HHS Public Access

Author manuscript

Inj Prev. Author manuscript; available in PMC 2023 May 29.

Published in final edited form as:

Inj Prev. 2023 April ; 29(2): 180–185. doi:10.1136/ip-2022-044709.

Hurricane Florence and suicide mortality in North Carolina: a controlled interrupted time series analysis

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Abstract

Background: Natural disasters are associated with increased mental health disorders and suicidal ideation; however, associations with suicide deaths are not well understood. We explored how Hurricane Florence, which made landfall in September 2018, may have impacted suicide deaths in North Carolina (NC).

Methods: We used publicly available NC death records data to estimate associations between Hurricane Florence and monthly suicide death rates using a controlled, interrupted time series analysis. Hurricane exposure was determined by using county-level support designations from the

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STATEMENTS

A. Contributorship

Vanessa Miller: Conceptualization, Methodology, Software, Writing—Original Draft; Brian Pence: Conceptualization, Methodology, Investigation, Writing—Original Draft, Supervision, Funding acquisition, Data curation, Writing- Reviewing and Editing; Kate Fitch: Writing- Reviewing and Editing; Monica Swilley-Martinez: Writing- Reviewing and Editing; Andrew Kavee: data curation, Writing- Reviewing and Editing; Samantha Dorris: Project administration, Writing- Reviewing and Editing; Toska Cooper: Project administration, Writing- Reviewing and Editing; Alex Keil: Writing- Reviewing and Editing; Bradley Gaynes: Writing- Reviewing and Editing; Timothy Carey: Writing- Reviewing and Editing; David Goldston: Writing- Reviewing and Editing; Shabbar Ranapurwala: Conceptualization, Methodology, Investigation, Writing—Original Draft, Visualization, Supervision, Funding acquisition

C. Competing interests

The authors declare no competing interests or conflict of interest.

E. Ethics approval Statement

This study was approved by the University of North Carolina (Chapel Hill, NC) IRB (20–2677).

The authors report no conflict of interest.

Federal Emergency Management Agency (FEMA). We examined effect modification by sex, age group, and race/ethnicity.

Results: 8363 suicide deaths occurred between January 2014-December 2019. The overall suicide death rate in NC between 2014 and 2019 was 15.53 per 100,000 person-years (95% CI: 15.20,15.87). Post-hurricane, there was a small, immediate increase in the suicide death rate among exposed counties (0.89/100,000 PY; 95% CI: −2.69,4.48. Comparing exposed and unexposed counties, there was no sustained post-Hurricane Florence change in suicide death rate trends (0.02/100,000 PY per month; 95% CI: −0.33,0.38). Relative to 2018, NC experienced a statewide decline in suicides in 2019. An immediate increase in suicide deaths in hurricane-affected counties versus hurricane-unaffected counties was observed among females, people under age 65, and non-Hispanic Black individuals but there was no sustained change in the months after Hurricane Florence.

Conclusions: Although results did not indicate a strong post-Hurricane Florence impact on suicide rates, subgroup analysis suggests differential impacts of Hurricane Florence on several groups, warranting future follow-up.

INTRODUCTION

In 2021, the United States saw Hurricane Ida inflict winds and flooding from Louisiana to Connecticut with disaster declarations in Delaware, New Jersey, New York, Mississippi, and Pennsylvania. As natural disasters become more common and more dangerous[1], the health effects of such disasters, particularly psychological distress in the wake of a disaster, is a public health concern[2–4].

Increased depression, post-traumatic stress, and anxiety are all documented sequalae of natural disasters.[5–8] Hurricanes introduce several possible sources of emotional turmoil including the immediate fear during the storm and flooding, but also the possibility of long-term displacement and economic challenges surrounding property damage. Meta-analysis of 45 studies found the combined prevalence of PTSD after a hurricane or typhoon to be 17.8%.[9] Researchers reported that mental health hospital admissions did not increase immediately after Hurricane Sandy hit New York in 2012, but increased by 8% in the following year among people over age 64.[10] Also focusing on the mental health burden after Hurricane Sandy, Boscarino et al[11] found predictors of mental health and mental health utilization included high exposure to hurricane-related events.

