C19 Mobility and Health

Investigating COVID-19 data trends in North Carolina

How is COVID-19 Impacting Mobility, Health, and Teen Driving in NC?

UNC Research Week

October 21, 2020

October 24, 2020

www.C19MobilityAndHealth.unc.edu

Welcome and an Overview

- Today, we will share initial results from a research study on COVID-19 Mobility & Health Impacts in NC
  - Led by the UNC Highway Safety Research Center (HSRC)
  - Funded by the NC Collaboratory at UNC

- Study Motivation
  - Investigate the interrelationships amongst public health policies, mobility changes, traffic safety, and the transmission and impacts of COVID-19.
  - Inform policy decisions in North Carolina, specifically if there is resurgence of infections due to cyclical outbreaks throughout the year.
  - Support the development of expertise, provide foundational research, and build data infrastructure at UNC-CH for mobility research involving future respiratory and other infectious disease pandemics.

Today's topics and Introductions

- Literature Review and Case Studies, Dr. Arrianna Planey (Co-PI), UNC Department of Health Policy & Management
- Effect on Young Drivers, Natalie O'Brien (co-PI), UNC HSRC
- Mobility Data Trends, Dr. Randa Radwan (PI), UNC HSRC
- Health Data Trends, Dr. Katherine (Katie) Harmon (co-PI), UNC HSRC

- In addition to team members presenting today, our multidisciplinary team consists of transportation research engineers, social scientists, computer scientists, biostatisticians, and public health professionals from the UNC Sheps Center, the UNC Gillings School of Public Health, the Odum Institute, and NC State University

Study Tasks/Components

- Task 1: Data Identification and Acquisition
- Task 2: Literature Review & Synthesis of Synergetic Studies
- Task 3: Base Analyses for COVID-19 Mobility and Health Impacts
- Task 4: Expanded Analyses COVID-19 Mobility and Health Impacts
- Task 5: Study of the Effect of COVID-19 on Young Drivers & Implications for Policy
- Task 6: Analysis of Effects of COVID-19 on Transportation Safety Sector
- Task 7: Data Management and Storage
- Task 8: Data visualization and Prototype Dashboard
- Task 9: Website Design and External Communication (http://www.c19mobilityandhealth.unc.edu/)

Literature Review

Arrianna Marie Planey

Key Themes in the Literature Review

1. The COVID-19 pandemic has a disproportionate impact among older and younger Black/Latinx people (overrepresented among essential workers).
2. In rural places, higher comorbidity and older populations, in conjunction with more scarce healthcare resources means that the pandemic has more deleterious consequences.
3. Domestic importation of COVID-19 cases (community spread) is driving increasing incidence in North Carolina, where cases are growing rapidly in rural places.
4. Density is an insufficient explanation for COVID spread, and we must account for mobility. New York City is dense, and its outcomes underscore the importance of policy in shaping outcomes.
5. Rapid increases in overall mobility were associated with increased COVID-19 incidence, possibly moderated by income and occupational sorting, as well as broadband access.

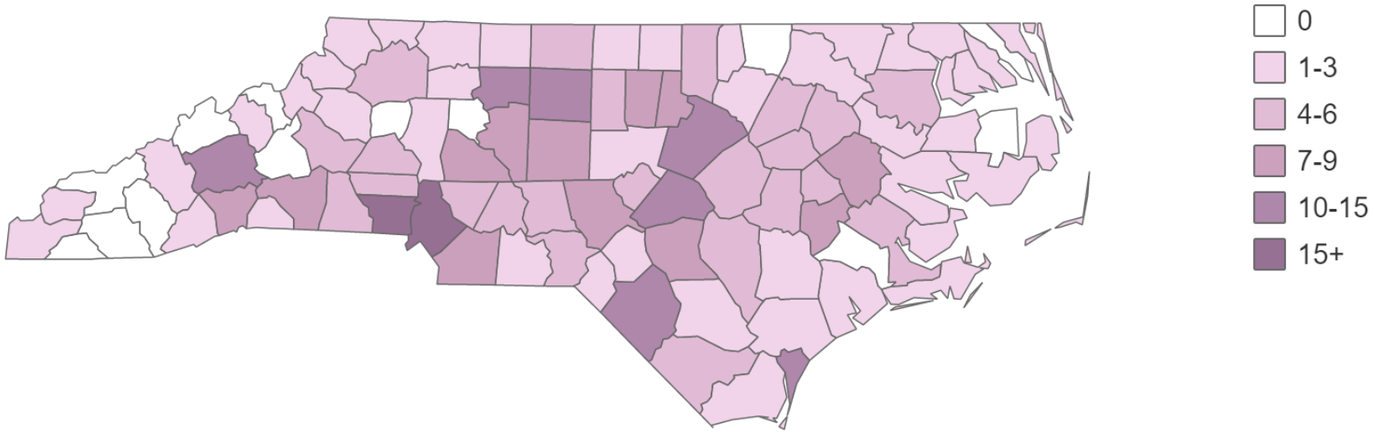
COVID-19 in North Carolina

- COVID-19 cases exceed 249,000 in North Carolina. Among cases with race and ethnicity reported, 23% are Black and 35% are Latinx, suggesting disproportionate impact in these communities.
- Rural places have less healthcare capacity, older populations than their metropolitan counterparts, and heavier burdens of chronic conditions associated with more severe COVID-19 symptomology.
- Nationally, congregate living settings (nursing homes, long term care, prisons…) account for nearly half of COVID-19-attributed deaths in the U.S.

Congregate Living Outbreaks

Nursing Home	214
Residential Care Facility	100
Correctional Facility	46
Other	4

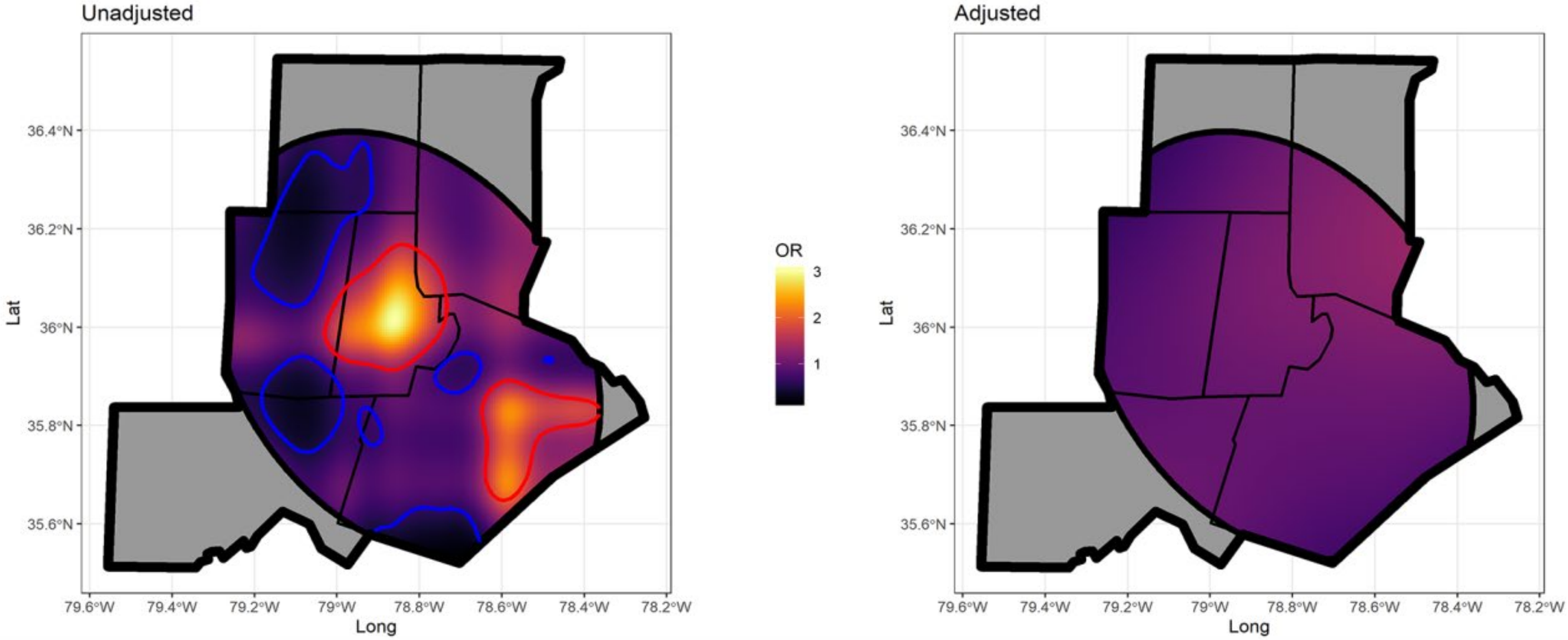
Ongoing Outbreaks and Clusters



Map Credit: NCDHHS

Currently, in North Carolina, there are 364 clusters associated with nursing homes, residential care facilities, and correctional facilities

Source: NC Department of Health and Human Services https://covid19.ncdhhs.gov/dashboard/outbreaks-and-clusters (20 Oct 2020)



Turner N.A., Pan W., Martinez-Bianchi, V.S., Maradiaga G.M., Planey A.M., Woods C.W., Lantos P.M. (2020). Racial, Ethnic, and Geographic Disparities in Novel Coronavirus (SARS-CoV-2) Test Positivity in North Carolina, *Open Forum Infectious Diseases*, ofaa413, https://doi.org/10.1093/ofid/ofaa413

Mobility Trends Amid the COVID-19 Pandemic

- Mobility is stratified by race, ethnicity, and class. Prior to the pandemic, the most mobile people were high-SES workers, whose mobility decreased the most, compared w/ low-SES workers.
- Notably, Black and Latinx workers are less able to reduce their work-related mobility because they are less likely to work in jobs that can be done remotely, compared with white workers.
- State-wide Shelter in Place Orders (SIPOs) were associated with decreased median travel distance and increased stay-at-home dwell time at the county level. However, downward trends in mobility reversed when states began “reopening” in May 2020.

