

Best Practices for Assessing Mortality and Significant Morbidity Following Large-Scale Disasters:

Charge to the Committee

National Academy of Medicine

May 28th, 2019



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DRRA 1244



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- (1) Study.-
 - (A) In general – the study described in this subsection shall be a study of matters concerning **best practices in mortality counts as a result of a major disaster** (as defined in section 102 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5122))
 - (B) Contents. – The study described in this subsection shall address **approaches to quantifying mortality and significant morbidity among populations affected by major disasters**, which shall include best practices and policy recommendations for –
 - (i) **equitable and timely attribution**, in order to facilitate access to available benefits, among other things;
 - (ii) **timely prospective tracking** of population levels of mortality and significant morbidity, and their causes, in order to continuously inform response efforts; and
 - (iii) **a retrospective study** of disaster-related mortality and significant morbidity to inform after-action analysis and improve subsequent preparedness efforts.

Goal: improve the validity and efficacy of post-disaster mortality and significant morbidity reporting

Background



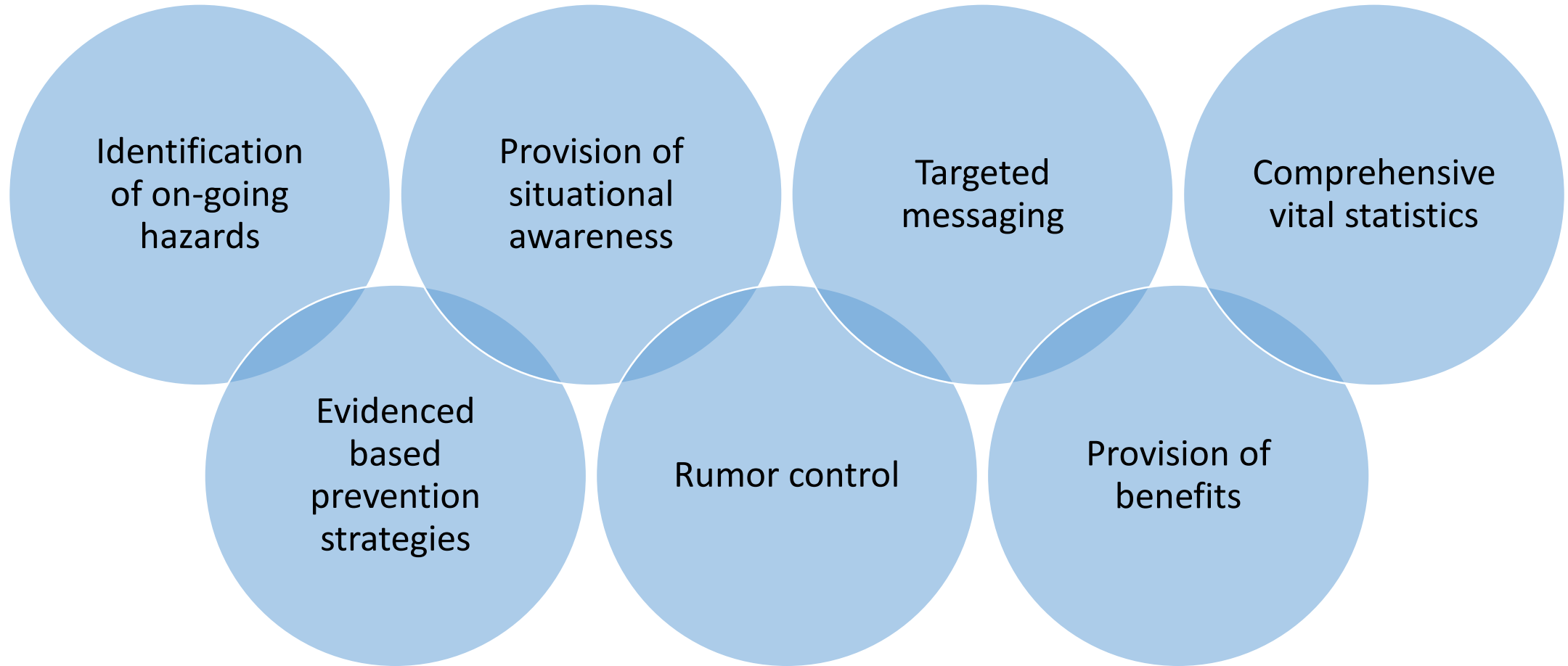
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Importance of this data - examples



