



Epi Data Brief

New York City Department of Health and Mental Hygiene

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Evacuation in New York City During Hurricanes Irene and Sandy

Recently New York City (NYC) has been affected by two consecutive coastal storms. In 2011 the city escaped the worst of the storm impact during Hurricane Irene, but in 2012 was struck by Hurricane Sandy which resulted in extensive structural and coastal damages. The city's coastal storm plan (CSP) previously had three hurricane evacuation zones (A, B, and C). In 2011, Zone A had 375,000 residents and was to be evacuated in the event of a category one hurricane, while zones B and C included low-lying areas more vulnerable to a category two, three, or four storm. Based on newly available data and information received from the National Weather Service, as well as a new storm model developed by the National Hurricane Center, city officials have revised the CSP to include six hurricane evacuation zones (labeled zones 1 to 6), ranked according to risk of surge impact, and encompassing 640,000 more residents than were previously included.¹ During both Hurricanes Irene and Sandy, evacuation orders were not followed by all residents living in impacted zones.¹ To understand evacuation behavior, and to better support future emergency preparedness, this data brief describes evacuation behaviors and chronic health conditions among residents in evacuation Zone A during Hurricanes Irene and Sandy.

The majority of New Yorkers in evacuation zones did not leave during Hurricanes Irene and Sandy

For both Hurricanes Irene and Sandy, the mayor ordered an evacuation of residents in Zone A before each hurricane made landfall, and prior to the shutdown of transportation and building systems.

- The majority of NYC residents living in Zone A (at the time of each storm) failed to evacuate at any time both for Hurricane Irene in 2011 and for Hurricane Sandy in 2012. Less than a third (31%) of Zone A residents evacuated during Irene, and 37% evacuated during Sandy.
 - Of those residents who evacuated due to Hurricane Sandy in 2012, 53% left before Sandy reached NYC and 61% were displaced from their homes for more than a week.[^]
- Women were more likely to evacuate than men during Hurricane Irene (39% vs. 22%). There was no difference in evacuation by sex during Hurricane Sandy (38% vs. 35%).
- Black New Yorkers were more likely to evacuate than whites during both Hurricanes Irene and Sandy (Irene: 49%* vs. 24%; Sandy: 52%* vs. 35%). However, the evacuation rate for Asians was less than that of whites during Hurricane Sandy (17%* vs. 35%).
- During Hurricane Sandy, adults ages 65 years and over were less likely to evacuate than those ages 18 to 24 years (25% vs. 45%*). There were no differences in evacuation rate by age group for Hurricane Irene.
- Foreign-born residents were more likely to evacuate than United States (US)-born residents during Hurricane Irene (40%* vs. 27%). Nativity did not impact evacuation behavior during Hurricane Sandy.
- Evacuation rates in Zone A were similar for both Hurricanes Irene and Sandy. However, more men (35% vs. 22%), whites (35% vs. 24%), residents with a low poverty level (44% vs. 29%), US-born residents (38% vs. 27%), and residents with a high education level (40% vs. 30%) evacuated for Sandy than for Irene, respectively.
- Past studies have found that households with children had higher evacuation rates.² However, in NYC, having a child in the home did not increase the likelihood of evacuation.

Characteristics of evacuees from Zone A in 2011 and 2012, New York City

Characteristic	Irene (2011)	Sandy (2012)
Evacuation Rate	31%	37%
Age		
18-24	46%*	45%*
25-44	32%	45%
45-64	26%	31%
65+	23%	25%
Gender		
Male	22%	35%
Female	39%	38%
Race/ethnicity		
White, non-Hispanic	24%	35%
Black, non-Hispanic	49%*	52%*
Hispanic	42%*	45%*
Asian/Pacific Islander	29%*	17%*

*Estimate should be interpreted with caution due to small sample. Source: NYC Community Health Survey 2012 and 2013

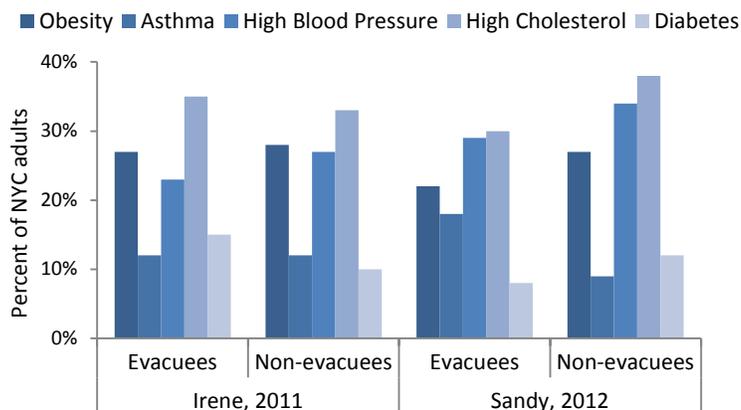
[^]Similar information not available for Hurricane Irene residents in evacuation zones.