References Cited

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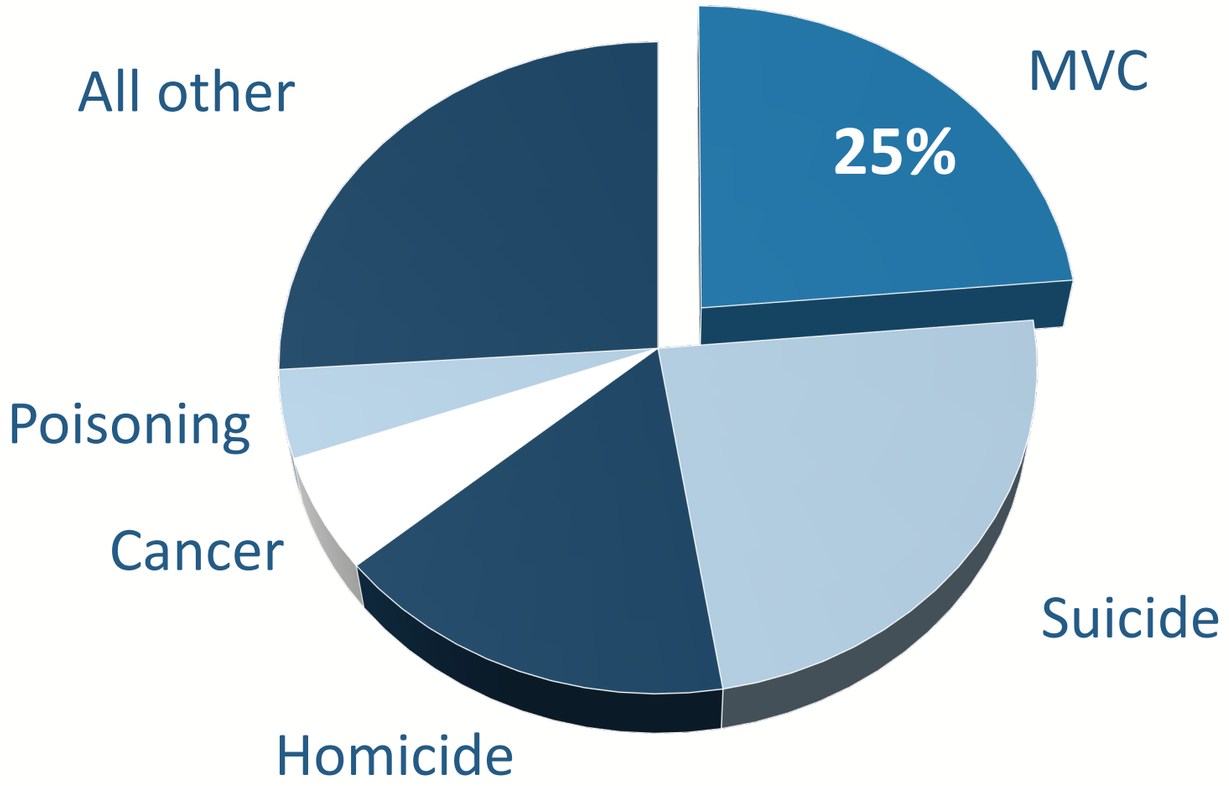
- Turner N.A., Pan W., Martinez-Bianchi, V.S., Maradiaga G.M., Planey A.M., Woods C.W., Lantos P.M. (2020). Racial, Ethnic, and Geographic Disparities in Novel Coronavirus (SARS-CoV-2) Test Positivity in North Carolina, *Open Forum Infectious Diseases*, ofaa413, https://doi.org/10.1093/ofid/ofaa413

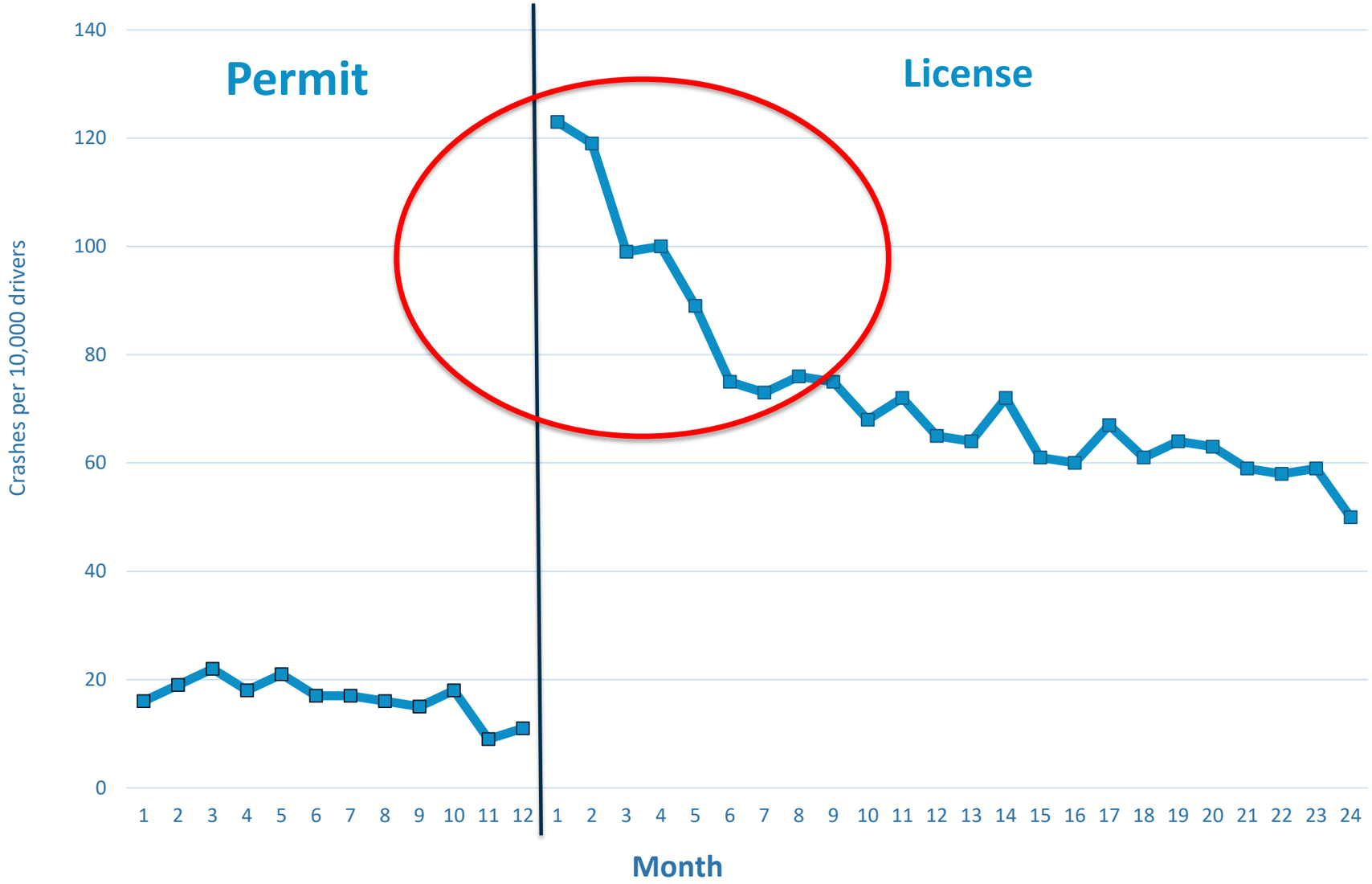
Effect of COVID-19 on Young Drivers in N.C.

Natalie O’Brien, M.S.

Leading Cause of Death, Age 15-18, U.S., 2018

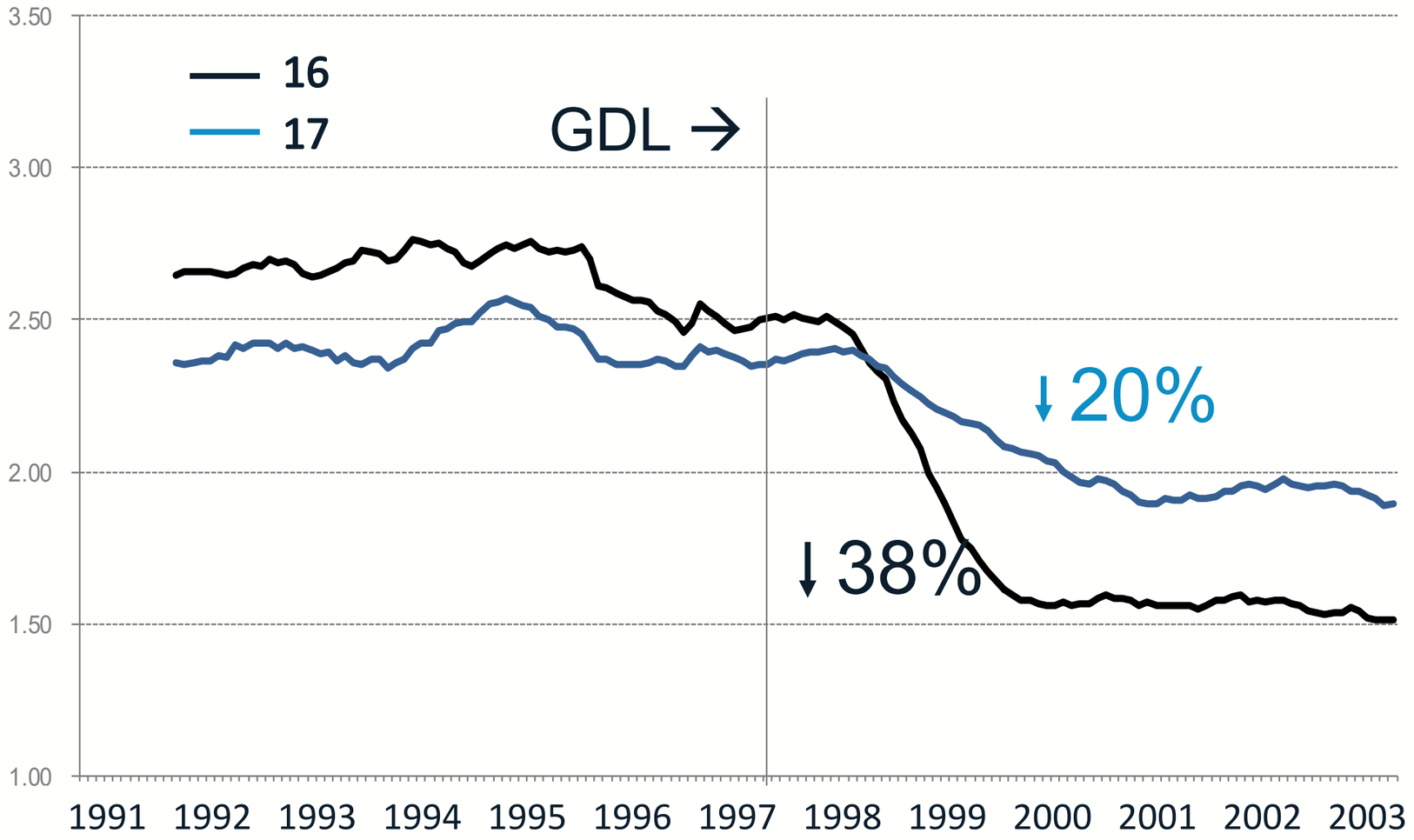


Crash rates for young drivers



Source: UNC HSRC

Graduated Driver Licensing (GDL) in North Carolina



Source: UNC HSRC

North Carolina GDL System

Stage 1: Learner Permit	Stage 2: Provisional License
Complete driver education	6 months
12 months	May drive unsupervised
Must be supervised	Night restriction (9 p.m.)
60 hrs (10 at night)	One teen passenger limit