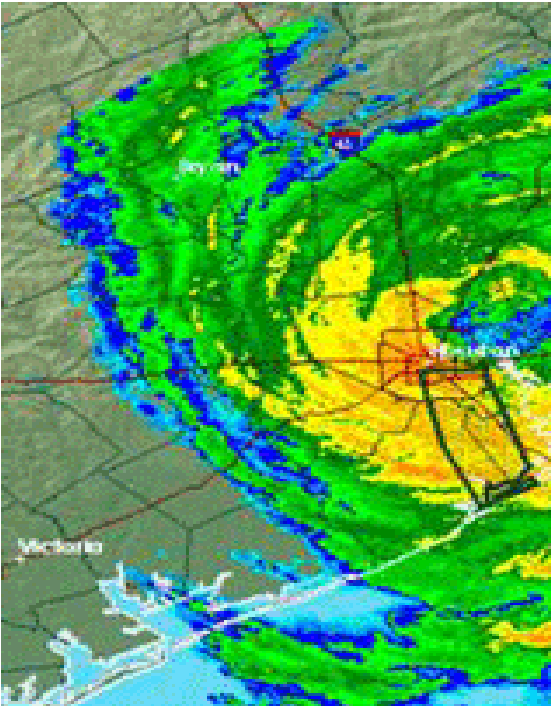
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Public messaging



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DANGER!

POISON GAS - POISON GAS - POISON GAS
CARBON MONOXIDE HAZARD

Using a generator indoors
WILL KILL YOU IN MINUTES.
Exhaust contains carbon monoxide,
a poison gas you can not see or smell.



NEVER use a generator indoors,
in garages, or carports.



ONLY use outdoors and far from
open windows, doors, and vents.

Flood Warning
Milam



"Please help us. People are still trying to drive through closed roads. You are endangering all of our lives. Please turn around. Don't drown"

Belton PD
@beltonpolice

BELTON POLICE: 'TURN AROUND DON'T DROWN'

69° 5:04 6 NEWS

FLOODING IN BELTON | TORNADO CONFIRMED | TEMPLE WASTEWATER SPILL

Public messaging



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Rumor control



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Rumor control



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Interpretation



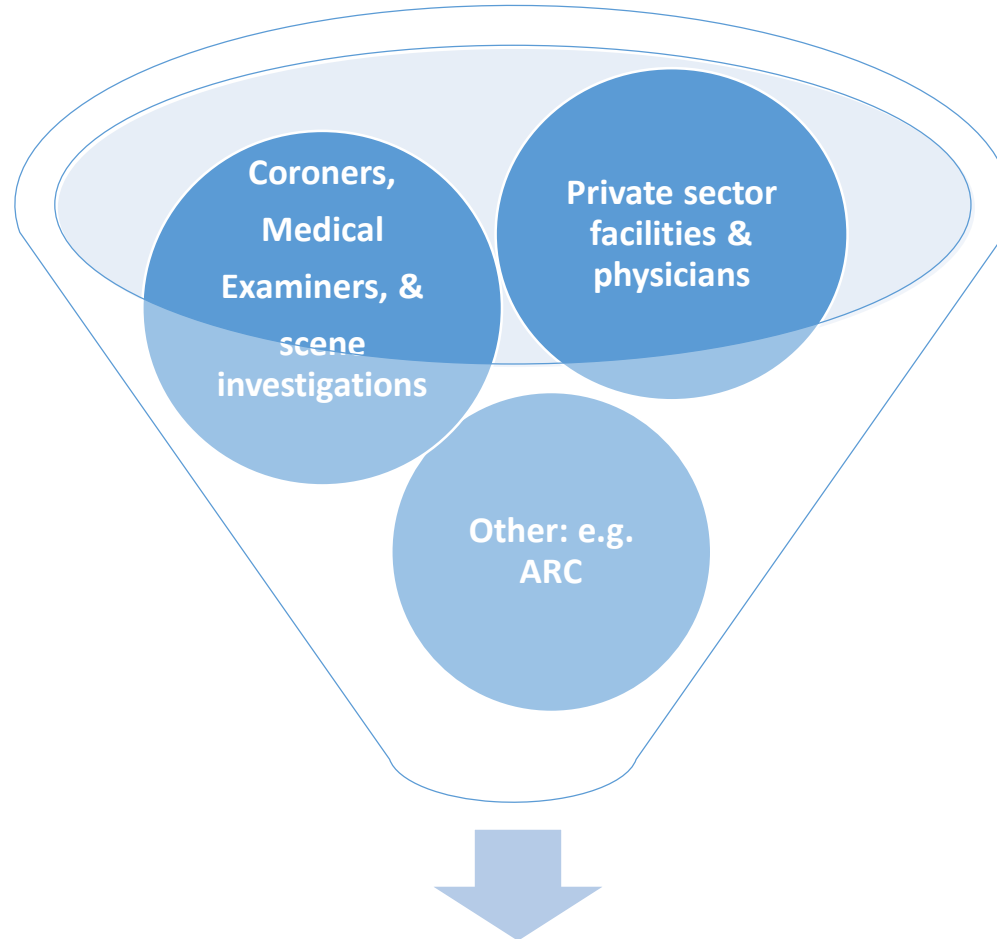
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Where does information come from?



