COUNTING EVERY DEATH WHEN EVERY DEATH COUNTS

A Mixed-Methods Study of Hurricane Michael Excess Mortality

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SUMMARY DOCUMENT

Point Your Phone's Camera and Follow the QR Code

BACKGROUND

- Secondary Disasters
- Vulnerability
- Hurricane Michael

EVOLVING DISASTERS

Becoming stronger and causing secondary disasters

Saffir-Simpson Hurricane Categories

1. **Some Damage** (75-95 MPH winds)
2. **Extensive Damage** (96-110 MPH winds)
3. **Devastating Damage** (111-129 MPH winds)
4. **Catastrophic Damage** (130-156 MPH winds)
5. **Catastrophic Damage** (>156 MPH winds)

Major Hurricanes

Growing coastal populations

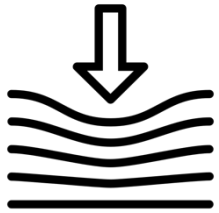
Infrastructure systems are more connected and interdependent on one another

Secondary disasters lead to more people being impacted

- Hurricane Katrina
- Hurricane Maria

COMMUNITY FACTORS

Secondary disasters occur in vulnerable populations



Resilience - ability to adapt or recover quickly

Vulnerability - opposite or absence of resilience

$$Risk = Vulnerability \ x \ Hazard$$

MEASURING VULNERABILITY

Can detect what communities will be more impacted by a hurricane

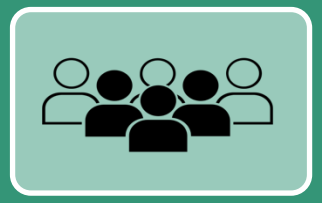
Categories within the CDC's Social Vulnerability Index

Socioeconomic Status:

Unemployment, poverty, income, education

Household Characteristics:

Older adults, children, single parents, disability, languages spoken



Racial and Ethnic Minority Status:

Racial and ethnic group identification

Housing Type and Transportation:

Multi-units, mobile homes, group housing, vehicle ownership

HURRICANE FATALITIES

A measure of a storm's impact that can provide critical insight

Fatality Count

- Direct deaths are clearly caused by the disaster
  - Example: drowning in hurricane storm surge
- Indirect deaths are more subjective and the "but for" principle should be used
  - Example: carbon monoxide poisoning from a generator two weeks after a hurricane

Excess Mortality

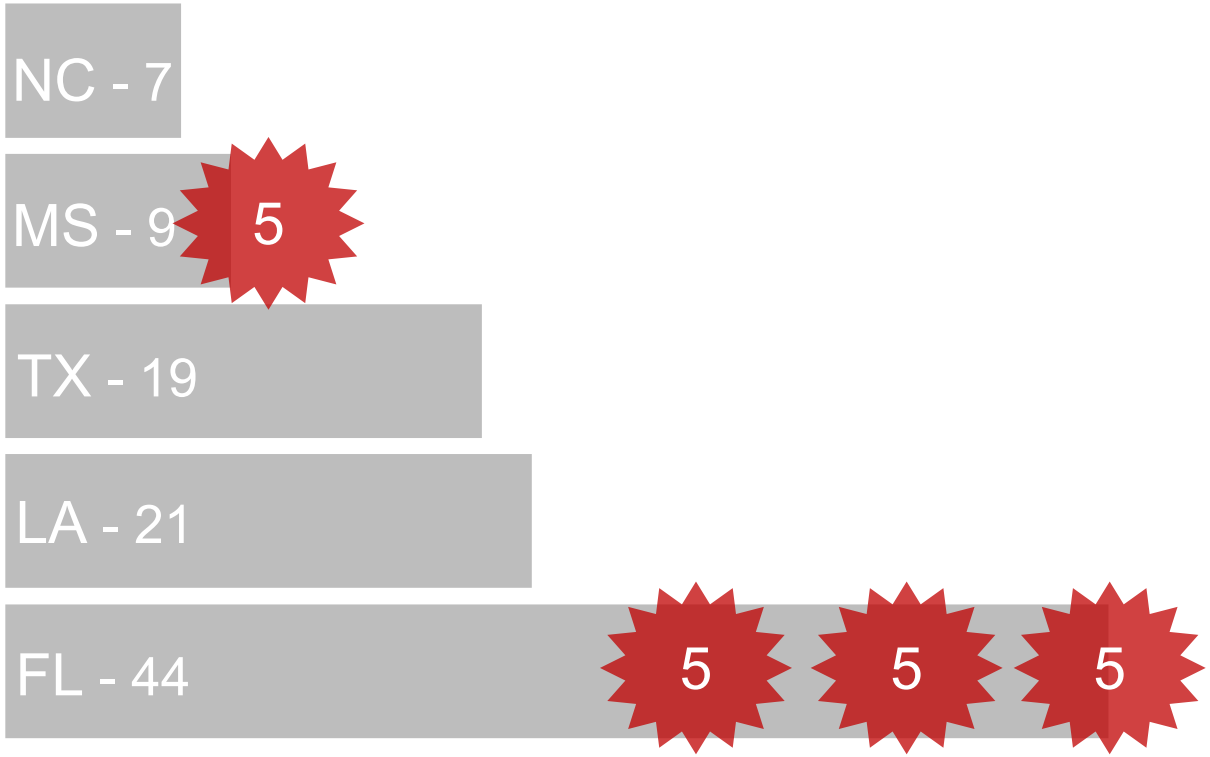
- An analysis of changes in the trends of mortality rates of a post-disaster area to determine if more deaths overall have occurred than expected

