Urban Sewerage Systems Disaster Impacts: Evidence From 311 Call Data In Louisiana

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1. Introduction

- Natural disasters are placing significant stress on critical urban infrastructure.
- Sewerage system are highly vulnerable to disaster impacts in densely populated areas.
- 311 service request records offer a promising proxy for post-disaster infrastructure conditions.
- This study examines 311 sewerage-related complaints in New Orleans and East Baton Rouge Baton Rouge parishes, Louisiana.
- The goal is to determine whether 311 reports can serve as early indicators of sewerage disruptions following natural disasters, before formal assessments are available.

2. Research Question

To what extent do daily sewerage-related 311 service request counts during and within two weeks following a disaster exceed those recorded during the corresponding period one year prior to the disaster?

3. Data Source

311 Citizen Requests for Service

- Sewerage related service request

Federal Emergency Management Agency

- Disaster Declarations Summaries
  - Disaster period
- Individual and Households Program
  - FEMA-determined damage to-
    - Real property components
    - Personal property components

4. Methodology

Period Definition

- **Disaster period (DP):** Disaster beginning to 2 weeks post-disaster
- **Baseline period (BP):** The same period during 1 year prior to the disaster

Hypothesis

- **Null hypothesis (H_0):** The distribution of daily sewerage-related 311 call counts during disaster period is equal to or lower than baseline period

$$H_0: X_{DP} \leq X_{BP}$$

- **Alternative hypothesis (H_a):** The distribution of daily sewerage-related 311 call counts during disaster period is greater than baseline period

$$H_a: X_{DP} > X_{BP}$$

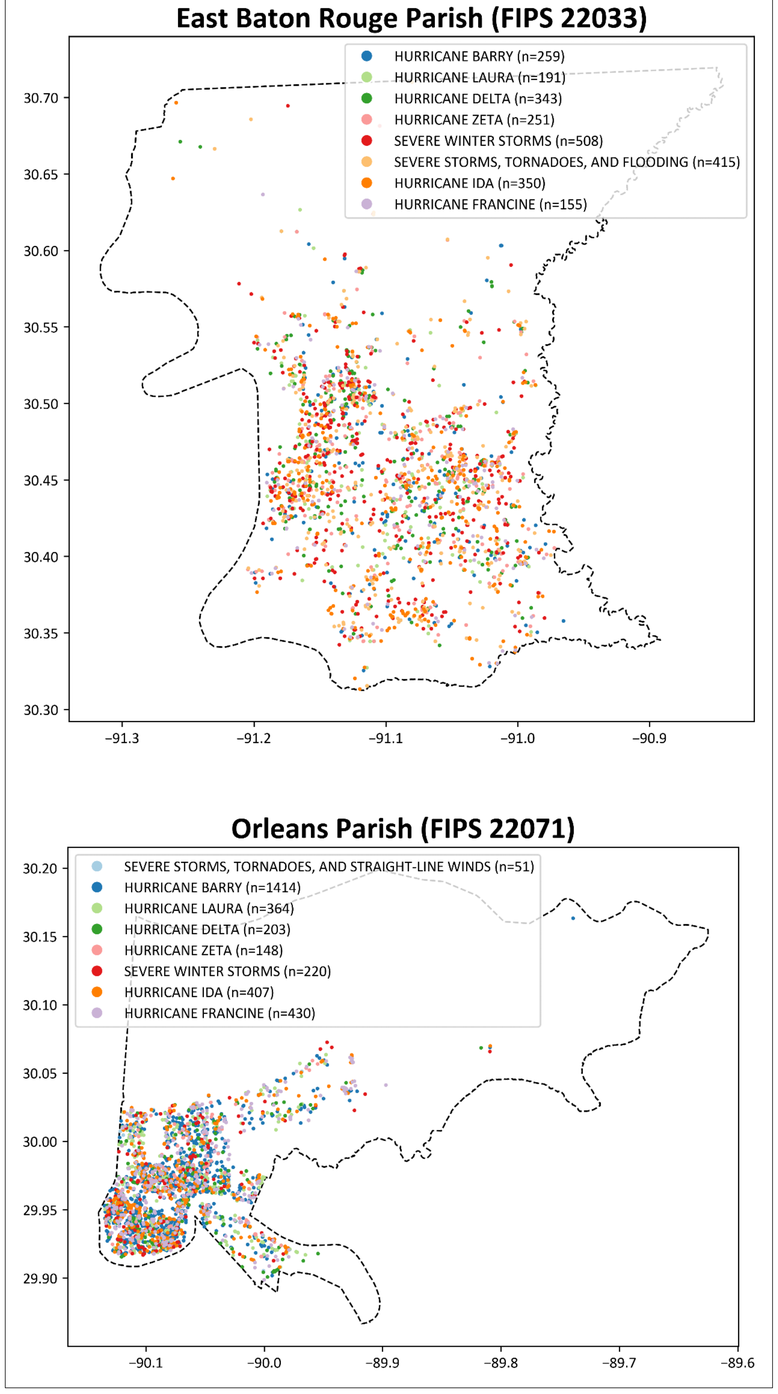
Statistical Test

One-tailed Mann-Whitney U test

- **Direction:** less (baseline < disaster period)
- **Unit of observation:** Daily call count