Proposed Legislation

- Waived road test (June 22, 2020)
- Reduce length of the permit
  - 12 months to 6 months

Restricted Teen Mobility

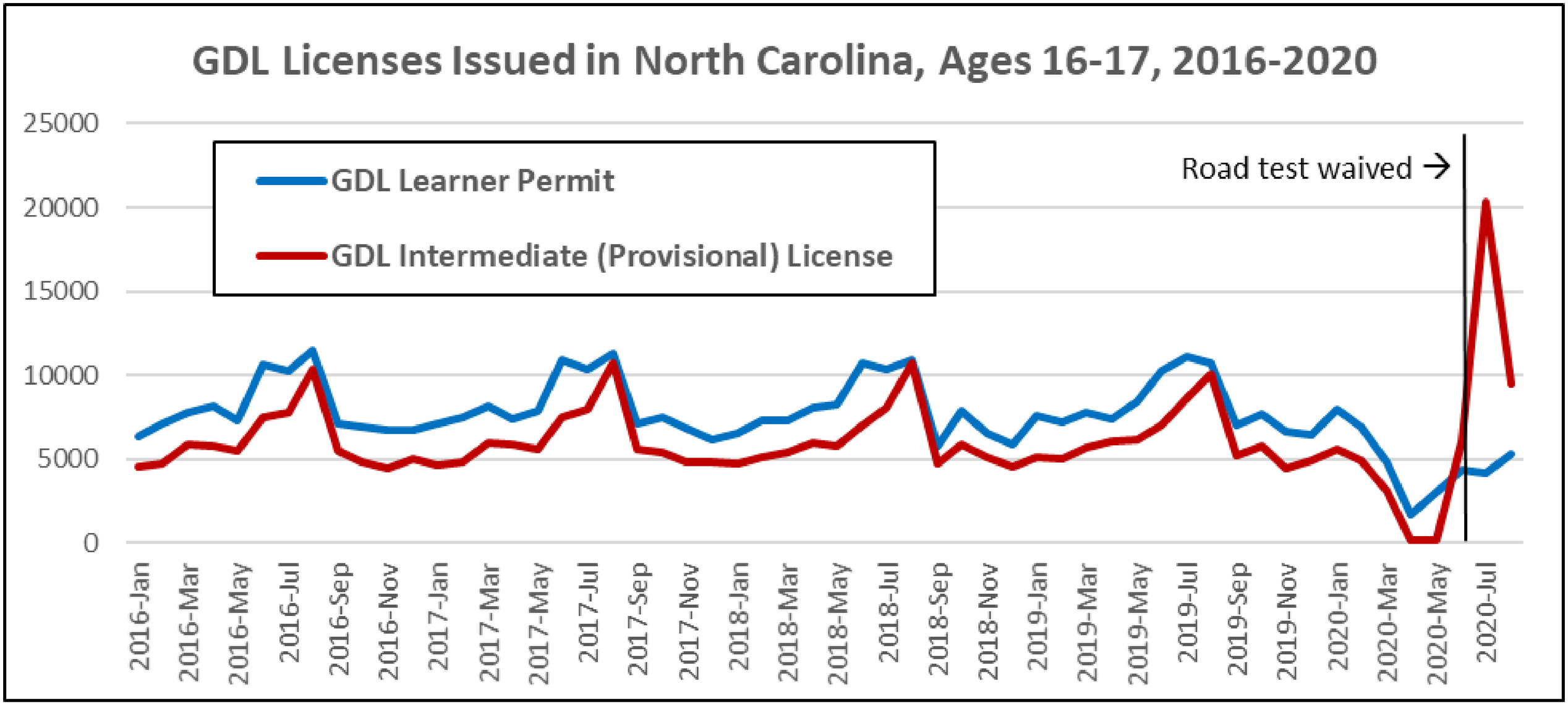
- DMV closures/restrictions
  - 30/115 closed during Phase 1
  - Long wait times
- Access to driver education classes

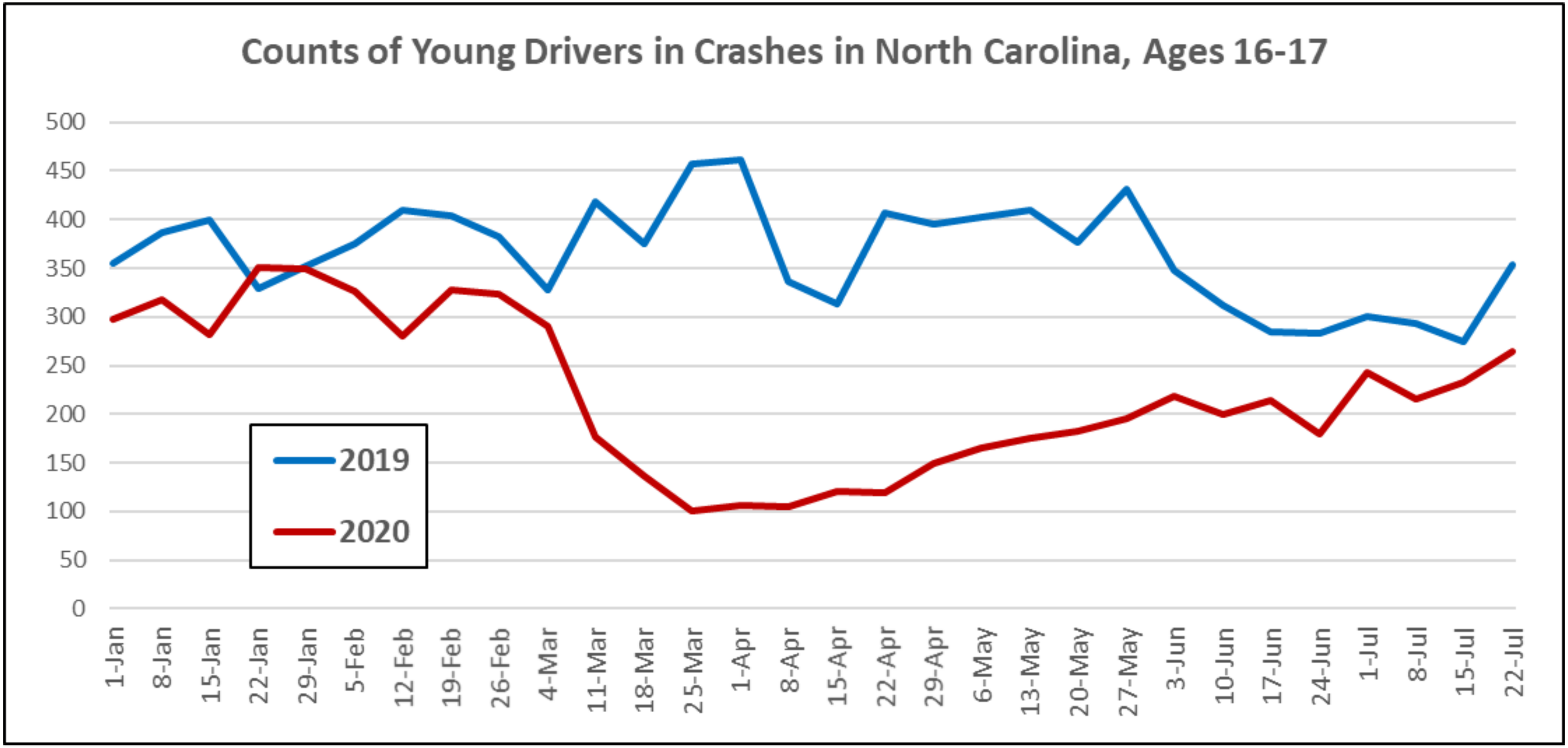
April -June	2018-19	2019-20
Classroom Students	25,689	6,035
Behind the wheel Students	22,166	21

Safety Implications

- Most practice occurs on routine trips
- Less practice + no test = more unqualified new drivers
- Examined licensing and crash data

GDL Licenses Issued in North Carolina, Ages 16-17, 2016-2020




Counts of Young Drivers in Crashes in North Carolina, Ages 16-17
500
450
400
350
300
250
200
150
100
50
0
2019
2020
1-Jan
8-Jan
15-Jan
22-Jan
29-Jan
5-Feb
12-Feb
19-Feb
26-Feb
4-Mar
11-Mar
18-Mar
25-Mar
1-Apr
8-Apr
15-Apr
22-Apr
29-Apr
6-May
13-May
20-May
27-May
3-Jun
10-Jun
17-Jun
24-Jun
1-Jul
8-Jul
15-Jul
22-Jul

Conclusions & Next Steps

- New permits and licenses dropped sharply in March 2020
- Crashes decreased
- Provisional licenses rebounded after N.C. waived road test
  - Track licensing & crash for second half of 2020
  - Online surveys & focus groups with parents

Base Analysis: NC COVID-19 Trends

Mobility Trends
Randa Radwan (Task Lead: Wes Kumfer, HSRC)