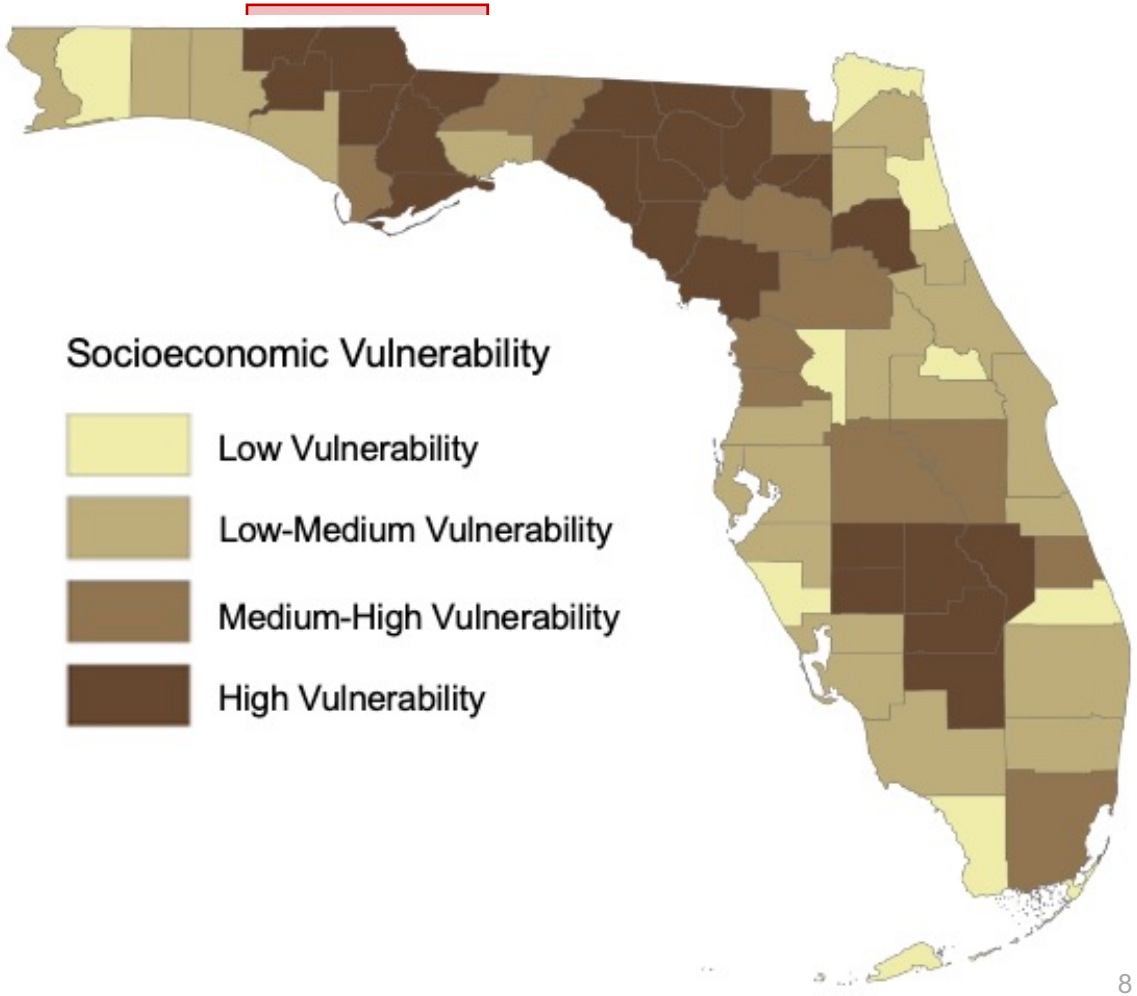
Measuring Hurricane Maria Fatalities

FLORIDA HURRICANES

Experiences more major hurricane and has areas of high vulnerability

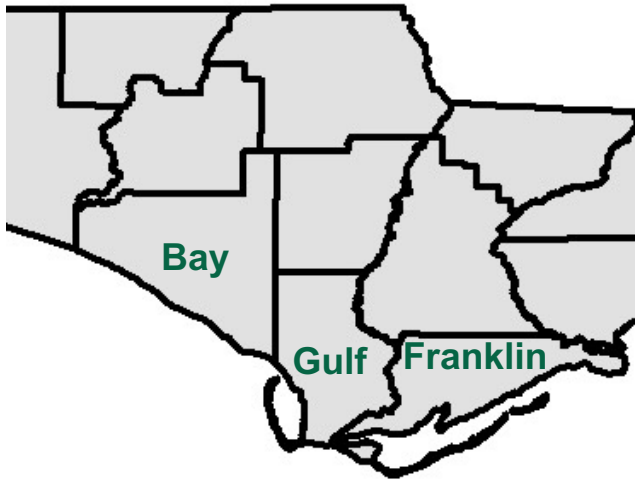
U.S. Major Hurricanes

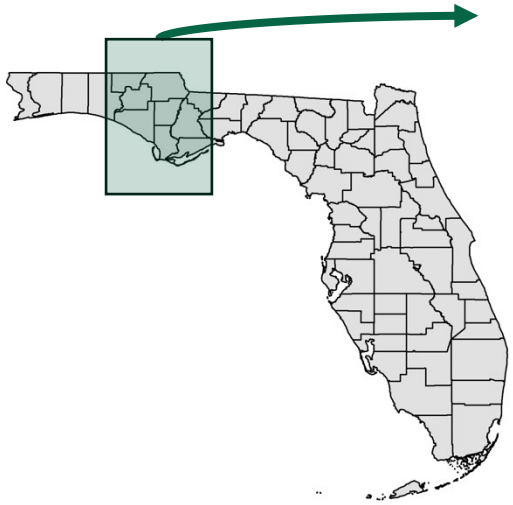




HURRICANE MICHAEL

A once in a hundred-year storm that devastated the Florida Panhandle





50 direct and indirect fatalities

$25 billion in damages

14-foot storm surge

Category 5 (160 mph winds)

