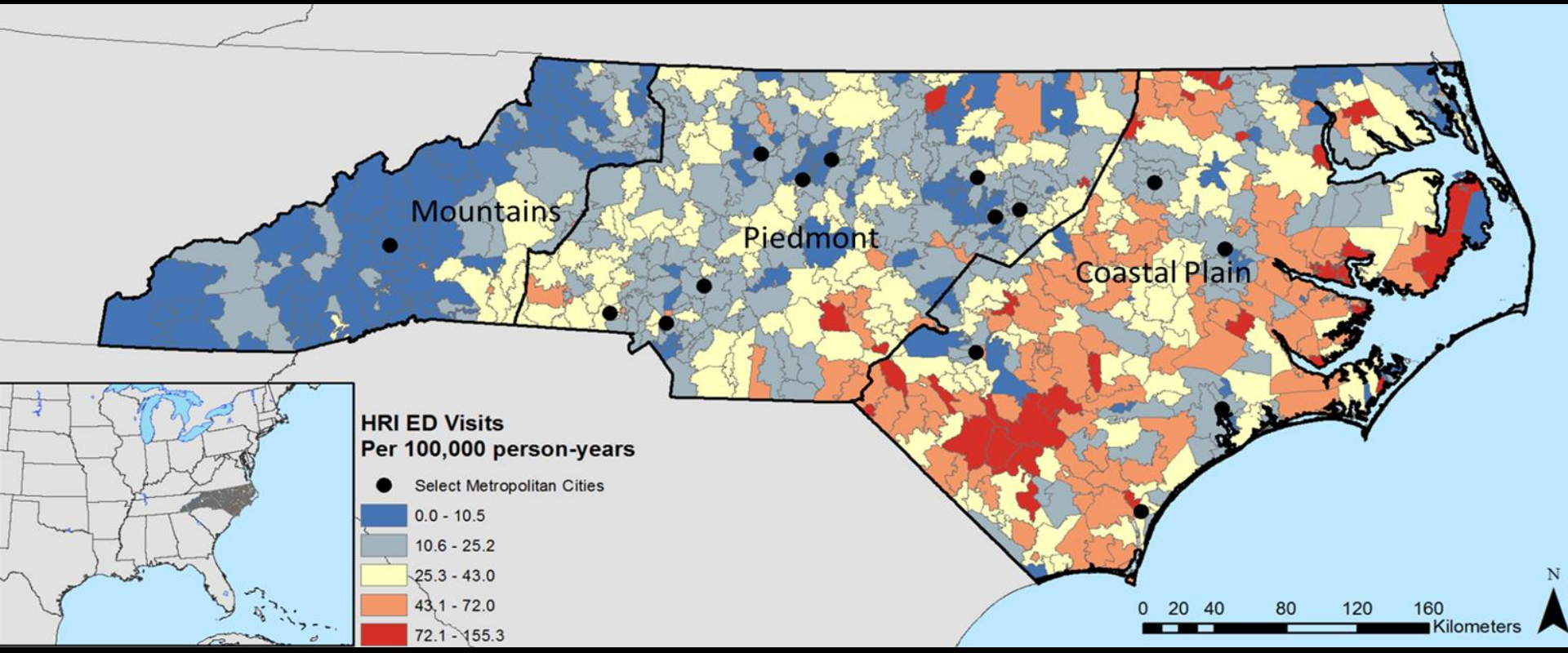
Climate and Public Health

<u>On-going and previous research projects:</u>
-Mental Health & Climate
-Severe Maternal Morbidity & Climate
-Temp Monitoring among Occupationally Exposed Populations
--COVID-19 and meteorological parameters
-Extreme Weather/Natural Hazards
-Heat related illness

Nearly 25 publications since 2018 together

What do we know about the effect of extreme heat locally in NC?



Case Study: Heat-related illness in North Carolina

Sugg, M. M., Konrad, C. E., & Fuhrmann, C. M. (2016). Relationships between maximum temperature and heat-related illness across North Carolina, USA. International journal of biometeorology, 60(5), 663-675.