NC COVID-19 Cases & Deaths
Katie Harmon

Research Questions: NC COVID-19 Trends

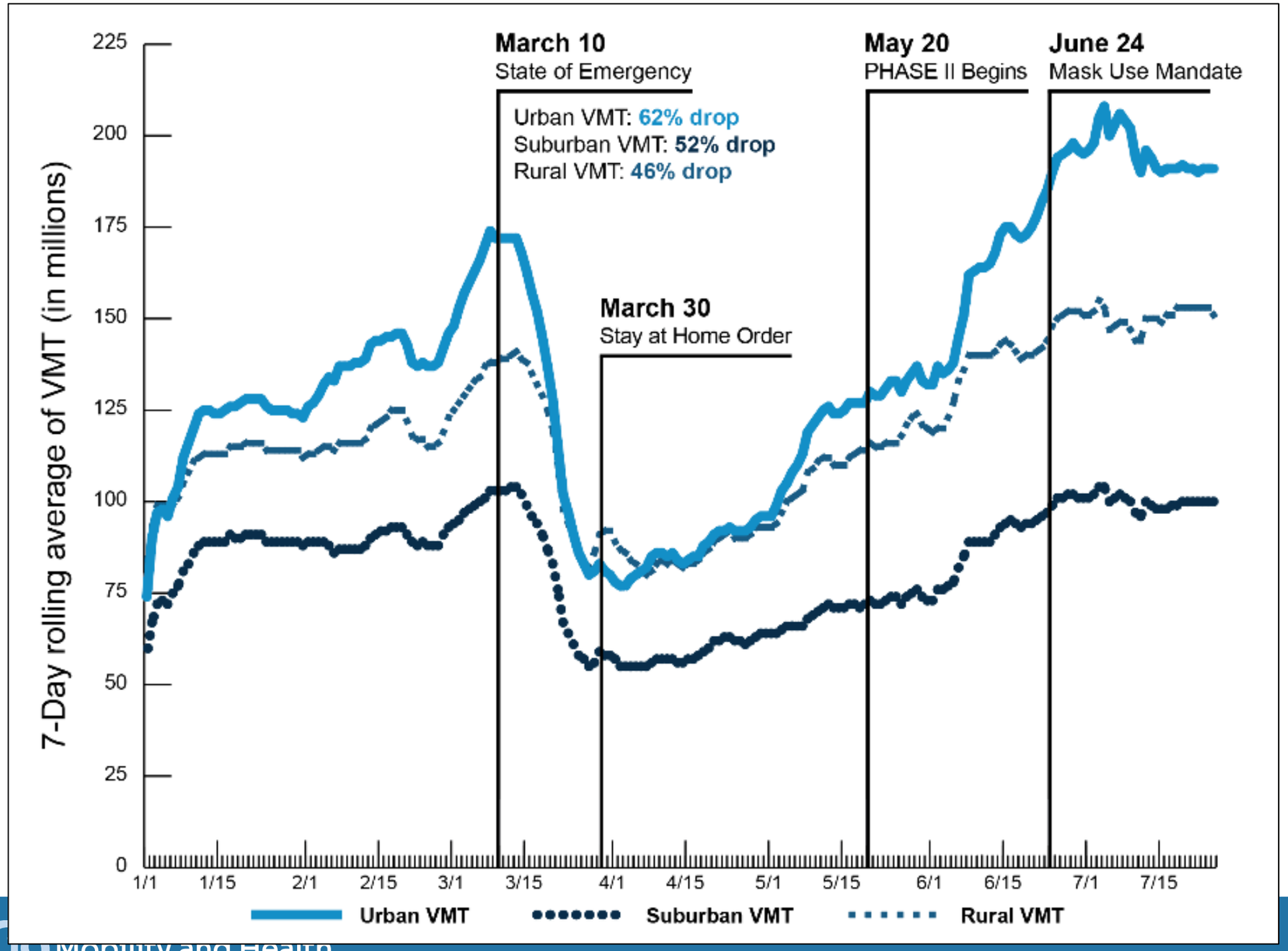
- Have shelter-in-place policies, emergency declarations, and general news and events reduced movement within North Carolina?
- What are the differences in mobility between urban and rural counties and how do these trends vary through time?
- How do NC COVID-19 cases/deaths trends compare to mobility trends?
- Are there temporal and geographic differences in the frequency of NC COVID-19 cases/deaths?

Data Sources

- Mobility
  - Streetlight (VMT- total Vehicle Miles Traveled)
  - Teralytics (Origin-Destination data)
  - Cuebiq (Mobility & Contact Indices)

- Health
  - New York Times (COVID-19 counts and deaths)
  - US Census

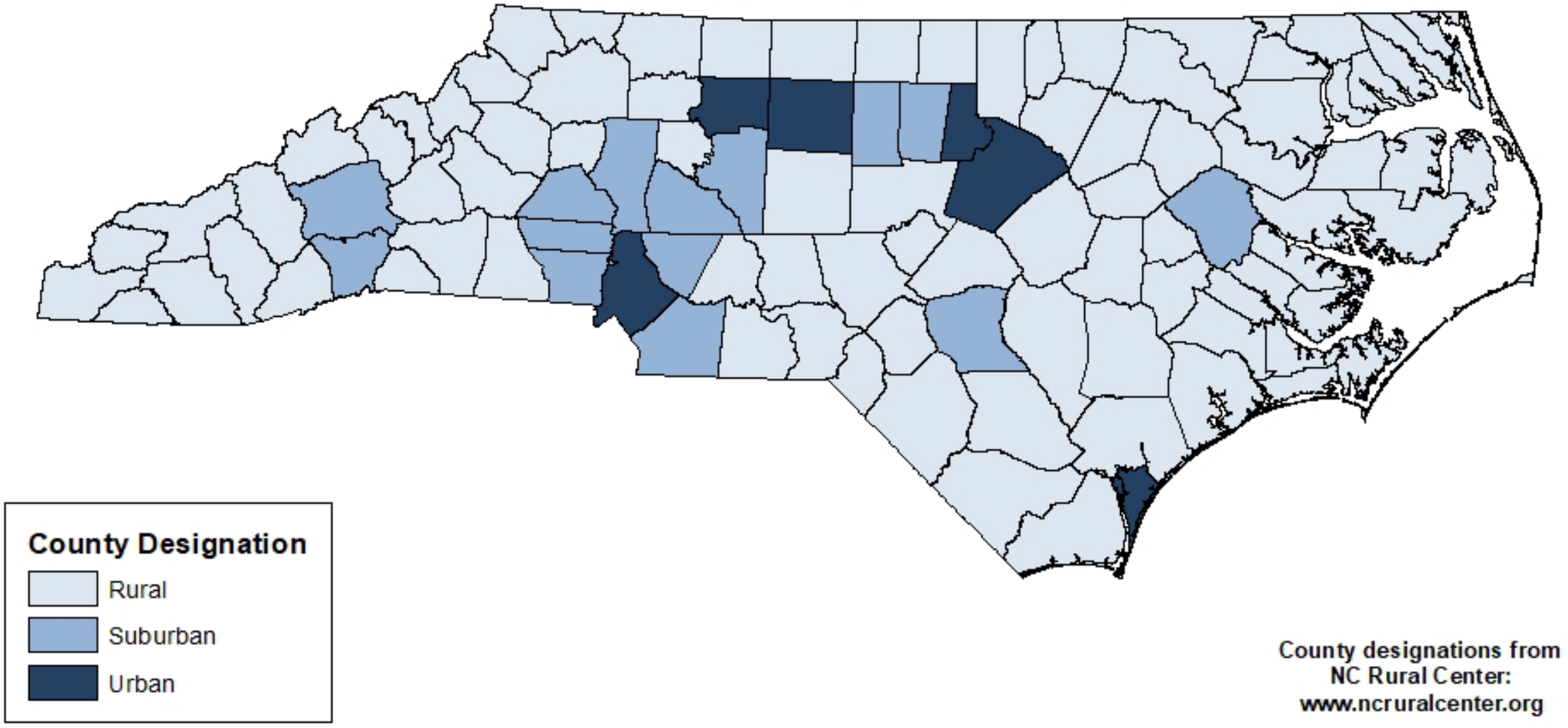
Vehicle Miles of Travel (7-Day Rolling Average)



NC Statewide VMT Trends for Urban, Suburban, and Rural Areas.