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Rolled up at the SLTT level

Who are the consumers of the data?



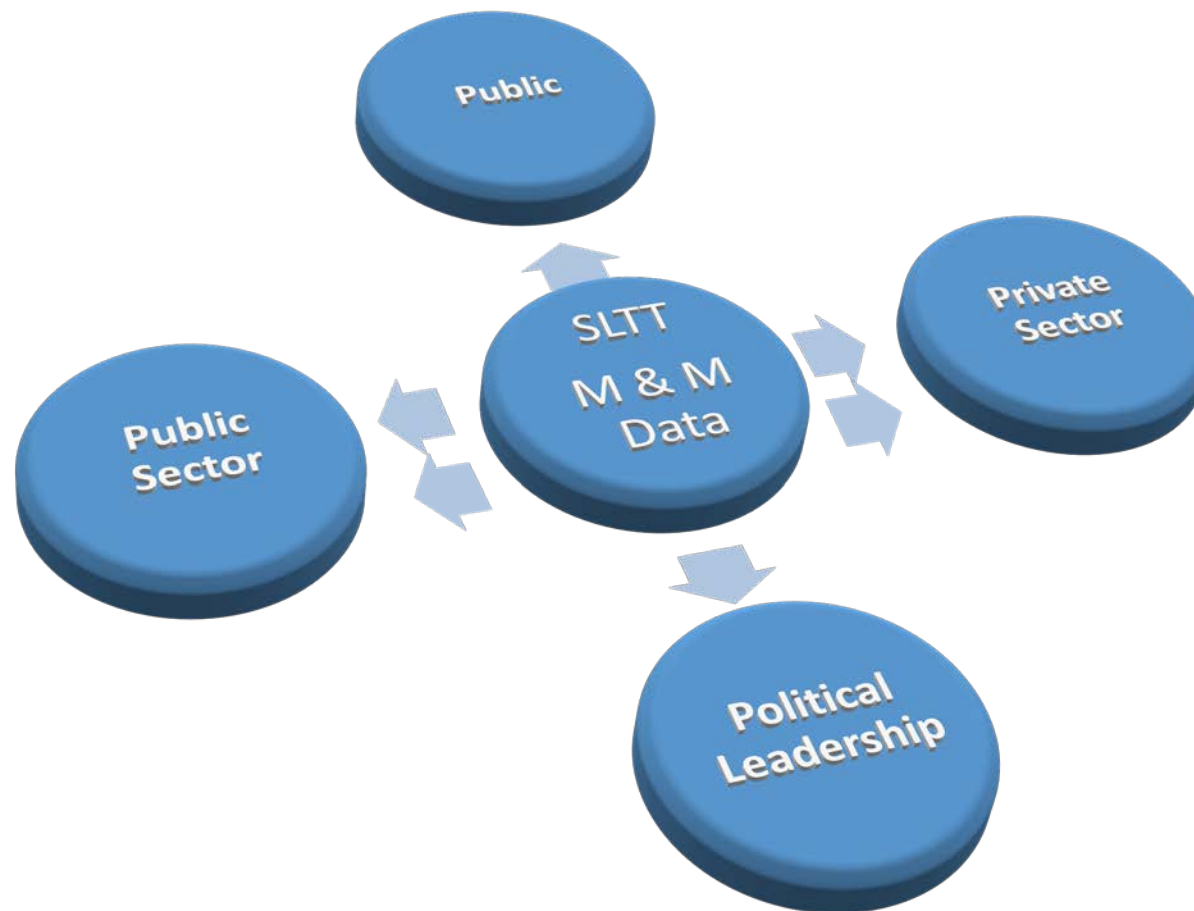
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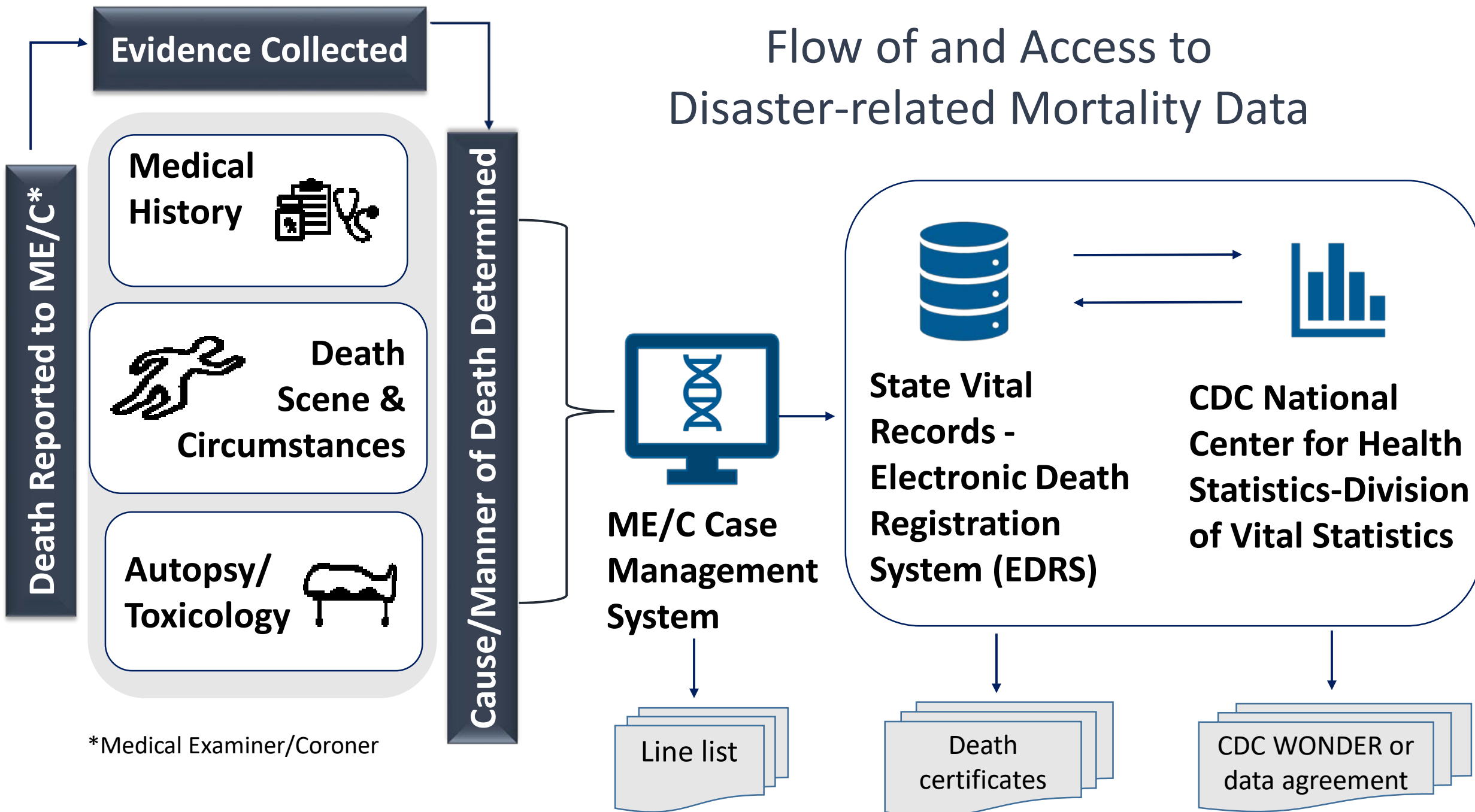
= Aggregate data