CLIMATE CHANGE AFFECTS THE HEALTH OF **ALL AMERICANS**

It's
COMPLICATED!

CLIMATE DRIVERS

- More frequent & intense precipitation
- More intense hurricane rainfall
- Sea level rise-related increases in storm surge
- Increasing snowmelt & rain-on-snow events

ENVIRONMENTAL & INSTITUTIONAL CONTEXT

- Development in vulnerable coastal areas, floodplains, or watersheds
- Flood control (both human-managed systems & ecosystem services)
- Water, power, transportation, communication, & health care infrastructure
- Preparedness (early warning systems, evacuation assistance)
- Emergency response & disaster relief

EXPOSURE PATHWAYS

- Flood waters & debris
- Loss of essential infrastructure
- Contaminated drinking water
- Evacuation & population displacement

SOCIAL & BEHAVIORAL CONTEXT

- Social determinants of health
- Storm preparation & evacuation warnings
- Occupation
- Dependency on caregivers or medications
- Limited English proficiency
- Homelessness or institutionalization (prisons, psychiatric facilities, nursing homes)

HEALTH OUTCOMES

- Drownings
- Injuries
- Mental health consequences

Source: CHA

Personal Monitoring of Occupational Heat Exposure

+

+

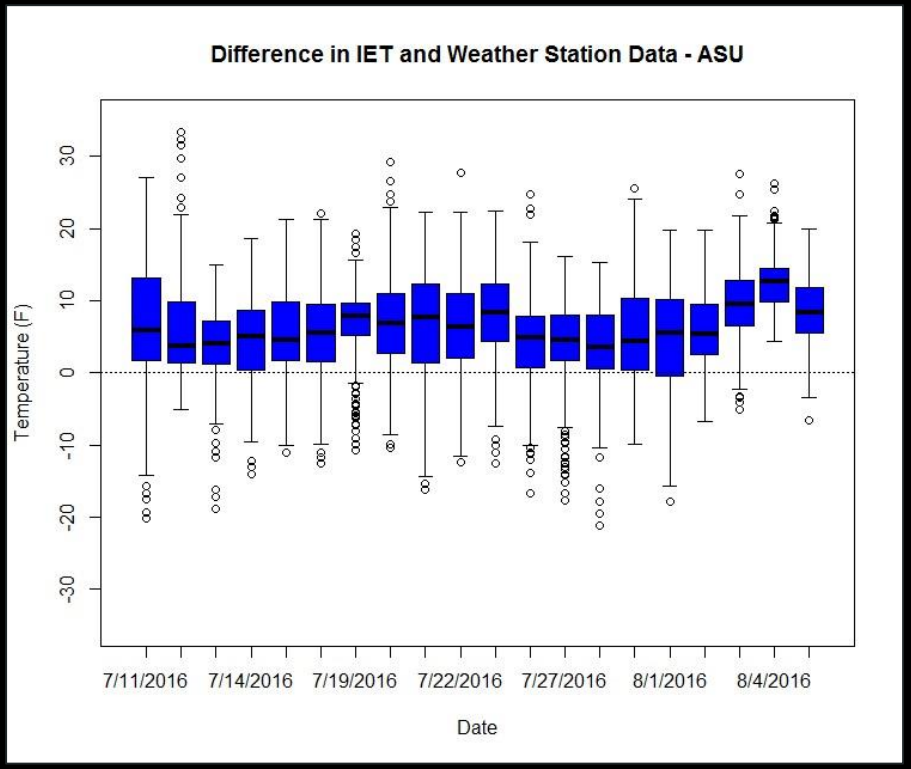
Case Study: Grounds workers and heat stress