The World Health Organization's conclusion from The WHO World Mental Health Surveys states, "*although specific traumatic events are useful in predicting suicide ideation, they are generally less useful in predicting the progression from suicide ideation to attempt*".[12] However, few studies have reported results on suicidal behaviors using either a pre-hurricane or unexposed comparison. A population-based study of the mental health impact of Hurricane Ike reported differences in suicidal ideation, plans and attempts among 448 people exposed to varying levels of hurricane damage. The researchers found the prevalence of suicidal ideation reported in the last month (measured 2–6 months post-hurricane) to be 2.6% (n=21), a prevalence identical to the 12-month prevalence of suicidal ideation in the general US population.[13] Among a sample of 316 Hurricane Harvey survivors,

10% endorsed thoughts about suicide since the hurricane.[14] Systematic review of eleven studies of hurricanes and suicide outcomes found only one study included pre-hurricane measurement of suicidal ideation in a cohort, with many studies reporting cross-sectional data.[15] Suicide behavior is complex and people experiencing suicidal thoughts often do not act on these thoughts and the relationship between suicidal ideation and suicide behavior is not well-understood. People who attempt suicide have higher levels of PTSD and anxiety compared to people who report experiencing suicidal ideation.[16] Data analyzed from a crisis counseling service for youth experienced a 15% increase in crisis texts for anxiety and stress and a 23% increase in texts for suicidal ideation in the 6 weeks after Hurricane Florence.[17]

In this study, we examined changes in the suicide rate among hurricane-exposed counties compared with counties that did not receive federal assistance to mitigate damage caused by Hurricane Florence in North Carolina (NC) in September 2018.

METHODS

Hurricane Florence was a Category One Hurricane that made landfall in North Carolina on September 14th, 2018. Bringing wind speeds of 92 mph,[18] producing 27 tornadoes in NC and 30 inches of rainfall to some areas, Hurricane Florence resulted approximately 1.1 million customers without power, 15 deaths directly related to hurricane conditions and approximately $24 billion in damage (95%CI 15.7 B-40.0 B).[19] This cost is estimated to include insured and uninsured losses collated from a variety of sources designed to estimate the cost “that would not have been incurred had the event not taken place”[20] and likely is not inclusive of costs that are difficult to define such as psychological distress. To assess whether Hurricane Florence was associated with an immediate or long-term change in suicide death rates, we employed a controlled interrupted time series (CITS) analysis comparing monthly suicide death rates from 2014–2019 between hurricane-affected and -unaffected counties in NC.[21] This study was approved by the University of North Carolina (Chapel Hill, NC) IRB (20–2677).

Data sources

Suicide data—North Carolina’s State Center for Health Statistics mortality data were used to identify deaths from suicide using the following criteria: a primary cause of death coded as one of the following ICD-10 codes: X60-X84 or Y87.0. We excluded deaths among people under age 10 for consistency with National Center for Health Statistics reporting[22] and those whose Death Certificate did not report a NC county of residence. We calculated the suicide death rates for exposed and unexposed counties for each month beginning with January 2014 and through December 2019 to create a monthly time series for all NC counties.

Population at risk—County-level population denominators were calculated using data from the National Vital Statistics System US Census Populations with Bridged Race Categories. Person-years at risk for each year were calculated using the county-level population estimate for each year from 2014–2019 using estimates from the July postcensal population estimate calculated in 2020.[23] The annual county-level population estimates were

combined to create a denominator for the exposed and unexposed counties and then that number was divided by 12 to account for the monthly contribution of person-time.

Hurricane exposure—Hurricane Florence made landfall in North Carolina on September 14, 2018 with heavy rain and winds. Persistent rainfall resulted in flooding occurring in large parts of eastern North Carolina which is quite flat with limited drainage. In the monthly time series, we identified October 2018 as the first month in the post-hurricane period.

We used Federal Emergency Management Agency (FEMA) designations for disaster assistance for Hurricane Florence to categorize counties as unexposed (not designated to receive assistance) or exposed (designated to receive individual and public assistance). We employed two definitions of county-level Hurricane Florence exposure (Figure 1). The first definition included all counties in NC. All counties that were FEMA-designated individual, public assistance or both (n=67) were considered exposed to Hurricane Florence and counties that were not designated for any support (n=33) were considered unexposed. For sensitivity analysis, we created a second definition limiting exposure status to only counties that received both individual and public assistance designations from FEMA (n=28), while unexposed referent counties were the same and other counties were excluded.

Statistical analysis—For each exposure definition, we conducted a controlled interrupted time series (CITS) study using PROC ARIMA, to compare suicide death rate trends in exposed and unexposed counties before and after Hurricane Florence. This method permits the identification of a temporary increase or decrease in suicide deaths followed by a return to pre-hurricane rates. This is particularly important to discern if there may be a “crisis period” post-hurricane during which intensive public health interventions would be most useful. The ARIMA model was also selected to be able to assess changes in the trend of suicide mortality beyond the immediate crisis period. A linear model was used based on trends in the raw data (Figures 2 and 3) which showed linear trends in both exposed and unexposed samples. We identified the start of exposure in October 2018 because although Hurricane Florence made landfall on September 14th, the extent of rainfall and damage from flooding occurred mainly in the days and weeks following the hurricane with damage and displacement due to sustained rain and poor drainage continuing to occur for weeks after landfall. We performed a sensitivity analysis indicating September as the first month of exposure. More details about the statistical model can be found in the supplementary materials.