THE AFTERMATH

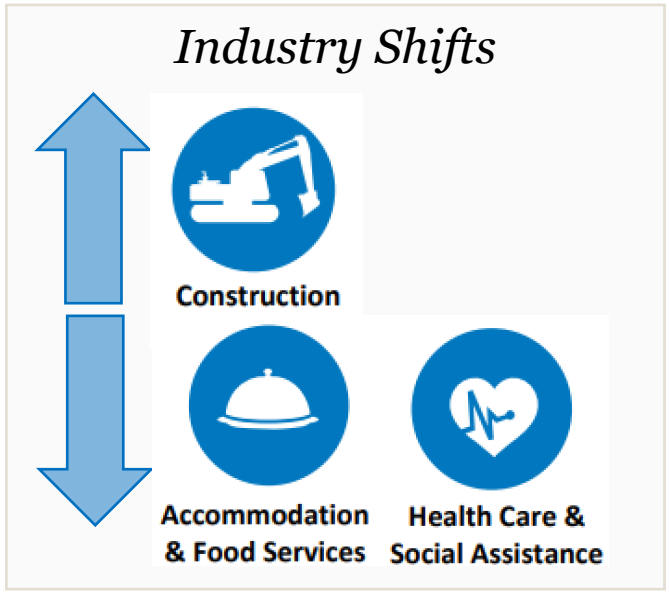
A long, stagnant recovery

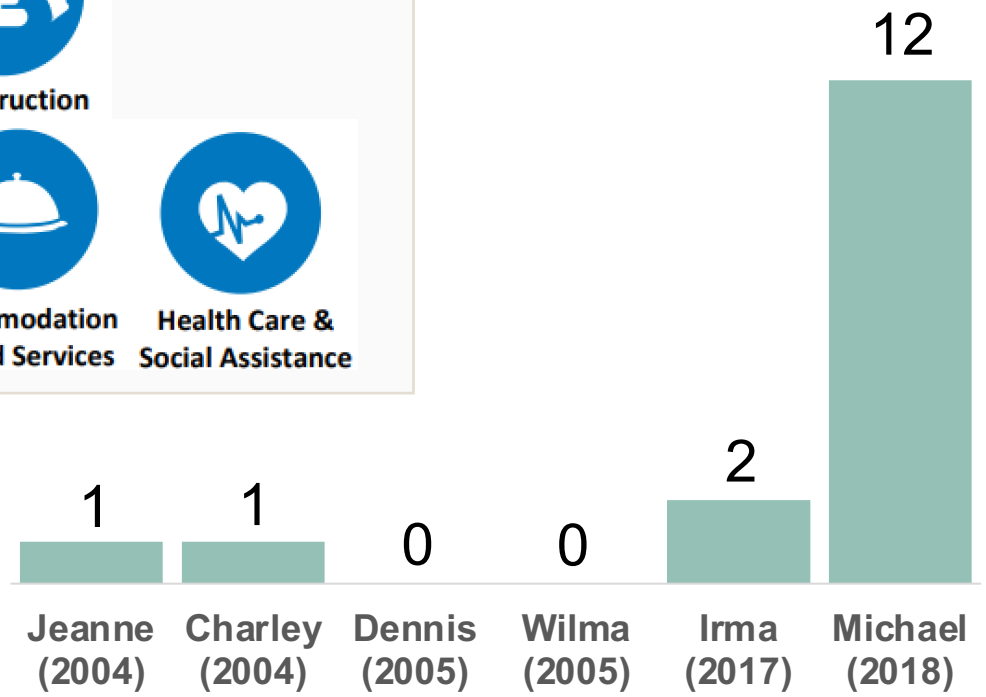
Damage and Impacts

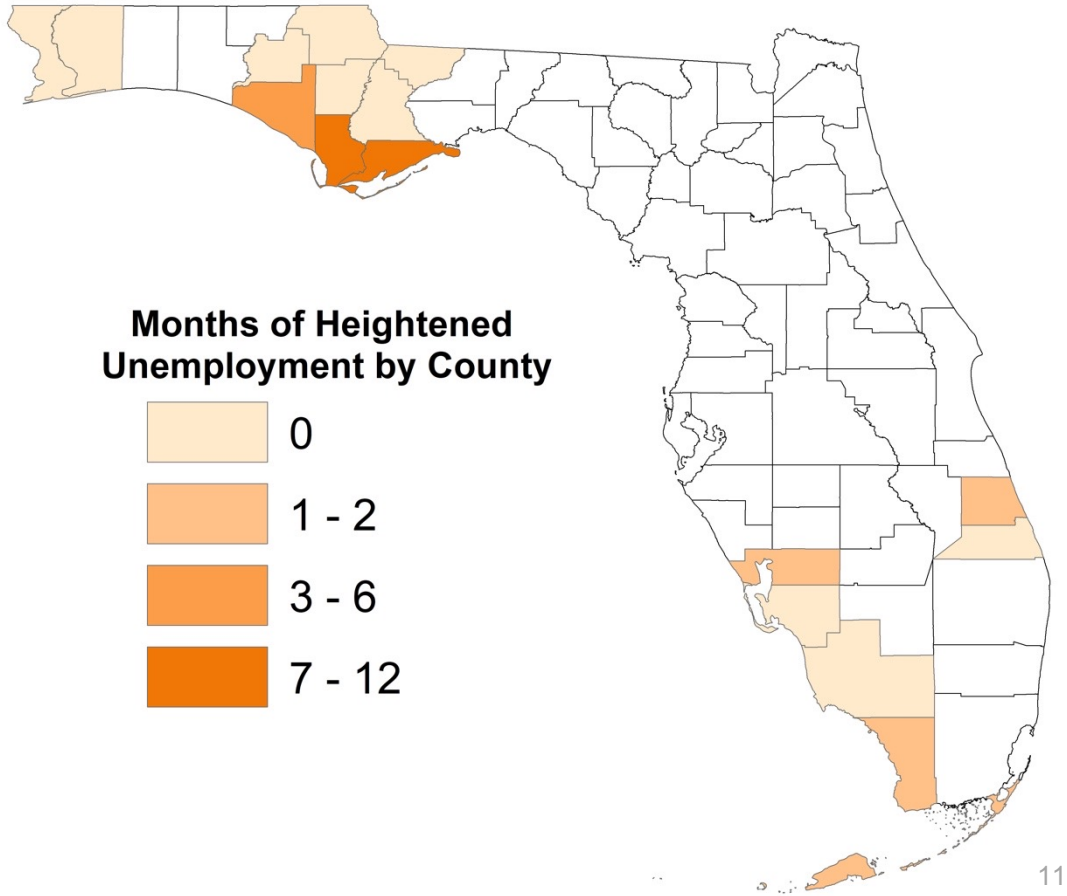
- Environmental changes
- Basic necessities and services
- Trauma Center destroyed
- Delays in prenatal care and increase in small for gestational age births
- Population changes one year later
  - Bay County decreased by over 2,300
- Community assessment found prolong impacts on mental health
- Economic Aid in 2021

PILOT PROJECT FINDINGS

Prolonged period of high unemployment in Bay, Gulf, and Franklin Counties







STUDY DESIGN

- Purpose
- Research Questions
- Mixed-Methods

STUDY PURPOSE & RESEARCH QUESTIONS

The purpose of this study was to identify if the Florida Panhandle experienced excess mortality in the year after Hurricane Michael and investigate what contextual factors potentially led to that increased mortality.

What place, sex, race, age group, or causes of death experienced mortality trend changes in the year post-storm?

1

How do survivors describe changes to health and health care services in the year post-storm?

2

How do survivors' accounts of post-storm health conditions and access to health care triangulate with excess mortality findings and the official fatality count?

3

STUDY DESIGN

A mixed-methods study in three sequential phases

Phase 1: Excess Mortality

Statistical analysis of changes in mortality trends

Phase 2: Qualitative

Focus groups and interviews on hurricane impacts

Phase 3: Triangulation

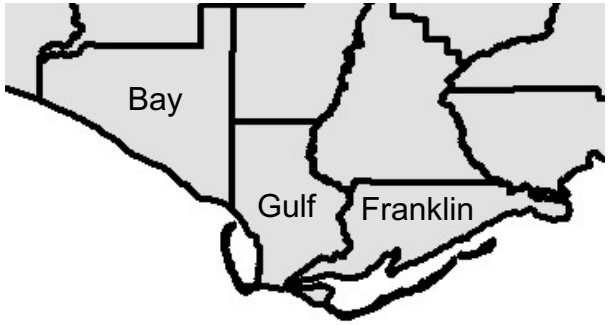
Ground-truthing and changes to accessing health care

PHASE 1: EXCESS MORTALITY

- Methodology
- Total mortality
- Demographic groups
- Cause of death

EXCESS MORTALITY MODELING

Using death records of coastal counties for three seasonal ARIMA analyses



Data

- Florida Department of Health vital statistics death records
- 2013-2019
  - 5 years pre-Hurricane Michael
  - 1 year post-Hurricane Michael

Two Areas

- Bay County (182,218)
- Gulf and Franklin Counties (28,595)