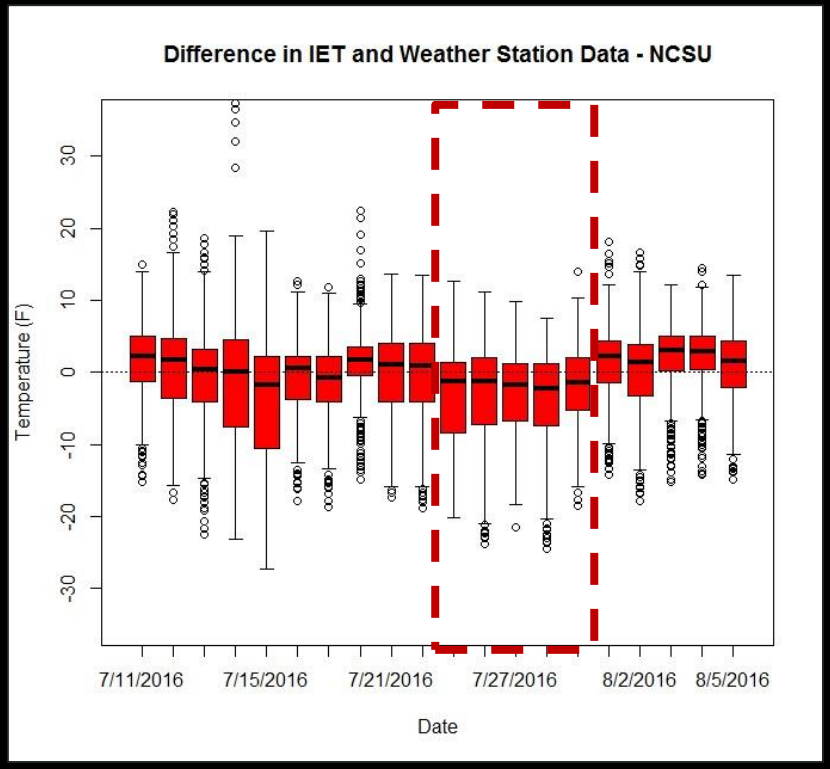
Runkle, J. D., Cui, C., Fuhrmann, C., Stevens, S., Del Pinal, J., & Sugg, M. M. (2019). Evaluation of wearable sensors for physiologic monitoring of individually experienced temperatures in outdoor workers in southeastern US. Environment international, 129, 229-238.

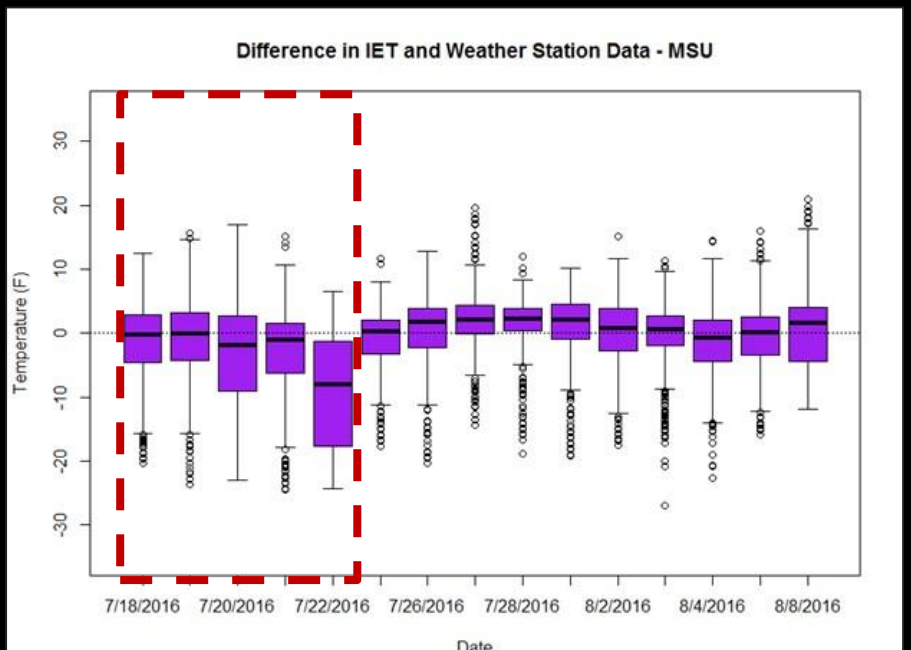
Sugg, M. M., Fuhrmann, C. M., & Runkle, J. D. (2018). Temporal and spatial variation in personal ambient temperatures for outdoor working populations in the southeastern USA. International Journal of Biometeorology, 1-14675.

