



# ESTIMATION OF EXCESS MORTALITY FROM HURRICANE MARÍA IN PUERTO RICO

## METHODS & FINDINGS

The George Washington University Milken Institute School of Public Health, in collaboration with the University of Puerto Rico Graduate School of Public Health, conducted an independent three-part study using the most complete data available to:

- 1** Estimate the excess mortality from Hurricane María from September 20, 2017 to February 28, 2018.
- 2** Understand the processes that caused hurricane-related deaths to be underreported.
- 3** Assess the communication efforts by the Government of Puerto Rico before and after the hurricane.



# METHODS

## COMPONENT 1: Estimation of Excess Mortality

**Objective:** Estimate total excess deaths by comparing the **total number of deaths** reported in existing records and death certificates between September 20, 2017 and February 28, 2018 to the **expected number of deaths** for that time period. Information on excess deaths will inform disaster response and preparedness planning.

### METHODS

**Total number of deaths**, or actual deaths, was calculated using multiple data sources. Information was cross-checked between sources to ensure accuracy.

**Expected number of deaths** was calculated by looking at mortality data from July 2010 to August 2017 to predict what mortality would have been if the hurricane had not happened. To do this prediction, we considered changes in population size and demographics over time, and also changes in mortality by season.

Data was adjusted by age, sex, season, and municipal socioeconomic development to identify subgroups that **have higher risk of death**.

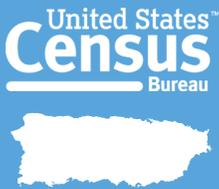
### DATA SOURCES



**Puerto Rico Demographic Registry Data, 2010-2017**  
(death certificates)



**Puerto Rico Bureau of Forensic Sciences**



**U.S. and Municipal Census Data, 2010-2017**  
(population estimates and projections)



**U.S. Bureau of Transportation Statistics** (provided by the Puerto Rico Institute of Statistics) and Puerto Rico Planning Board  
(data for mortality outside of Puerto Rico and air travel )

## COMPONENT 1: Estimation of Excess Mortality

# 2,975

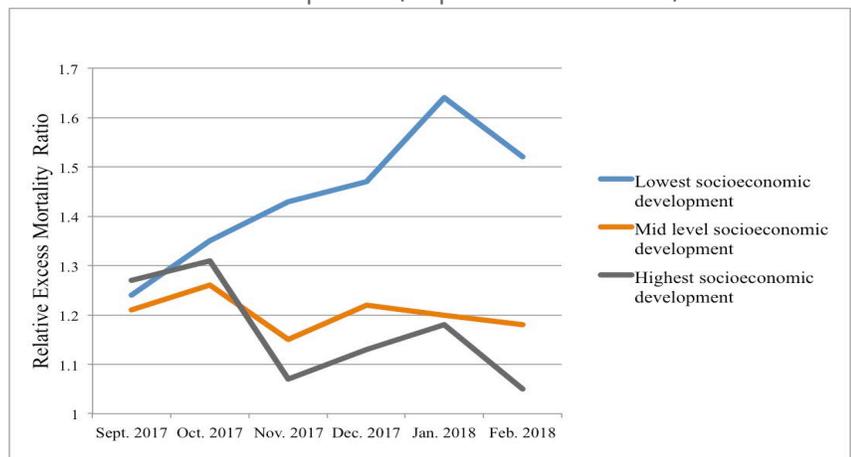
2,658 | Confidence Interval | 3,290

**ESTIMATED  
EXCESS MORTALITY**  
due to Hurricane Maria from  
September 20, 2017 to February  
28, 2018

### POPULATIONS MOST VULNERABLE TO EXCESS DEATHS

- Residents of municipalities with lower levels of socioeconomic development
- Men 65 years and older

Estimated Excess Mortality Risk in Puerto Rico, by Level of Socioeconomic Development (Sept 2017-Feb 2018)



Deaths were overall **22% HIGHER** for that time period

**APPROXIMATELY 8% OF  
THE POPULATION MIGRATED**

Mortality estimates take into consideration dramatic displacement of people from Puerto Rico between September 2017 and February 2018

## METHODS

### COMPONENT 2: Assessment of the Death Registration Process

**Objective:** Describe and assess Puerto Rico's mortality surveillance system under normal conditions and its adherence to the Centers for Disease Control and Prevention (CDC) protocol for documenting hurricane-related deaths. Information on the death certification process will inform public health disaster preparedness and planning.

