# Social Vulnerability and Natural Disasters

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# Outline of the Presentation

► **Introduction**
  ► Project description
  ► Conceptual model & definitions

► **Vulnerability in Texas & Harris County**
  ► Household Composition & Disability
  ► Minority Status & Language

► **Exposure to Natural Disasters & Vulnerability**
  ► Preparedness
  ► Adaptive capacity

► **Policy considerations**
  ► Relevance of findings
  ► Long-term disaster impacts
  ► Survey limitations

► **Applications**
  ► Houston Dashboard

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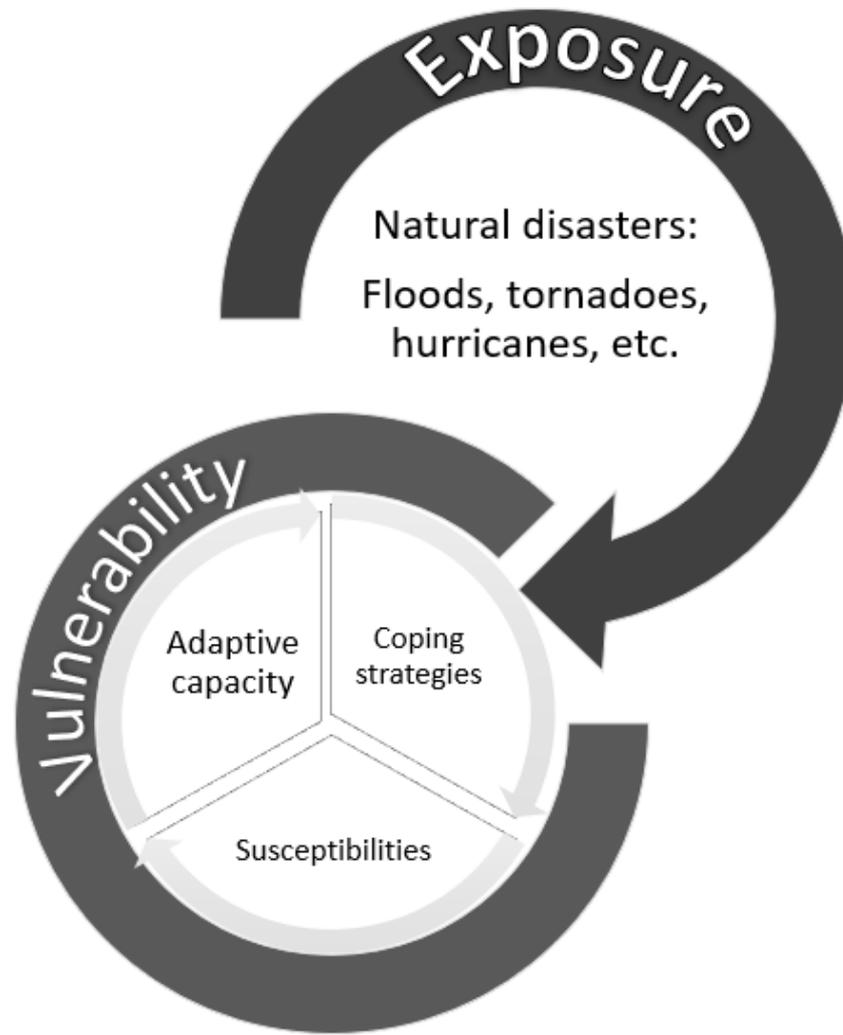
# Vulnerability in Texas & Harris County

▶ After Hurricane Harvey hit Houston in August 2017, the University of Houston's Hobby School of Public Affairs initiated a five-year survey study to understand:

  ▶ Long-term experiences of people impacted by Harvey and other natural disasters

  ▶ Preparedness and coping strategies to natural disasters

  ▶ How individuals, community organizations, government, and private sector leaders try to mitigate the consequences of natural disasters

▶ This presentation covers results form the fourth wave of the Hobby School Harvey Survey

  ▶ The survey was fielded between December 22, 2021 and March 2, 2022

  ▶ Our analysis focuses on respondents' experience and vulnerability to natural disasters

  ▶ We develop an index of vulnerability for the Houston area, for which we draw on the CDC's Social Vulnerability Index (SVI)

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# Conceptual Model of Vulnerability



Exposure

Natural disasters:
Floods, tornadoes, hurricanes, etc.

Vulnerability
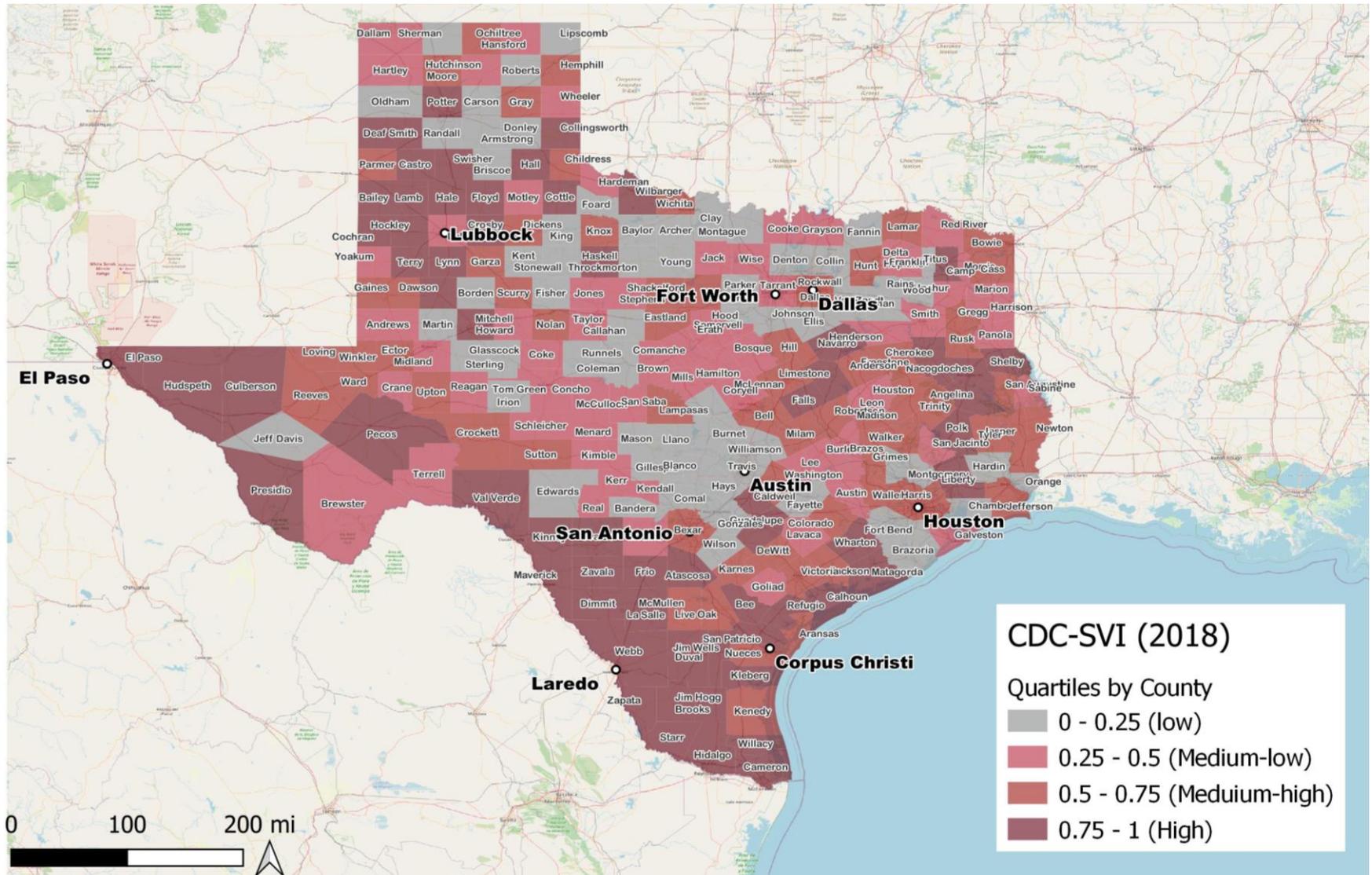
Adaptive capacity

Coping strategies
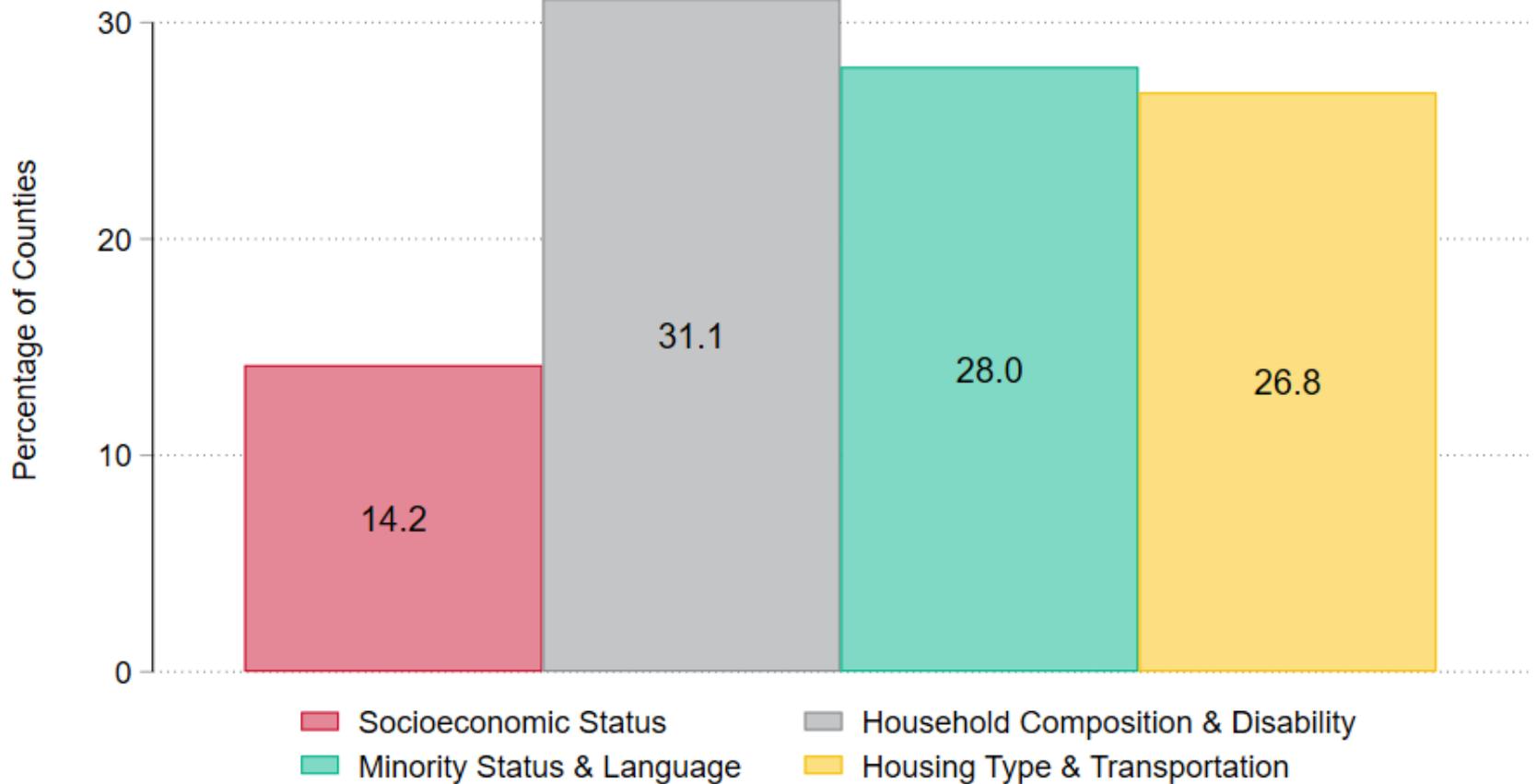
Susceptibilities

# Vulnerability in Texas & Harris County

▶ Vulnerability to natural disasters determine community's resiliency to future hazards

  ▶ Household vulnerability encompasses many concepts, such as exposure, susceptibilities, adaptive capacity, and preparedness

  ▶ Different socio-economic conditions, affect a community's ability to prepare, withstand, recover, and prevent loss in the event of natural hazards or external shocks, including:

    ▶ High poverty rates

    ▶ Low percentage of vehicle access

    ▶ Inability to communicate in English

    ▶ Physical disabilities

▶ Household vulnerability varies across Texas; the most prevalent types of vulnerability, as defined by the CDC, are:

  ▶ Minority Status & Language vulnerability

  ▶ Household Composition & Disability vulnerability

▶ We analyze patterns of survey responses on the impact of natural disasters by the two binary measures of vulnerability constructed

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# Social Vulnerability in Texas



**CDC-SVI (2018)**

Quartiles by County

- 0 - 0.25 (low)
- 0.25 - 0.5 (Medium-low)
- 0.5 - 0.75 (Meduium-high)
- 0.75 - 1 (High)

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# Texas Counties by Major Vulnerability Type

# Type of Vulnerability in Texas



CDC-SVI (2018)

Major vulnerability by county

- Socioeconomic status
- Household composition & disability
- Minority status & language
- Housing type & transportation

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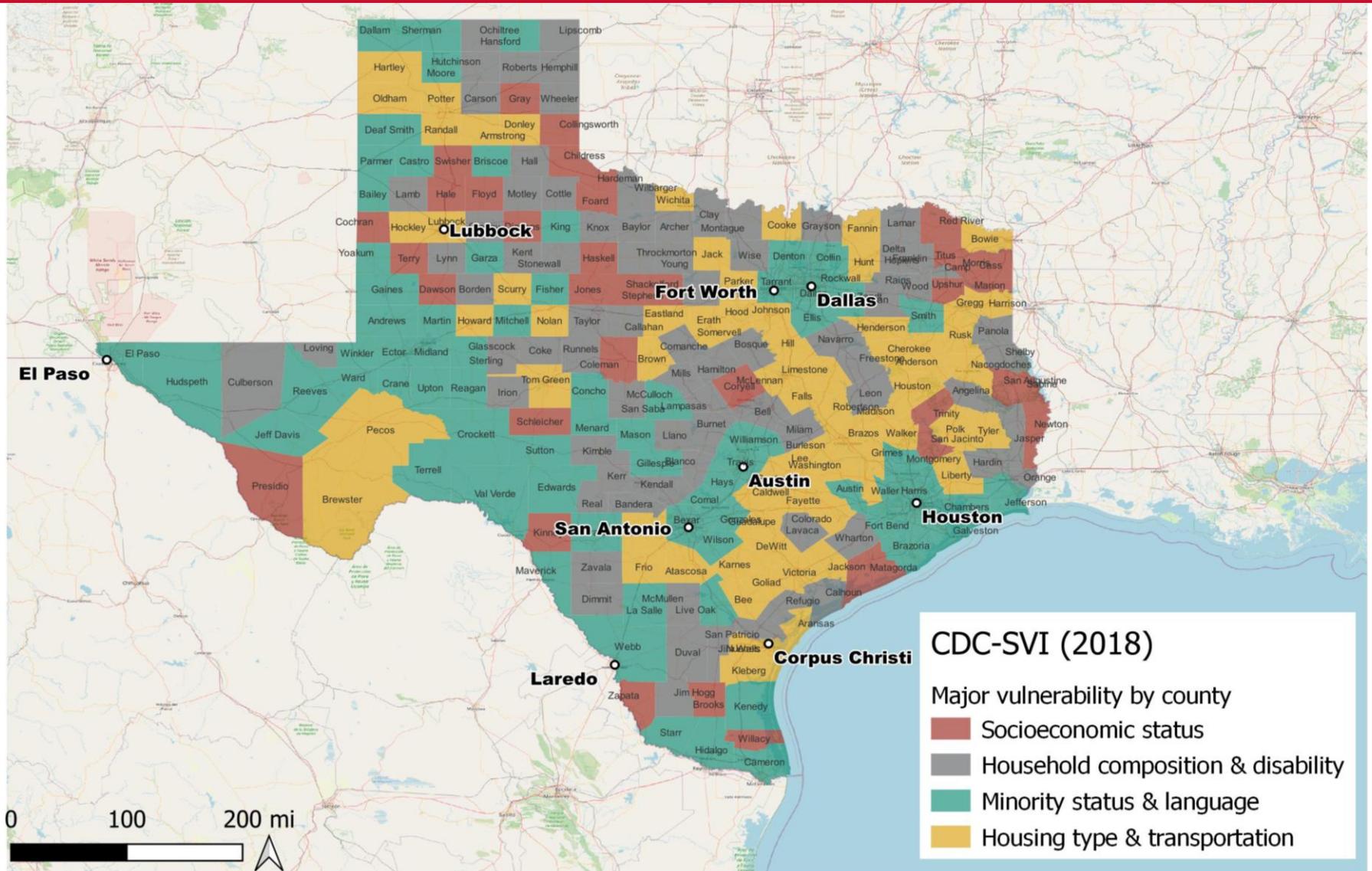
# SVI Binary Measures