Sugg, M. M., Stevens, S. S., & Runkle, J. D. (2019). Estimating Personal Ambient Temperature in Moderately Cold Environments for Occupationally Exposed Populations. Environmental Research. https://doi.org/10.1016/j.envres.2019.03.066

Nelson, K.*, J. D, Runkle, Sugg, M.M. (2020). Reporting back environmental health data among outdoor occupational workers in the cold season in North Carolina, USA. Southeastern Geographer, 60(2), 159-182. https://doi:10.1353/sgo.2020.0013







Air Temperature

Median Difference (PAT– Wx Station)

ASU	+6.3 degF
NCSU	+0.7 degF
MSU	+0.9 degF

Box indicates dates where local NWS issued a Heat Advisory

Crisis Text Line (Mental Health) and Heat

Objective | Examine the association between crisis-support seeking behavior in young adults and temperature patterns in four geographically and climatologically diverse metropolitan centers.

Crisis support-seeking behavior and temperature in the United States: Is there an association in young adults and adolescents?

Runkle, J., Michael, K., Stevens, S., & Sugg, M. (2020). Quasi-Experimental Evaluation of Text-based Crisis Patterns in Youth following Hurricane Florence in the Carolinas, 2018. Science of The Total Environment. *IN PRESS*

Sugg, M. M., Dixon, P. G., & Runkle, J. D. (2019). Crisis support-seeking behavior and temperature in the United States: Is there an association in young adults and adolescent Science of The Total Environment, 669, 400-411.

Methods

Total CTL conversations, 2013-2017:
n = 21,048 in Los Angeles,
n = 13,981 in Chicago,
n = 9703 in Atlanta, and
n = 14,321 in New York City

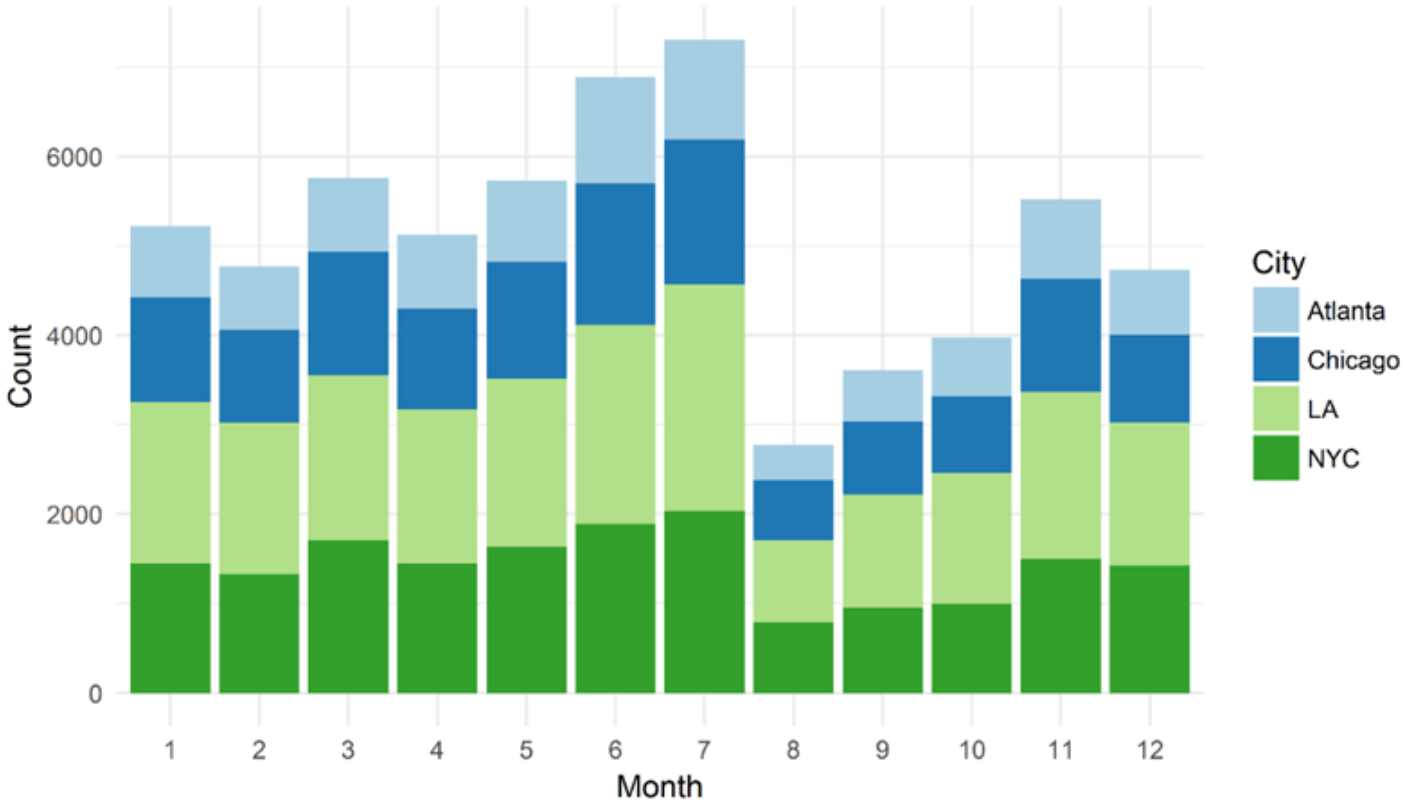
Primary outcome: Daily anonymized crisis texts were aggregated at the city level