= Aggregate &
individualized data



Flow of and Access to Disaster-related Mortality Data



FEMA's Funeral Assistance (Individual Assistance)



Eligibility/documentation requirements:

- Applicants must meet identity and citizenship requirements.
- Documentation (such as a death certificate) must be submitted in which a state, territorial, tribal, or local government licensed medical official has attributed the death, either directly or indirectly, to the disaster.
- Receipts or verifiable estimates must be submitted demonstrating that the applicant has incurred, or will incur, eligible expenses.
- For reinterment, documentation must be submitted demonstrating that the disinterment occurred in a privately owned, licensed cemetery or burial facility.
- Eligible costs cannot be covered by other means of assistance, such as burial insurance or assistance from a voluntary agency.

FEMA's Funeral Assistance (Individual Assistance)



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Eligible expenses:

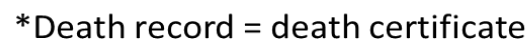
- Funeral services, including clergy or officiant services
- Transfer of remains
- Casket or urn
- Burial plot/cremation niche
- Marker or headstone
- Transportation for up to two individuals to identify the deceased
- Administrative costs associated with obtaining up to 5 death certificates
- Reinterment and costs associated with identifying disinterred remains.

Existing efforts



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Retrospective studies



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Morbidity and Mortality Weekly Report (MMWR)

CDC



Deaths Related to Hurricane Irma — Florida, Georgia, and North Carolina, September 4–October 10, 2017

Weekly / August 3, 2018 / 67(30):829–832

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People™

Search

Morbidity and Mortality Weekly Report (MMWR)

CDC



Notes from the Field: Mortality Associated with Hurricane Matthew — United States, October 2016

Weekly / February 10, 2017 / 66(5):145–146



Home

Articles

Home » American Journal of Public Health (AJPH) » August 2013

Mortality From a Tornado Outbreak, Alabama, April 27, 2011

Disaster Medicine and Public Health Preparedness

Article

Metrics

Volume 10, Special Issue 3 (Superstorm Sandy) June 2016, pp. 378–385

Injury Deaths Related to Hurricane Sandy, New York City, 2012

Milken Institute School
of Public Health
THE GEORGE WASHINGTON UNIVERSITY



PROJECT REPORT

ASCERTAINMENT OF THE ESTIMATED EXCESS MORTALITY FROM HURRICANE MARÍA IN PUERTO RICO

IN COLLABORATION WITH THE UNIVERSITY OF
PUERTO RICO GRADUATE SCHOOL OF PUBLIC HEALTH

THE NEW ENGLAND JOURNAL of MEDICINE

SPECIAL ARTICLE

Mortality in Puerto Rico after Hurricane Maria

Nishant Kishore, M.P.H., Domingo Marqués, Ph.D., Ayesha Mahmud, Ph.D.,
Mathew V. Kiang, M.P.H., Irmay Rodriguez, B.A., Arlan Fuller, J.D., M.A.,
Peggy Ebner, B.A., Cecilia Sorensen, M.D., Fabio Racy, M.D., Jay Lemery, M.D.,
Leslie Maas, M.H.S., Jennifer Leaning, M.D., S.M.H., Rafael A. Irizarry, Ph.D.,
Satchit Balsari, M.D., M.P.H., and Caroline O. Buckee, D.Phil.

ABSTRACT

BACKGROUND

Quantifying the effect of natural disasters on society is critical for recovery of public health services and infrastructure. The death toll can be difficult to assess in the aftermath of a major disaster. In September 2017, Hurricane Maria caused massive infrastructural damage to Puerto Rico, but its effect on mortality remains contentious. The official death count is 64.