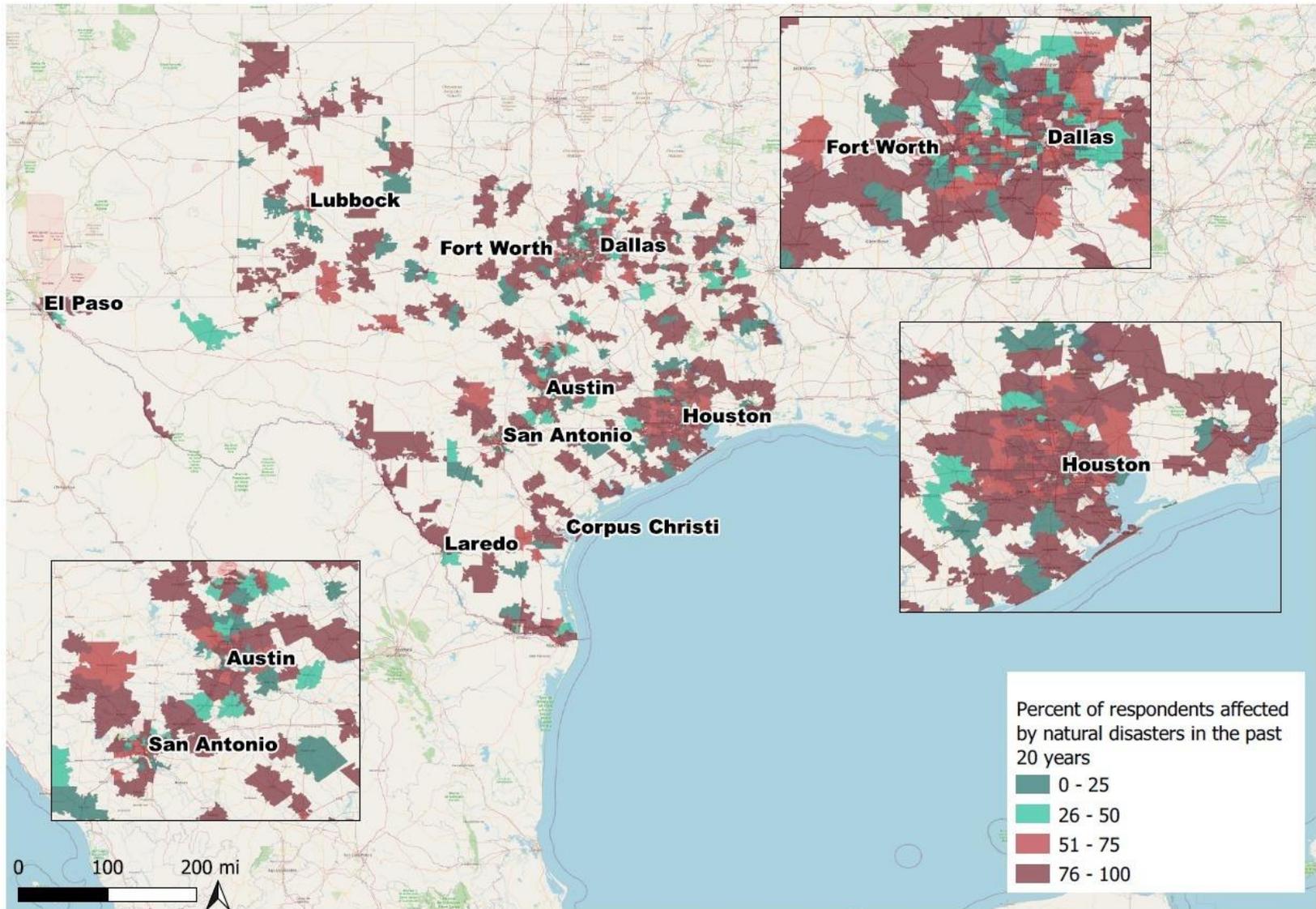| | CDC-SVI* | Binary measure+ |
|---|---|---|
| **Socioeconomic Status** | Below Poverty<br>Unemployed<br>Income<br>No High School diploma | *Not included* |
| **Household Composition & Disability** | Aged 65 or Older | HCDV=1 if yes; HCDV=0 if not |
| | Aged 17 or Younger | HCDV=1 if yes; HCDV=0 if not |
| | Civilian with a Disability | HCDV=1 if yes; HCDV=0 if not |
| | Single-Parent Household | HCDV=1 if yes; HCDV=0 if not |
| **Minority Status & Language** | Minority | MSLV=1 if non-white; MSLV=0 if white |
| | Speaks English "Less than Well" | MSLV=1 if yes; MSLV=0 if not |
| **Housing Type & Transportation** | Multi-Unit Structures<br>Mobile Homes<br>Crowding<br>No Vehicle<br>Group Quarters | *Not included* |
| **Type of measure** | Overall Vulnerability | Texas Top Vulnerabilities |
| **Measurement** | Census Tracts & Counties | Survey respondents in Texas |

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# Natural Disasters and Vulnerabilities

► Compared to the rest of Texas, Harris County has been substantially more affected by natural disasters in the past 20 years.

   ► Most respondents were affected by:

      ► Winter Storm Uri (2021), with highest percentage of affected respondents

      ► Hurricane Harvey (2017), which ranked second

► While most respondents in Harris county were affected by extreme cold and flooding, the impact varied by socio-demographic characteristics and vulnerability status:

   ► Vulnerable households in terms of minority status, language, household composition, and physical disability were affected the most

   ► A higher percentage of respondents classified as vulnerable based on Minority Status & Language vulnerable were affected by flooding

   ► Household Composition & Disability vulnerable households were more affected by tornadoes
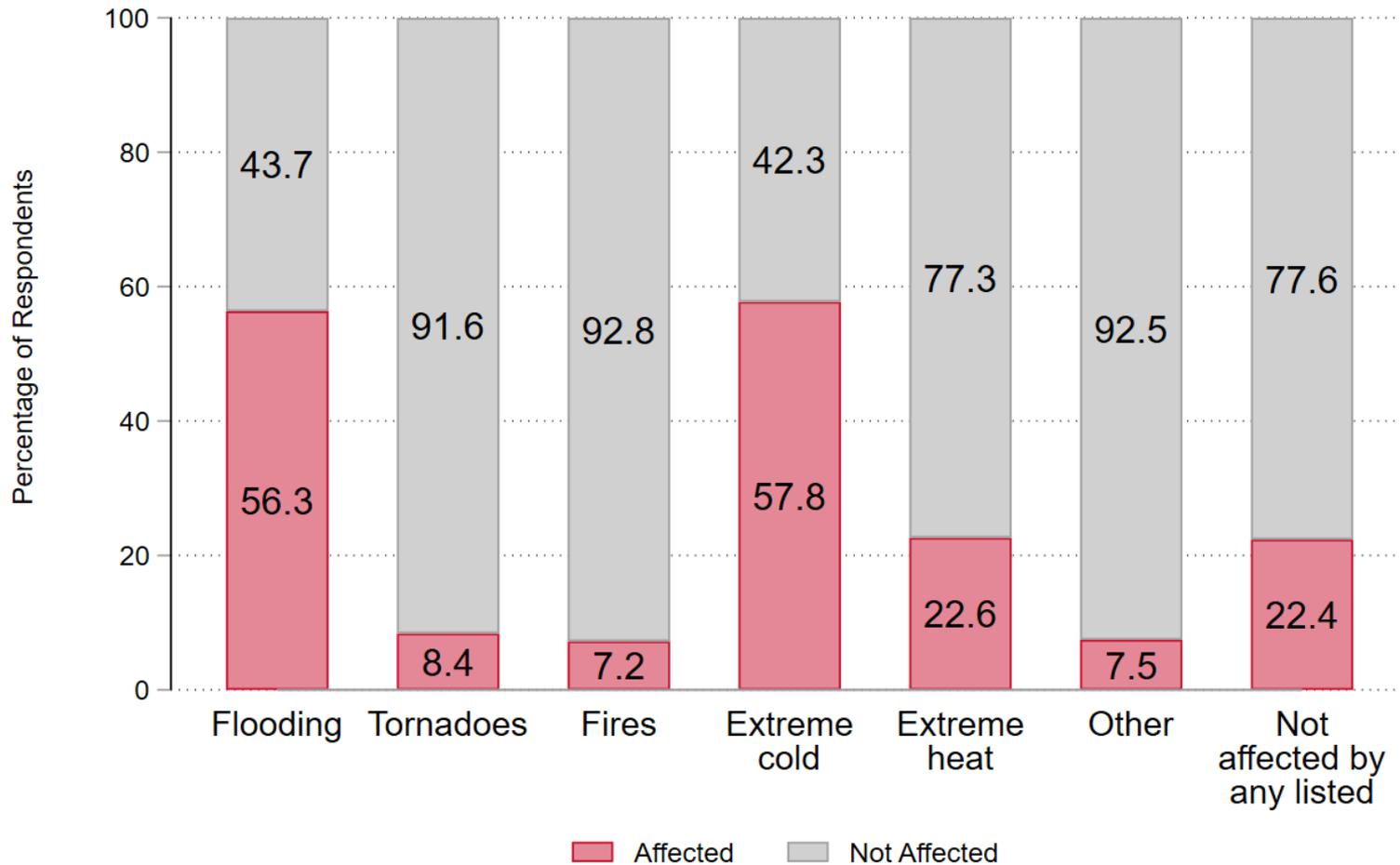
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# Impact of Natural Disasters



Percent of respondents affected by natural disasters in the past 20 years
- 0 - 25
- 26 - 50
- 51 - 75
- 76 - 100

# Impact of Natural Disasters

## Affected by Natural Disasters in Past 20 Years, Harris County



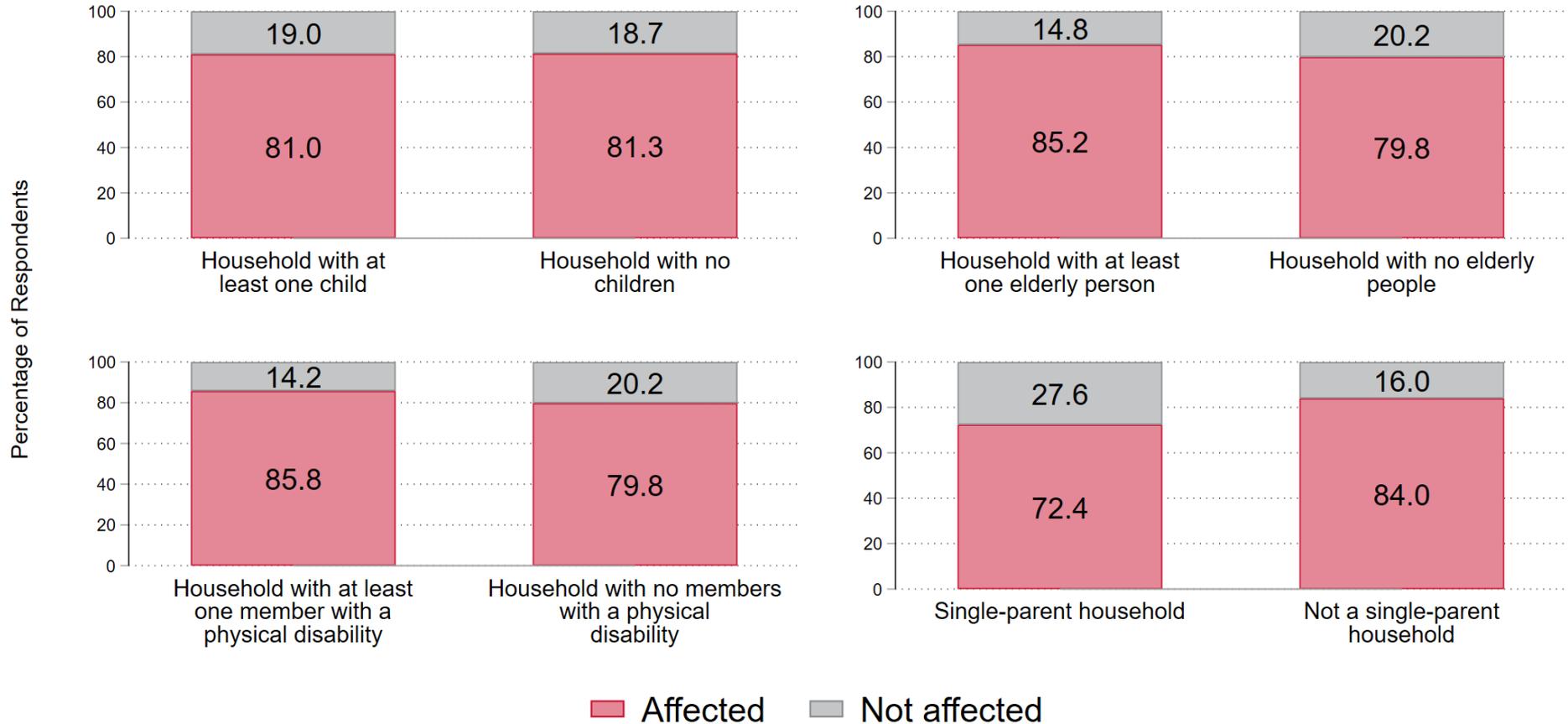**Hobby School of Public Affairs**
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# Impact of Natural Disasters