Time Interval

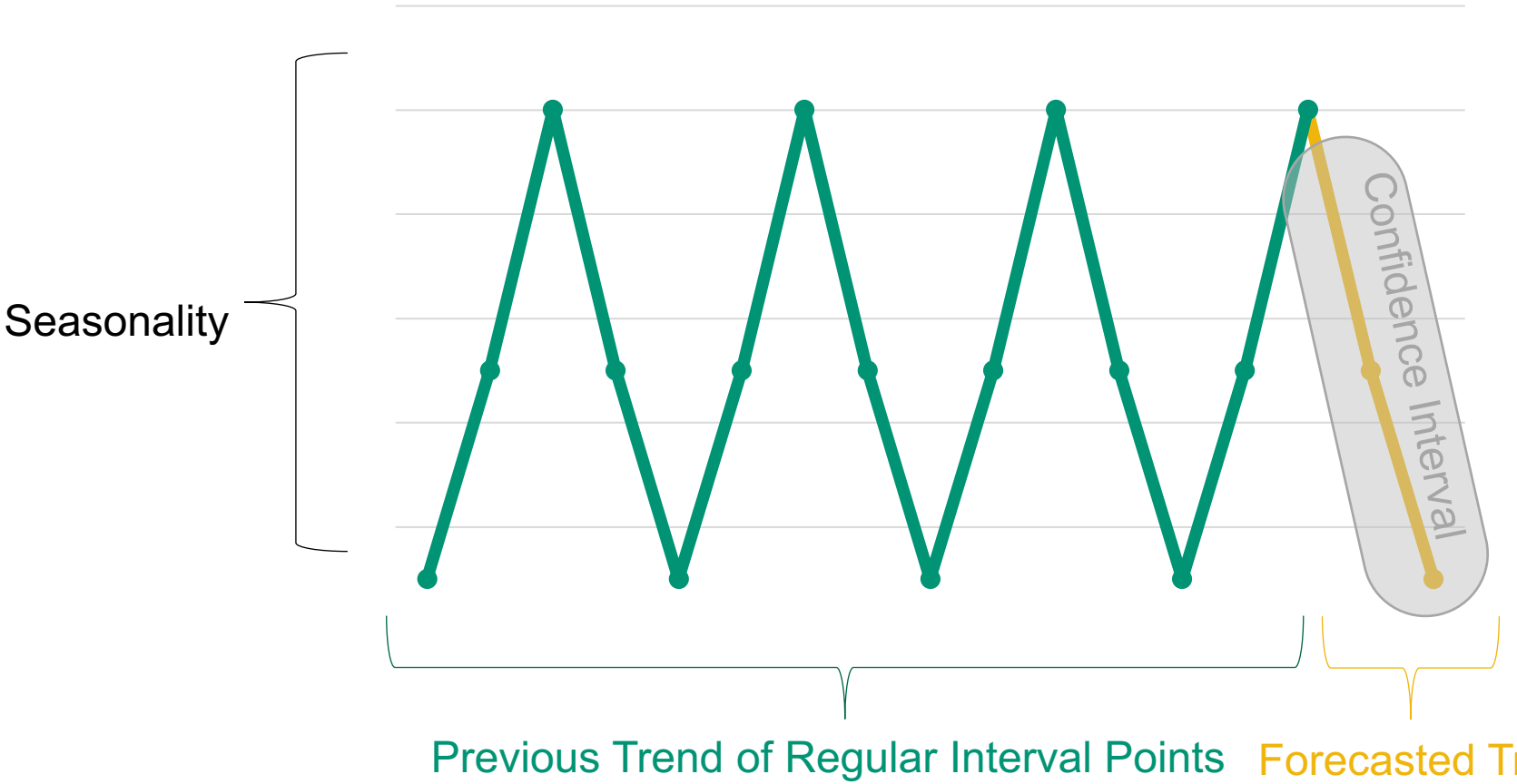
- Annual quarter

Analysis

- Seasonally adjusted ARIMA (auto-regressive integrated moving average)
- All-cause rate of mortality
- Mortality rates by age group, race, and sex
- Cause of death

METHODOLOGY

A time-series analysis using a seasonally adjusted ARIMA (Auto-Regressive Integrated Moving Average)



Seasonality

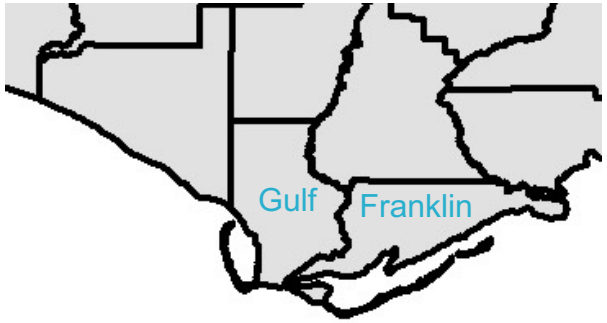
Allows for more accurate predicted forecasts

Excess Mortality

If the real world, observed mortality is beyond the range of the confidence interval, that is evidence of excess mortality

TOTAL MORTALITY

Excess mortality in Gulf and Franklin Counties



Gulf and Franklin County Results

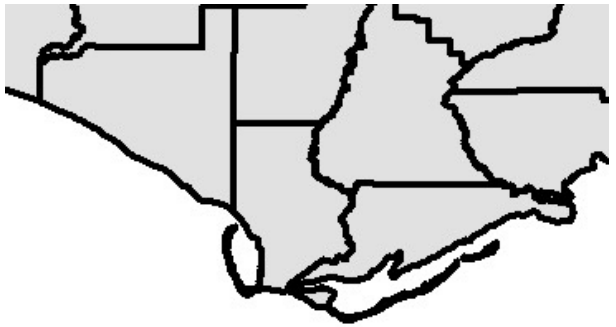
Quarter	Forecasted Mortality Rate	Observed Mortality Rate
2018, Quarter 4	254.8 (95% CI, 181.7 – 347.6)	262.3
2019, Quarter 1	293.0 (95% CI, 207.2 – 403.2)	273.3
2019, Quarter 2	227.8 (95% CI, 159.8 – 316.0)	322.5
2019, Quarter 3	249.8 (95% CI, 173.5 – 348.7)	245.4

Estimated 27 additional deaths

**Mortality Rates per 100,000*

TOTAL MORTALITY (Cont'd)