Effect measure modification—We examined potential effect measure modification due to demographic factors by restricting the CITS analysis by sex (female or male), age groups (10–24, 25–65, 66 and older). We combined race and ethnicity data from NC Death Certificates with county-level population estimates from Census data. Census estimates of county population by race/ethnicity was derived from two variables: a variable indicating Hispanic or non-Hispanic ethnicity and a race variable that included four categories: White, Black, Asian or Pacific Islander, American Indian or Alaska Native. The four race categories result from bridging 31 self-reported race categories used in Census 2000 and Census 2010, as specified in the 1997 Office of Management and Budget (OMB) standards for

the collection of data on race and ethnicity, to the four race categories specified in the 1977 OMB standards.[24] State Death Certificate data includes a variable capturing Hispanic or non-Hispanic ethnicity, and a race variable with the following categories: White, Black or African American, American Indian or Alaska Native, Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese and unknown. Race/ethnicity data from NC death certificates are collected using a fill-in the blank box completed by the person completing the death certificate.[25] We collapsed all Asian categories into one group. Race/ethnic categories for both death data and Census population denominators were: non-Hispanic White, non-Hispanic Black, Asian or Pacific Islander, American Native/Eskimo/Aleut, Hispanic, and those missing race/ethnicity data. However, the low number of suicides per month among the Asian and Native American groups resulted in uninterpretable estimates from the CITS model. We combined American Indian, Alaskan Native and Asian Pacific Islander and those missing race/ethnicity data into a category labeled “other” due to small numbers of suicides in these groups to obtain estimates from the CITS model.

All analysis were performed using SAS version 9.4 (Cary, NC, USA).

RESULTS

During the six-year period under study (2014–2019), there were 8363 suicide deaths among persons ages 10 and older and currently residing in NC. The overall rate of suicide deaths during the study period was 15.53 per 100,000 person-years. The rate was higher among men compared to women, highest in the age group of 25–65 years, and higher among those identified as non-Hispanic white compared to other race/ethnicity groups (Table 1). Restricting by race/ethnicity suggests that the overall suicide rate was highest in the non-Hispanic white group (20.13 [19.66, 20.60] per 100,000 person-years), with the second highest rate among the American Native group (12.92 [10.40, 16.04] per 100,000).

Using the broad exposure definition, in 2018, 35% and 65% of the population of NC was classified as exposed and unexposed respectively. Under the strict exposure criteria, 25% of the population was classified as exposed and 50% of the state population was unexposed in 2018 (Appendix Table 1 contains a list of counties included in both exposure definitions).

Suicide death rates were similar and stable over the study period in both hurricane exposed and unexposed counties prior to the hurricane (Figures 2 and 3). A decrease in suicide death rates in North Carolina as a whole occurred in 2019 relative to 2018. After Hurricane Florence, there may have been a short-term increase in the suicide death rate among the exposed counties relative to the unexposed counties, followed by a decline in suicide death rates in both the groups (Figures 2 and 3). However, the immediate increase was small [0.89 suicide deaths per 100,000 person-years (95% CI: −2.69, 4.48)]. There was no sustained post-Hurricane Florence change in suicide death rates relative to unexposed counties (0.02 [95% CI: −0.33, 0.38] deaths per 100,000 per month) (Table 2). When we used the strict criteria for exposure (exposed counties were designated by FEMA as eligible for both individual assistance and public assistance but counties with only one or the other were excluded), the differences in suicide death rate trends between the exposed and unexposed counties were even smaller. When we changed the exposure month to September to reflect

the date of Hurricane Florence landfall, we found a slight immediate decrease in deaths (−0.10 [95% CI −3.59, 3.40] suicide deaths per 100,000 person-years and a slightly larger sustained post-Hurricane Florence change in trend (0.09 [−0.08, 0.26] deaths per 100,000 per month). Note that this sensitivity analysis loses temporality as some of the pre-hurricane outcomes are attributed to the hurricane.

Stratified analyses were exploratory to identify potential effect measure modification by restricting analyses to specific subgroups. Some differences in patterns between subgroups were apparent (Table 2). For example, females experienced an increase in suicide deaths in exposed relative to unexposed counties immediately after the hurricane (3.31 [−0.11, 6.72] deaths per 100,000) followed by a declining trend in exposed relative to unexposed counties (−0.24 [−0.58, 0.10] deaths per 100,000 per month). In men, the direction of the immediate effect was reversed with an initial decrease in the suicide death rate in exposed relative to unexposed counties (−1.66 [−7.75, 4.43] deaths per 100,000), followed by a decreasing trend over the months after the hurricane (−0.31 [−0.30, 0.91] deaths per 100,000 per month).