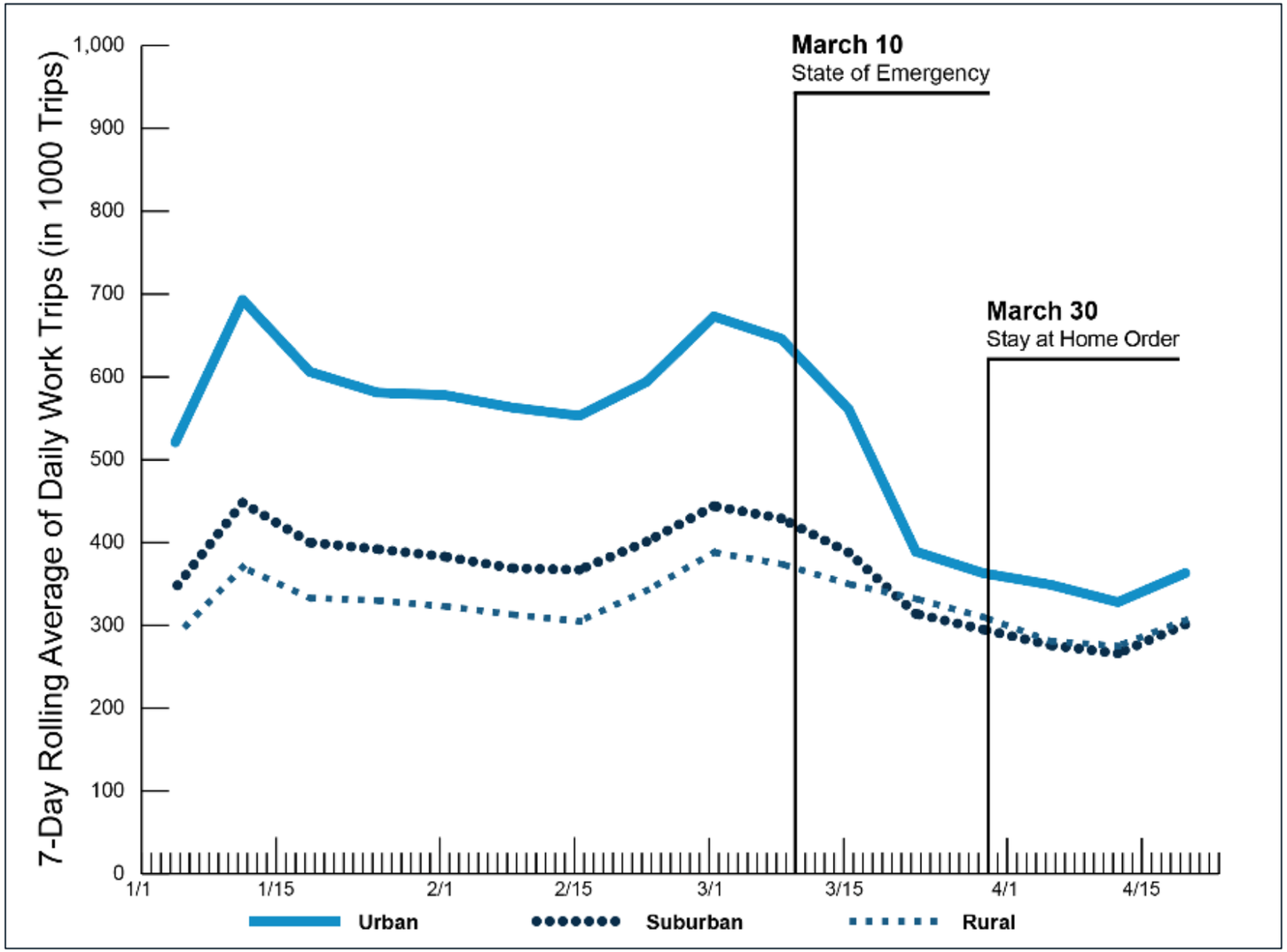
Data Source: Streetlight

NC County Classification*



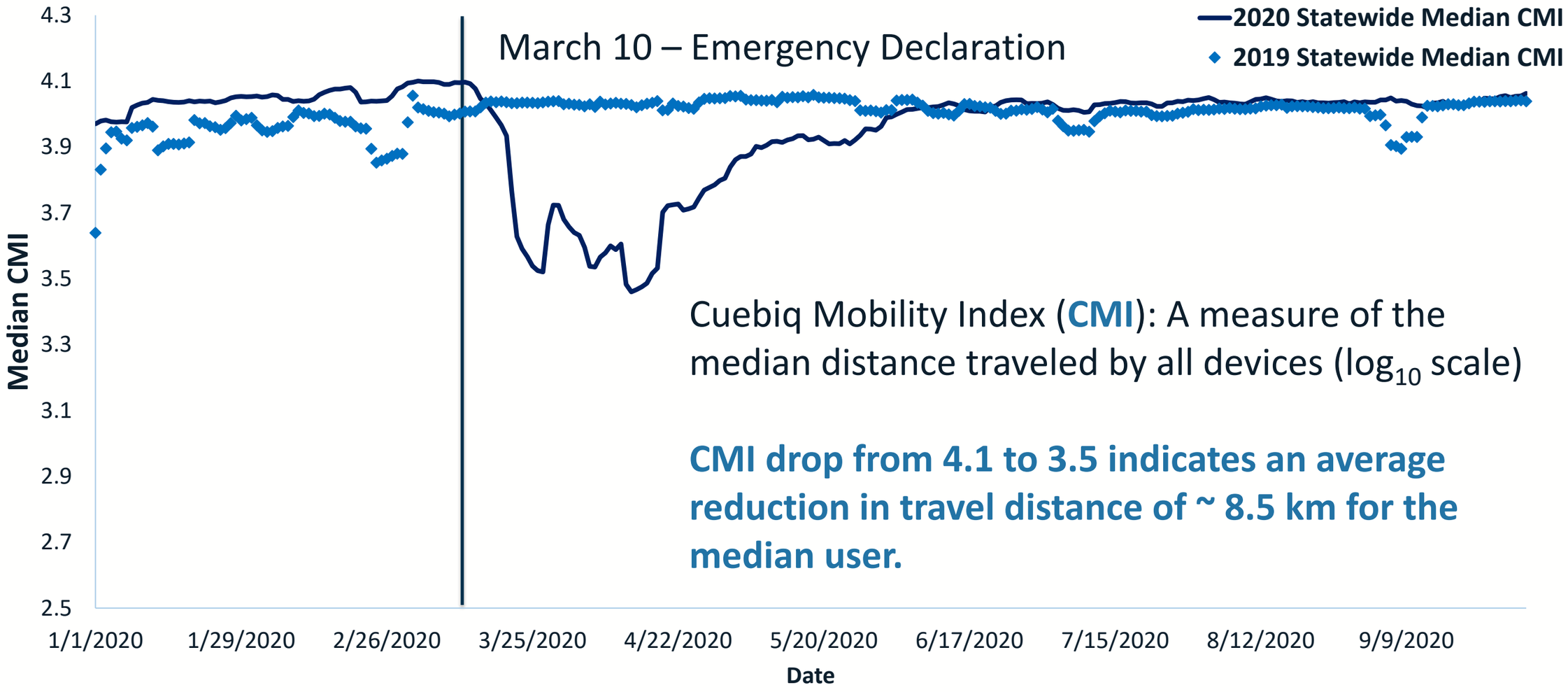
* NC Rural Center (2020, Oct). *North Carolina Counties*. Retrieved Oct 8, 2020. https://www.ncruralcenter.org/about-us/.

Work Trips (7-Day Rolling Average)



NC Statewide Work Trip Trends for Urban, Suburban, and Rural Areas: January 1, 2020-April 21, 2020, ***Data Source:*** *Teralytics*

Mobility Index (7-Day Rolling Average)

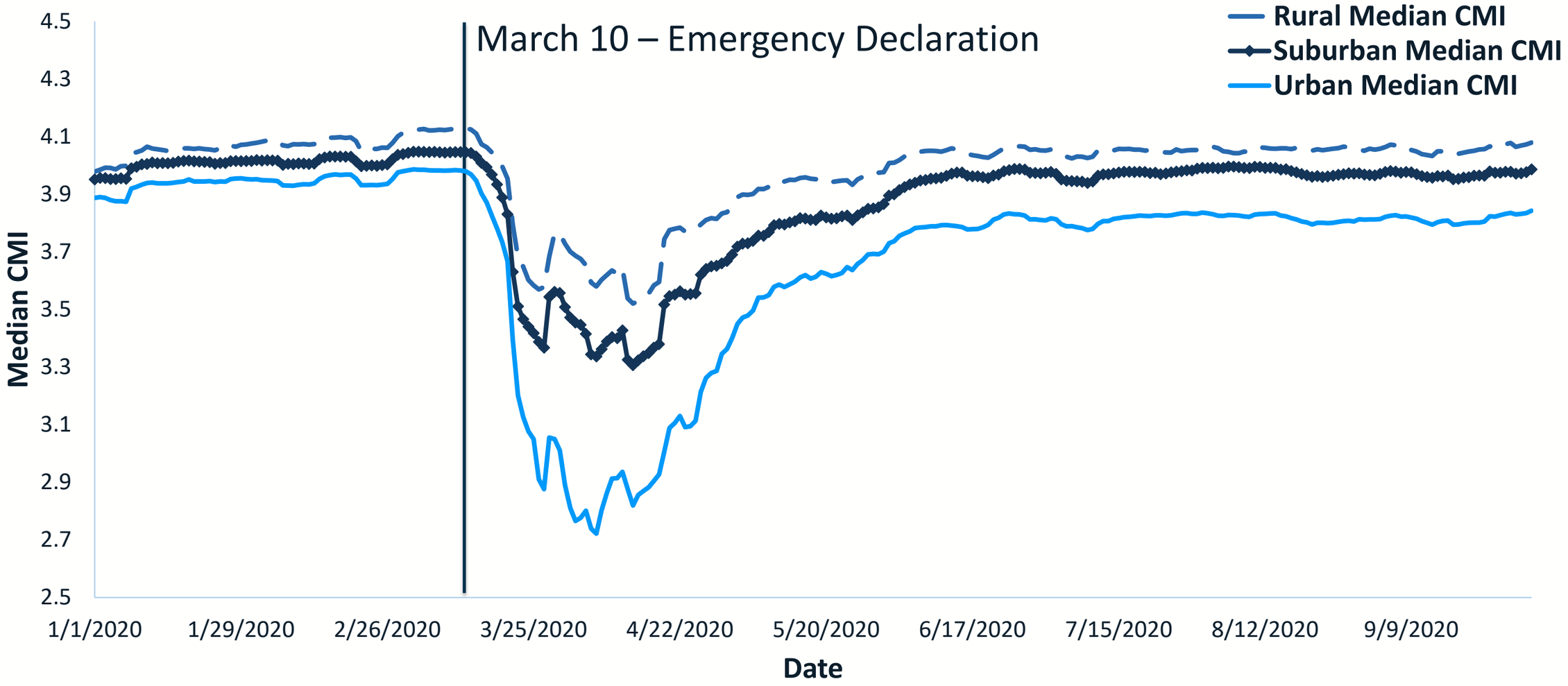


Cuebiq Mobility Index (**CMI**): A measure of the median distance traveled by all devices (log_{10} scale)

CMI drop from 4.1 to 3.5 indicates an average reduction in travel distance of ~ 8.5 km for the median user.

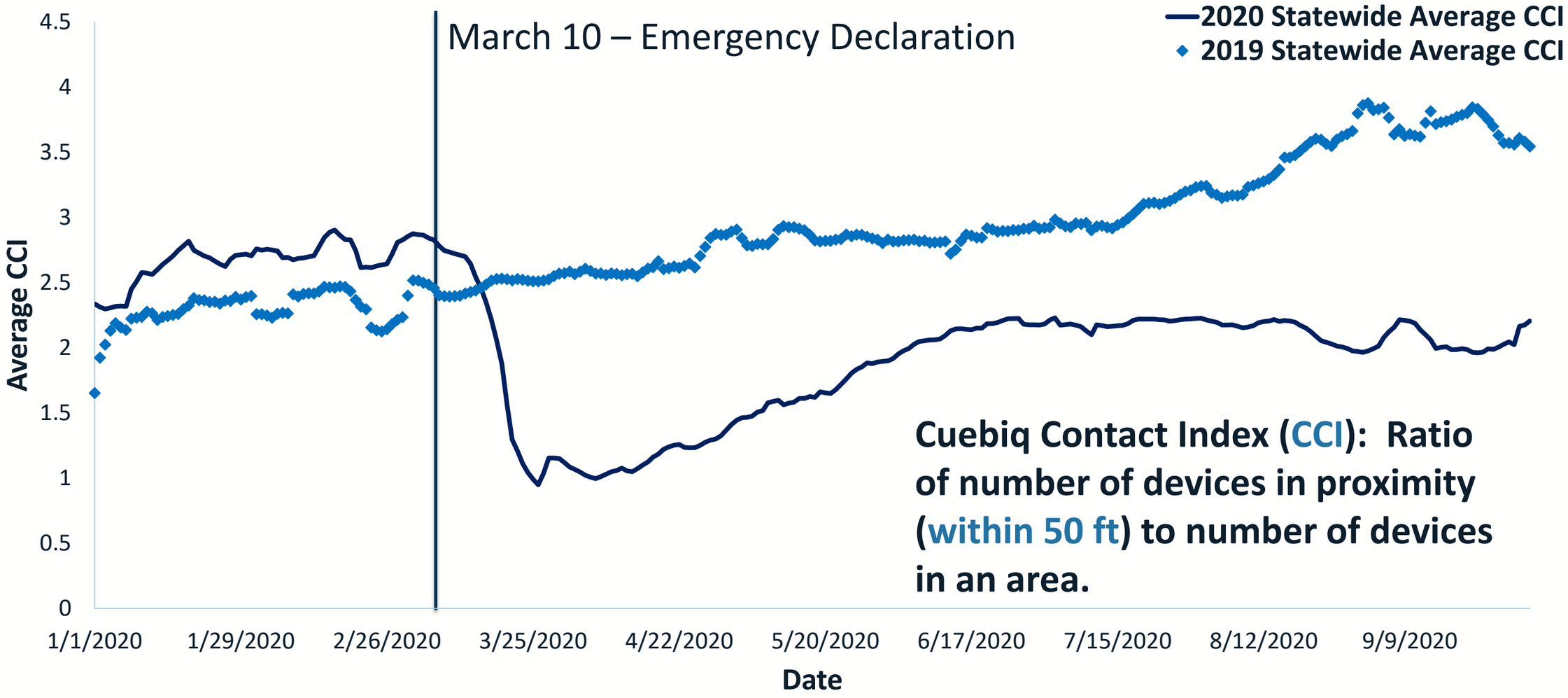
NC Statewide Mobility Index Trends (7-day Rolling Average): January 1, 2020-October 2, 2020, ***Data Source: Cuebiq***

Mobility Index (7-Day Rolling Average)