No excess mortality in Bay County



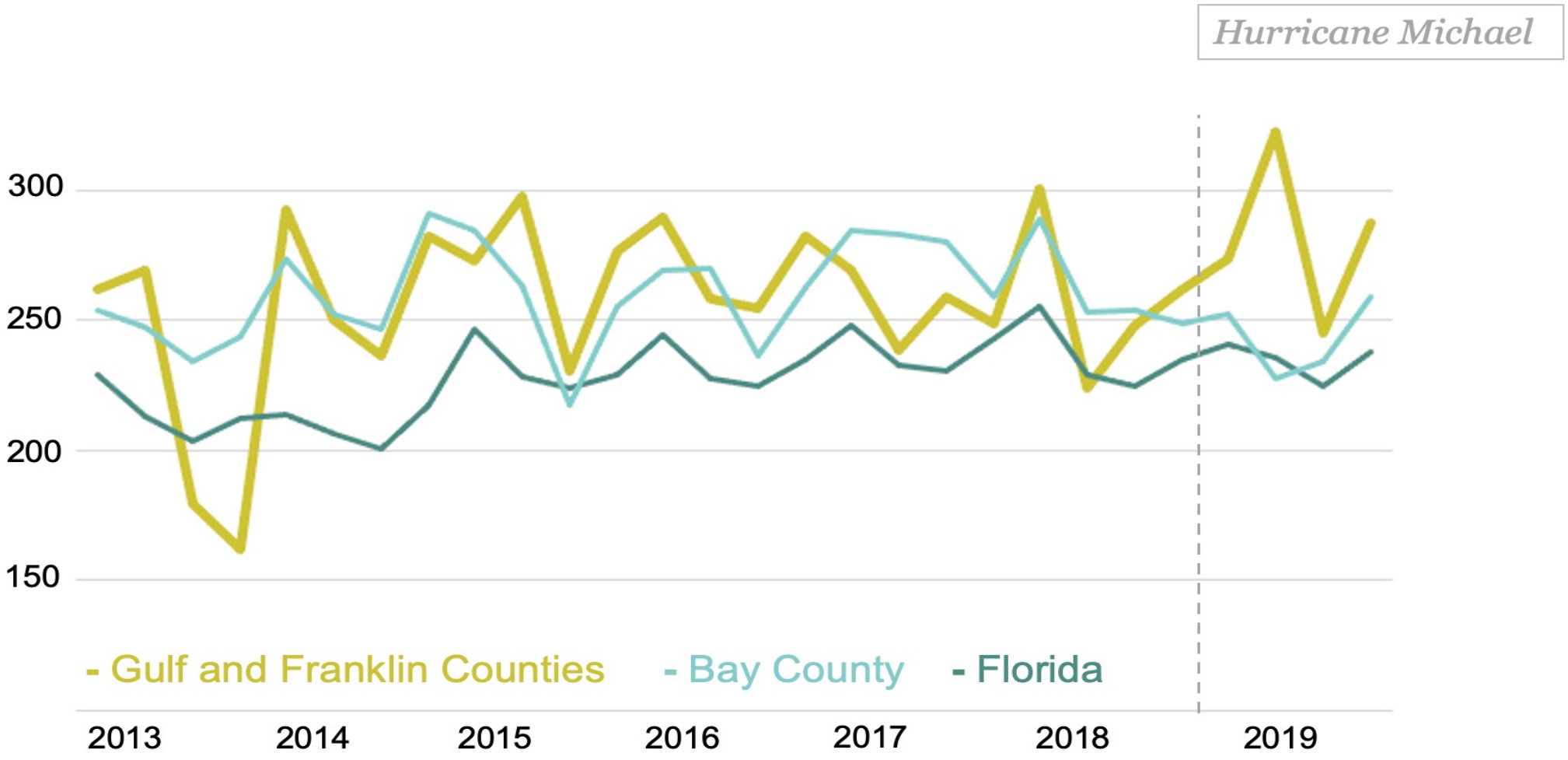
Bay County Results

Quarter	Forecasted Mortality Rate	Observed Mortality Rate
2018, Quarter 4	275.9 (95% CI, 241.2 – 314.3)	249.2
2019, Quarter 1	293.7 (95% CI, 255.8 – 333.8)	252.4
2019, Quarter 2	277.7 (95% CI, 242.7 – 316.7)	227.9
2019, Quarter 3	259.1 (95% CI, 226.5 – 295.5)	234.0

**Mortality Rates per 100,000*

TOTAL MORTALITY (3)

Noticeable spike of mortality in Gulf and Franklin Counties



*Mortality Rates per 100,000

SENSITIVITY TESTING

No anomalies found in the mortality trend from 2012 to 2018

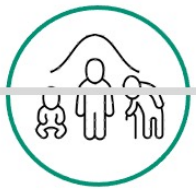
2018 (2012-2017)	2017 (2011-2016)	2016 (2010-2015)
2015 (2009-2014)	2014 (2008-2013)	2013 (2007-2012)
	2012 (2006-2011)	

Analysis

- Same analysis as for total mortality
- Used 5 years of data to forecast the following four quarters
- Every quarter from 2012 up to Hurricane Michael had an observed mortality that was not above the range of the forecasted mortality
- Evidence that strengthens the validity of the model

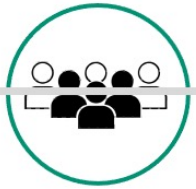
ADJUSTED MORTALITY

Excess mortality in older and White residents in Gulf and Franklin Counties



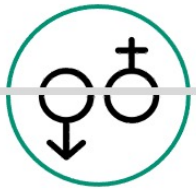
Age

- 55+ in Gulf and Franklin Counties
  - Forecasted 575.4 (90% CI 426.0-755.2)
  - Observed 771.2
  - Quarter 2, 2019
- No significant findings in Bay County for any quarter



Race

- Whites in Gulf and Franklin Counties
  - Forecasted 253.9 (95% CI 117.9-352.3)
  - Observed 365.0
  - Quarter 2, 2019
  - 88% of records
- No significant findings in Bay County for any quarter



Sex

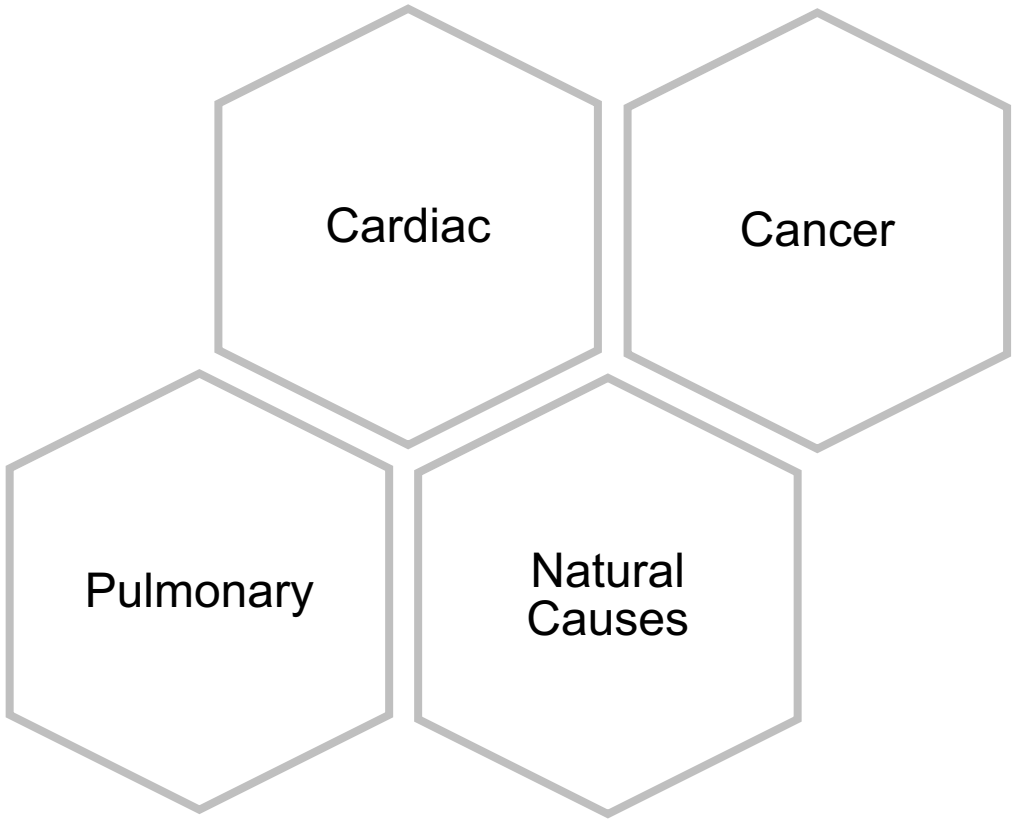
- No significant findings in Gulf and Franklin Counties for any quarter
- No significant findings in Bay County for any quarter

**Mortality Rates per 100,000*

CAUSE OF DEATH

Excess mortality in cancer-related deaths

Most Common Causes of Death



Cancer

- Gulf and Franklin Counties
  - Forecasted 48.7 (90% CI 28.9-72.3)
  - Observed 80.6
  - Quarter 3, 2019
  - Estimated 9 additional deaths
- No significant findings in Bay County for any cause of death in any quarter

**Mortality Rate per 100,000*

PHASE 1 FINDINGS

What geographical areas, demographic groups, and causes of death experienced excess mortality in the year after Hurricane Michael?