When stratified by age, the youngest age group in exposed counties appeared to have the largest increase in the suicide death rate post-Hurricane Florence, while those ages 25–65 had a smaller increase compared to those under age 25. People over 65 in exposed counties experienced a slight decrease in the suicide death rate compared to unexposed counties.

Restriction by race/ethnicity resulted in immediate increases within every racial group, but the smallest increase was among people classified as non-Hispanic White. The largest increase was observed in the non-Hispanic Black population where there was an immediate increase in suicide deaths among exposure counties relative to unexposed counties (3.34 [−1.46, 8.14] deaths per 100,000).

DISCUSSION

In this study, we did not observe either an immediate or a sustained significant change in suicide deaths after Hurricane Florence among FEMA-designated disaster assistance counties compared with counties that were not designated for disaster assistance.

Studies addressing suicide rate changes subsequent to hurricanes have been conflicting. Suicide rates pre- and post-natural disasters studied using a difference-in-differences approach found a 3.1% increase in yearly suicide rates when suicide rates were pooled from 2003 to 2015 to compare pre- and post-disaster suicide rates across multiple hurricanes.[26] One study of 366 persons displaced due to the 2005 Gulf Coast hurricane season in Louisiana and Mississippi found suicide death rates after displacement were 161 per 100,000 person years compared to the baseline state suicide rate of 11.9 per 100,000 person years.[27] This dramatic increase likely reflects a vulnerable population of people experiencing extreme hardship as a direct result of storm damage. In 2018, the county suicide rate of Monroe County Florida (site of Hurricane Irma in 2017) increased from a 5-year average (2013–2017) of 25.2 to 34.9 suicide deaths per 100,000 population.[28] Predictors of post-hurricane suicidal ideation have been identified as pre-hurricane suicidal

ideation, low socioeconomic status, high stress scores, and low family support.[29] Also in Florida, the rate of dyadic deaths (homicide-suicide) reportedly doubled in the six months following Hurricane Andrew.[30]

Researchers have also reported decreased suicide thoughts and behavior after a natural disaster. Among 52 young people assessed before and after Hurricane Katrina, researchers reported higher prevalence of serious mental illness among the sample (11.3% after vs 6.1% before) but lower prevalence of suicidal ideation (0.7% after vs 8.4% before) and lower plans for suicide (0.7% after vs 3.6% before).[31] Further, this decrease was associated with self-reported faith in one's ability to rebuild their life post-disaster and realization of inner strength.[31] A similar finding was reported in 826 adults, an increase in prevalence of mental illness observed post-Hurricane Katrina compared with pre-Hurricane levels (11.3% after vs. 6.1% before) but significantly lower suicidal ideation (0.7% after vs 8.4% before) and suicide plans (0.4% after vs 3.6% before).[32] Moderate hurricane exposure, as opposed to intense exposure, demonstrated increased psychological functioning when social support, global distress, and negative emotion were measured among moderately exposed college students before and 6 weeks after Hurricane Sandy and compared to matched with controls without hurricane exposure.[33] Research on post-traumatic growth suggests increases in social support and social cohesion may reduce negative psychological consequences immediately following a natural disaster. [34–36] The increase in social support within communities or social networks may provide a haven for those struggling with thoughts of suicide in the aftermath of a hurricane.[4,13,37]

Our finding suggests that increases in psychological distress associated with Hurricane Florence did not translate into a temporary or sustained increase in suicide death rates at the county level when comparing counties exposed to Hurricane Florence to counties that did not have the same experience of rainfall, damage, and disruption of daily life.

Using multiple years of mortality data for the entire State of North Carolina with a population over 10 million and the use of robust quasi-experimental methodology with a clearly defined control group supports the generalizability of this finding to NC[38,39]. This research is important because NC remains vulnerable to hurricane damage, as the state has experienced 7 hurricanes since 2010 classified as categories 1–5 and 11 tropical storms that did not reach Hurricane status.[40]

In addition to the use of monthly mortality data for a period of 6 years in North Carolina, this research study has several strengths. Given the overall decrease in suicide rates across NC in 2019, if we compared suicide rates from 2017 (the year before Hurricane Florence) to the year after Hurricane Florence, we would have observed a decrease in suicide mortality surrounding Hurricane Florence and potentially misattributed the change to the hurricane. Suicide mortality decreased in both hurricane-exposed and hurricane-unexposed counties starting in 2019 and the CITS model permits us to make comparisons between the exposed and unexposed counties while incorporating monthly data from before and after Hurricane Florence. The use of vital statistics data allows for a reliable measurement of suicide mortality. Outcome misclassification is not a strong concern in interpreting these results. In general, there may have been suicide deaths that were not classified as

suicide on the death certificate, but there is no reason to expect that suicide deaths went uninvestigated, unreported or misclassified in hurricane exposed counties relative to counties not experiencing hurricane damage.