METHODS

Using a representative, stratified sample, we surveyed 3299 randomly chosen households across Puerto Rico to produce an independent estimate of all-cause mortality after the hurricane. Respondents were asked about displacement, infrastructure loss, and causes of death. We calculated excess deaths by comparing our estimated post-hurricane mortality rate with official rates for the same period in 2016.

RESULTS

From the survey data, we estimated a mortality rate of 14.3 deaths (95% confidence interval [CI], 9.8 to 18.9) per 1000 persons from September 20 through December 31, 2017. This rate yielded a total of 4645 excess deaths during this period (95% CI, 793 to 8498), equivalent to a 62% increase in the mortality rate as compared with the same period in 2016. However, this number is likely to be an underestimate because of survivor bias. The mortality rate remained high through the end of December 2017, and one third of the deaths were attributed to delayed or interrupted health care. Hurricane-related migration was substantial.

CONCLUSIONS

This household-based survey suggests that the number of excess deaths related to Hurricane Maria in Puerto Rico is more than 70 times the official estimate. (Funded by the Harvard T.H. Chan School of Public Health and others.)

N ENGL J MED 379:2 NEJM.ORG JULY 12, 2018

The New England Journal of Medicine

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Recurring challenges



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- Chaotic
- Unpredictable
- Resource intensive in time of limited resources
- Perishable data
- Difficulty obtaining denominator
- Underreporting



Statement of Work.....



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Limitations



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- Study is to focus on non-infectious disease related disasters (e.g. hurricanes) as declared under the Stafford Act
- Not part of the study
 - Syndromic surveillance
 - Long term surveillance
 - Surveillance of responders

Deliverable one



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- Overview: importance of morality and morbidity data after disaster impact
 - Use of data
 - Organizations involved in capture
 - End users
 - Intended audience for this quite broad

Deliverable two



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- Detailed description: architecture, methodologies, and information systems in use or available to SLTT
 - System diagram
 - Variabilities highlighted
 - Highlight best practices
 - Comment on existing guidance (e.g. CDC attribution document)
 - Role of information technology systems
 - Critical points of failure highlighted
 - Preparedness (e.g. data sharing agreements)
 - Continuity mechanisms (to ensure continued reporting, collection, and sharing) in post impact environment.



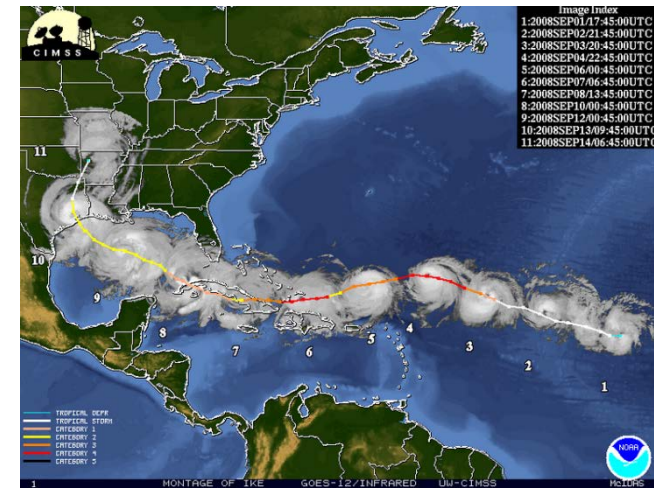
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Deliverable two - nuances



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- Hurricane Ike: Texas efforts to document hurricane related fatalities
 - Indirect death from injury related to 52 yo male reinforcing roof with additional screws drilled into electrical wiring causing electrocution
 - Indirect death from 10 yo male struck and killed by falling tree limb that was cut down in preparation for the storm
- Importance of on scene investigations (such as MVC), especially when considered an indirect injury or death



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Deliverable three



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- Detailed description: current challenges
 - Collection, recording, and reporting
 - Lack of standardization
 - Attribution
 - Coordination
 - Training/preparation
 - To include analysis of timing of attribution (acute, delayed)



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Deliverable three – timing of attribution

RESEARCH

Hurricane Katrina Deaths, Louisiana, 2005

Joan Brunkard, PhD, Gonza Namulanda, MS, and Raoult Ratard, MD, MPH

ABSTRACT

Objective: Hurricane Katrina struck the US Gulf Coast on August 29, 2005, causing unprecedented damage to numerous communities in Louisiana and Mississippi. Our objectives were to verify, document, and characterize Katrina-related mortality in Louisiana and help identify strategies to reduce mortality in future disasters.