**focus on crisis events that are upstream to more adverse mental-health outcomes as a potential intervening pathway*

Exposure: Daily maximum and minimum temperature

Statistical analysis: quasi-Poisson generalized linear model + Distributed Lag Non-Linear Model

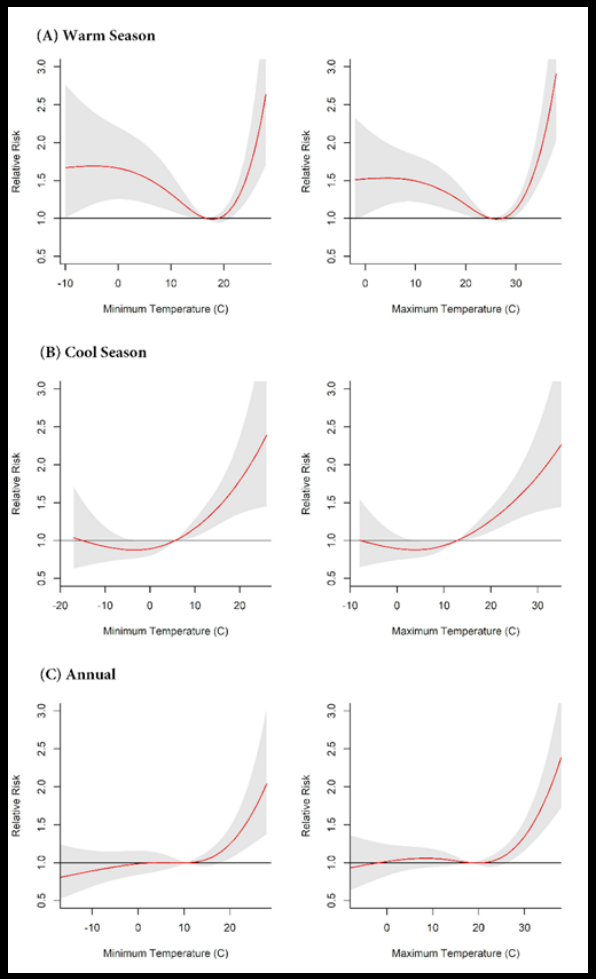
Monthly distribution of CTL crisis-support seeking texts at each metropolitan location, 2013-2017.