Generalizing about the impact of hurricanes on suicide rates beyond Hurricane Florence in NC requires future study including mortality data from multiple states and multiple hurricanes. For example, comparing Hurricane Florence to a much deadlier and more devastating disaster such as Hurricane Katrina which resulted in over 1,800 deaths and over $100 billion dollars[41] is problematic due a failure to consider existing socio-economic disparities prior to the hurricane impact and the extended displacement experienced by Hurricane Katrina survivors.[42] Differences in the population, socioeconomic status, resilience of communities, available assistance, and mental health interventions invariably impact suicide mortality trends.[15,43,44] The World Health Organization's large sample of structured interviews (n=102,245) explored the complexity of the progression from suicide ideation to suicide plans and attempts and tested the relationship between natural disasters and subsequent suicidal behavior. The results indicated the relationship that existed in bivariate analysis subsequently diminished or disappeared when multivariable models were used to control for demographic factors, life course, parent psychopathology, and childhood adversity.[12] In our study, the lack of data about demographic factors and consideration of individual risk factors that may predispose toward or protect someone from suicide prevents conclusions about who may be most vulnerable to suicide in the wake of a disaster.

Further, understanding the impact of flooding on a county-level may introduce exposure misclassification since we do not expect the entire county to be flooded, or that all counties in our exposed group were impacted by Hurricane Florence to the same extent. To address this concern, we restricted our analyses to the exposed counties that received the highest FEMA support designation, and the results did not meaningfully differ. However, this sensitivity analysis still does not completely address the exposure misclassification, which requires detailed individual-level data.

It is important to continue to assess the burden of suicide due to hurricanes reflected in population-level aggregate data. Future research should integrate additional data sources such as emergency room visits to capture suicide-related behaviors and include individual-level exposures not addressed in our study. These studies can help states, counties, and health systems plan in advance for mental health responses to future natural disasters.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

ACKNOWLEDGEMENTS

Financially supported by the National Institutes of Health, National Institute of Mental Health, 5-R01MH124752

D. Data sharing/Data availability

The programming code used to perform analyses for this article is available from the corresponding author on request. The suicide data was obtained through a restricted data use agreement with the NC Center for Health Statistics and is not available for public dissemination.

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What is already known on this topic

Research has documented increases in crisis counseling including increases in texts for suicidal ideation in the acute post-Hurricane period and increases in mental hospital admissions in the year following a Hurricane.

What this study adds

Suicide mortality was evaluated around Hurricane Florence comparing Hurricane impacted counties to counties without a FEMA disaster designation for Hurricane Florence. We found evidence of a small increase in suicide mortality immediately post-hurricane and no evidence of post-Hurricane change in suicide death rate trends. Higher rates of suicide were among women, people under age 65 and non-Hispanic Black people.

How this study might affect research, practice or policy

Our research suggests that women, people under age 65, and non-Hispanic Black people may benefit from targeted disaster response focused on mental health.