Methods: We assessed Hurricane Katrina mortality data sources received in 2007, including Louisiana and out-of-state death certificates for deaths occurring from August 27 to October 31, 2005, and the Disaster Mortuary Operational Response Team's confirmed victims' database. We calculated age-, race-, and sex-specific mortality rates for Orleans, St Bernard, and Jefferson Parishes, where 95% of Katrina victims resided and conducted stratified analyses by parish of residence to compare differences between observed proportions of victim demographic characteristics and expected values based on 2000 US Census data, using Pearson chi square and Fisher exact tests.

Results: We identified 971 Katrina-related deaths in Louisiana and 15 deaths among Katrina evacuees in other states. Drowning (40%), injury and trauma (25%), and heart conditions (11%) were the major causes of death among Louisiana victims. Forty-nine percent of victims were people 75 years old and older. Fifty-three percent of victims were men; 51% were black; and 42% were white. In Orleans Parish, the mortality rate among blacks was 1.7 to 4 times higher than that among whites for all people 18 years old and older. People 75 years old and older were significantly more likely to be storm victims ($P < .0001$).

Conclusions: Hurricane Katrina was the deadliest hurricane to strike the US Gulf Coast since 1928. Drowning was the major cause of death and people 75 years old and older were the most affected population cohort. Future disaster preparedness efforts must focus on evacuating and caring for vulnerable populations, including those in hospitals, long-term care facilities, and personal residences. Improving mortality reporting timeliness will enable response teams to provide appropriate interventions to these populations and to prepare and implement preventive measures before the next disaster. (*Disaster Med Public Health Preparedness*. 2008;2:215-223)

Key Words: Hurricane Katrina, Louisiana, mortality, drowning, flooding, disaster preparedness

Hurricane Katrina struck the US Gulf Coast on August 29, 2005 as a category 3 hurricane on the Saffir-Simpson scale, causing unprecedented damage to numerous Louisiana and Mississippi communities.¹ During the hours and days after Hurricane Katrina, breaches in the levee infrastructure resulted in flooding throughout approximately 80% of New Orleans. A massive rescue and recovery effort was launched by local, state, and federal governments and nongovernmental organizations. Before Hurricane Katrina, the deadliest hurricane to make landfall in the United States during the previous 50 years was Hurricane Audrey (1957), with an estimated 416 deaths.² Hurricane Andrew (1995), the last category 5 hurricane to strike the United States, caused 26 deaths.² Although several preliminary estimates exist of the deaths attributable to Hurricane Katrina,^{1,3,4} no prior report has systematically reviewed all of the available death databases to accurately document Hurricane Katrina mortality in Louisiana.

Our objectives were to verify and document the number of deaths from Hurricane Katrina among people in Louisiana at the time of the storm and to characterize the storm's mortality burden by victim demographics, geographic location, timeline, and cause of death. This report is the first to combine multiple death databases to assess the number of storm-related deaths among Louisiana residents and people who were in Louisiana at the time of the storm and to provide information regarding the causes of death. The findings in this report will aid public health and emergency preparedness efforts and may help reduce the mortality burden in future natural disasters.

METHODS

Data Sources

Data sources included the Hurricane Katrina Disaster Mortuary Operational Response Team (DMORT) database and death certificates collected through Louisiana vital statistics and out-of-state coroners' offices.

TWO MONTH
STUDY PERIOD

ONE MONTH
STUDY PERIOD

ORIGINAL RESEARCH

Tracking Deaths Related to Hurricane Ike, Texas, 2008

David F. Zane, MS; Tesfaye M. Bayleyegn, MD; John Hollisten, PhD; Ryan Beal, MPH; Crystal Beasley, MS; Tracy Haywood, BS; Dana Wiltz-Beckham, DVM; Amy F. Wolkin, MSPH

ABSTRACT

Background: On September 13, 2008, Hurricane Ike, a category 2 storm with maximum sustained winds of 110 mph, made landfall near Galveston, Texas. Ike produced a damaging, destructive, and deadly storm surge across the upper Texas and southwestern Louisiana coasts. Thirty-four Texas counties were declared disaster areas by the Federal Emergency Management Agency; 15 counties were under mandatory evacuation orders. To describe causes of death associated with this hurricane and identify prevention strategies during the response and recovery phases, the Texas Department of State Health Services (DSHS) monitored mortality data in 44 counties throughout the state. This report summarizes Ike-related deaths reported by Texas medical examiners, justices of the peace (coroners), forensic centers, public health officials, and hospitals.