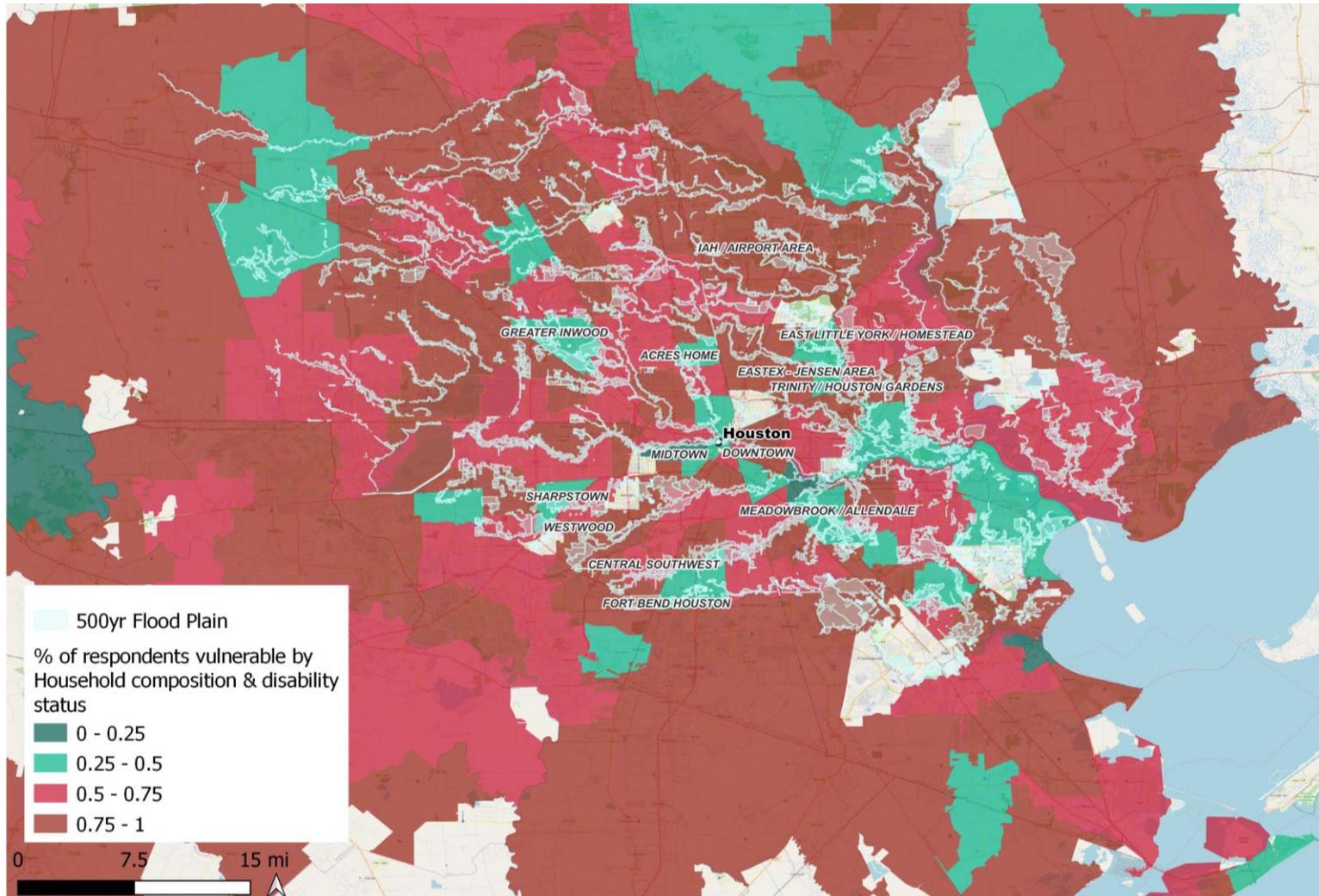**Affected by any Natural Disaster by Household Composition & Disability Vulnerability, Harris County**
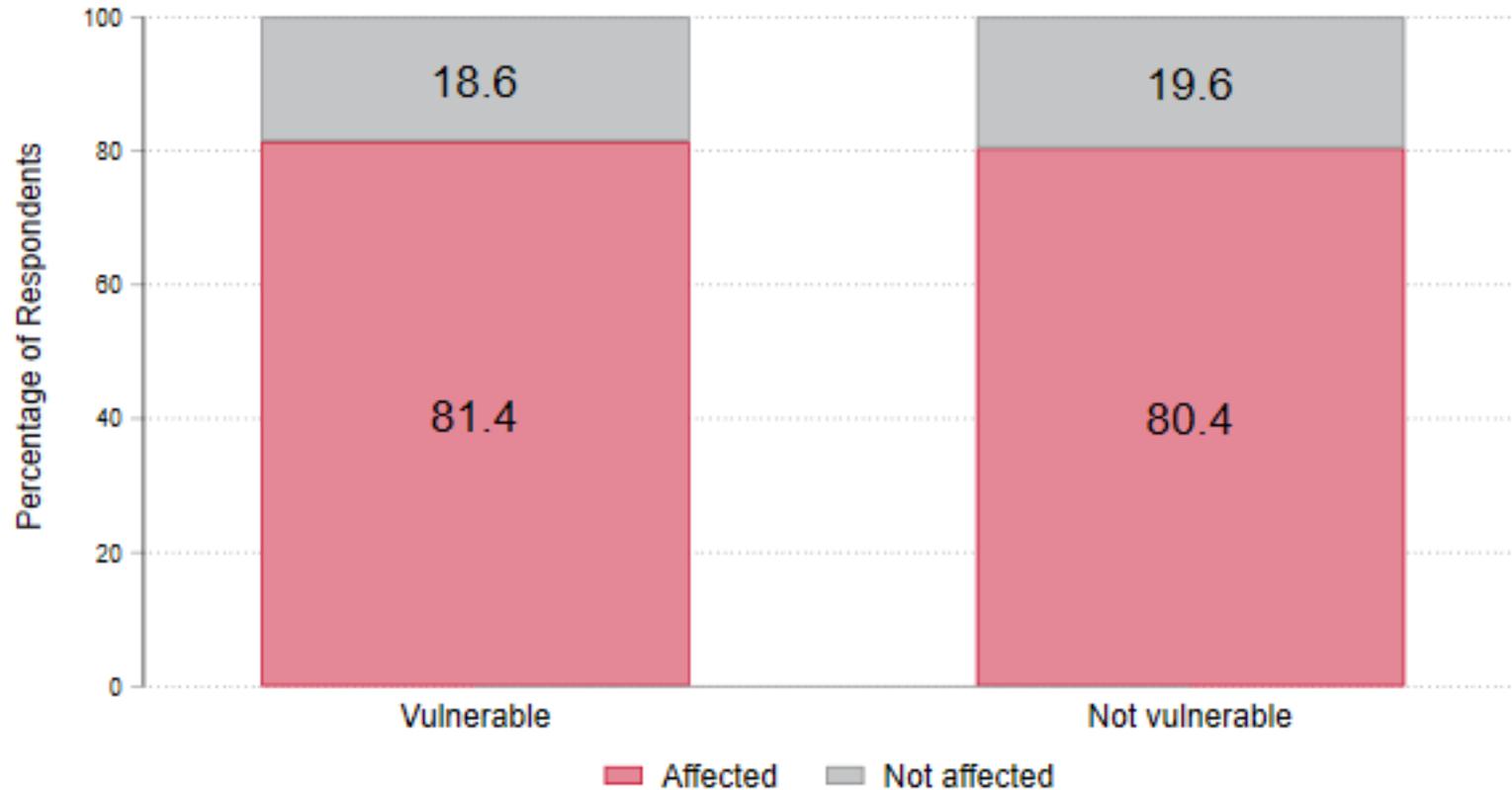
# Impact of Natural Disasters

## Affected by Any Natural Disaster by Household Composition & Disability Vulnerability Categories, Harris County



Percentage of Respondents

**Household with at least one child:** 19.0 (Not affected), 81.0 (Affected)
**Household with no children:** 18.7 (Not affected), 81.3 (Affected)

**Household with at least one elderly person:** 14.8 (Not affected), 85.2 (Affected)
**Household with no elderly people:** 20.2 (Not affected), 79.8 (Affected)

**Household with at least one member with a physical disability:** 14.2 (Not affected), 85.8 (Affected)
**Household with no members with a physical disability:** 20.2 (Not affected), 79.8 (Affected)

**Single-parent household:** 27.6 (Not affected), 72.4 (Affected)
**Not a single-parent household:** 16.0 (Not affected), 84.0 (Affected)

Legend: Affected, Not affected

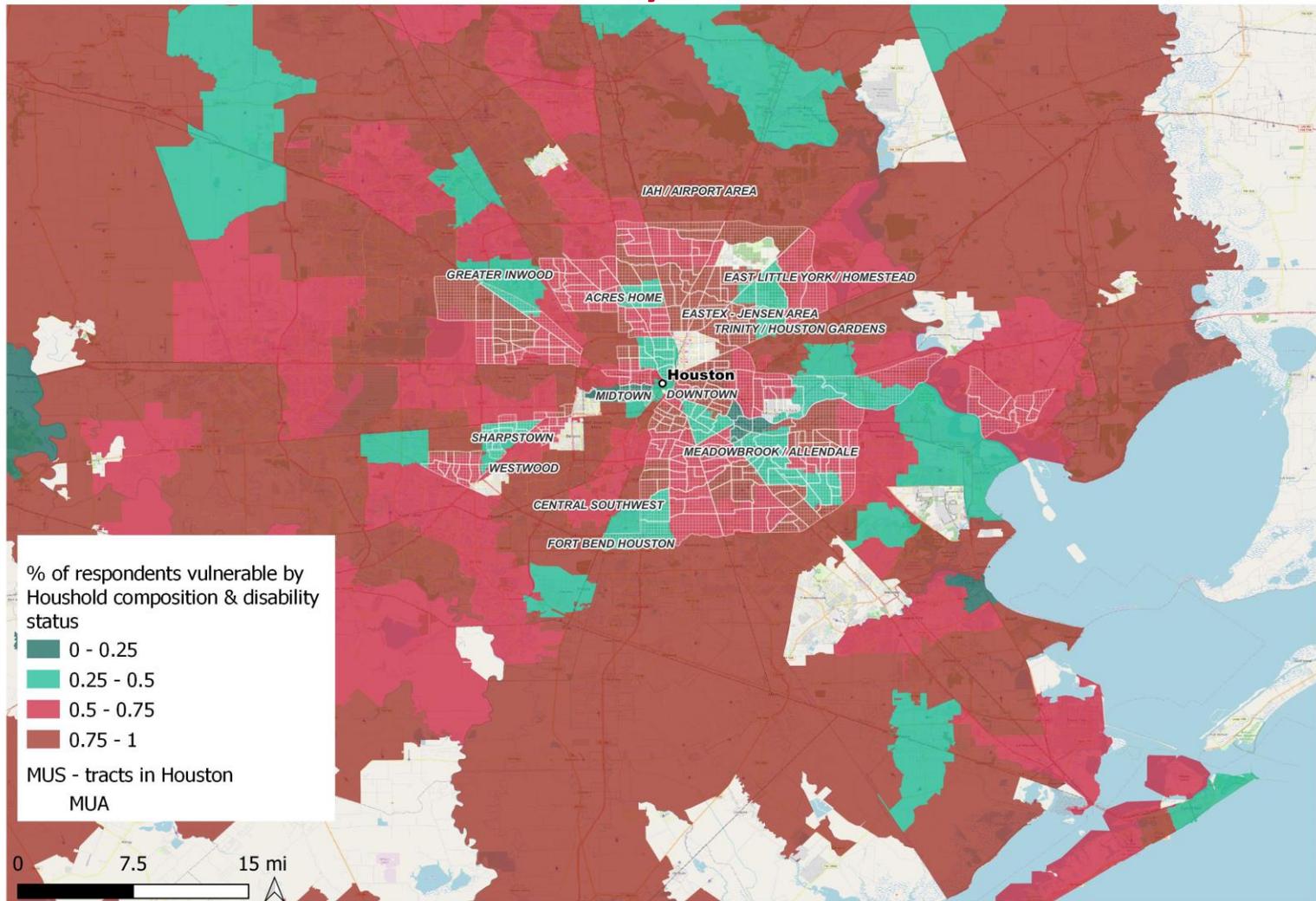Hobby School of Public Affairs
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# Impact of Natural Disasters

## Household Composition & Disability Vulnerability

# Impact of Natural Disasters

## HCDV and Medically Underserved Areas



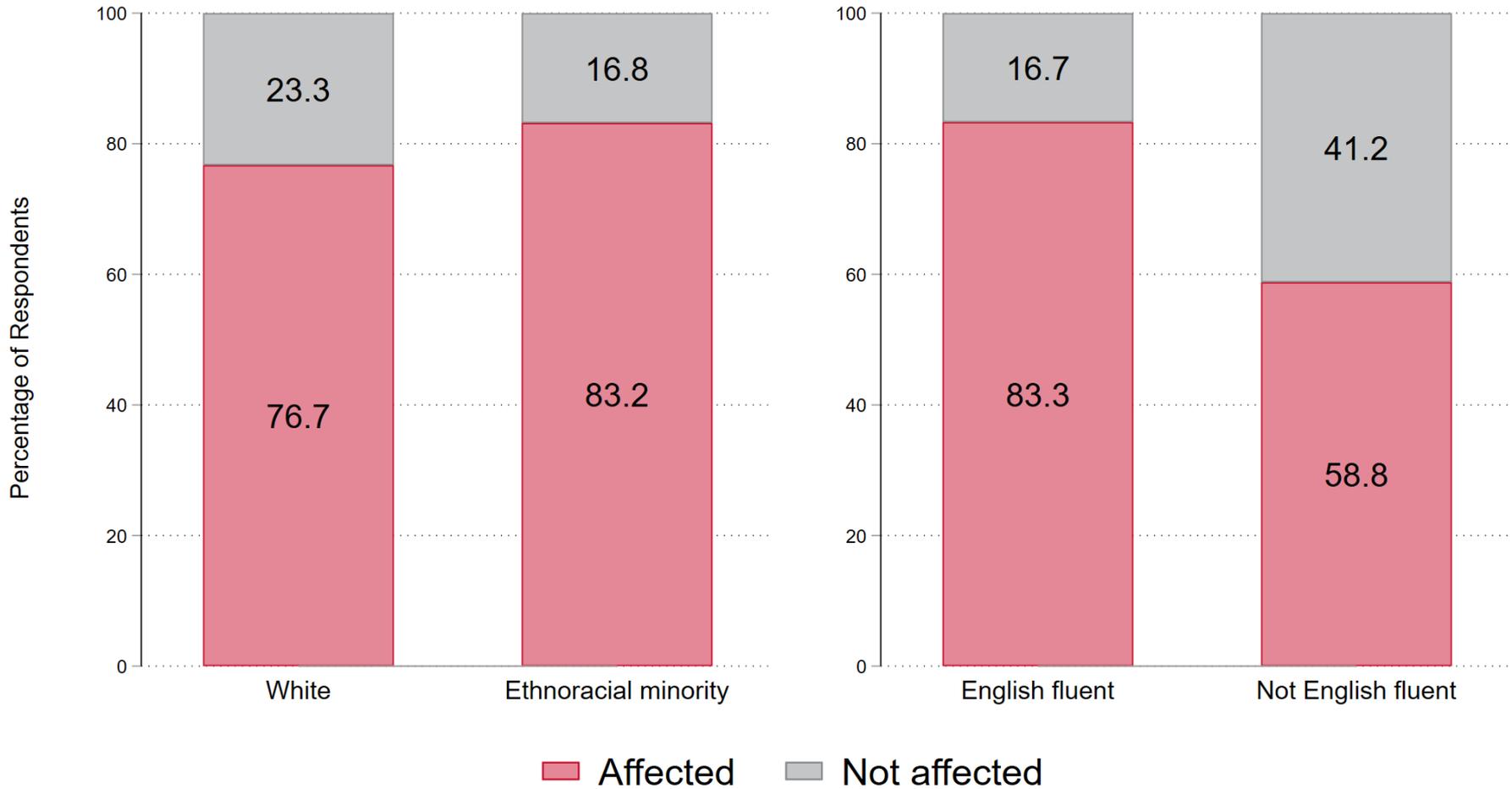Hobby School of Public Affairs
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# Impact of Natural Disasters