*Estimate should be interpreted with caution due to small sample size.

Overall, chronic health conditions were not associated with evacuation behavior

- Among those in Zone A, the prevalence of most chronic conditions did not differ by evacuation status for Hurricanes Irene or Sandy. However, the prevalence of asthma was twice as high among Zone A evacuees compared with non-evacuees for Hurricane Sandy (18% vs. 9%).
- The prevalence of any chronic condition among residents in Zone A during Hurricane Irene was similar to the citywide prevalence (61% vs. 58%). However, the prevalence was higher among Zone A residents during Sandy (65% vs. 58% citywide).
- The most prevalent conditions among Zone A residents were high cholesterol (32% Irene and 35% Sandy), obesity (27% Irene and 25% Sandy), and high blood pressure (26% Irene and 32% Sandy), followed by asthma and diabetes. Levels were similar to citywide prevalences.
- Non-evacuees among those in Zone A during Hurricane Sandy had a higher burden of high blood pressure (34%) and high blood cholesterol (38%) than non-evacuees in Zone A during Hurricane Irene (27% and 33% respectively).

Chronic health conditions* among residents of hurricane evacuation zones, New York City, 2011 and 2012



*Chronic conditions include self-reported history of diabetes, high blood pressure, high cholesterol and asthma, or obesity at time of survey.

Source: NYC Community Health Survey 2012 and 2013

Zone awareness and prior warnings to evacuate may impact evacuation behaviors among New Yorkers

- During Hurricane Irene, half (50%) of Zone A residents knew they lived in an evacuation zone.
 - Among Zone A residents who did not evacuate during Irene, two thirds (66%) did not know they lived in an evacuation zone. Of those who evacuated, 87% knew they lived in an evacuation zone during Hurricane Irene.
- Zone awareness also impacted evacuation behavior for Hurricane Sandy. According to a survey conducted among Zone A residents by city officials, approximately 88% of those in Zone A knew they lived in an evacuation zone, and 78% of those who were aware of their zone and had received an official evacuation warning evacuated.¹

Definitions:

Evacuation status was determined only for those residents who were living in ZIP codes within Zone A at the time of each hurricane.

US- and Foreign-born status:

Regions based on United States (US) State Department regions; Puerto Rico and the US Territories are classified as US born.

Chronic conditions include those with a self-reported history of diabetes, high blood pressure, high cholesterol, asthma, or obesity at the time of the survey. Although this self-reported history was collected after the fact, it was reasonable to assume that conditions likely existed at the time of the hurricanes.

Authored by: Shakara Brown, Hilary Parton

Data source: The Community Health Survey (CHS) is conducted annually by the Health Department with approximately 9,000 NYC residents ages 18 and older. 2012 and 2013 data presented in this brief are age adjusted to the US 2000 standard population, except for age-specific estimates. Starting in 2009, the CHS included adults with landline as well as cell phones. For more survey details, visit nyc.gov/health/survey. Analysis supported by CDC grant TP000585-01, *Impact of Hurricane Sandy on Morbidity and Mortality in NYC*.

References:

¹The Hurricane Sandy After Action Report, 2013; http://www.nyc.gov/html/recovery/downloads/pdf/sandy_aar_5.2.13.pdf.

²Heath SE, Kass PH, Beck AM, & Glickman LT. Human and pet-related risk factors for household evacuation failure during a natural disaster. *Am J Epidemiol.* 2001; 153(7), 656-665.

MORE New York City Health Data and Publications

- For complete tables of data presented in this Brief, visit nyc.gov/html/doh/downloads/pdf/epi/datatable51.pdf
- Visit EpiQuery – the Health Department’s online, interactive health data system: nyc.gov/health/EpiQuery

Data & Statistics at nyc.gov/health/data

Know your hurricane evacuation zone: check out nyc.gov/knowyourzone