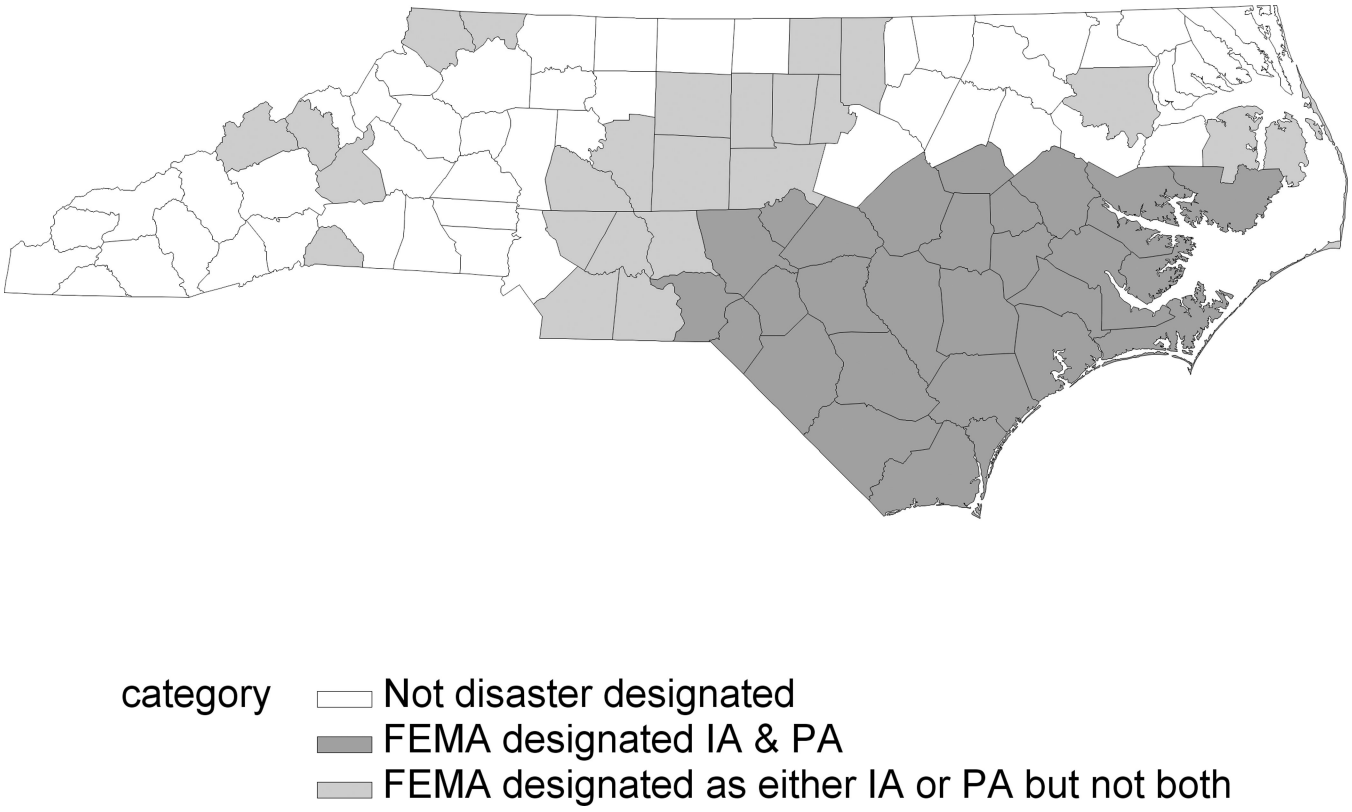

Figure 1.
Categorisation of hurricane exposure among North Carolina counties based on FEMA designation, September 2018. FEMA, Federal Emergency Management Agency; IA, individual assistance; PA, public assistance.