Methods: Based on the Centers for Disease Control and Prevention (CDC) disaster-related mortality surveillance form, DSHS developed a state-specific 1-page form and collected (optimally daily) data on demographic, date and place of death, and cause and circumstance of deaths. A case was defined as any death that was directly or indirectly related to Ike among evacuees, residents, nonresidents, or rescue personnel in the declared disaster counties, counties along the Texas Gulf coast or counties known to have evacuation shelters occurring September 8, 2008, through October 13, 2008. Analyzed data were shared with the state emergency operation center and the CDC on a daily basis.

Results: The surveillance identified 74 deaths in Texas as directly (10 [14%]), indirectly (49 [66%]), or possibly (15 [20%]) related to Ike. The majority of deaths (n=57) were reported by medical examiners. Deaths occurred in 16 counties of the 44 counties covered by the surveillance. The majority of deaths occurred in Harris and Galveston (28 [38%] and 17 [23%]), respectively. The deceased ranged in age from younger than 1 year to 85 years, with an average age of 46 years (median 50 years); 70% were male. Of the 74 deaths, 47 (64%) resulted from injuries, 23 (31%) from illnesses, and 4 (5%) were undetermined. Among the injuries, carbon monoxide poisoning (13 [18%]) and drowning (8 [11%]) were the leading causes of injury-related deaths. Cardiovascular failure (12 [16%]) was the leading cause of illness-related deaths.

Conclusions: Defining the relation of death to hurricane using an active mortality surveillance system is possible. The active mortality surveillance form used in Ike provided valuable daily information to DSHS, state emergency management officials, and the CDC regarding the characteristics of deaths in the state. Most of the Ike-related deaths were caused by injury (direct and indirectly related) such as carbon monoxide poisonings and drowning and may have been preventable by educating the public.

(*Disaster Med Public Health Preparedness*. 2011;5:23-28)

Key Words: hurricanes, disasters, mortality surveillance, Hurricane Ike

Tropical cyclones, variously defined as hurricanes, typhoons, and cyclones, are meteorological depressions or low-pressure weather systems that develop from atmospheric disturbances over the warm waters of the tropical oceans. Tropical cyclones or hurricanes produce destructive winds, inundating rains, and storm surges that are frequently accompanied by floods, tornadoes, and landslides.^{1,2}

The United States ranks first in the number of annual tropical cyclone impacts: an average of 12 tropical cyclones per year strike the continental United States, Puerto Rico, the US Virgin Islands, and Pacific jurisdictions.³ According to the National Oceanic and Atmospheric Administration, the United States has been

in an increased cycle of hurricane activity since 1995, and this trend is predicted to continue for another 10 to 20 years.⁴ Each year (1998-2007) during hurricane season (June 1-November 30), hurricanes account for approximately 12 deaths (range 0-1016, including Hurricane Katrina deaths) and \$5 billion in damages to property and infrastructure annually.⁵

Although cumulative hurricane mortality for the United States for the period 1900-2004 was approximately 15 000, half of these deaths occurred in 1900 when the unnamed hurricane (the deadliest natural disaster in US history) killed 7200 citizens in Galveston, Texas.⁶ From 2005 to 2008 (August), 2 tropical storms (Erin and Edouard) and 4 hurricanes (Rita, Humberto, Dolly, and Gustav)



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Deliverable four



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- Identify best practices for collecting, recording, and reporting
- Sharing of this data – within the health department and to partners (e.g. FEMA)
- Recommend priority areas of emphasis and allocation of resources

- Feasibility
- Sustainability
- Continuity



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Deliverable five



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- Review of analytical approaches and methods
 - Prospective
 - Retrospective



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Questions?



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