CTL usage **increased** from the cold season (December) to the warm season (July)

66% drop in August, a month with both hot and humid conditions in most of the study locations

Case Study: Crisis Events - Highlights



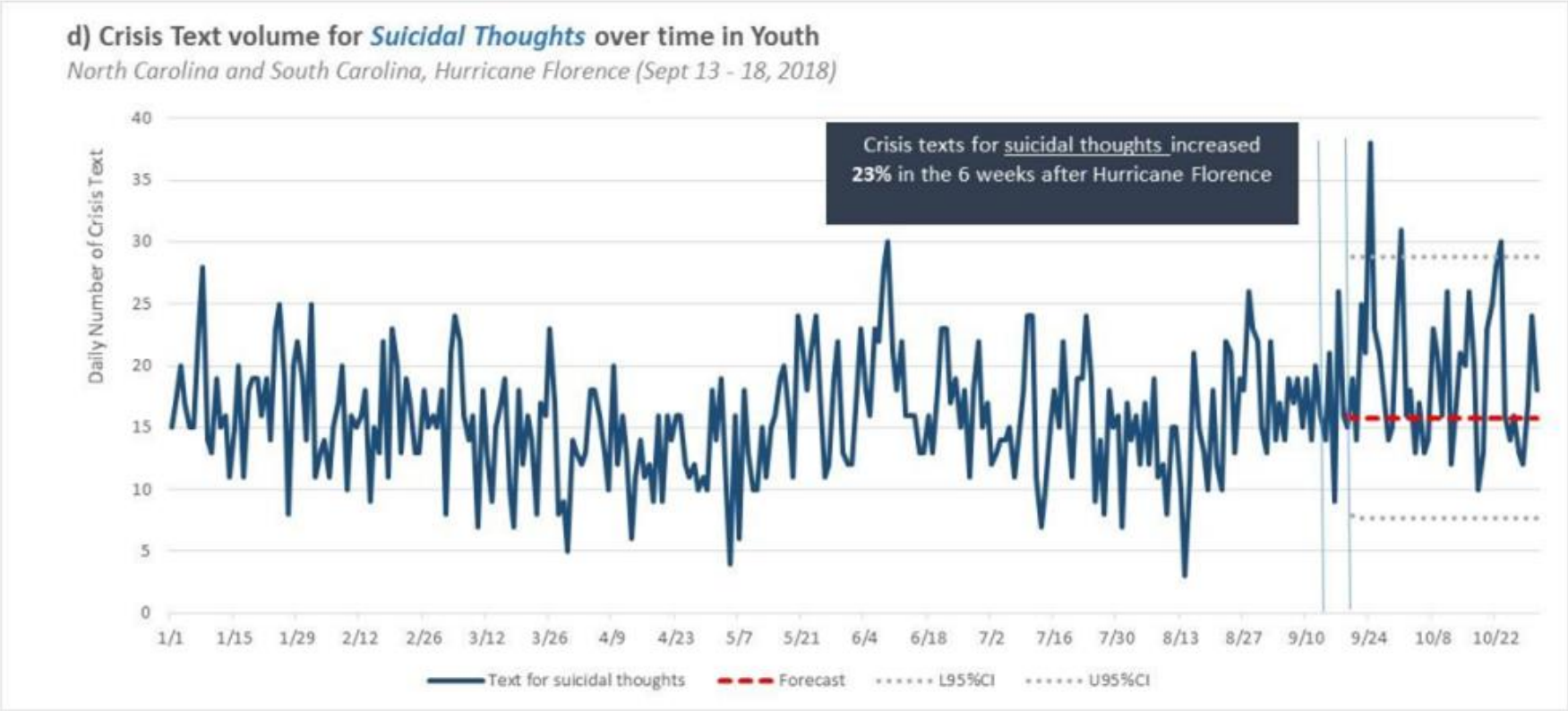
New York

Increase in CTL usage is observed at the highest temperatures (approximately 20 °C / 60 °F).

<u>Annual</u> results for *maximum temp*
27 °C / 80.6 °F (RR: 1.19, CI: 1.03–1.38) to
38 °C / 100.4 °F (RR: 2.04 CI: 1.73–3.29)

<u>Annual</u> results for *minimum temp*
19 °C / 66.2 °F (RR: 1.14, CI: 1.03–1.31) to
28 °C / 82.4 °F (RR: 1.88 CI: 1.38–3.02)

Case Study: Hurricane Florence



Data source. Crisis Text Line data, 2018.