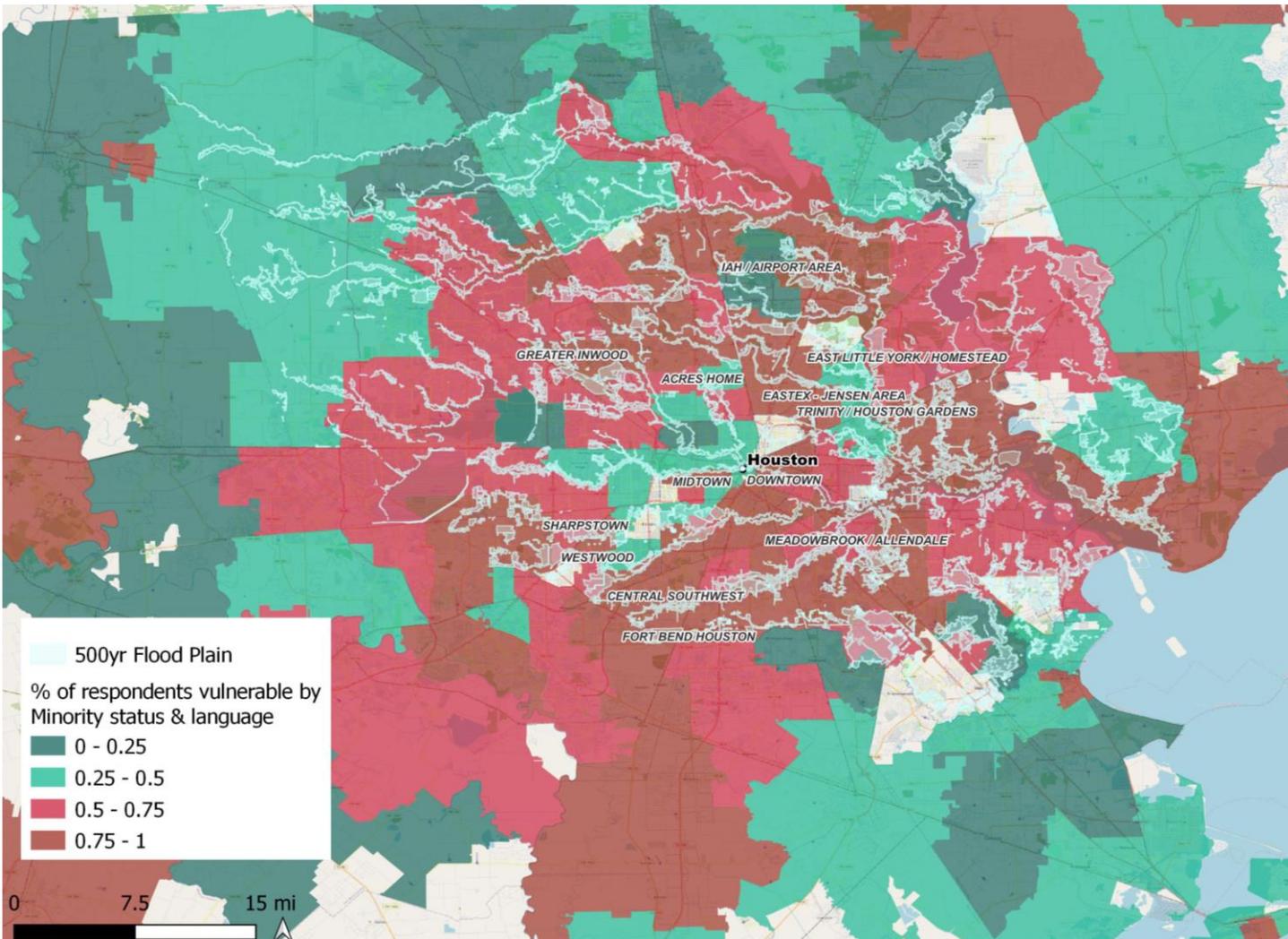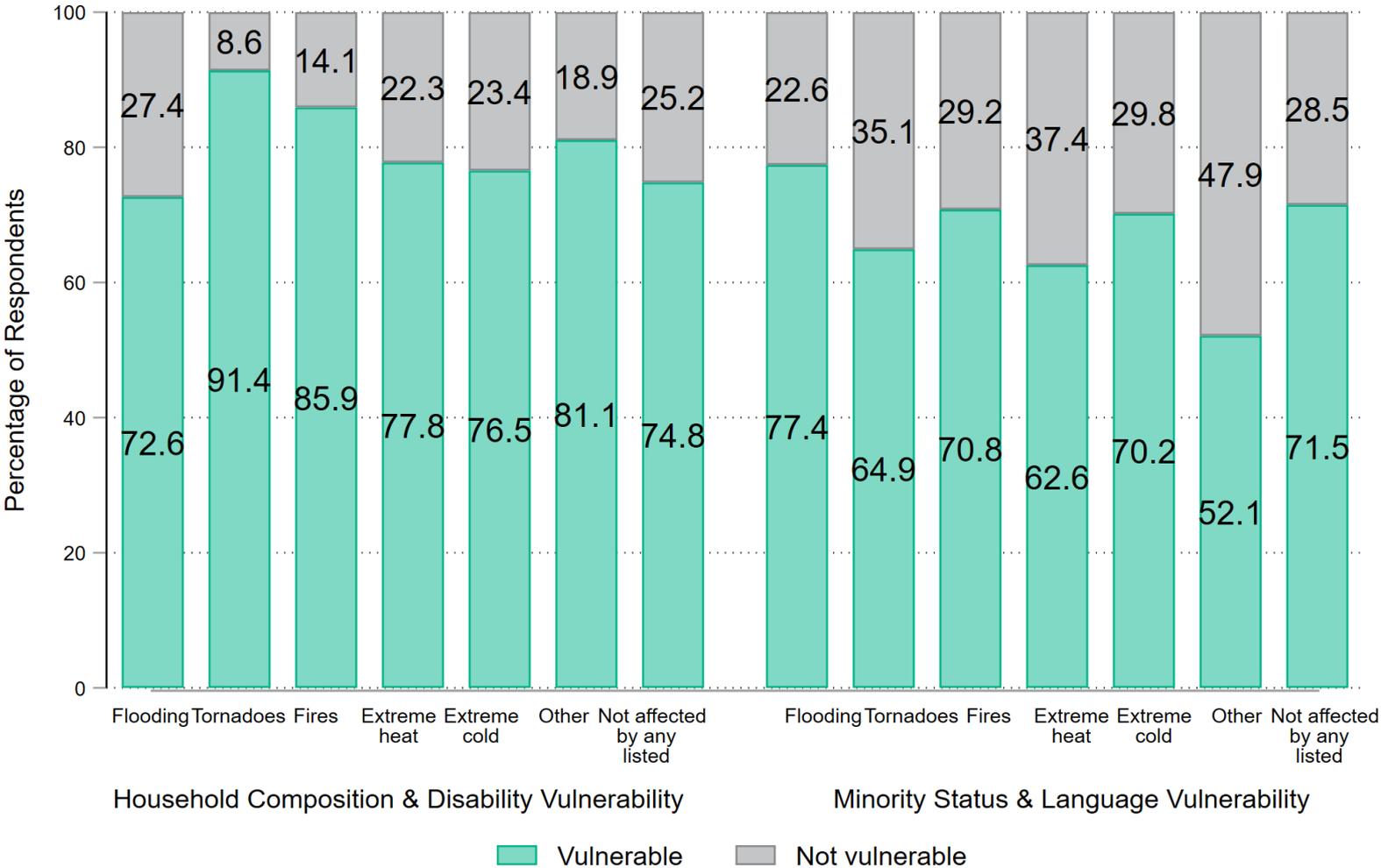## Affected by Any Natural Disaster by Minority Status & Language Vulnerability, Harris County
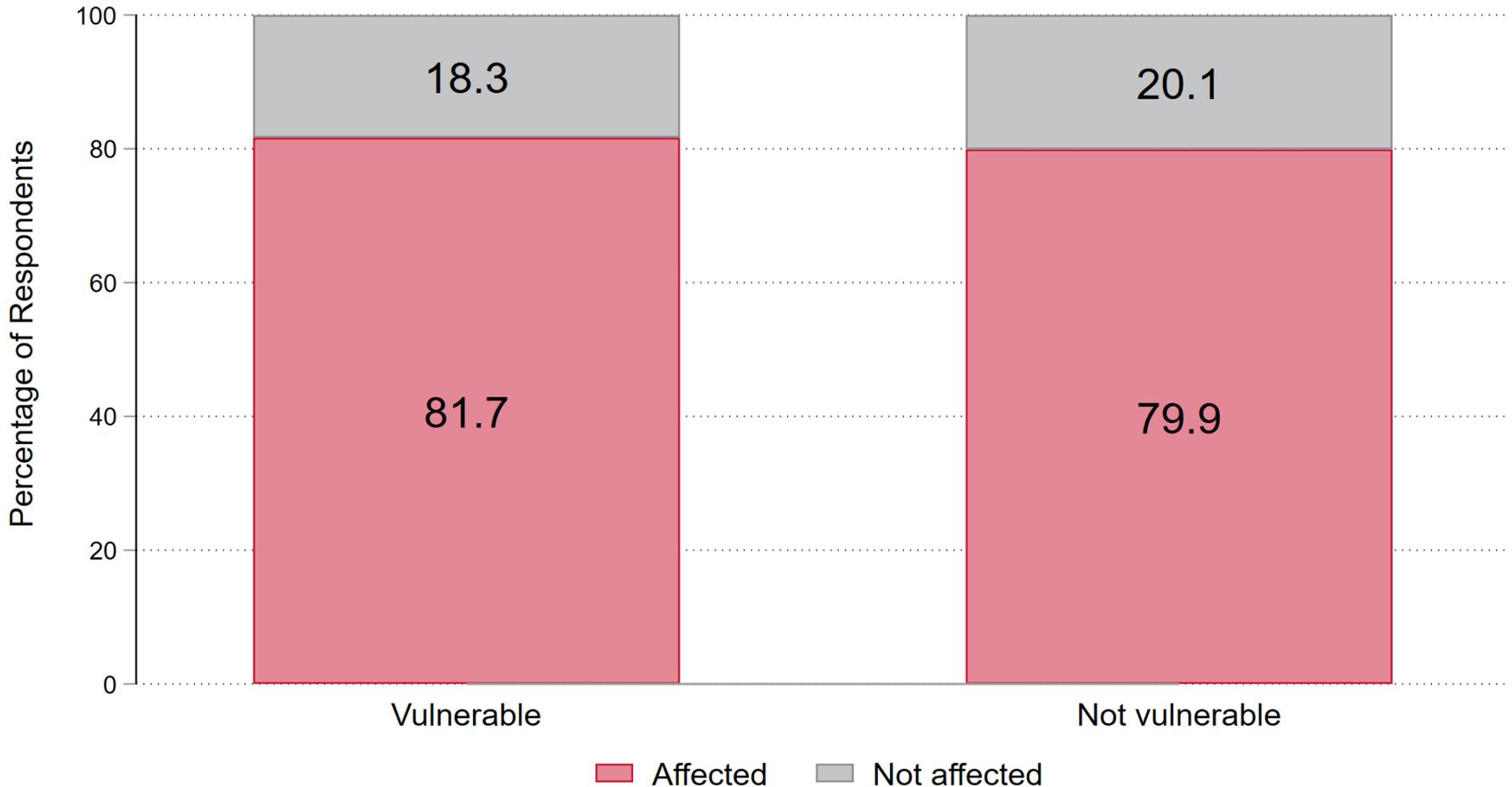
# Impact of Natural Disasters

## Minority Status & Language Vulnerability

# Impact of Natural Disasters

## Affected by Natural Disasters and Vulnerability Status in Harris County

# Preparedness

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# Patterns of Preparedness

► Almost 70% of respondents reported having prepared for the 2021 hurricane season in Harris County

  ► The highest percentages prepared by stockpiling, getting alternative power supply, and by subscribing to local emergency notifications

  ► There has been a change in the way people prepare for disasters: more prepared by getting alternative power supplies

► In general, those that were affected by Hurricane Harvey prepared more than those not affected

► Vulnerable households prepared slightly more than those that were not vulnerable, especially those with Minority Status & Language Vulnerabilities

► More white and Black or African American respondents reported NOT preparing compared to Asian or Pacific Islanders and Hispanics/Latinos

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# Patterns of Preparedness
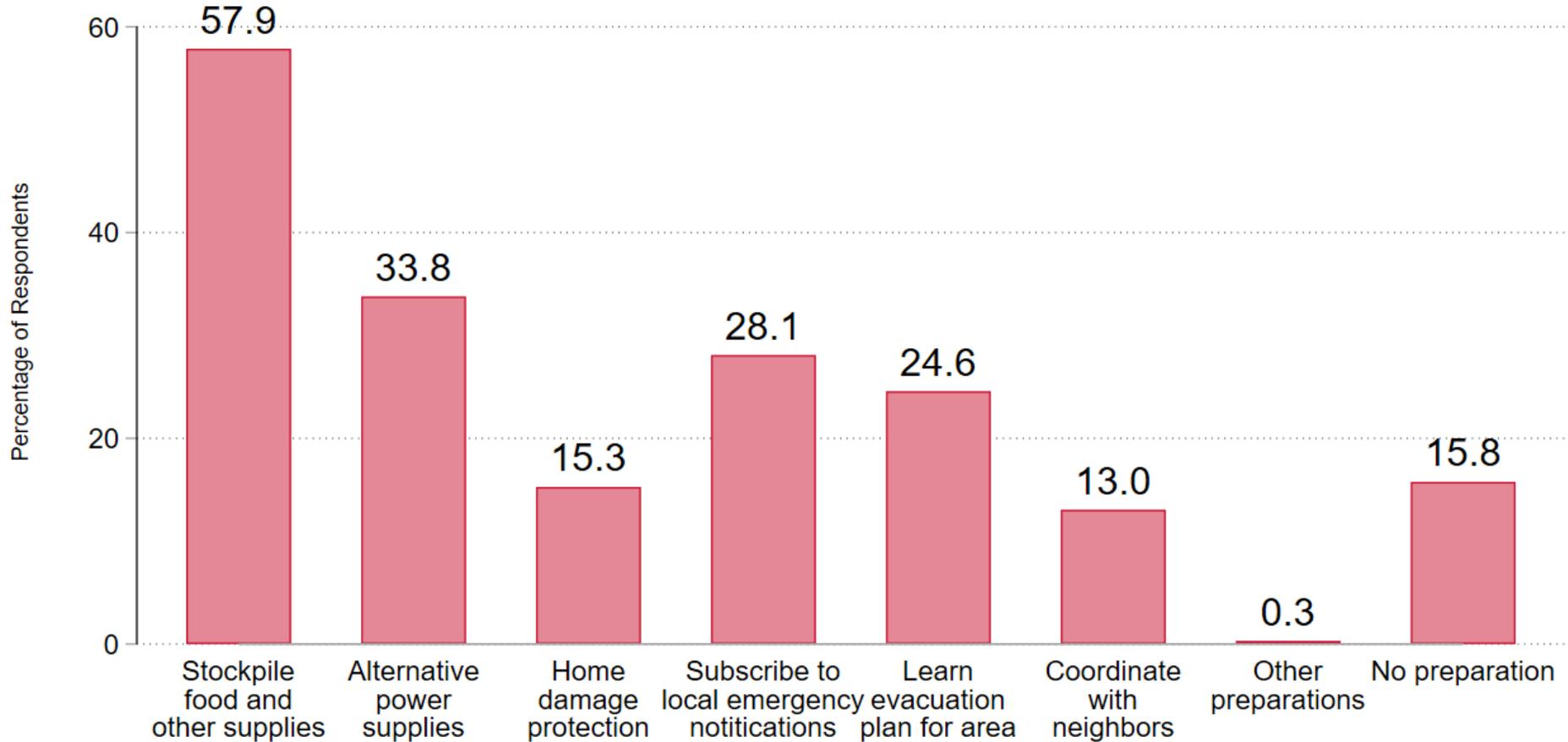
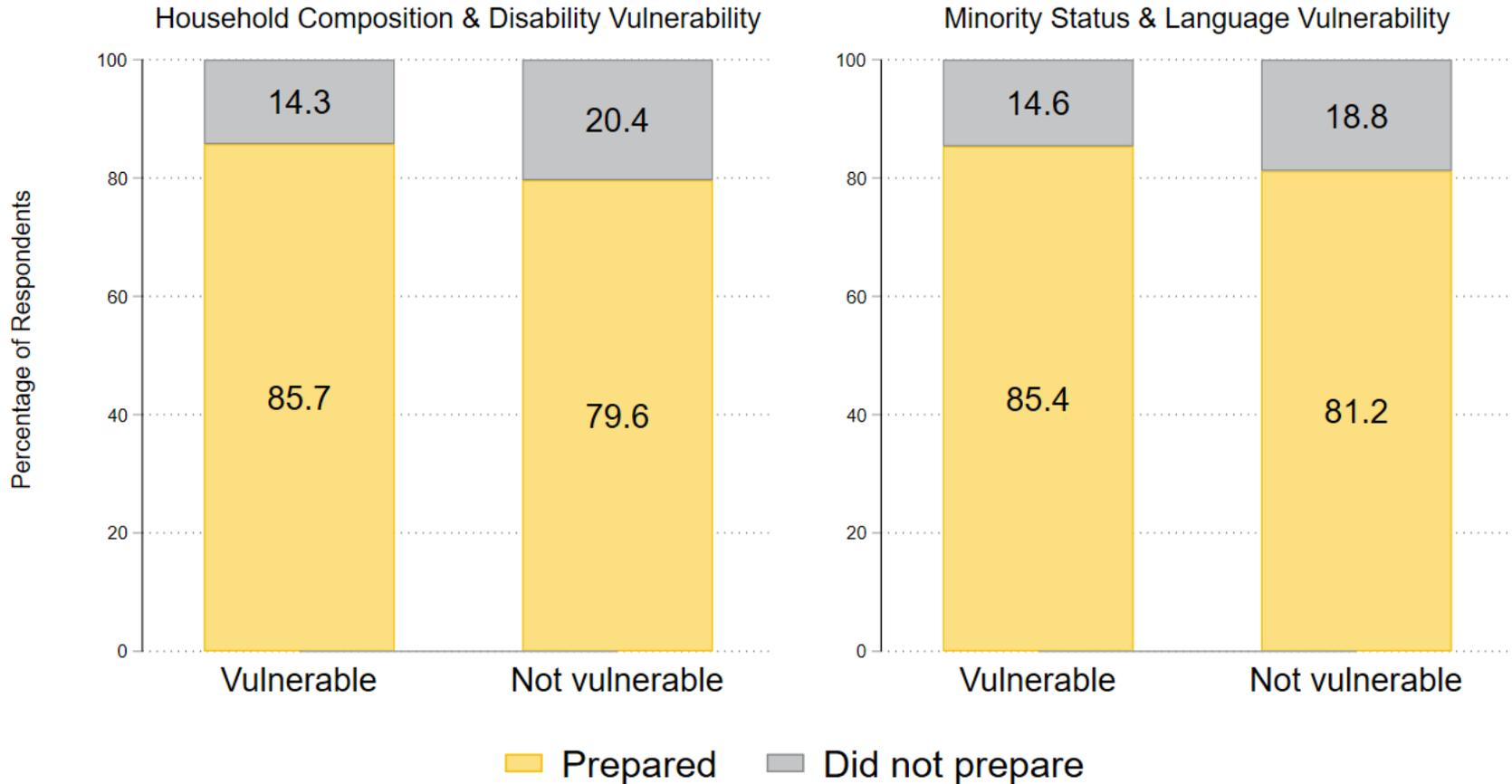## Hurricane Preparedness in the Greater Houston Area, 2017 and 2022

