necessary to understand the effects of one component on another. With limited resources, comprehensive evaluation is critical for addressing barriers to implementation and providing holistic insight into the interrelated systems, like determining whether focus should be placed on search and rescue or hospital support. Comprehensive disaster evaluation can determine how to best utilize resources for the largest effect and improve the disaster cycle resulting in more effective disaster preparation and policy development, saving lives, and minimizing costs.

Appendix 1

Complete search strategy for PubMed (January 21,2021)

(hurricane katrina[tiab] AND (english[Filter])) AND (evaluation study[PT:NOEXP] OR "evaluation studies as topic"[MESH:NOEXP] OR "program evaluation"[MESH:NOEXP] OR validation study[PT:NOEXP] OR "validation studies as topic"[MESH:NOEXP] OR (pre-[TIAB] AND post-[TIAB]) OR (pretest[TIAB] AND posttest[TIAB]) OR (program*[TIAB] AND (evaluate[TIAB] OR evaluated[TIAB] OR evaluates[TIAB] OR evaluating[TIAB] OR evaluation[TIAB] OR evaluations[TIAB] OR evaluator[TIAB] OR evaluators[TIAB])) OR effectiveness[TIAB] OR intervention[TIAB] AND (english[Filter]))

Bibliography

Bea, K., Halchin, E., Hogue, H., Kaiser, F., Love, N., McCarthy, F. X., . . . Schwemle, B. (2006). *Federal Emergency Management Policy Changes after Hurricane Katrina: A Summary of Statutory Provisions*: Federation of American Scientists.

Berry, S., Soltau, E., Richmond, N. E., Kieltyka, R. L., Tran, T., & Williams, A. (2011). Care coordination in a medical home in post-Katrina New Orleans: lessons learned. *Matern Child Health J, 15*(6), 782-793. doi:10.1007/s10995-010-0641-4

Brevard, S. B., Weintraub, S. L., Aiken, J. B., Halton, E. B., Duchesne, J. C., McSwain, N. E., Jr., . . . Marr, A. B. (2008). Analysis of disaster response plans and the aftermath of Hurricane Katrina: lessons learned from a level I trauma center. *J Trauma, 65*(5), 1126-1132. doi:10.1097/TA.0b013e318188d6e5

Bourque L.B., S. J. M., Kano M., Wood M.M. (2007). Morbidity and Mortality Associated with Disasters. In Q. E. L. Rodríguez H., Dynes R. R. (Ed.), *Handbook of Disaster Research.* New York, NY: Springer.

Carafano, J. J., & Keith, L. P. (2006). *Learning Katrina's lessons: Coast Guard modernization is a must*: Heritage Foundation.

Collogan, L. K., Tuma, F., Dolan-Sewell, R., Borja, S., & Fleischman, A. R. (2004). Ethical Issues Pertaining to Research in the Aftermath of Disaster. *Journal of traumatic stress, 17*(5), 363-372. doi:10.1023/B:JOTS.0000048949.43570.6a

Fleishman, A. R., Collogan, L., & Tuma, F. (2014). Ethical Issues in Disaster Research. In F. H. Norris, S. Galea, M. J. Friedman, & P. J. Watson (Eds.), *Methods for Disaster Mental Health Research*. New York: The Guilford PRess.

Franco, C., Toner, E., Waldhorn, R., Maldin, B., O'Toole, T., & Inglesby, T. V. (2006). Systemic collapse: Medical care in the aftermath of Hurricane Katrina. *Biosecur Bioterror, 4*(2), 135-146. doi:10.1089/bsp.2006.4.135

Fussell, E., Sastry, N., & Vanlandingham, M. (2010). Race, socioeconomic status, and return migration to New Orleans after Hurricane Katrina. *Popul Environ, 31*(1-3), 20-42. doi:10.1007/s11111-009-0092-2

Greenough, P. G., Lappi, M. D., Hsu, E. B., Fink, S., Hsieh, Y. H., Vu, A., . . . Kirsch, T. D. (2008). Burden of disease and health status among Hurricane Katrina-displaced persons in shelters: a population-based cluster sample. *Ann Emerg Med, 51*(4), 426-432. doi:10.1016/j.annemergmed.2007.04.004

Jenkins, W. O. (2010). *Disaster Response: Criteria for Developing and Validating Effective Response Plans*: United States Government Accountability Office.

Jenkins, W. O., Jr. (2009). *National Preparedness: FEMA Has Made Progress, but Needs to Complete and Integrate Planning, Exercise, and Assessment Efforts*: United States Government Accountability Office.

Kochems, A. (2005). *Military support to civilian authorities: an assessment of the response to Hurricane Katrina*: Heritage Foundation.

Lewis Jr, M., & Murray, I. (2006). *Katrina and Her Policy Waves*: Competitive Enterprise Institute.

Lichtveld, M., Covert, H., El-Dahr, J., Grimsley, L. F., Cohn, R., Watson, C. H., . . . Kennedy, S. (2020). A Community-Based Participatory Research Approach to Hurricane Katrina: When Disasters, Environmental Health Threats, and Disparities Collide. *Am J Public Health, 110*(10), 1485-1489. doi:10.2105/ajph.2020.305759

Lister, S. A. (2005). *Hurricane Katrina: the public health and medical response*: United States Foreign Press Center.