Findings demonstrated an immediate and sustained increase in crisis texts for stress/anxiety and suicidal thoughts among youth in the 6 weeks following Florence and was confirmed with emergency department (ED)

Questions? Thank you!

jrrunkle@ncsu.edu
kovachmm@appstate.edu

Highlights

- This study is the first to explore the relationship between temperature-crisis events.
- Nonlinear J-shaped relationship between temperature and crisis text was observed.
- Significant relationships between crisis events and temperature were found in 3 out of the 4 cities.
- Crisis events peaked in the summer (Late July).

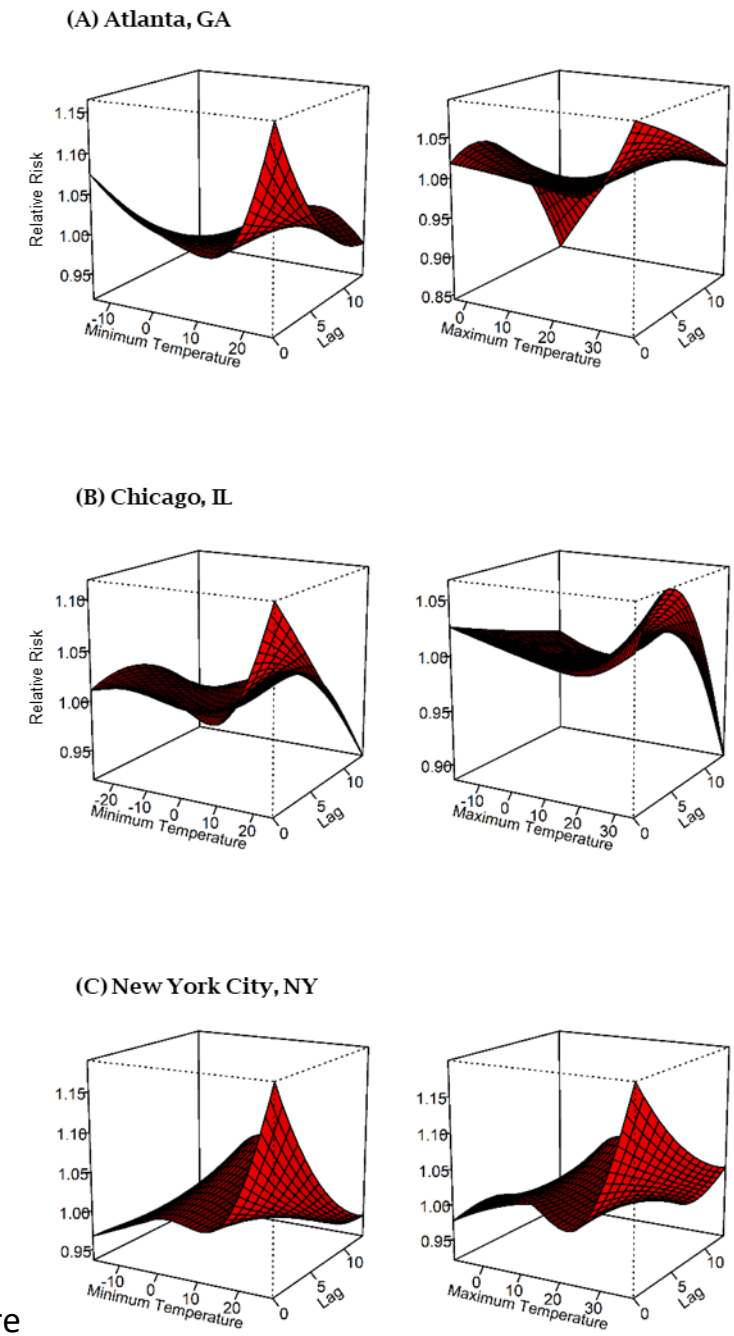


Figure 4: The three-dimensional plot illustrate the relationship between (left) minimum and (right) maximum temperature relative to a 13-day lag (Figure 3) for **Atlanta** (A), **Chicago** (B) and **New York City** (C). **Los Angeles** is not shown due to an insignificant relationship with temperature and support-seeking behaviors.