# Patterns of Preparedness

## Preparing for the 2021 Hurricane Season by Affected by Hurricane Harvey, Harris County
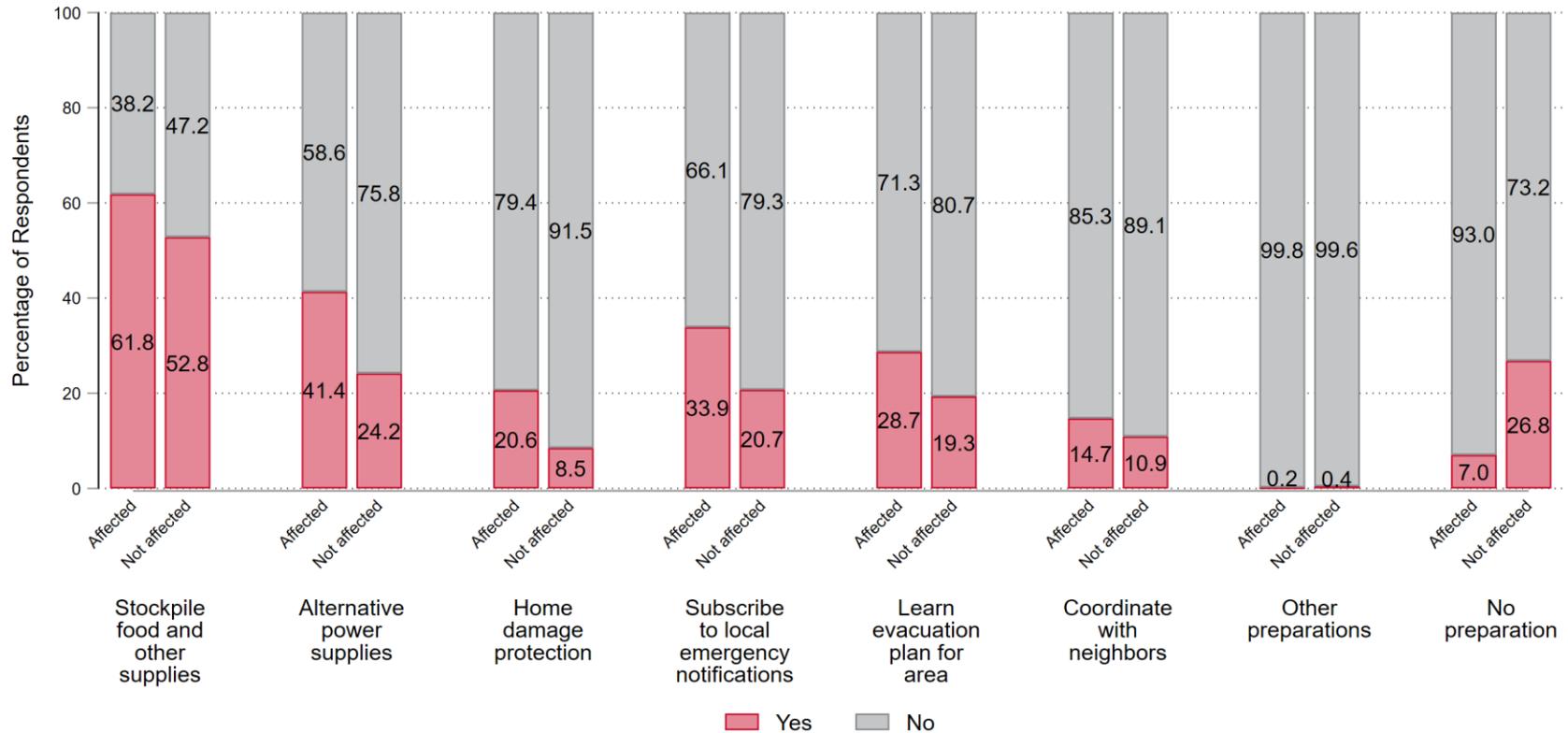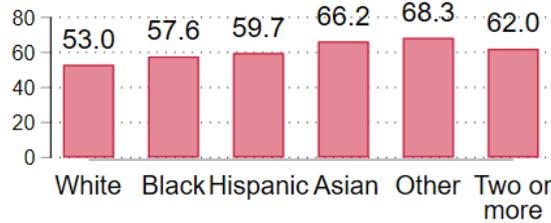
# Patterns of Preparedness

## Preparedness by Vulnerability Type in Harris County



Household Composition & Disability Vulnerability

Minority Status & Language Vulnerability

# Patterns of Preparedness

## 2021 Hurricane Preparations by Race/Ethnicity in Harris County

**Stockpile food & other supplies**

| White | Black | Hispanic | Asian | Other | Two or more |
|-------|-------|----------|-------|-------|-------------|
| 53.0 | 57.6 | 59.7 | 66.2 | 68.3 | 62.0 |

**Alternate power supplies**

| White | Black | Hispanic | Asian | Other | Two or more |
|-------|-------|----------|-------|-------|-------------|
| 34.2 | 23.7 | 42.6 | 14.9 | 21.5 | 25.9 |

**Home damage protection**

| White | Black | Hispanic | Asian | Other | Two or more |
|-------|-------|----------|-------|-------|-------------|
| 17.8 | 15.4 | 13.5 | 12.1 | 24.6 | 20.6 |
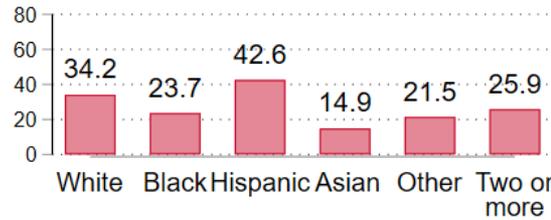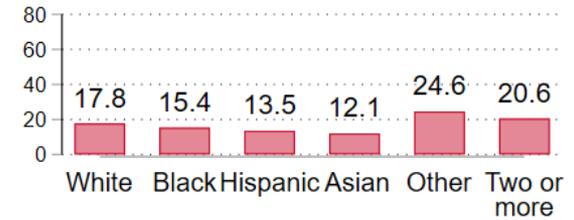
**Subscribe to local emergency notifications**

| White | Black | Hispanic | Asian | Other | Two or more |
|-------|-------|----------|-------|-------|-------------|
| 29.7 | 21.8 | 30.4 | 28.8 | 20.6 | 16.3 |

**Learn evacuation plan**

| White | Black | Hispanic | Asian | Other | Two or more |
|-------|-------|----------|-------|-------|-------------|
| 20.6 | 22.3 | 29.2 | 24.5 | 10.7 | 20.1 |
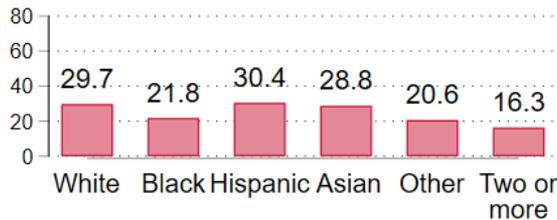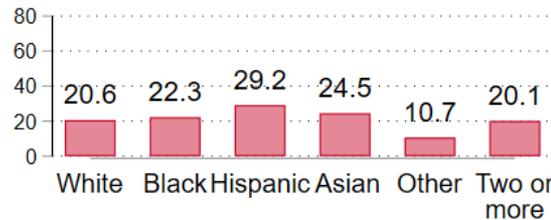
**Coordinate with neighbors**

| White | Black | Hispanic | Asian | Other | Two or more |
|-------|-------|----------|-------|-------|-------------|
| 14.2 | 7.4 | 11.2 | 32.4 | 9.1 | 10.5 |

**No preparation**

| White | Black | Hispanic | Asian | Other | Two or more |
|-------|-------|----------|-------|-------|-------------|
| 16.4 | 24.6 | 10.8 | 15.2 | 9.9 | 23.7 |
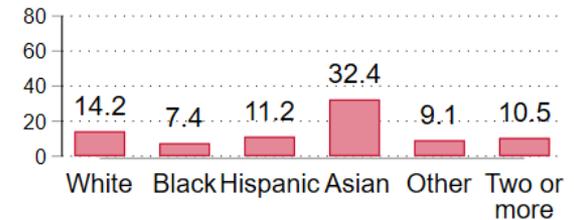
*Percentage of Respondents*
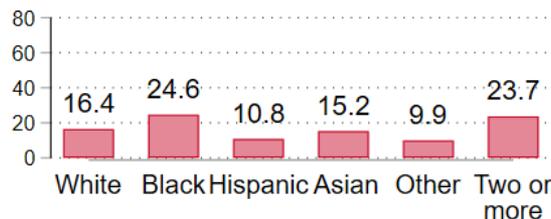
Note: Values exclude 'Other preparations' due to low response rate.

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Adaptive Capacity

# Adaptive Capacity

► Those affected by natural disasters were more likely to have insurance

► Vulnerable populations are most likely to have insurance compared to the non-vulnerable populations

► Insurance rates are positively related to higher income respondents, specifically for homeowners and flood insurance

Types of Insurance in Harris County
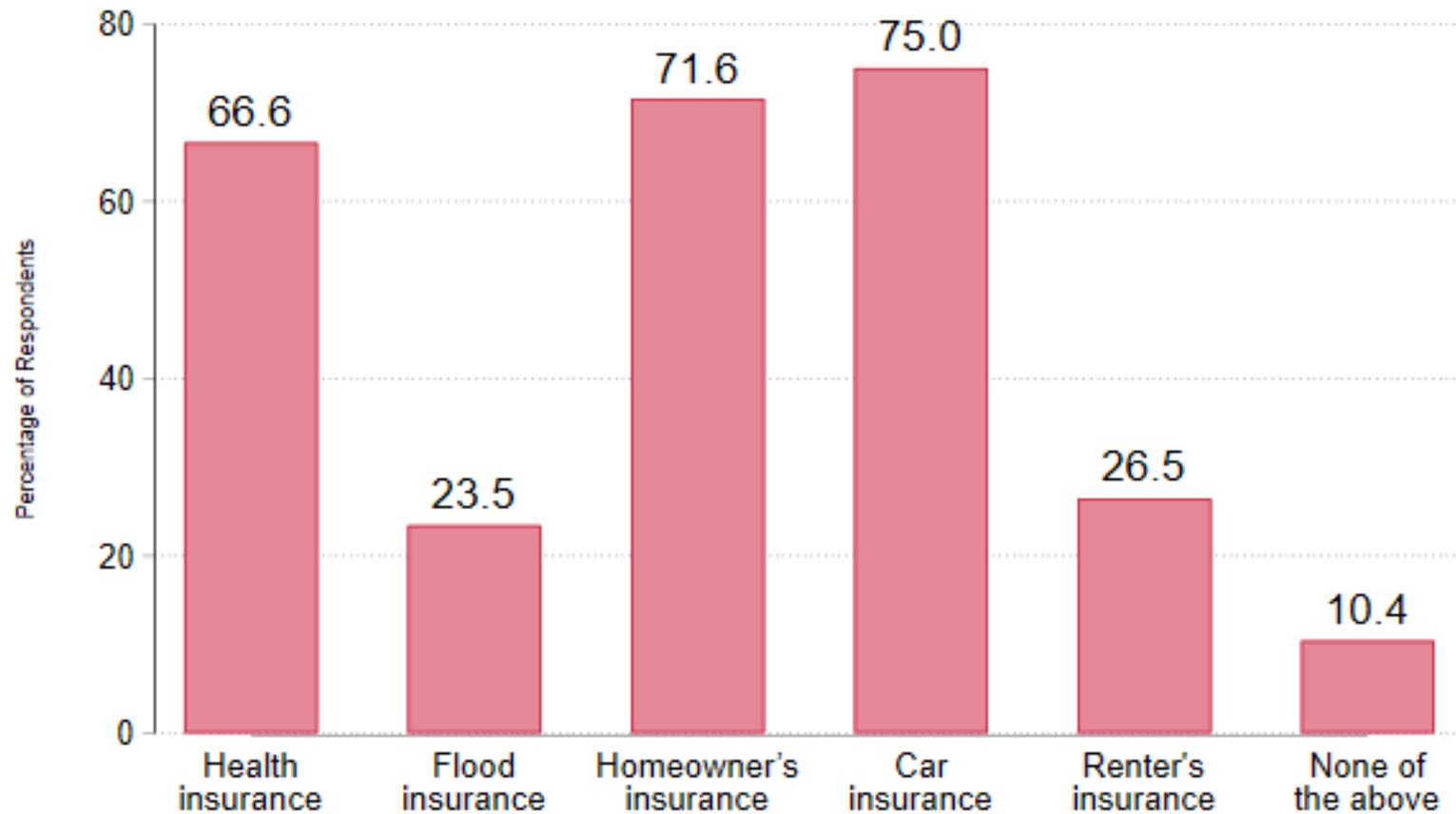
# Insured and Uninsured by Vulnerability Type



**Household Composition & Disability Vulnerability**

- Vulnerable: 14.5 (Does not have insurance), 85.5 (Has insurance)
- Not vulnerable: 13.4 (Does not have insurance), 86.6 (Has insurance)

**Minority Status & Language Vulnerability**

- Vulnerable: 16.9 (Does not have insurance), 83.1 (Has insurance)
- Not vulnerable: 7.1 (Does not have insurance), 92.9 (Has insurance)

Percentage of Respondents

■ Has insurance    ■ Does not have insurance

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# Income by Insurance Type in Harris County

## Less than $30,000

Percentage of Respondents

| | |
|---|---|
| Health insurance | 23.6 |
| Flood insurance | 14.9 |
| Homeowner's insurance | 13.7 |
| Car insurance | 22.6 |
| Renter's insurance | 33.5 |
| None of the mentioned insurances | 74.7 |

## $30,000 to $59,999

| | |
|---|---|
| Health insurance | 27.7 |
| Flood insurance | 27.6 |
| Homeowner's insurance | 29.1 |
| Car insurance | 30.2 |
| Renter's insurance | 32.2 |
| None of the mentioned insurances | 19.1 |

## $60,000 to $89,999

| | |
|---|---|
| Health insurance | 21.8 |
| Flood insurance | 27.0 |
| Homeowner's insurance | 23.9 |
| Car insurance | 23.0 |
| Renter's insurance | 24.0 |
| None of the mentioned insurances | 4.6 |

## $90,000 or more

| | |
|---|---|
| Health insurance | 26.9 |
| Flood insurance | 30.6 |
| Homeowner's insurance | 33.4 |
| Car insurance | 24.2 |
| Renter's insurance | 10.3 |
| None of the mentioned insurances | 1.5 |

**Legend:**
- Health insurance
- Flood insurance
- Homeowner's insurance
- Car insurance
- Renter's insurance
- None of the mentioned insurances