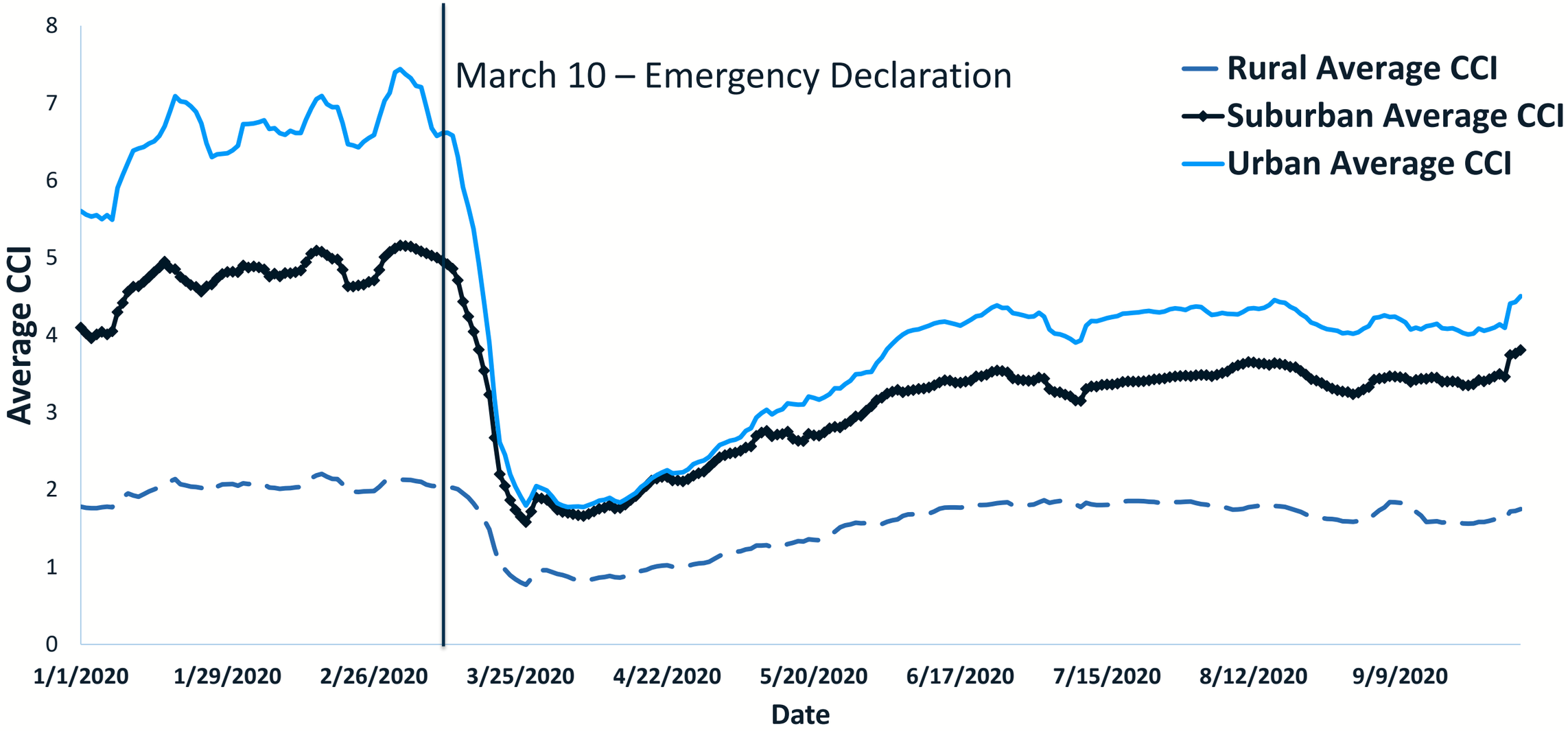
NC Statewide Mobility Index Trends (7-day Rolling Average) for Urban, Suburban, and Rural Areas: January 1, 2020-October 2, 2020, ***Data Source: Cuebiq***

Contact Index (7-Day Rolling Average)



NC Statewide Contact Index Trends (7-day Rolling Average): January 1, 2020-October 2, 2020, ***Data Source: Cuebiq***

Contact Index (7-Day Rolling Average)



NC Statewide Contact Index Trends (7-day Rolling Average) for Urban, Suburban, and Rural Areas: January 1, 2020-October 2, 2020, ***Data Source: Cuebiq***

Mobility Trends Key Results

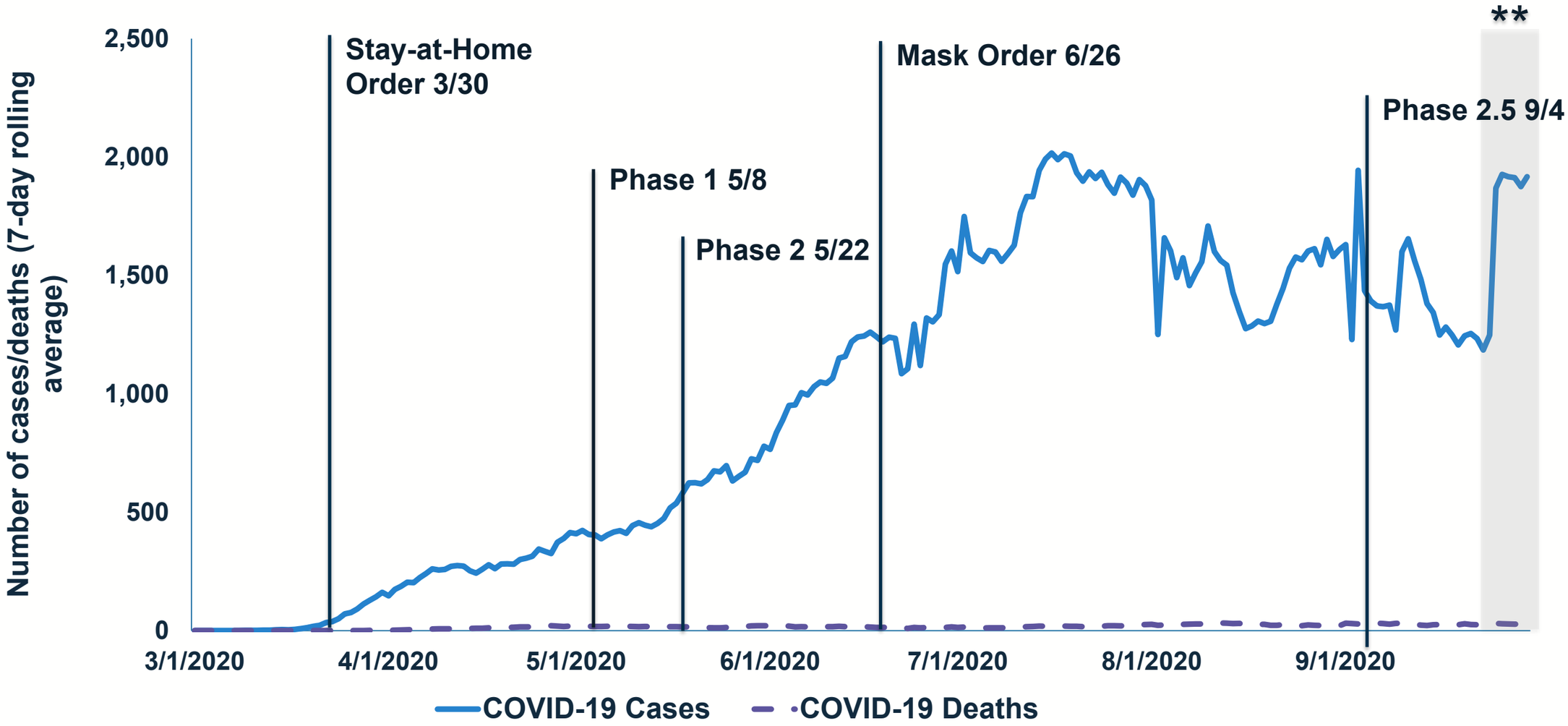
- All area types (urban, suburban, and rural) showed statistically significant decreases in every mobility metric after the State of Emergency Declaration on March 10th.
- Urban work trips had a more pronounced response to the pandemic than rural or suburban work trips.
- Travel stabilized in early June.
- Despite travel changes, contact index shows social distancing has taken effect.

Health Trends: NC COVID-19 Cases & Deaths

Katie Harmon

7-Day Rolling Average of Confirmed COVID-19 Cases & Deaths

North Carolina, March 1 – September 30, 2020*

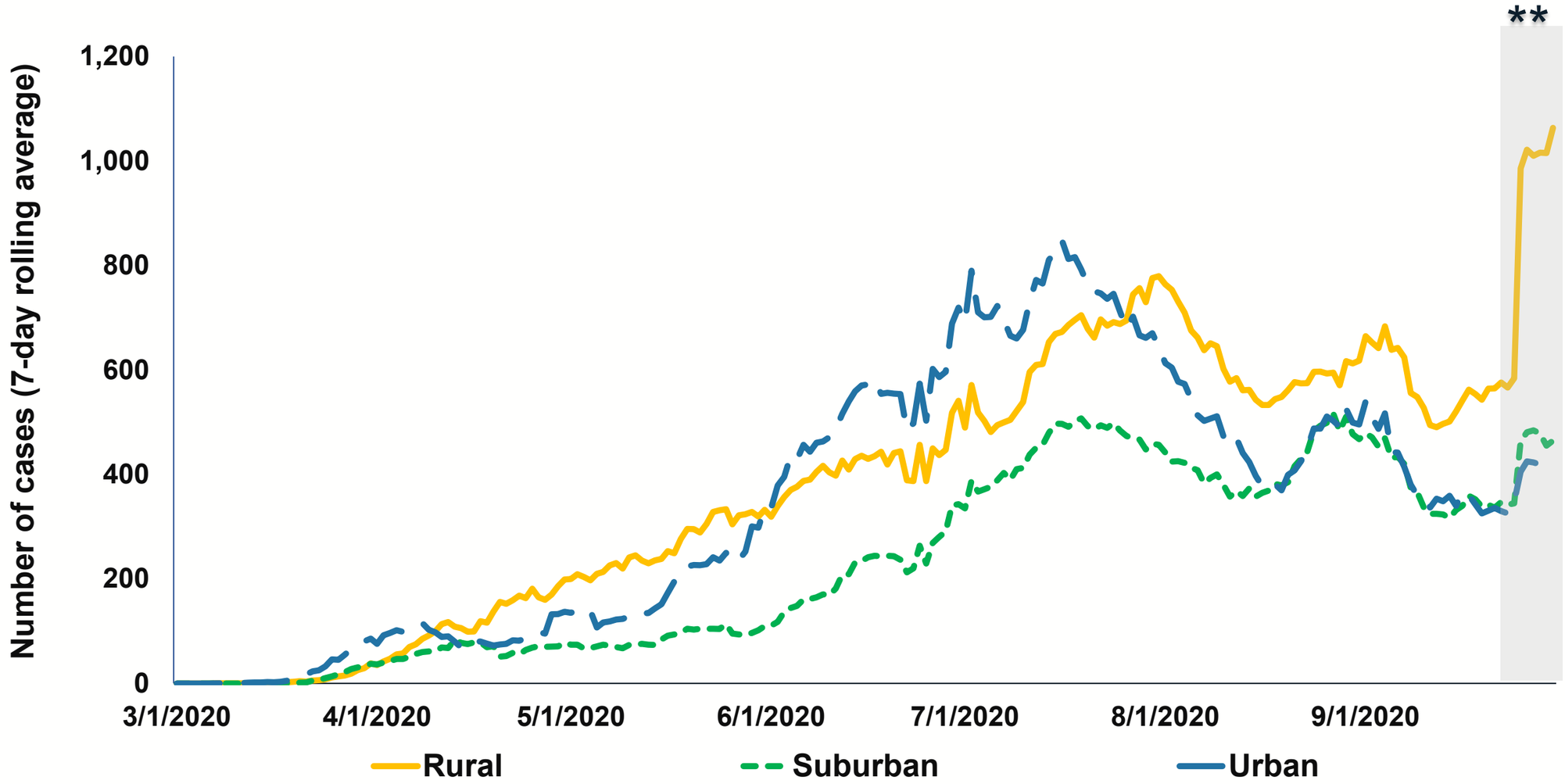


*Not all individuals with COVID-19 are confirmed through testing.