Gulf and Franklin Counties

- Quarter 2 (April-June), 2019
  - Total mortality
  - Ages 55+
  - Whites
- Quarter 3 (July-September), 2019
  - Cancer-related deaths
- 36 additional deaths
  - 27 in quarter 2
  - 9 in quarter 3

PHASE 2: COMMUNITY HEALTH IMPACTS

- Methods
- Thematic analysis
- Findings

QUALITATIVE METHODS

Focus groups and interviews with survivors and responders

Data Collection & Analysis

- 6 Focus groups and 9 interviews with 46 total participants in May through August of 2022
- Thematic analysis of transcripts

Participants

- Those that lived or worked in a Hurricane Michael impacted county since pre-storm or were part of the disaster response.

Questions Asked

- How long did it take the area to recover?
- How did people's mental and physical health change the year after?
- What were the factors that led to any health changes?
- What were the changes in accessing health care?
- Were any groups of people more impacted by Hurricane Michael than others?

MENTAL HEALTH & WELL-BEING

A heavy psychological impact on the community

Emotional Toll

- Symptoms of anxiety, PTSD, and depression
- Few available mental health services destroyed
- Unrelenting reminders of the hurricane

Children

- Schools were closed rest of the year and didn't fully reopen until 2019
- Increased involuntary psychiatric hospitalizations along with bomb and gun threats
- Increased homeless due to damage and displacement

"We had a lack of mental health support across the board. "

"Physically, it took us about 11 months beyond the storm to find a home and get settled. Mentally, I still have some anxieties from that dreadful experience."

"The school Baker Acts went through the roof."

SERVICES & HOUSING

Housing crisis and prolonged service disruptions

Housing

- Increase in people who are un-housed
- Much of the affordable housing was destroyed
- Uninsured and under-insured couldn’t afford repairs and others were scammed
- Relocation post-storm

Services

- Electricity, telecommunications, out for months
- Main highway was badly damaged
- Trauma center, clinics, and pharmacies destroyed

"We lost employees who had to move because of housing. Lost their house."

“A lot of people are living in RVs and sheds. That's their primary homes now. I'm never even surprised anymore when I pull up to the shed to do the home visit for a pregnant women and children.”

“well it happened October the 10th and I was without power until December the 14th."

SOCIAL CAPITAL

Strong, positive connections were a resilience factor

"We didn't have no doctors. And you end up crying on your neighbor's shoulders or your family shoulders or, you know, letting out your anxieties."

"We're invested in each other. Because this county is so strong. And then the love that we have for one another."

PHASE 2 FINDINGS

How do survivors describe changes to health and health care services in the year after Hurricane Michael?

Mental Health, Rebuilding, and Services

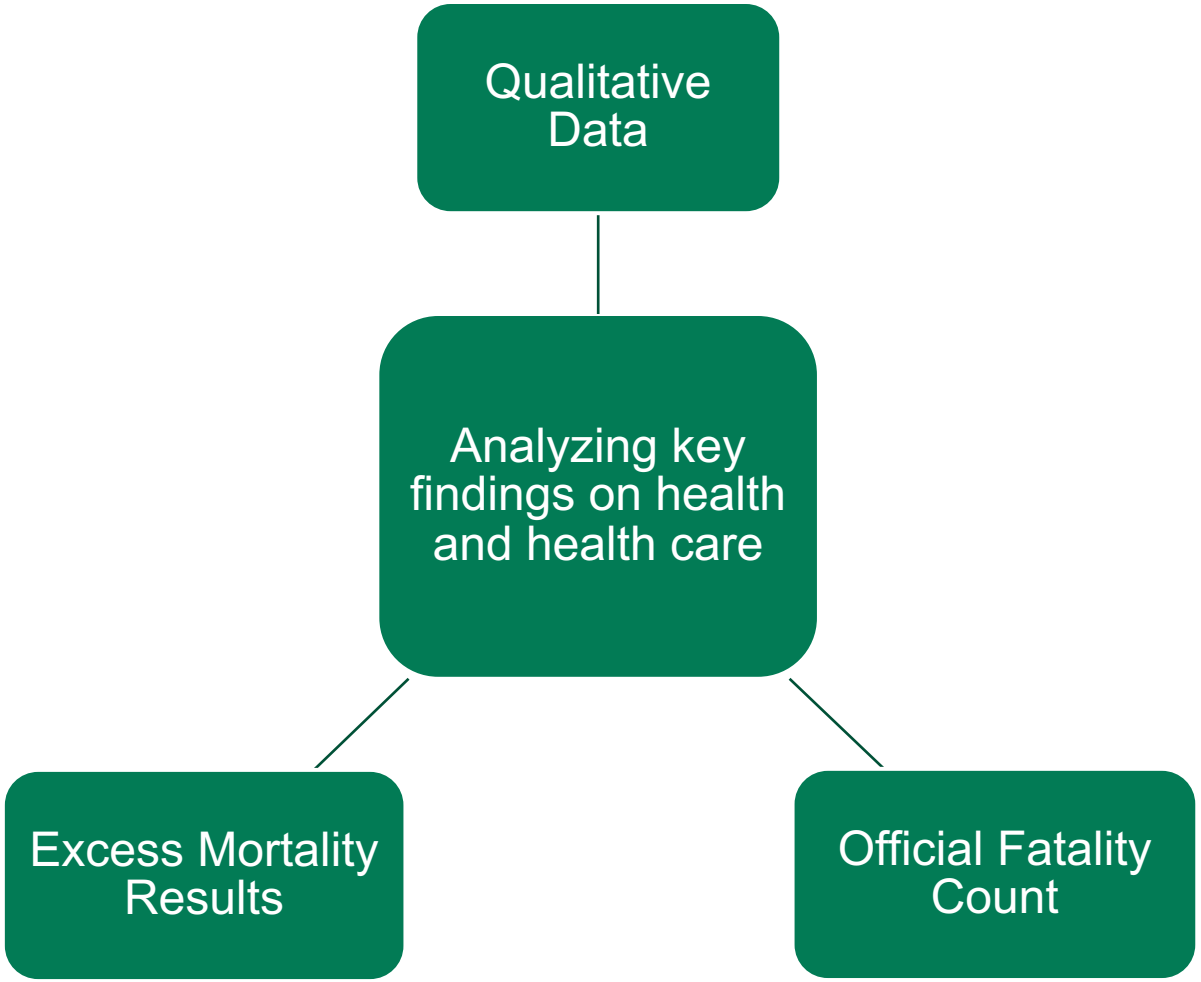
- Prolonged Depression, PTSD, and lingering anxiety
  - Particularly children
  - Compounded by lack of mental health services and COVID
  - Social capital
- Service disruptions including health care

PHASE 3: ACCESS TO HEALTH CARE

- Utilizing qualitative data
- Health care barriers
- Distances traveled

METHODOLOGY (2)

Thematic analysis to assess the accuracy of excess mortality results



Analysis

- Focus groups and interviews on changes to physical health and access to health care
- Analyzed transcript segments on physical health, healthcare infrastructure and staffing, and medically fragile individuals
- Evaluate which is a more accurate representation of the hurricane's impact on health

HEALTHCARE INFRASTRUCTURE

Extensive damage to nursing homes, clinics, and the trauma center

Physical Health

- Few health issues noted by participants

Health Services and Facilities

- Limited pre-storm in Gulf and Franklin counties
- Nursing homes, specialists, and trauma center were in Bay County
- Hurricane Michael destroyed most of the healthcare infrastructure in Bay County
- The area is still not back to where it was before the hurricane

"Yeah, from the ESF8 standpoint, long term. We're years from getting back to where we were."

