Disaster Preparedness in Primary Care: Reducing Excess Deaths After Hurricanes and Floods

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BACKGROUND

Hurricanes and floods are major public health threats in the U.S. Gulf Coast, where communities may experience repeated disaster exposure. Disaster-related mortality may extend beyond immediate deaths, with indirect health effects persisting for months of years after an event.



Figure 1. Flood waters after Hurricane Harvey

Understanding excess mortality can help primary care physicians identify vulnerable patients and support continuity of care before and after disasters.

Study Area

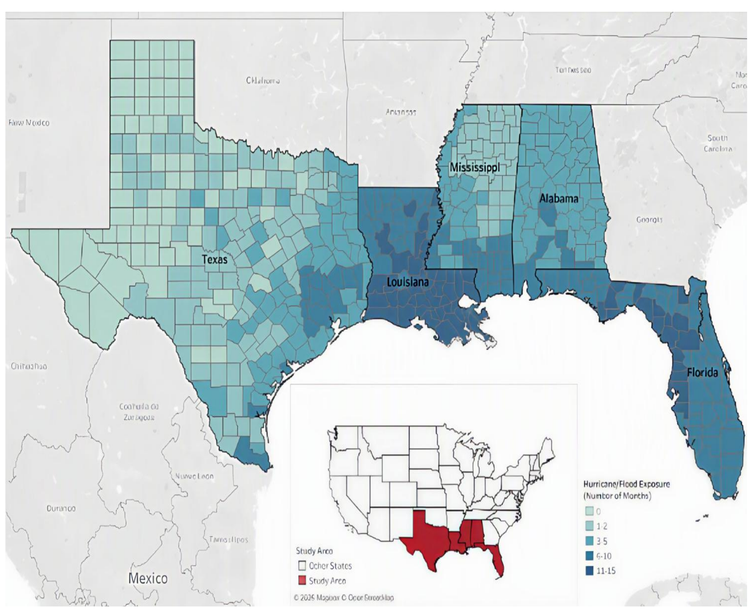


Figure 2. Hurricane/Flood Exposure based off region and number of months

OBJECTIVE

- We examined the association between disaster exposure and county-level mortality across over 500 counties in the five Gulf Coast states from 2010 through 2024. We assessed the impact of hurricane and flood events on all-cause mortality, excess mortality, and demographic specific mortality patterns.

METHODS

- 531 counties within the costal states including Alabama, Florida, Louisiana, Mississippi, and Texas were studied from January 2010-December 2024.
- Data was used from the CDC WONDER to determine county-level mortality and annual population. CDC WONDER was then paired with FEMA disaster declarations. These declaration provided county FIPS codes and month-county identifiers.
- Exposure was defined as a county-month with at least one FEMA hurricane- or flood-related disaster declaration.
- Outcomes are all cause monthly mortality rate per 100,000 people. Demographic data includes sex, age, race and ethnicity.

RESULTS

Table 1 shows key findings.

- Mean mortality was higher during exposed than unexposed months (106.49 vs. 98.13 deaths per 100,000; p<0.001).

- Hurricane/flood exposure was associated with 4.75 excess deaths per 100,000 population (*P*<0.001), translating to **47,995 excess deaths** between 2010-2024
    - Largest increase occurred among adults ≥65
- Associations varied across states, with the strongest and most consistent positive associations observed in Louisiana and Texas.

Table 1. Associations Between Hurricane/Flood Exposure and Mortality Outcomes in Gulf Coast Counties, 2010–2024

Outcome	B	95% Confident Interval	Std. Error	P-value
Primary Analysis				
All-cause mortality rate	4.75	[3.70, 5.80]	0.54	<0.001
All-cause mortality rate (Imputed Suppressed Counts)	5.34	[[4.12, 6.55]	0.62	<0.001
Subgroup Analyses				
Sex				
Female deaths	3.21	[1.99, 4.42]	0.62	<0.001
Male deaths	3.56	[2.00, 5.11]	0.79	<0.001
Age Group				
Age 0–24 deaths	-0.10	[-0.26, 0.05]	0.08	0.20
Age 25–44 deaths	0.45	[0.04, 0.87]	0.21	0.03
Age 45–64 deaths	1.18	[0.05, 2.31]	0.58	0.04
Age ≥65 deaths	7.91	[5.19, 10.64]	1.39	<0.001
Race				
White deaths	2.04	[0.68, 3.40]	0.69	0.003
Black deaths	0.21	[-0.70, 1.13]	0.46	0.64
Other Race deaths	-2.56	[-7.00, 1.89]	2.26	0.26
Ethnicity				
Hispanic deaths	15.08	[5.70, 24.46]	4.74	0.002
Non-Hispanic deaths	3.96	[2.64, 5.28]	0.67	<0.001

Notes: Models included county, year, and calendar-month fixed effects with county-clustered standard errors. Exposure was defined as ≥1 hurricane/flood-related FEMA declaration per county-month. The primary outcome was all-cause mortality per 100,000; subgroup analyses used monthly death counts. Suppressed counts (<10) were imputed as 5 in sensitivity analyses. *P*<0.05 was considered significant.

RESULTS

Table 2. Distributed Lag Effects of Hurricane/Flood Exposure on Mortality Rates

Lag Period	β	95% Confident Interval	Std. Error	P-value
Disaster Month (0)	4.98	[3.83, 6.13]	0.58	<0.001
3 Month Lag	2.09	[0.87, 3.31]	0.62	<0.001
6 Month Lag	-0.42	[-1.43,0.59]	0.51	0.41
9 Month Lag	-3.05	[-4.11, -1.98]	0.54	<0.001
12 Month Lag	4.22	[3.06, 5.38]	0.59	<0.001
15 Month Lag	-1.42	[-2.47 – -0.37]	0.54	0.01
18 Month Lag	0.93	[-0.04, 1.90]	0.49	0.06
21 Month Lag	0.67	[-0.27, 1.60]	0.47	0.16
24 Month Lag	-0.33	[-1.43, 0.77]	0.56	0.56

Note: Estimates are changes in monthly mortality rates per 100,000; models included county, year, and month fixed effects with county-clustered standard errors.

- Lag effects models shows that impact of disasters on deaths continue even until over a year after
- Deaths increased during the disaster month and again at 3 and 12 months, but by 24 months there was no longer a significant difference.

CONCLUSIONS

- Hurricane and flood exposure was associated with significant excess mortality extending beyond the acute disaster period, disproportionately affecting older adults, with the greatest burden concentrated in Louisiana and Texas.

- These findings highlight the critical role of primary care teams in identifying high-risk patients, maintaining continuity of medications, chronic disease management, and providing ongoing follow-up during disaster recovery.

- Integrating disaster preparedness into routine primary care may help reduce delayed disaster-related deaths among vulnerable populations and off-set vulnerabilities in high-risk groups.

REFERENCES

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