### METHODS



Personnel who participate in death certification and registration were interviewed.



Reviewed:

- Death certification training manuals
- Demographic Registry and mortality surveillance laws
- CDC guidelines on documenting disaster-related mortality



How deaths were certified after the hurricane was determined to understand if the death certification process worked and to understand the quality of death certificates.

### PERSONNEL INTERVIEWED



HOSPITALS



DEMOGRAPHIC  
REGISTRY



PATHOLOGISTS



PHYSICIANS



FUNERAL HOME  
DIRECTORS



PROFESSIONAL  
ASSOCIATIONS

## COMPONENT 2: Assessment of the Death Registration Process

Our assessment showed that there is no formal training on completing death certificates for physicians in Puerto Rico or most other jurisdictions in the U.S.



**There is no training on completing death certificates after disasters.**



Our analyses also showed that death certificate quality was high in terms of completeness and internal consistency, with the percentage of mis-assigned cause of death codes increasing only slightly after the hurricane.



The Puerto Rico Vital Statistics Registry offices sustained damage and did not have power to operate for some time after the hurricane, which delayed registration of deaths.



Following the hurricane, it took an average of 17 days, where it took only 12 days the year before.

## METHODS

### COMPONENT 3: Communication Assessment



**Objective:** Assess crisis and emergency risk communication, death reporting, and media coverage before and after the hurricane, and understand perceptions about these communications. Information on communication processes and perceptions will inform future planning of communication for emergency preparedness and response.

#### METHODS

Key leaders that represent diverse stakeholder groups were interviewed about experiences and perceptions.

Puerto Rico Government agency personnel were interviewed to understand crisis, emergency risk, and mortality communication processes before and after the hurricane. The information and media environment was assessed after the hurricane.

#### DATA SOURCES



Key Leader and Puerto Rico Government Personnel Interviews



Press coverage and social media commentary of hurricane-related death reporting



Puerto Rico Government press releases



Puerto Rico Government press conferences and Facebook live events

#### STAKEHOLDER TYPES



COMMUNITY LEADERS



COMMUNITY-BASED ORGANIZATIONS



HEALTH PROFESSIONALS



FAITH LEADERS



MUNICIPAL MAYORS



FUNERAL HOME DIRECTORS



EMERGENCY RESPONDERS



POLICE



# FINDINGS

## COMPONENT 3: Communication Assessment



### Crisis and Emergency Risk Communication Plans



- Crisis and emergency risk communication plans for government agencies either did not exist or were outdated
- Plans did not reflect recent government restructuring (e.g., Department of Public Safety establishment)

- Plans did not anticipate consequences of a catastrophic event, such as telecommunications failures



### Communication Staffing

Communication personnel did not have the supports they needed to fulfill key functions, including:



- Sufficient staff- especially those dedicated to crisis and emergency risk communication

- Training and expertise for communication in disasters



### Coordination of Mortality Reporting

Telecommunications failures without viable contingencies contributed to delays in information exchange, including the reporting of deaths across Puerto Rico



Gaps in information provided by the Government of Puerto Rico contributed to public perceptions of non-transparency and the spread of misinformation

Conflicting information about mortality was provided to the public, potentially due to:



- A lack of official protocols in place to coordinate mortality reporting across government agencies
- Inconsistent spokesperson training for disasters

- Limited government strategies in place to correct misinformation or counteract rumors