Insurance Type by Race/Ethnicity for Harris County
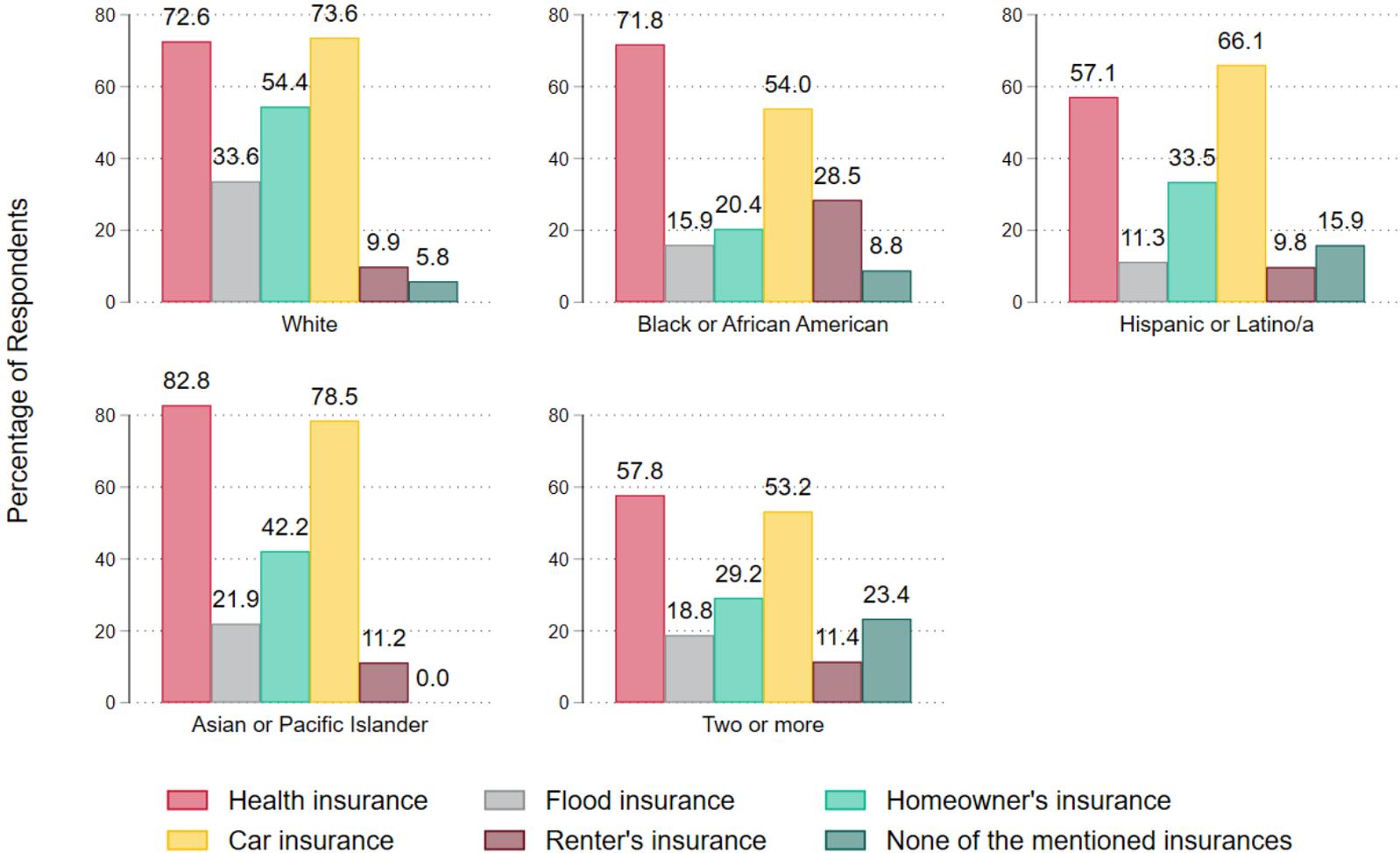
# Recovery

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# Recovery

► Respondents in Harris County are resilient
  ► Higher recovery rates compared to other areas of Texas

► Non-vulnerable respondents have higher recovery rates than vulnerable respondents

► Tropical Storm Imelda and severe storms and floodings of 2019 show the highest non-recovery rates for vulnerable respondents

► No apparent correlation between FEMA and GLO applications and recovery

► Strong correlation between insurance attainment and recovery
  ► Overall, those insured have higher recovery rates

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# Recovery

## Recovery by Household Composition & Disability Vulnerability in Harris County
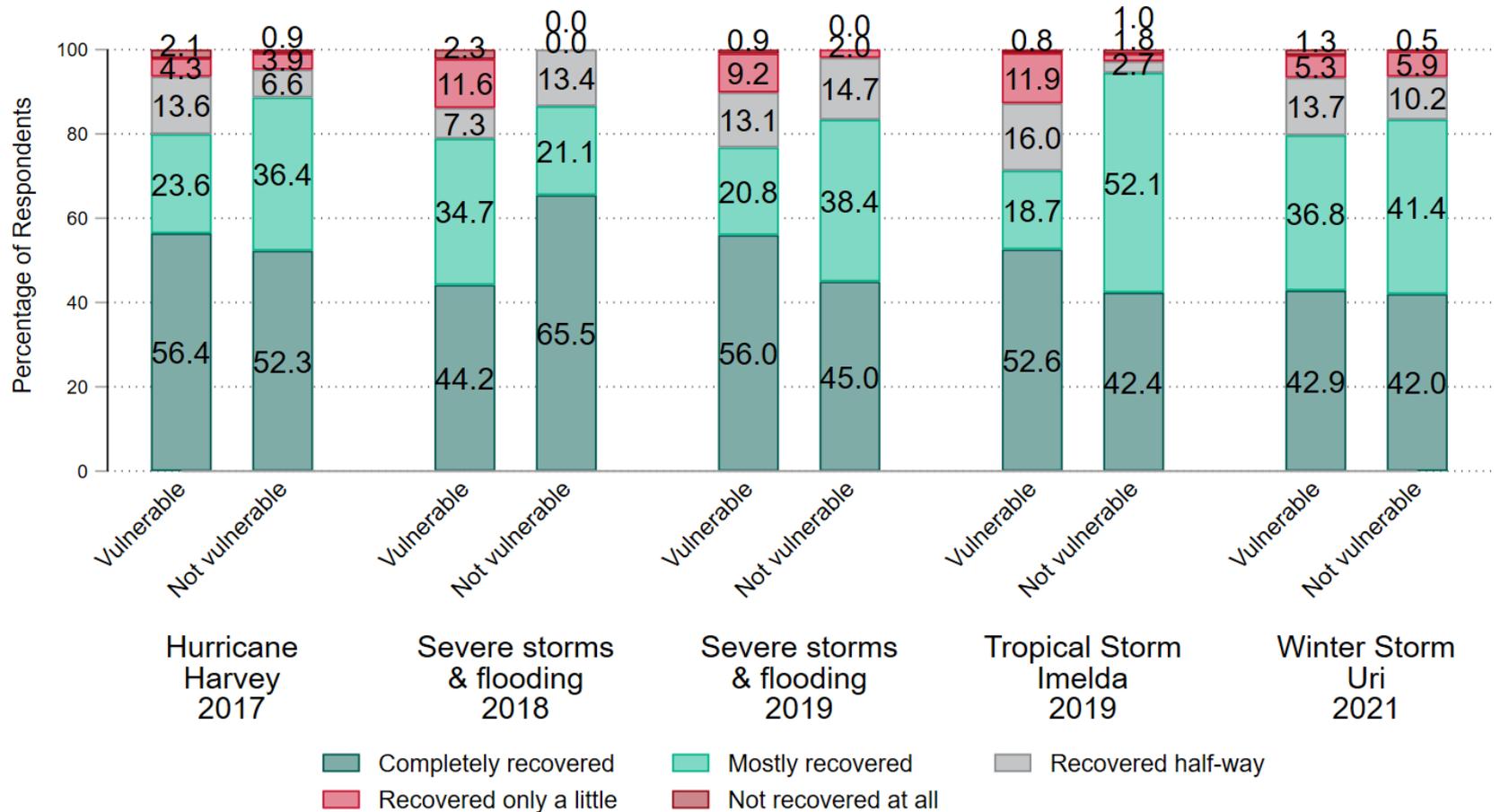
# Recovery

## Recovery by Minority Status & Language Vulnerability in Harris County
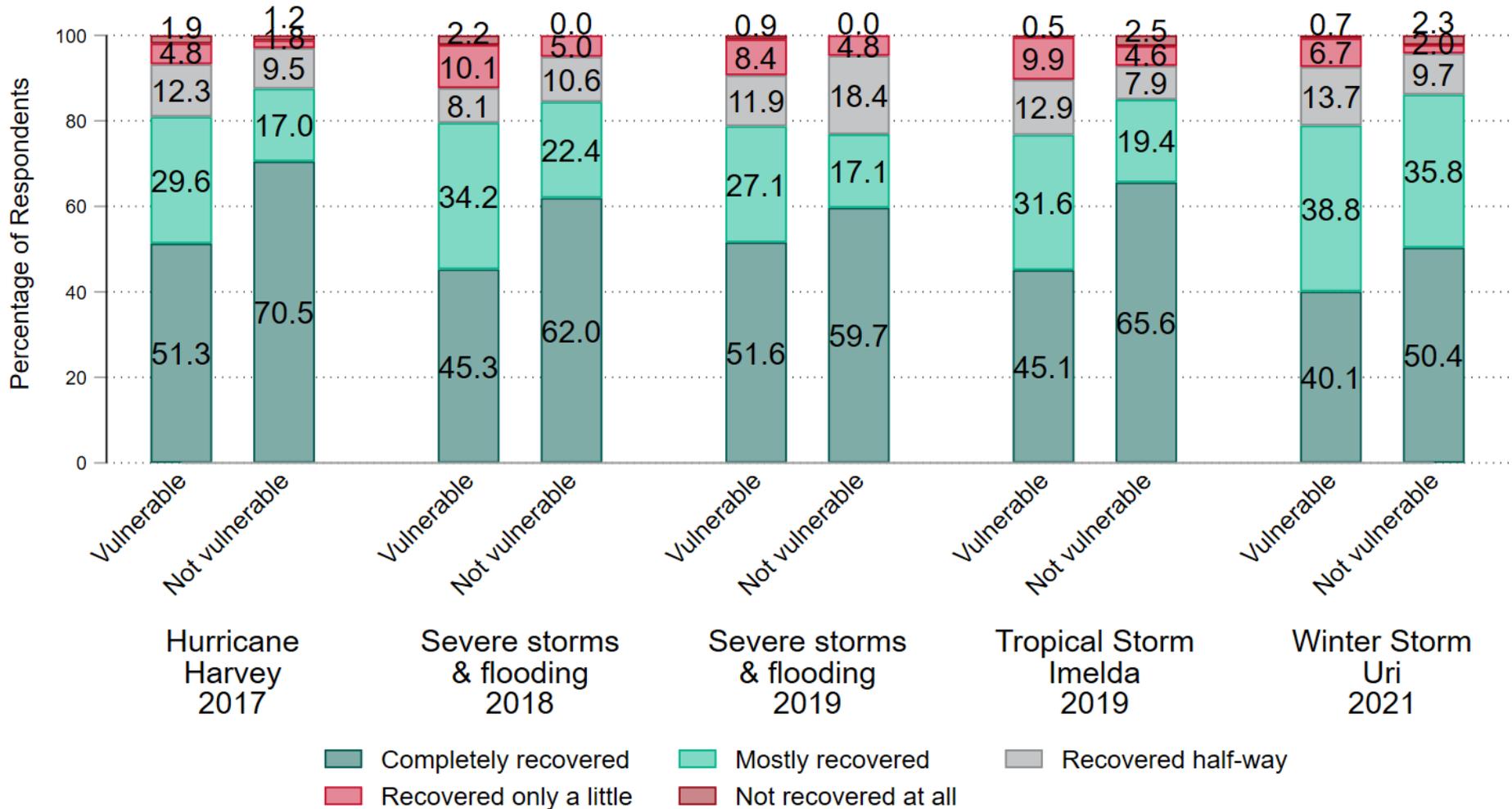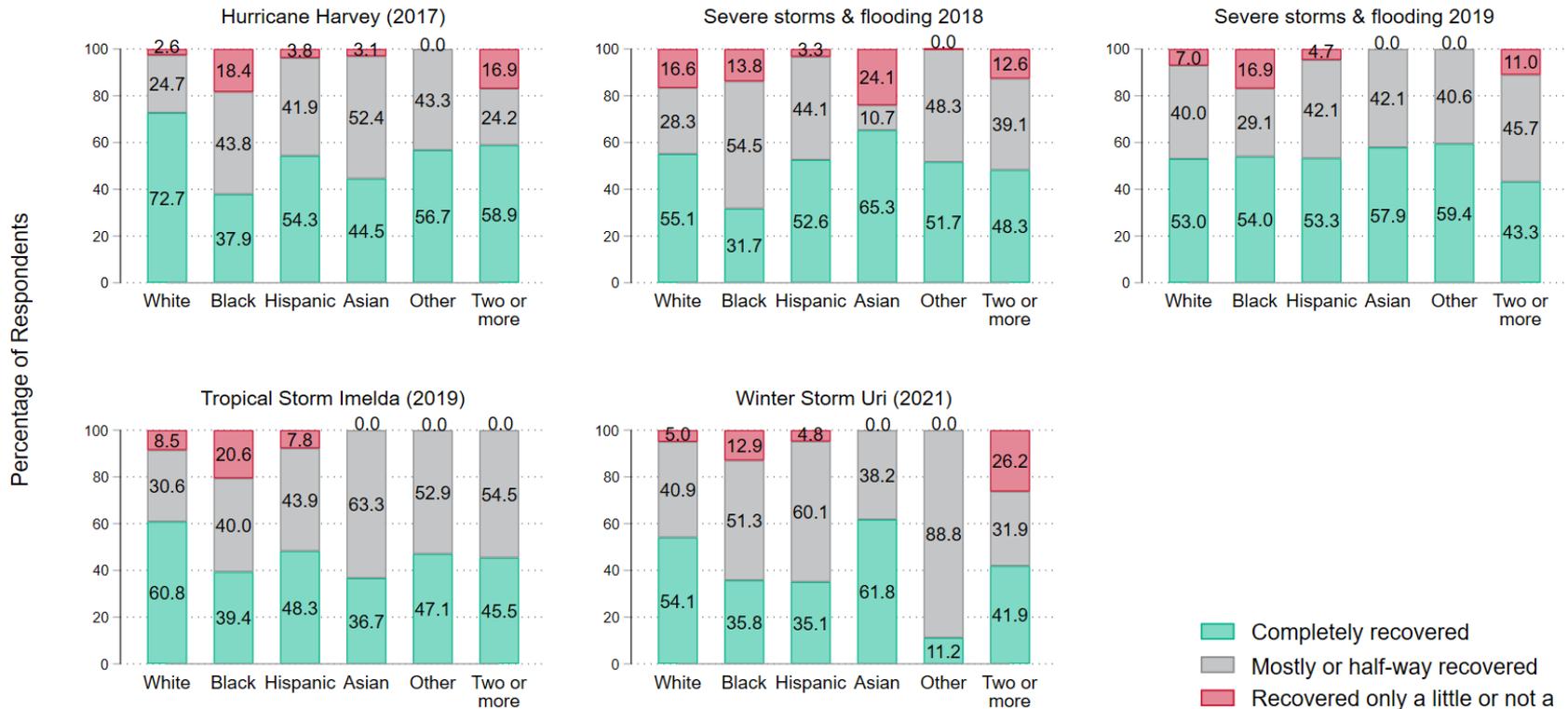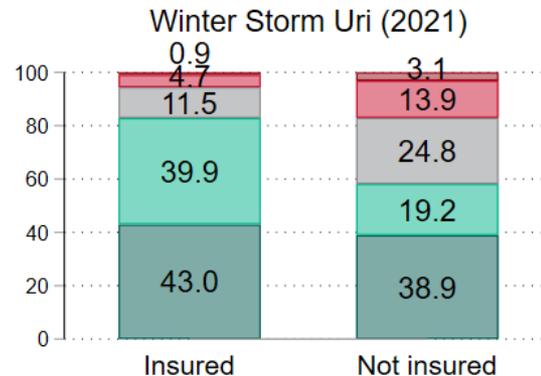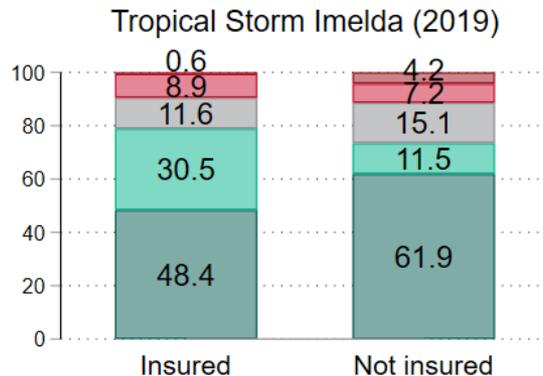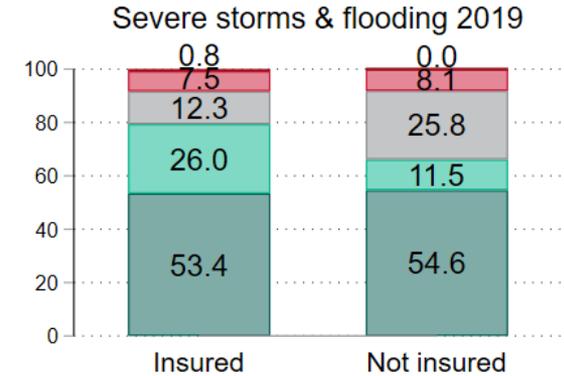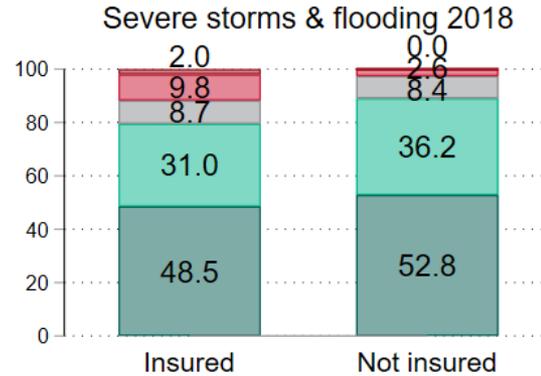