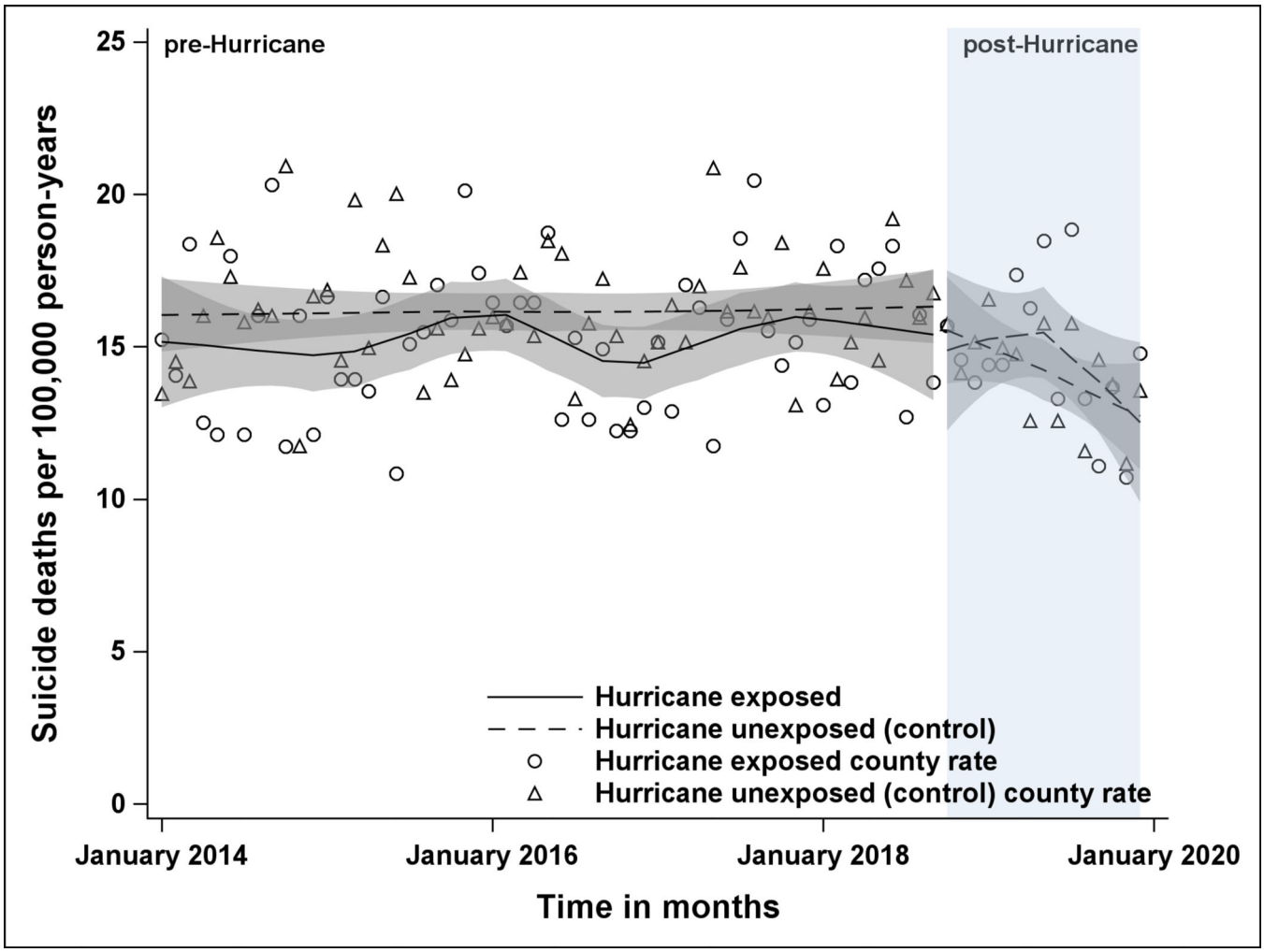

Figure 2.

Suicide rates among people living in counties designated as exposed and unexposed during the period before Hurricane Florence and after Hurricane Florence, North Carolina 2014–2019. Lines and confidence bands represent LOESS (locally estimated scatterplot smoothing) curves based on the observed monthly data and 95% confidence bands around the LOESS curves.