Mezinska, S., Kakuk, P., Mijaljica, G., Waligóra, M., & O'Mathúna, D. P. (2016). Research in disaster settings: a systematic qualitative review of ethical guidelines. *BMC medical ethics, 17*(1), 62-62. doi:10.1186/s12910-016-0148-7

Nemeth, D. G., Kuriansky, J., Reeder, K. P., Lewis, A., Marceaux, K., Whittington, T., . . . Safier, J. A. (2012). Addressing anniversary reactions of trauma through group process: the Hurricane Katrina anniversary wellness workshops. *Int J Group Psychother, 62*(1), 129-142. doi:10.1521/ijgp.2012.62.1.129

Newcomer, K. E., Hatry, H. P., & Wholey, J. S. (2015). *Handbook of Practical Program Evaluation*. Hoboken: John Wiley & Sons, Incorporated.

Noji, E. K. (1997). *The public health consequences of disasters*. New York: Oxford University Press.

Norris, F. H., & Rosen, C. S. (2009). Innovations in disaster mental health services and evaluation: national, state, and local responses to Hurricane Katrina (introduction to the special issue). *Adm Policy Ment Health, 36*(3), 159-164. doi:10.1007/s10488-009-0218-y

Office, U. S. G. A. (2006a). *Hurricane Katrina: better plans and exercises needed to guide the military's response to catastrophic natural disasters*: United States Government Accountability Office.

Office, U. S. G. A. (2006b). *Hurricane Katrina: comprehensive policies and procedures are needed to ensure appropriate use of and accountability for international assistance*: United States Government Accountability Office.

Patton, M. Q. (1997). *Utilization-focused evaluation: the new century text* (3rd ed.). Thousand Oaks, Calif: Sage Publications.

Patton, M. Q. (2015). The Sociological Roots of Utilization-Focused Evaluation. *The American sociologist, 46*(4), 457-462. doi:10.1007/s12108-015-9275-8

Quarantelli, E. L. (2001). Statistical and conceptual problems in the study of disasters. *Disaster Prevention and Management: An International Journal, 10*(5), 325-338. doi:10.1108/09653560110416175

Quast, T. (2018). Healthcare utilization by children with asthma displaced by Hurricane Katrina. *The Journal of asthma, 55*(4), 416-423. doi:10.1080/02770903.2017.1339244

Rabkin, N. J. (2005). *Hurricane Katrina: providing oversight of the nation's preparedness, response, and recovery activities*: United States Government Accountability Office.

Ricci, E. M. (2019). *Disaster evaluation research : a field guide*. Oxford, England: Oxford University Press.

Ricci, E. M., & Nolan, B. (2009). The future integration of scientific evaluation in project management. In D. Cleland & B. Bidanda (Eds.), *Project Management Circa 2025* (pp. 201-213). Newtown Square, PA: Project Management Institute.

Rossi, P. H., Lipsey, M. W., & Freeman, H. E. (2004). *Evaluation: A systematic approach* (Seven ed.). 2455 Teller Road, Thousand Oaks, California 9130: Sage Publications.

Rowe, C. L., & Liddle, H. A. (2008). When the levee breaks: treating adolescents and families in the aftermath of hurricane katrina. *J Marital Fam Ther, 34*(2), 132-148. doi:10.1111/j.1752-0606.2008.00060.x

Rowe, C. L., La Greca, A. M., & Alexandersson, A. (2010). Family and individual factors associated with substance involvement and PTS symptoms among adolescents in greater New Orleans after Hurricane Katrina. *J Consult Clin Psychol, 78*(6), 806-817. doi:10.1037/a0020808

Sapat, A., Yanmei, L., Mitchell, C., & Esnard, A.-M. (2011). Policy Learning and Policy Change: Katrina, Ike and Post-Disaster Housing. *International Journal of Mass Emergencies & Disasters, 29*(1), 26-56. Retrieved from https://www.researchgate.net/publication/272789261_Policy_learning_and_policy_change_Katrina_Ike_and_post-disaster_housing

Scanlon, J. (1988). Disaster's Little Known Pioneer: Canada's Samuel Henry Prince. *International Journal of Mass Emergencies & Disasters, 6*, 213-232.

Suchman, E. A. (1967). *Evaluative research : principles and practice in public service & social action programs*. New York: Russell Sage Foundation.

Sudnes, K. O. (2014). Health Disaster Management: Guidelines for Evaluation and Research in the "Utstein Style". Structural Framework, Operational Framework and Preparedness. *Scandinavian Journal of Public Health, 42*(14).

Townsend, F. F. (2006). *The federal response to Hurricane Katrina : lessons learned*. Washington, D.C: White House.

Vu, L., & Vanlandingham, M. J. (2012). Physical and mental health consequences of Katrina on Vietnamese immigrants in New Orleans: a pre- and post-disaster assessment. *J Immigr Minor Health, 14*(3), 386-394. doi:10.1007/s10903-011-9504-3

Weaver, J. M. (2015). The Department of Defense and Homeland Security relationship: Hurricane Katrina through Hurricane Irene. *J Emerg Manag, 13*(3), 265-274. doi:10.5055/jem.2015.0240

Weeks, E. (2007). *Lessons From Katrina: Response, Recovery and the Public Health Infrastructure*. Paper presented at the Symposium on Shaping a New Direction for Law and Medicine: An International Debate on Culture, Disaster, Biotechnology & Public Health, DePaul University. https://digitalcommons.law.uga.edu/fac_artchop/1243

Weiss, C. H. (1993). Where politics and evaluation research meet. *Evaluation practice, 14*(1), 93-106. doi:10.1016/0886-1633(93)90046-r