**Hurricane Harvey 2017**
- Vulnerable: Completely recovered 51.3, Mostly recovered 29.6, Recovered half-way 12.3, Recovered only a little 4.8, Not recovered at all 1.9
- Not vulnerable: Completely recovered 70.5, Mostly recovered 17.0, Recovered half-way 9.5, Recovered only a little 1.8, Not recovered at all 1.2

**Severe storms & flooding 2018**
- Vulnerable: Completely recovered 45.3, Mostly recovered 34.2, Recovered half-way 8.1, Recovered only a little 10.1, Not recovered at all 2.2
- Not vulnerable: Completely recovered 62.0, Mostly recovered 22.4, Recovered half-way 10.6, Recovered only a little 5.0, Not recovered at all 0.0

**Severe storms & flooding 2019**
- Vulnerable: Completely recovered 51.6, Mostly recovered 27.1, Recovered half-way 11.9, Recovered only a little 8.4, Not recovered at all 0.9
- Not vulnerable: Completely recovered 59.7, Mostly recovered 17.1, Recovered half-way 18.4, Recovered only a little 4.8, Not recovered at all 0.0

**Tropical Storm Imelda 2019**
- Vulnerable: Completely recovered 45.1, Mostly recovered 31.6, Recovered half-way 12.9, Recovered only a little 9.9, Not recovered at all 0.5
- Not vulnerable: Completely recovered 65.6, Mostly recovered 19.4, Recovered half-way 7.9, Recovered only a little 4.6, Not recovered at all 2.5

**Winter Storm Uri 2021**
- Vulnerable: Completely recovered 40.1, Mostly recovered 38.8, Recovered half-way 13.7, Recovered only a little 6.7, Not recovered at all 0.7
- Not vulnerable: Completely recovered 50.4, Mostly recovered 35.8, Recovered half-way 9.7, Recovered only a little 2.0, Not recovered at all 2.3

Legend: Completely recovered | Mostly recovered | Recovered half-way | Recovered only a little | Not recovered at all

Y-axis: Percentage of Respondents

# Recovery

## Recovery by Race and Ethnicity in Harris County



**Hurricane Harvey (2017)**

| | White | Black | Hispanic | Asian | Other | Two or more |
|---|---|---|---|---|---|---|
| Recovered only a little or not a | 2.6 | 18.4 | 3.8 | 3.1 | 0.0 | 16.9 |
| Mostly or half-way recovered | 24.7 | 43.8 | 41.9 | 52.4 | 43.3 | 24.2 |
| Completely recovered | 72.7 | 37.9 | 54.3 | 44.5 | 56.7 | 58.9 |

**Severe storms & flooding 2018**

| | White | Black | Hispanic | Asian | Other | Two or more |
|---|---|---|---|---|---|---|
| Recovered only a little or not a | 16.6 | 13.8 | 3.3 | 24.1 | 0.0 | 12.6 |
| Mostly or half-way recovered | 28.3 | 54.5 | 44.1 | 10.7 | 48.3 | 39.1 |
| Completely recovered | 55.1 | 31.7 | 52.6 | 65.3 | 51.7 | 48.3 |

**Severe storms & flooding 2019**

| | White | Black | Hispanic | Asian | Other | Two or more |
|---|---|---|---|---|---|---|
| Recovered only a little or not a | 7.0 | 16.9 | 4.7 | 0.0 | 0.0 | 11.0 |
| Mostly or half-way recovered | 40.0 | 29.1 | 42.1 | 42.1 | 40.6 | 45.7 |
| Completely recovered | 53.0 | 54.0 | 53.3 | 57.9 | 59.4 | 43.3 |

**Tropical Storm Imelda (2019)**

| | White | Black | Hispanic | Asian | Other | Two or more |
|---|---|---|---|---|---|---|
| Recovered only a little or not a | 8.5 | 20.6 | 7.8 | 0.0 | 0.0 | 0.0 |
| Mostly or half-way recovered | 30.6 | 40.0 | 43.9 | 63.3 | 52.9 | 54.5 |
| Completely recovered | 60.8 | 39.4 | 48.3 | 36.7 | 47.1 | 45.5 |

**Winter Storm Uri (2021)**

| | White | Black | Hispanic | Asian | Other | Two or more |
|---|---|---|---|---|---|---|
| Recovered only a little or not a | 5.0 | 12.9 | 4.8 | 0.0 | 0.0 | 26.2 |
| Mostly or half-way recovered | 40.9 | 51.3 | 60.1 | 38.2 | 88.8 | 31.9 |
| Completely recovered | 54.1 | 35.8 | 35.1 | 61.8 | 11.2 | 41.9 |

Percentage of Respondents

Legend:
- Completely recovered
- Mostly or half-way recovered
- Recovered only a little or not a

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# Insurance and Recovery in Harris County

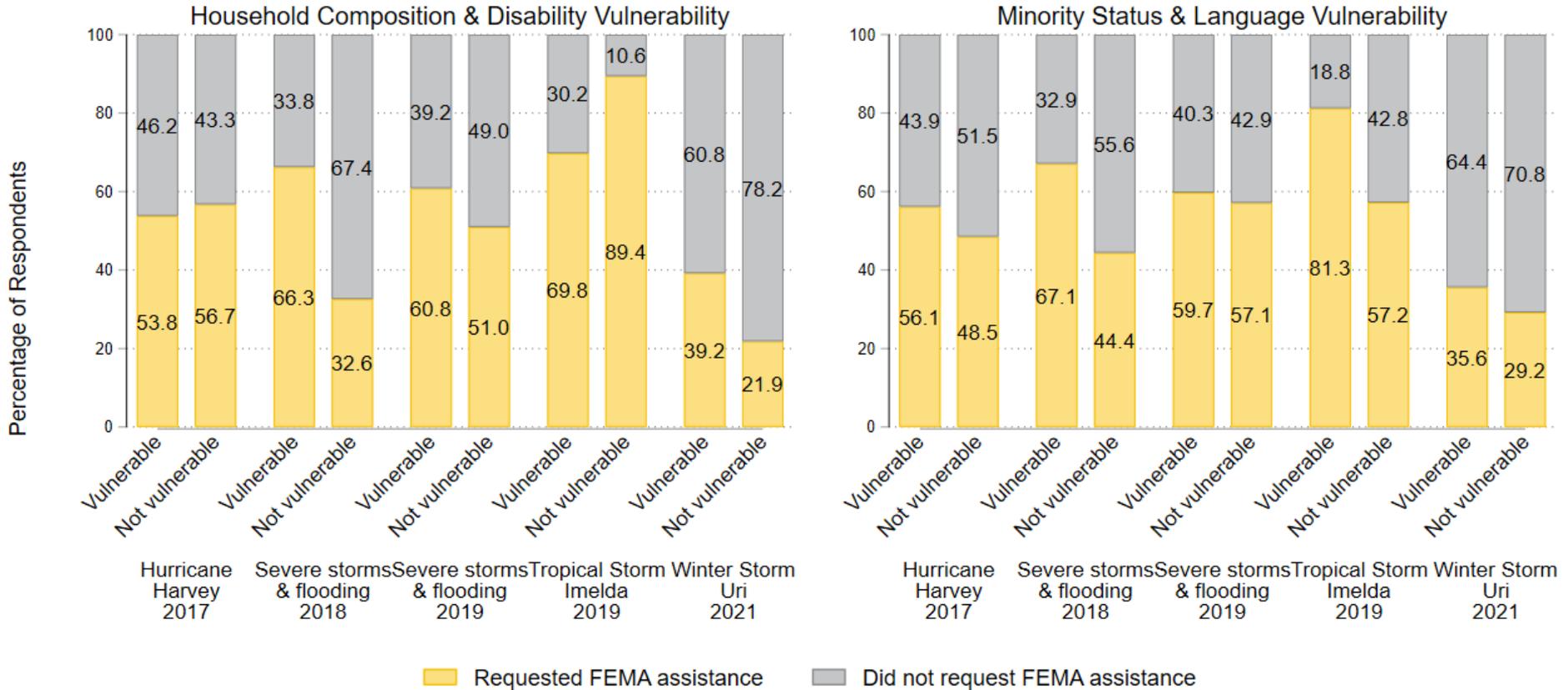## Insurance and Recovery in Harris County

# Recovery

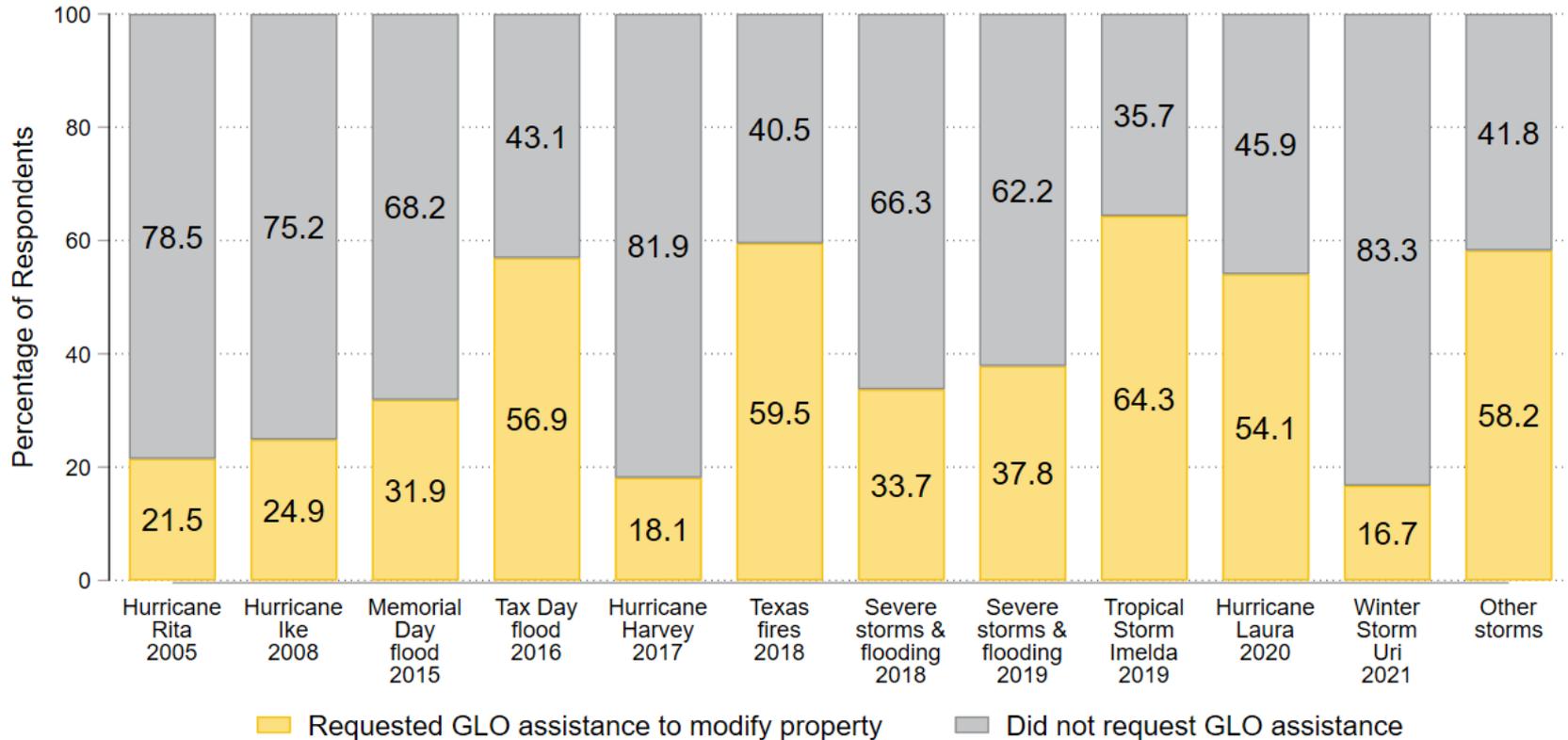## FEMA Assistance Requests by Storm for Harris County

# Recovery

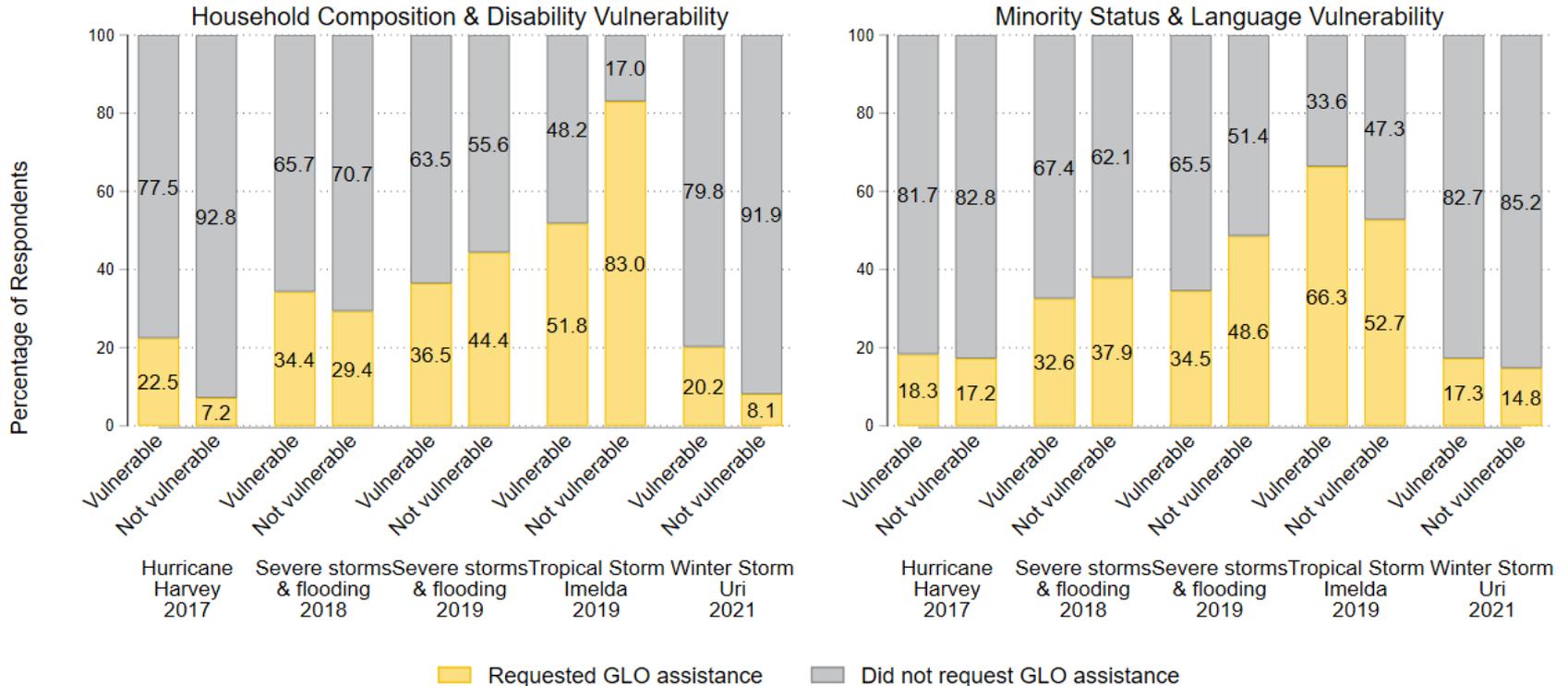## FEMA Assistance Requests by Storm and Vulnerability Type