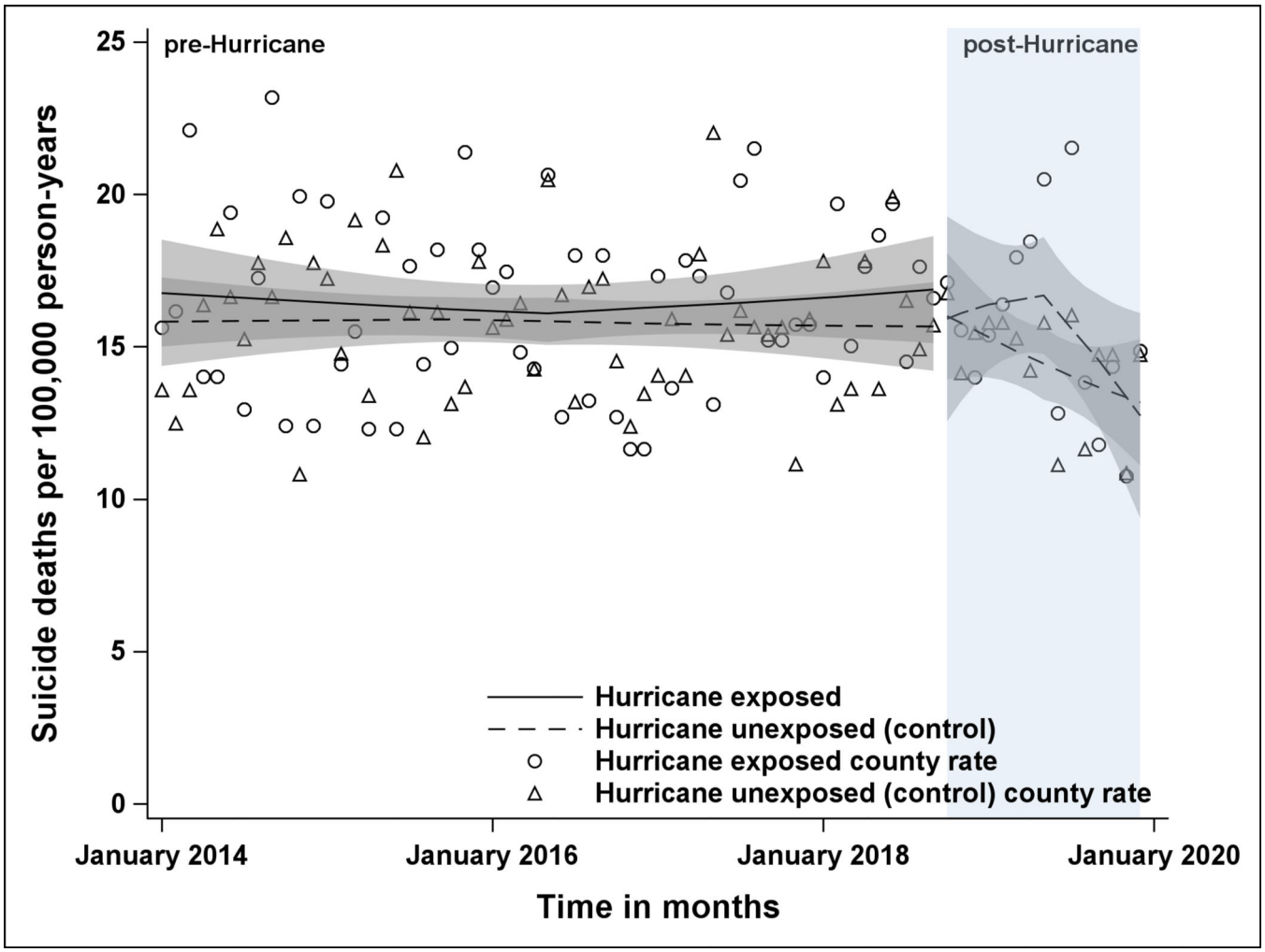

Figure 3.

Suicide rates among people living in counties designated as exposed and unexposed not including counties designated as either IA or PA but not both during the period before Hurricane Florence and after Hurricane Florence, North Carolina 2014–2019. Lines and confidence bands represent LOESS (locally estimated scatterplot smoothing) curves based on the observed monthly data and 95% confidence bands around the LOESS curves. IA, individual assistance; PA, public assistance.

Table 1.

Unadjusted suicide N and rate with 95% confidence intervals for North Carolina including total, hurricane exposed and unexposed, 2014–2019

	N	Rate per 100,000 (95% CI)
Overall	8363	15.53 (15.20, 15.87)
Sex		
Female	2028	7.29 (6.98, 7.62)
Male	6335	24.34 (23.75, 24.95)
Age		
10–24	1087	8.90 (8.38, 9.44)
25–65	5777	17.67 (17.22, 18.13)
66 and up	1499	16.80 (15.97, 17.67)
Race/Ethnicity		
Non-Hispanic White	7102	20.13 (19.66, 20.60)
Non-Hispanic Black	749	6.38 (5.94, 6.86)
Other[b]	226	11.85 (10.70, 13.13)
Asian or Pacific Islander	125	7.67 (6.44, 9.15)
American Native or Eskimo or Aleut	82	12.92 (10.40, 16.04)
Not otherwise categorized[a]	19	-
Hispanic	283	6.51 (5.80, 7.31)

[a]includes missing or unknown racial classification; 95% CI=95% confidence interval

Table 2.

Association of Hurricane Florence exposure with suicide mortality among entire population in NC: 2014–2019

	Immediate absolute change (β6) after Hurricane Florence among exposed counties (95% CI) relative to unexposed counties	Sustained trend changes (β7) after Hurricane Florence exposure (95% CI) relative to control
Exposed counties vs all unexposed counties	0.89 (−2.69, 4.48)	0.02 (−0.33, 0.38)
Highly exposed counties vs unexposed (excluding counties designated as IA or PA but not both)	0.70 (−3.72, 5.12)	−0.03 (−0.48, 0.41)
Stratified analysis		
Sex		
Female	3.31 (−0.11, 6.72)	−0.24 (−0.58, 0.10)
Male	−1.66 (−7.75, 4.43)	0.31 (−0.30, 0.91)
Age (years)		
10–24	1.58 (−4.35, 7.51)	−0.21 (−0.81, 0.38)
25–65	1.19 (−3.64, 6.01)	0.12 (−0.37, 0.60)
66 and up	−0.73 (−10.40, 8.94)	−0.05 (−0.95, 0.86)
Race/Ethnicity		
Non-Hispanic White	0.25 (−4.72, 5.21)	0.14 (−0.35, 0.64)
Non-Hispanic Black	3.34 (−1.46, 8.14)	−0.30 (−0.78, 0.18)
Asian, Native American, Missing or Unknown[a]	2.08 (−10.86, 15.01)	−0.64 (−1.93, 0.66)
Hispanic	0.61 (−7.95, 9.17)	−0.02 (−0.87, 0.84)

[a]Includes Asian, Native American, missing or unknown racial classification; note: “Immediate absolute change” refers to the first month after exposure (change from September to October 2018); “sustained trend changes” refers to the slope of the line from October 2018-December 2019 (15 months after Hurricane Florence) compared to the slope of the line from January 2014-September 2018 (57 months before Hurricane Florence); 95% CI=95% confidence interval