**Results of COVID-19 antigen testing released (spike reflects historical cases).

7-Day Rolling Average of Confirmed COVID-19 Cases

North Carolina, March 1 - September 30, 2020*

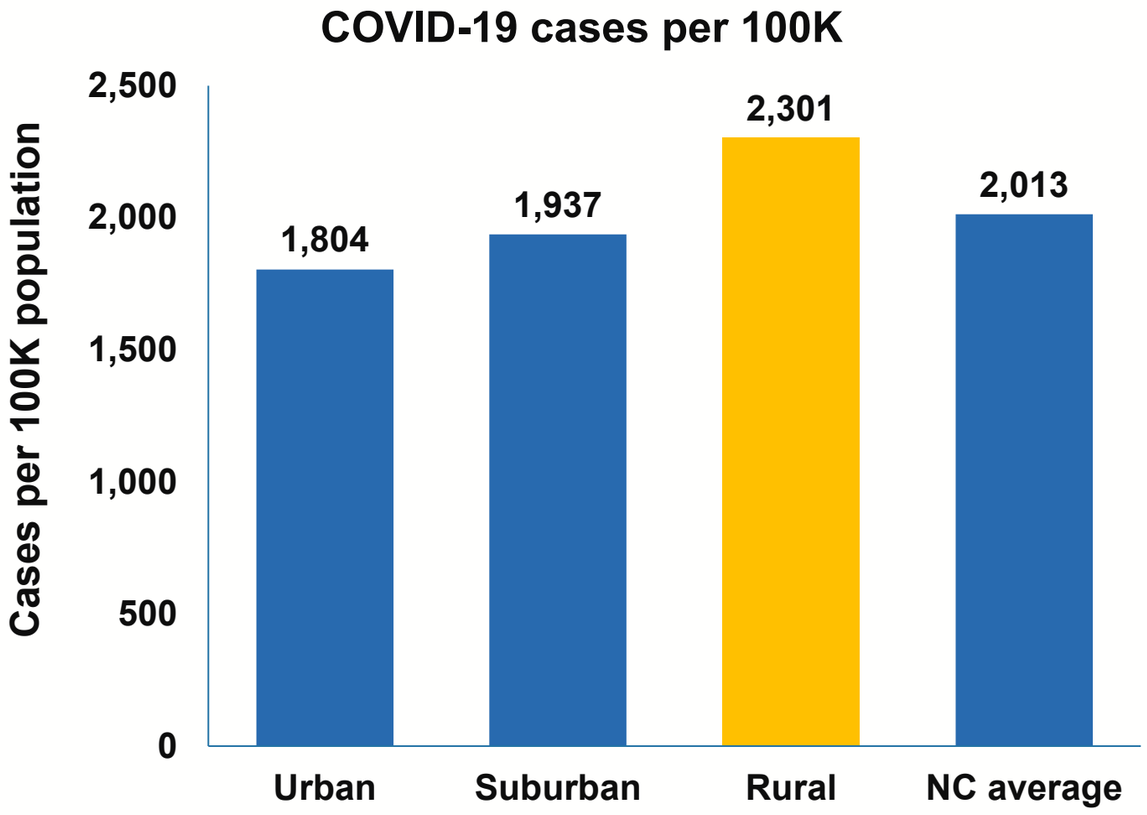


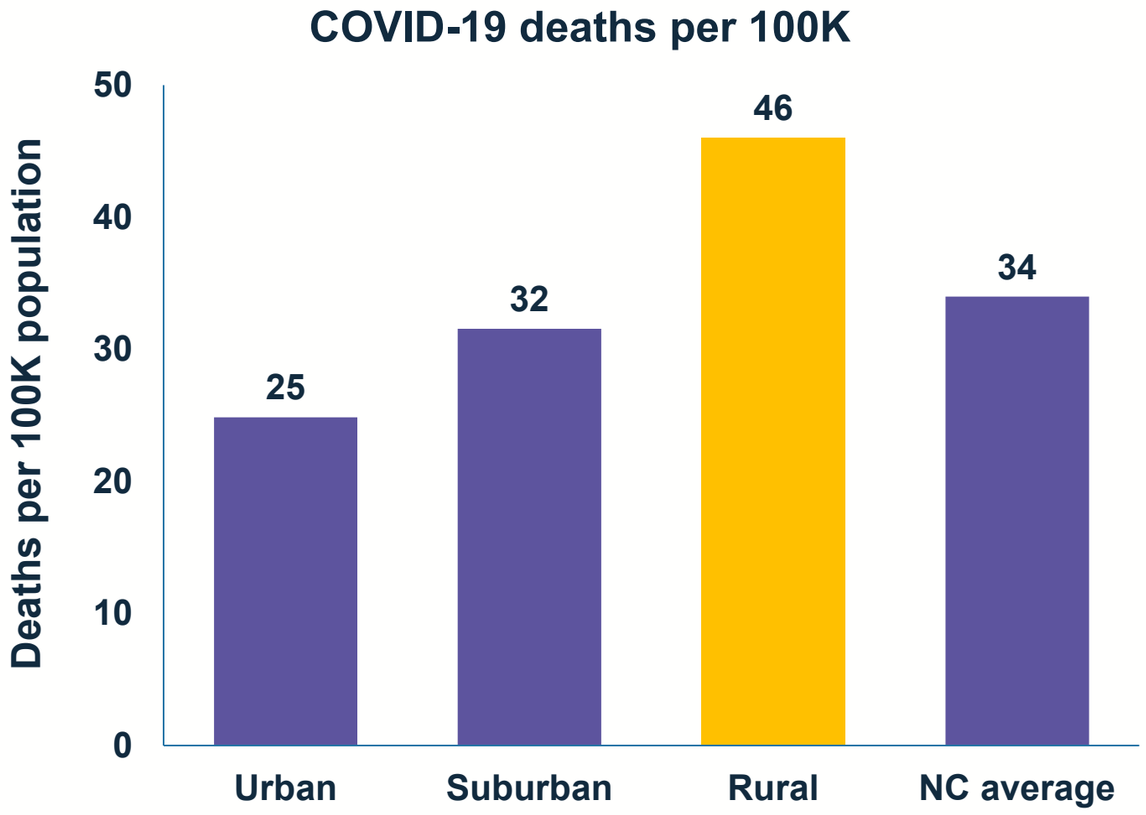
*Not all individuals with COVID-19 are confirmed through testing.

**Results of COVID-19 antigen testing released (spike reflects historical cases).

Confirmed COVID-19 Cases and Deaths Per 100,000 Population

North Carolina, March 1 – September 30, 2020*



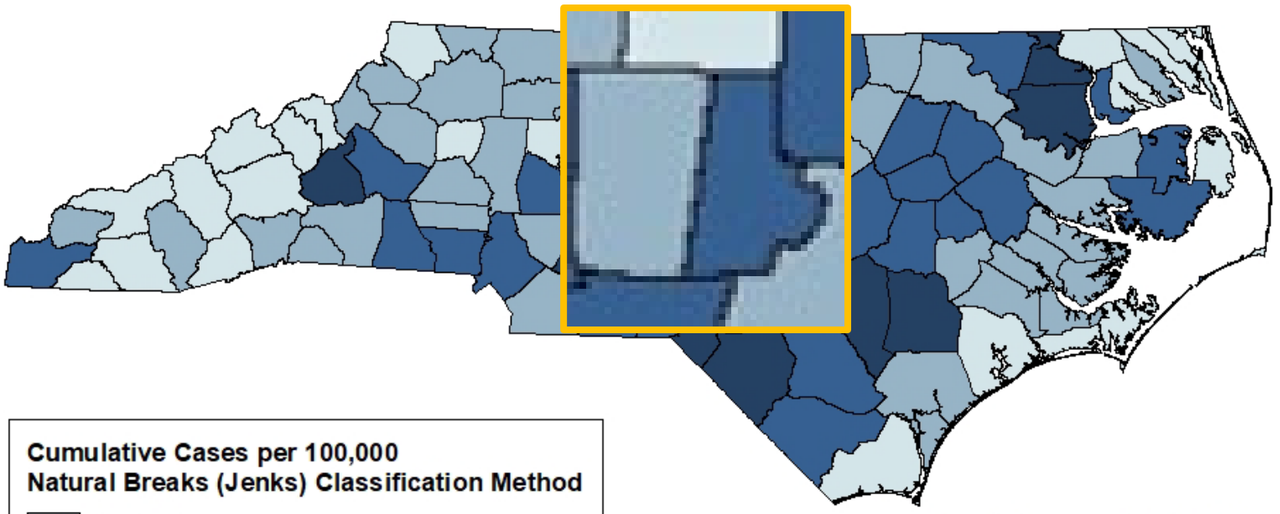


*Not all individuals with COVID-19 are confirmed through testing.