# Recovery

## GLO Assistance Requests by Storm for Harris County

# Recovery

## GLO Assistance Requests by Storm and Vulnerability Type in Harris County
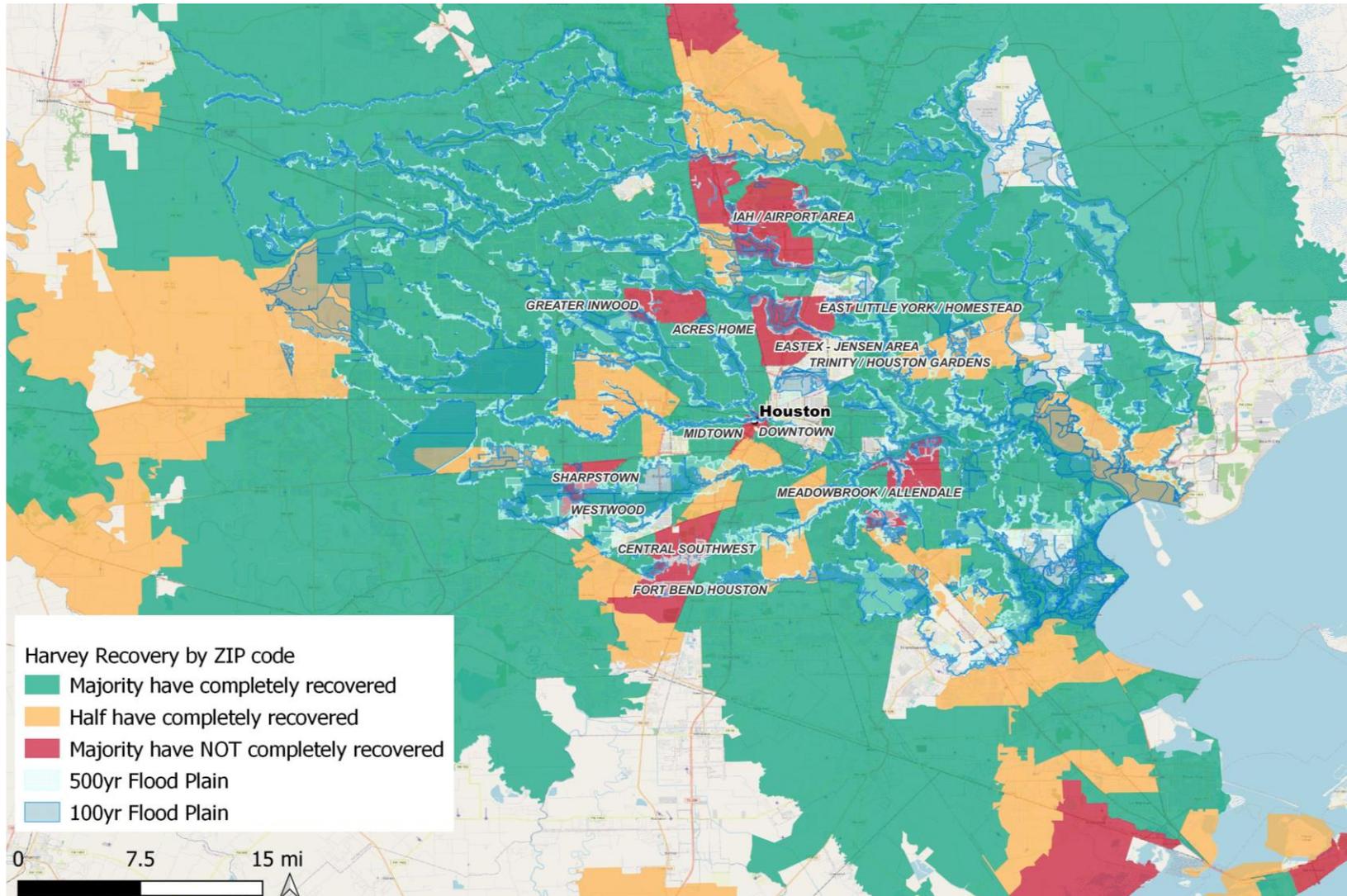
# Hurricane Harvey Recovery

► Some areas in Harris County have not completely recovered from Hurricane Harvey

  ► Areas in the Northeast and Southwest that are also highly vulnerable, specifically to Household Composition & Disability Vulnerabilities

► Respondents from Harris County recovered at higher rates than those in the rest of Texas from damages caused by Hurricane Harvey

  ► This was true regardless their vulnerability status
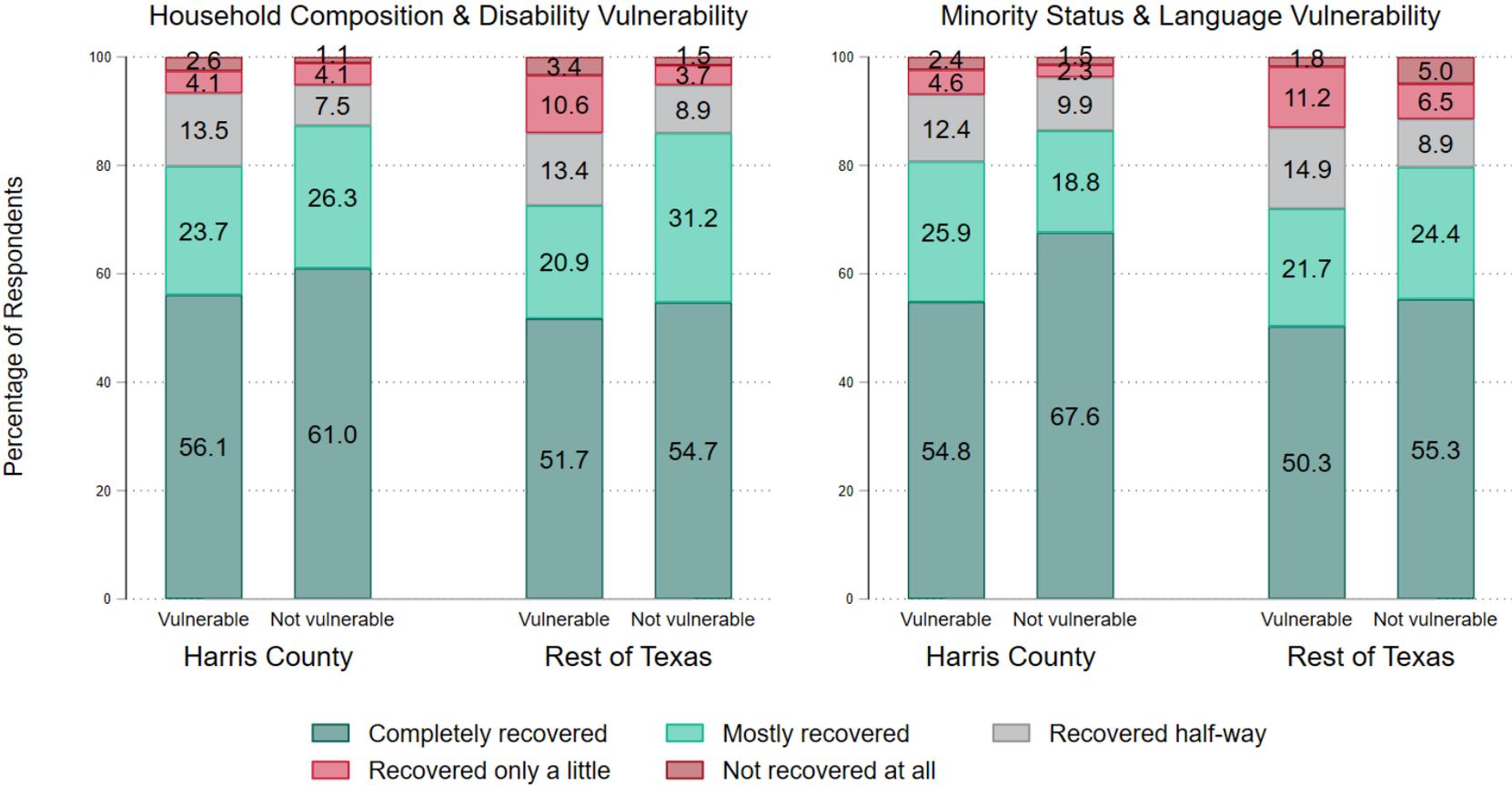
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# Recovery after Hurricane Harvey by ZIP



Harvey Recovery by ZIP code
- Majority have completely recovered
- Half have completely recovered
- Majority have NOT completely recovered
- 500yr Flood Plain
- 100yr Flood Plain

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# Recovery Status from Hurricane Harvey

## Harris County and Rest of Texas



Household Composition & Disability Vulnerability

Minority Status & Language Vulnerability

Legend: Completely recovered · Mostly recovered · Recovered half-way · Recovered only a little · Not recovered at all

Flood Insurance in Harris County by Type of Vulnerability
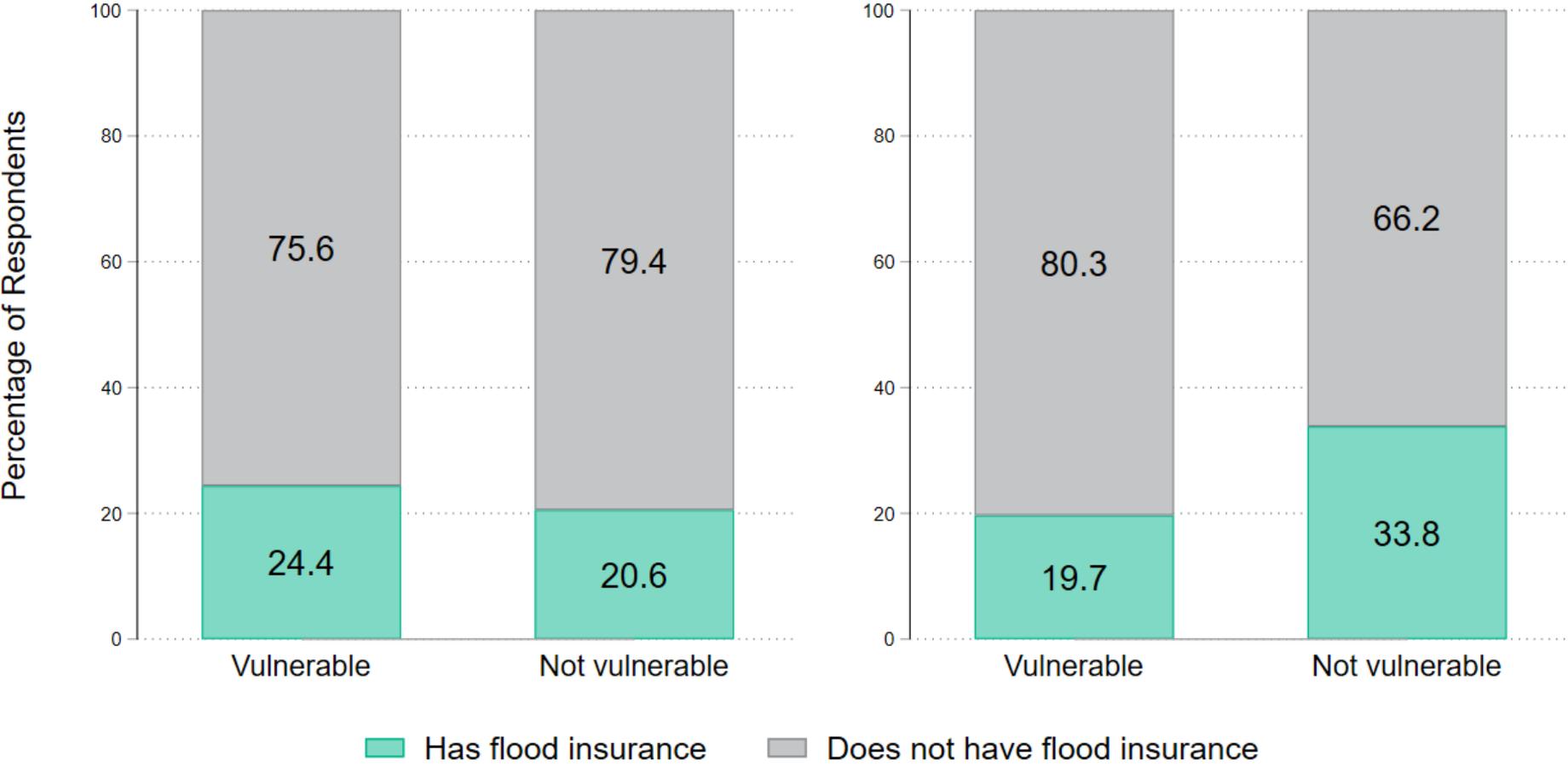
Policy Considerations

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# Policy Considerations

▶ The impact of Hurricane Harvey in the Greater Houston area is still prevalent nearly five years later

▶ Even when vulnerable populations prepare for natural disasters, they take longer to fully recover than non-vulnerable populations

▶ In Harris County, the ethnoracial categorization has different characteristics than the global minority categorization

▶ Insurance attainment mattered for full recovery after a natural disaster, more than government assistance such as FEMA and GLO

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# Policy Considerations

▶ Policies that aim to mitigate the effects of natural disasters are not one-size-fits-all

▶ While the CDC-SVI is widely used for policy making decisions at the local level (e.g., COVID vaccines distribution or food banks location), it is a broad measure that does not include specific characteristics
of each community

▶ Survey research is limited:

    ▶ Hard to reach populations are usually not captured

    ▶ There is a need for a better understanding of underserved areas

Applications

# Hobby School VRAP Dashboard

## **V**ulnerability **R**esiliency **A**daptability **P**reparedness
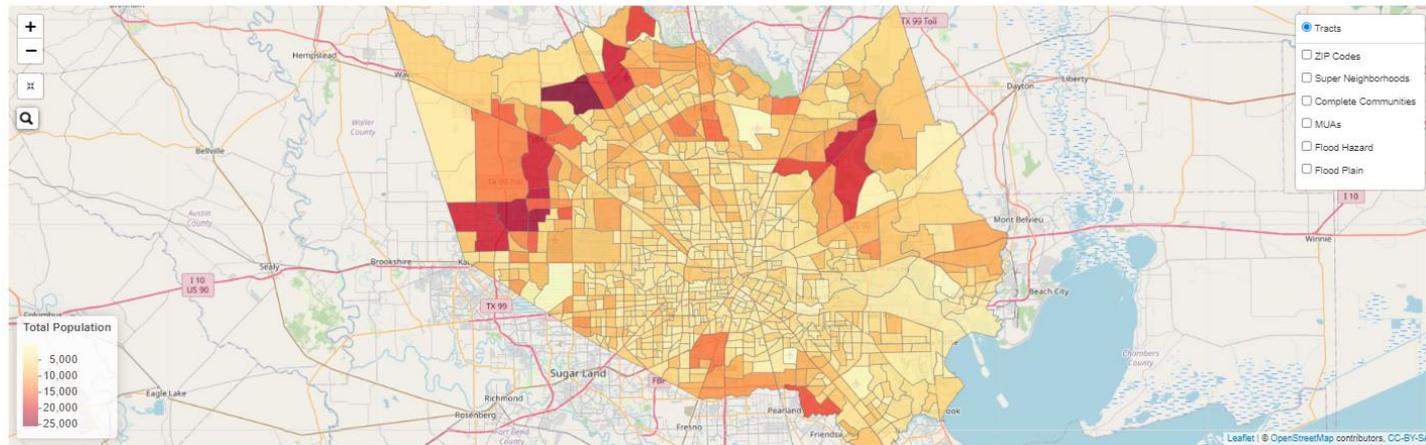


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# Hobby School VRAP Measures

| | Topic | Index | Variables | Source |
|---|---|---|---|---|
| **Overall VRAP measures** | **Vulnerability** | SVI | 1. Socioeconomic Status<br>2. Household composition & Disability<br>3. Minority Status & Language<br>4. Housing Type & Transportation<br>5. SVI | CDC |
| | | H-vulnerability | SVI + homeowners, internet, insurance, floods | Hobby |
| | **Resiliency** | CRE | 1. 0- Risk factors<br>2. 1-2- Risk Factors<br>3. 3 Risk Factors | Census Bureau |
| | **Adaptability** | NA | 1. FEMA: renters & owners- damage, applications.<br>2. Flood insurance | |
| | **Preparedness** | NA | Internet access | |
| **Other** | **Demographics** | - | Race, children, elder, etc. | ACS |
| | **Education** | - | Education levels | ACS |
| | **Health** | - | MUAs/MUPs, Insured | HRSA;ACS |
| | **Mobility** | - | Use of public transportation, commute, etc. | ACS |
| | **Housing** | - | Eviction, housing units, renters, owners, internet, affordable housing, etc. | ACS |
| | **Economic** | - | Income, poverty, etc. | ACS |

# THANK YOU

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## Contact Us

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