"You're talking about a town who, before Hurricane Michael, had five to six primary care providers on a normal day."

"we had lost so many facilities and buildings, and then the hospitals were at such a small capacity for a long time while they rebuilt."

"they got that whole brand new wing, but they don't have the staffing to fill it.."

BARRIERS TO ROUTINE CARE

Limited routine care for chronic health conditions

Routine Medical Care

- Challenges refilling maintenance drugs
- Medical records destroyed
- Delays in preventative screenings

"And even as a provider, how we define what's happened in our medical history even has been "well, I didn't have a mammogram since before Hurricane Michael." "I haven't had a pap smear since before Hurricane Michael."

“working in the ER, we've seen a lot of visits for months, months, seeing visits for med refills... six, seven months later, seeing "Oh, I can't get into somebody" and I'm out of my meds" and "I need my blood pressure medicine refilled.".”

“I had some skin cancer removed, years ago, the doctor's office basically had no way of providing me with my records, you know, for for another doctor, you know, so I could, to get a follow up."

BARRIERS TO SPECIALIZED CARE

Limited specialized treatment and surgeries

Specialists

- Follow-up visits not available
- Surgeries rescheduled elsewhere
- Delayed cancer treatment
- Next closest metro areas also had delays in treatment

"Yes, my son in law was diagnosed [cancer] in February. And then it took a long time to get things going. And a lot of his treatments was delayed because of Hurricane Michael."

”[surgical] procedures were backlogged for several months”

“I have struggled to get an immediate appointment with my endocrinologist. When I need my meds, I need my meds”

“And we both had skin cancer. So we felt like we would have to go to Tallahassee, but even then you have to wait and finding people that because we have insurance that's not local."

TRAVEL TO TREATMENT

Using facilities further away became the only option

"We tried to schedule in Tallahassee for my sister and they were three months out... And so we said to hell with that and went to MD Anderson"

"Dothan, Tallahassee, [for cancer treatment]"

"When Mama's daddy was going through cancer treatments, which was before Michael, we went to Panama"

"Mayo Clinic, Moffitt, MD Anderson was the one we used, MD Anderson. And then you've got UAB [cancer treatment options]."

Reported Distances Traveled for Cancer Treatment

PHASE 3 FINDINGS

How do survivors' accounts of post-storm health conditions and access to health care triangulate with excess mortality findings and the fatality count?

Multiple Barriers to Accessing Health Care

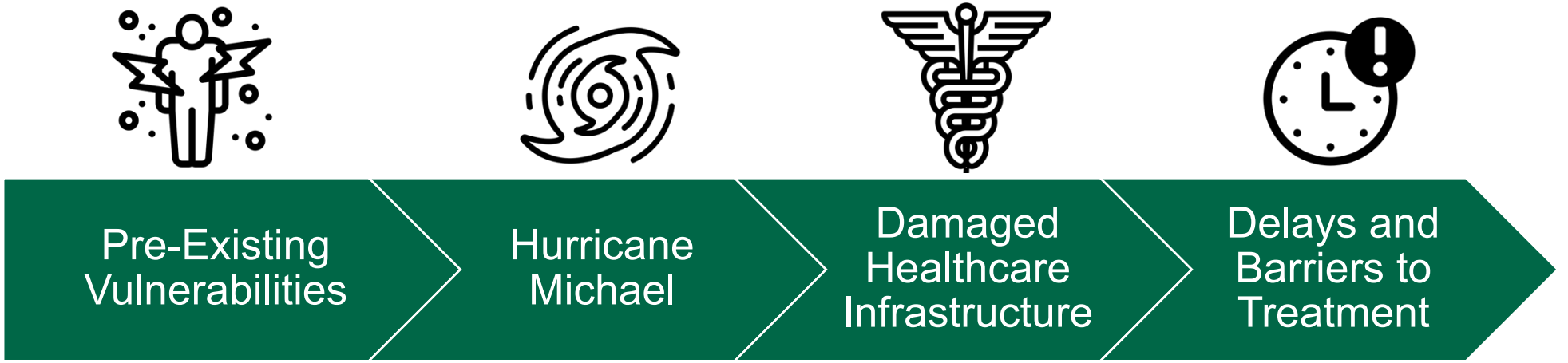
- Nearly all healthcare infrastructure in Bay County was destroyed or damaged
  - Gulf and Franklin Counties had relied on those resources
- Barriers to routine health services, screenings, and specialized care
- Some had to travel far for cancer treatment
- Supports a delayed, greater impact on health than just the fatality count

DISCUSSION & CONCLUSION

- Overall Findings
- Application
- Conclusion

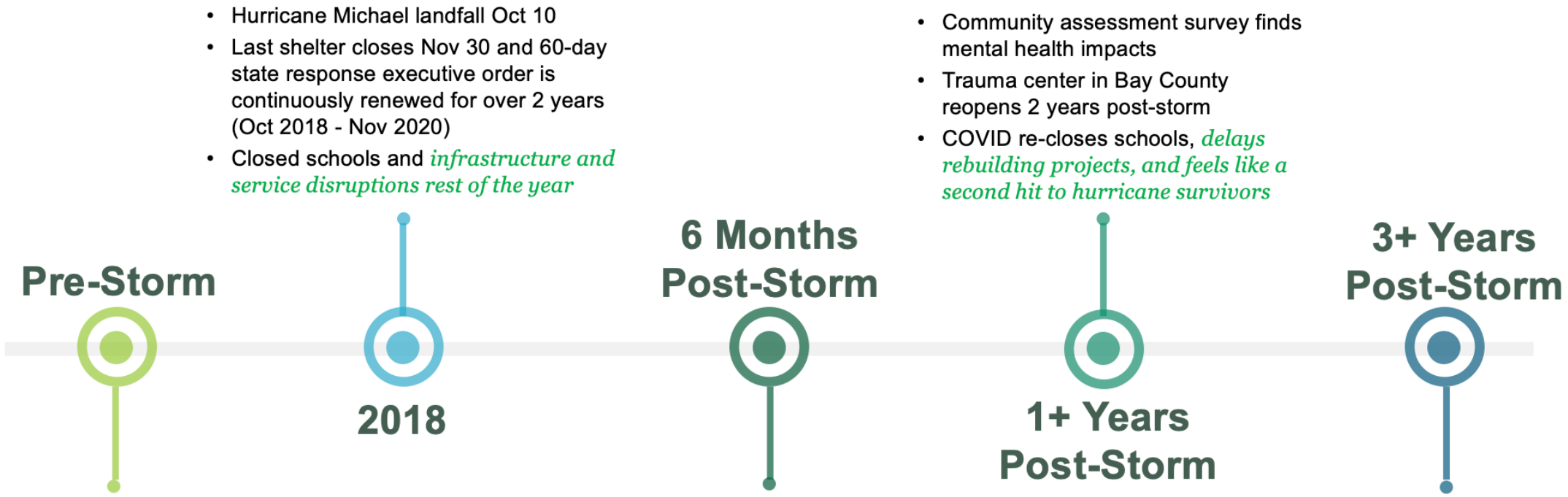
OVERALL FINDINGS

Vulnerabilities and damaged infrastructure resulted in delays in health care and contributed to additional deaths beyond the fatality count.