5. Study Area

Spatial Distribution of Sewerage-Related 311 Calls from Disaster Onset to 2 Weeks Post-Disaster

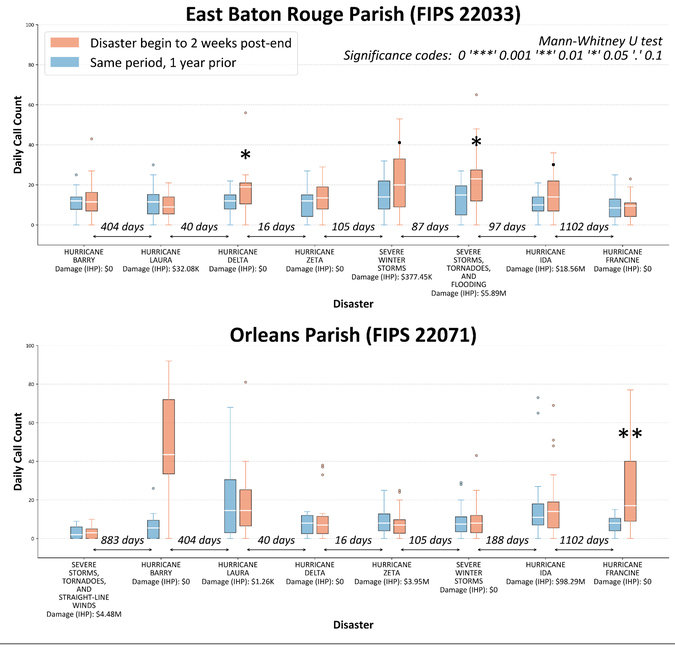


Research Implication

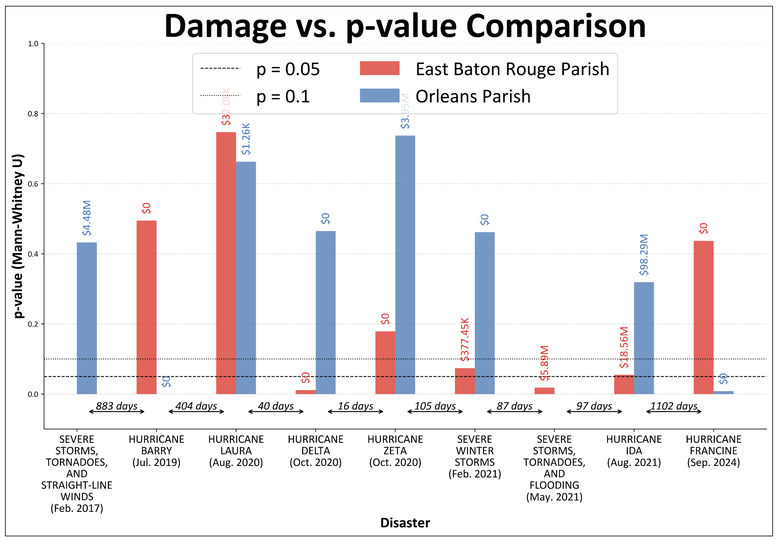
- 311 sewerage-related calls data shows potential use as an early warning indicator.
- Response patterns are event- and location-specific.
- Disasters may suppress reporting activity.
- Moderate-to-severe disasters generate the strongest reporting signals.

6. Result

Daily Sewerage-Related 311 Call Counts: Baseline vs. Disaster Onset to 2 Weeks Post-Disaster



Damage vs. p-value Comparison



7. Findings

- Earlier disasters (2017–2020) showed no significant increase in 311 sewerage-related call counts regardless of damage amount suggesting that reporting may have strengthened over time as 311 adoption increased.
- Damage does not have linear association with 311 response: some high-damage events showed no increase, while zero-damage hurricanes still triggered significant sewerage complaints.
- Hurricane Ida shows a sharp contrast: significant response in East Baton Rouge but not in heavily damaged Orleans, supporting the idea that mass evacuation might have suppressed 311 reporting.
- Significance rarely occurs simultaneously in both parishes, highlighting distinct infrastructure, urban conditions, and population responses.