Total Health Impact

WHAT THIS STUDY ADDS



- Gulf and Franklin Counties are rural have higher vulnerability and limited health care providers
- Bay County is more resilient and has the only trauma center within 100 miles for some
- Area relies heavily on tourism

- Hurricane Michael landfall Oct 10
- Last shelter closes Nov 30 and 60-day state response executive order is continuously renewed for over 2 years (Oct 2018 - Nov 2020)
- Closed schools and *infrastructure and service disruptions rest of the year*

- Delays in prenatal care
- *Locals support one another during recovery and experienced barriers to accessing health services*
- *Excess mortality in Gulf and Franklin Counties*
- *Pilot project found increased unemployment, decreased health care workforce*

- Community assessment survey finds mental health impacts
- Trauma center in Bay County reopens 2 years post-storm
- COVID re-closes schools, *delays rebuilding projects, and feels like a second hit to hurricane survivors*

- Rebuild Florida Hometown business grant and loan program announced to help restore the local economy
- *Residents say the area is still not back to normal*
- *Children experience more psychiatric hospitalizations than pre-storm*

APPLICATION

Communicating and leveraging these findings

Local Agencies

- Encourage health screenings during prolonged recovery periods
- Build partnerships with nearby local health departments and share lessons learned
- Connect with the closest facilities that offer specialized care and treatment
- Conduct a post-disaster community assessment (CASPER)
- Utilize telehealth services
- Be mindful of burnout and tap into sources of social capital

Research Expansion

- Excess mortality modeling can be applied to small population areas
- Combining mixed methods can be a strength in disaster sciences

Policy Development

- Considerations for long-term healthcare infrastructure rebuilding
- Identify vulnerabilities to be aware of them before a disaster

CONCLUSION

A hurricane's impacts last much longer than the storm

Expanding how Hurricane Michael's impact on health was measured showed the depth and breadth of how the community was affected.

By expanding the way that hurricane impacts are measured, we can better understand how to protect communities.

Questions?

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ACTIVITY

How Differences in Social Vulnerabilities Change a Disaster's Impact

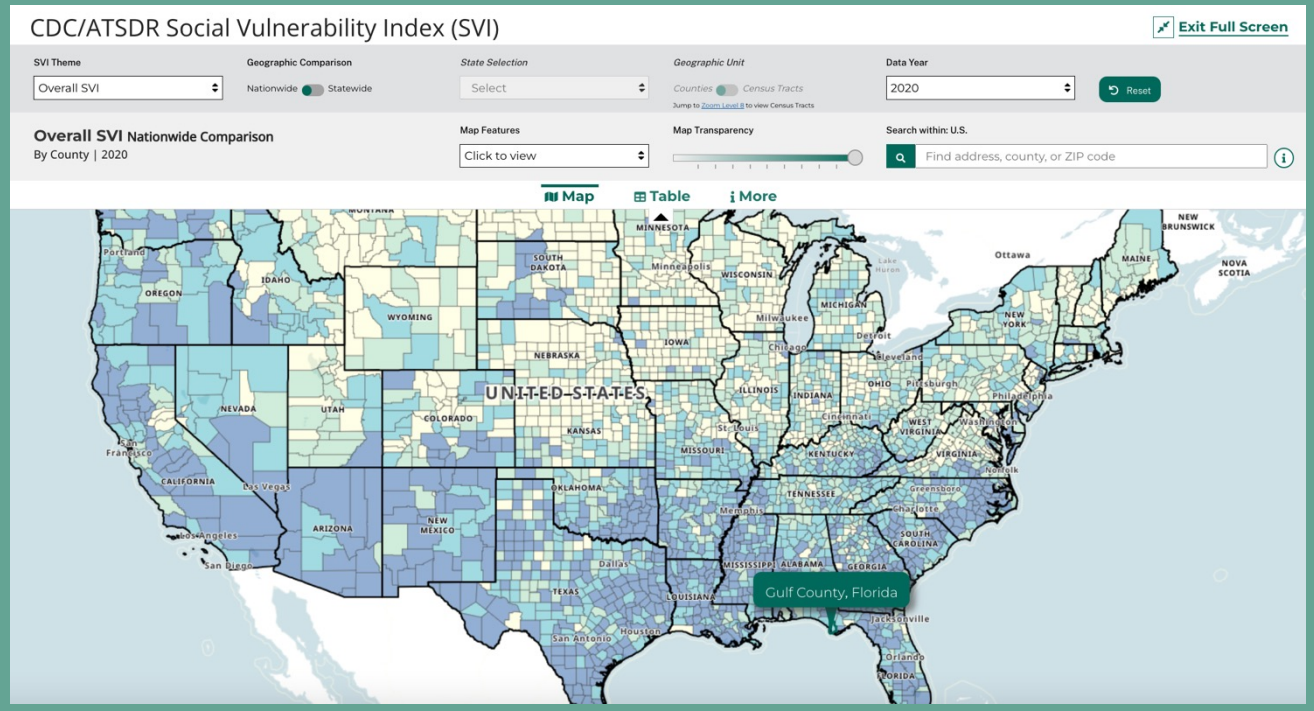
To Begin, Pick a Location You Are Very Familiar With:

- What type of natural disaster might happen there?
- Who are the vulnerable populations that live there?
- What resources are abundant there?
- What industries make up the workforce there?

ACTIVITY (2)

Go to That Location on the CDC's Social Vulnerability Index Interactive Map

https://www.atsdr.cdc.gov/placeandhealth/svi/interactive_map.html



ACTIVITY (3)

Explore Various Vulnerability Categories

Socioeconomic Status:

Unemployment, poverty, income, education

Household Characteristics:

Older adults, children, single parents, disability, languages spoken

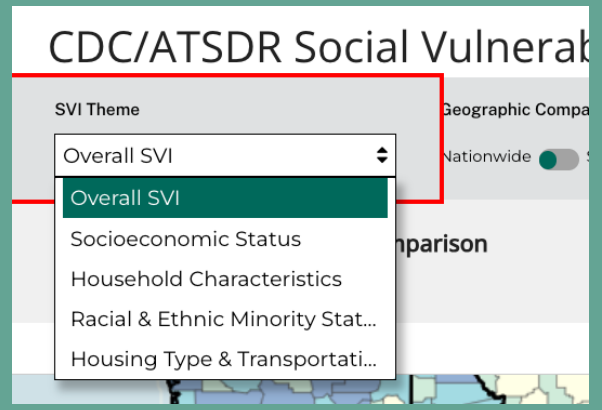
Racial and Ethnic Minority Status:

Racial and ethnic group identification

Housing Type and Transportation:

Multi-units, mobile homes, group housing, vehicle ownership

Select Different SVI Themes at the Top of the Map



ACTIVITY (4)

How Would Your Area Thrive or Struggle After a Disaster?

Questions to Consider:

- Are there any resilience factors (low vulnerability)?
- Are there high vulnerability for any category?
- How could a natural disaster impact those local vulnerabilities?
- Is there a nearby area with an abundance of certain resources?
- What if a disaster hit a neighboring county, would your area become a hub of resources for them?

Thank you!

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List of References

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