COVID-19 Cases & Deaths Per 100,000 Population, By County of Residence

North Carolina March 1 – September 30, 2020*

COVID-19 Cases



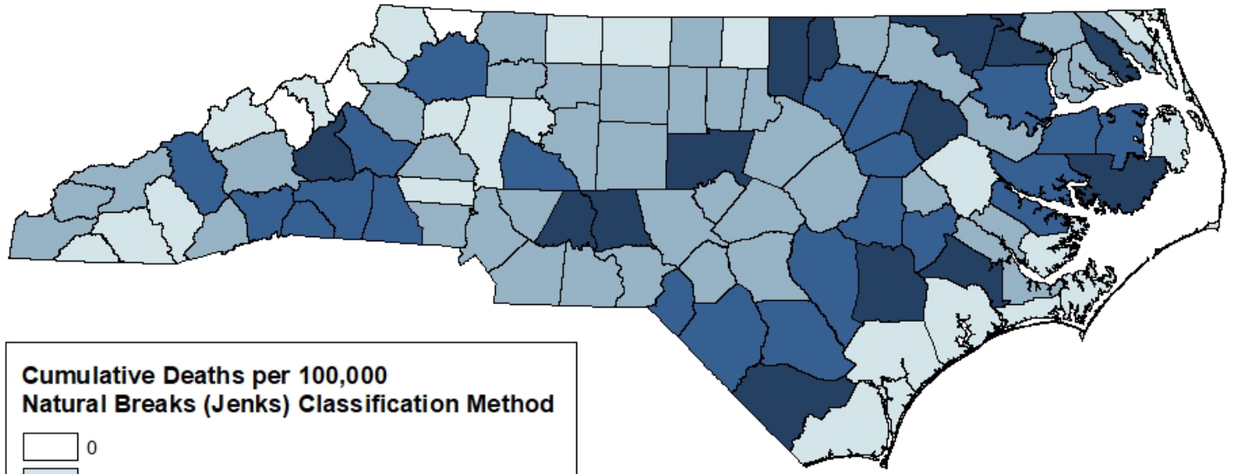
Cumulative Cases per 100,000
Natural Breaks (Jenks) Classification Method

- 304 - 1,424
- 1,425 - 2,142
- 2,143 - 2,957
- 2,958 - 4,537

Cumulative counts of COVID-19 cases by county of residence between Mar. 1 and Sept. 30, 2020. Data is from The New York Times.

Population data is based on July 2019 US Census estimates.

COVID-19 Deaths



Cumulative Deaths per 100,000
Natural Breaks (Jenks) Classification Method

- 0
- 2 - 20
- 21 - 42
- 43 - 75
- 76 - 127

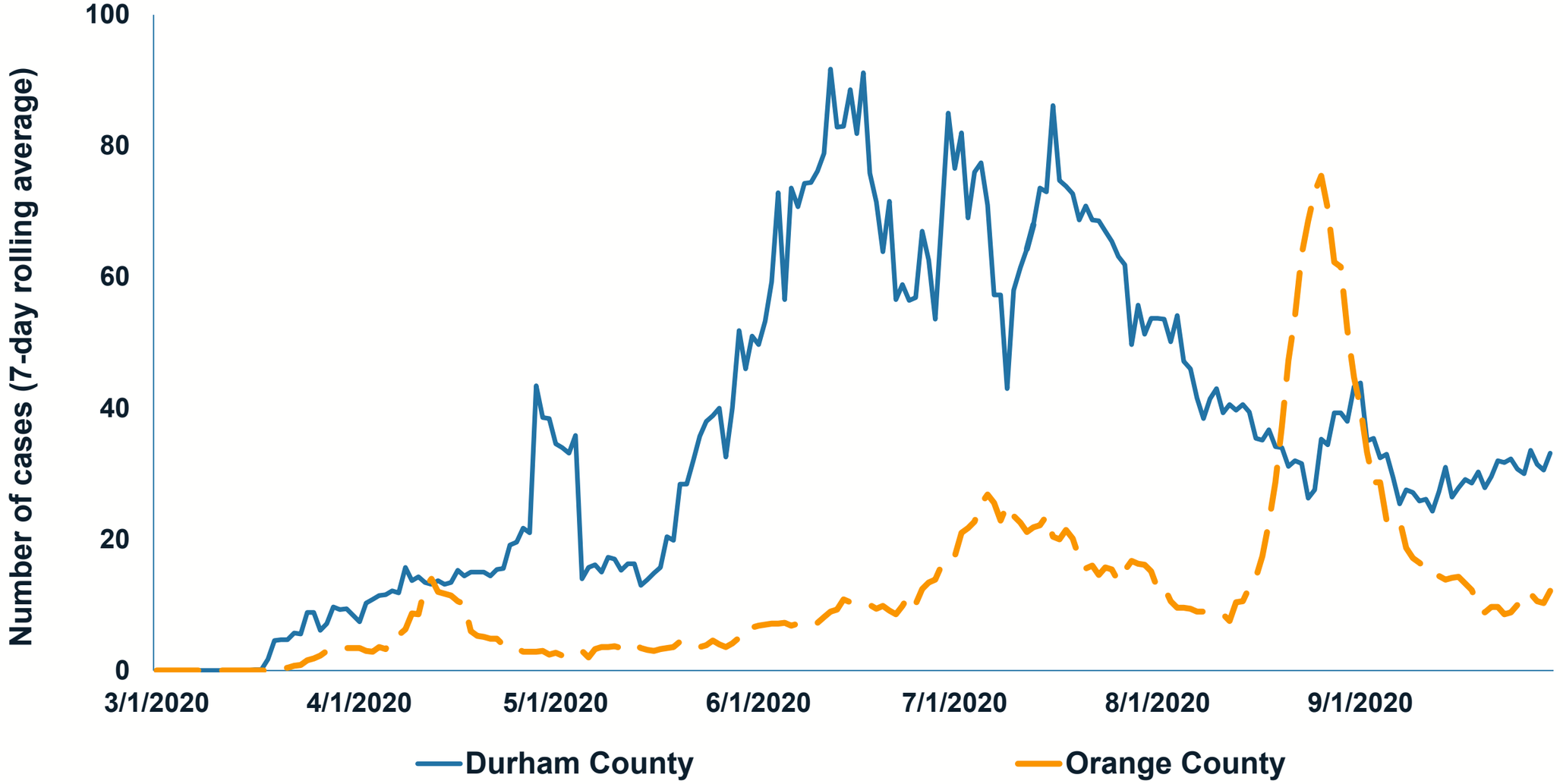
Cumulative counts of COVID-19 deaths by county of residence between Mar. 1 and Sept. 30, 2020. Data is from The New York Times.

Population data is based on July 2019 US Census estimates.

*Not all individuals with COVID-19 are confirmed through testing.

7-Day Rolling Average of Confirmed COVID-19 Cases

Durham & Orange Counties, March 1 – September 30, 2020*



*Not all individuals with COVID-19 are confirmed through testing.

Health Trends and Key Results

- North Carolina COVID-19 cases have fluctuated over time, with a statewide peak in mid-to-late summer.
- Differences in trends and burden of cases/deaths by region and county.
- Rural North Carolina counties contain a disproportionate burden of COVID-19 cases and deaths.

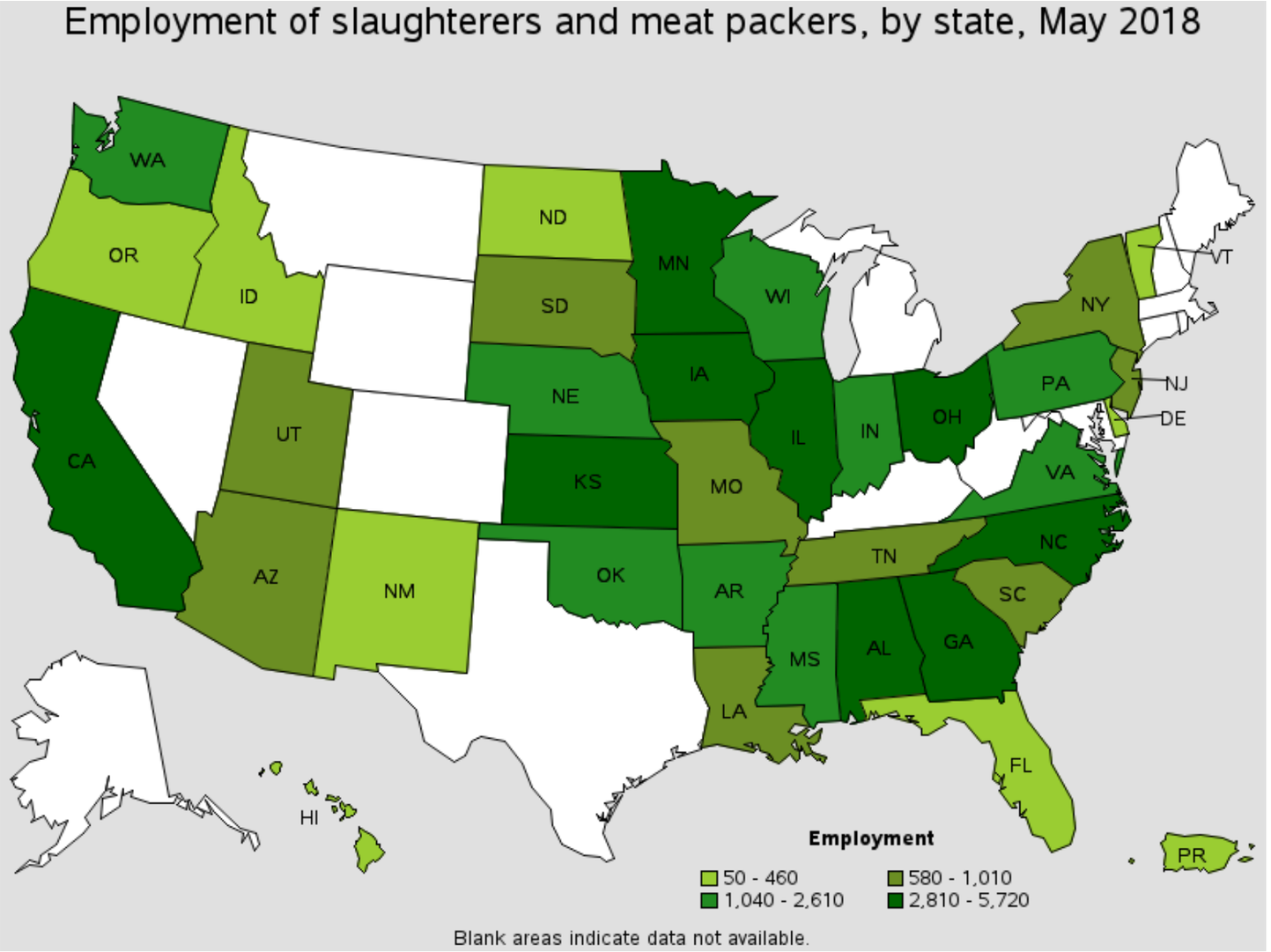
Meat & Poultry Processing Plants

Arrianna Marie Planey

Meat & Poultry Processing Plants & COVID-19 Spread

- Nationally, meat and poultry processing plants account for notable COVID-19 clusters.

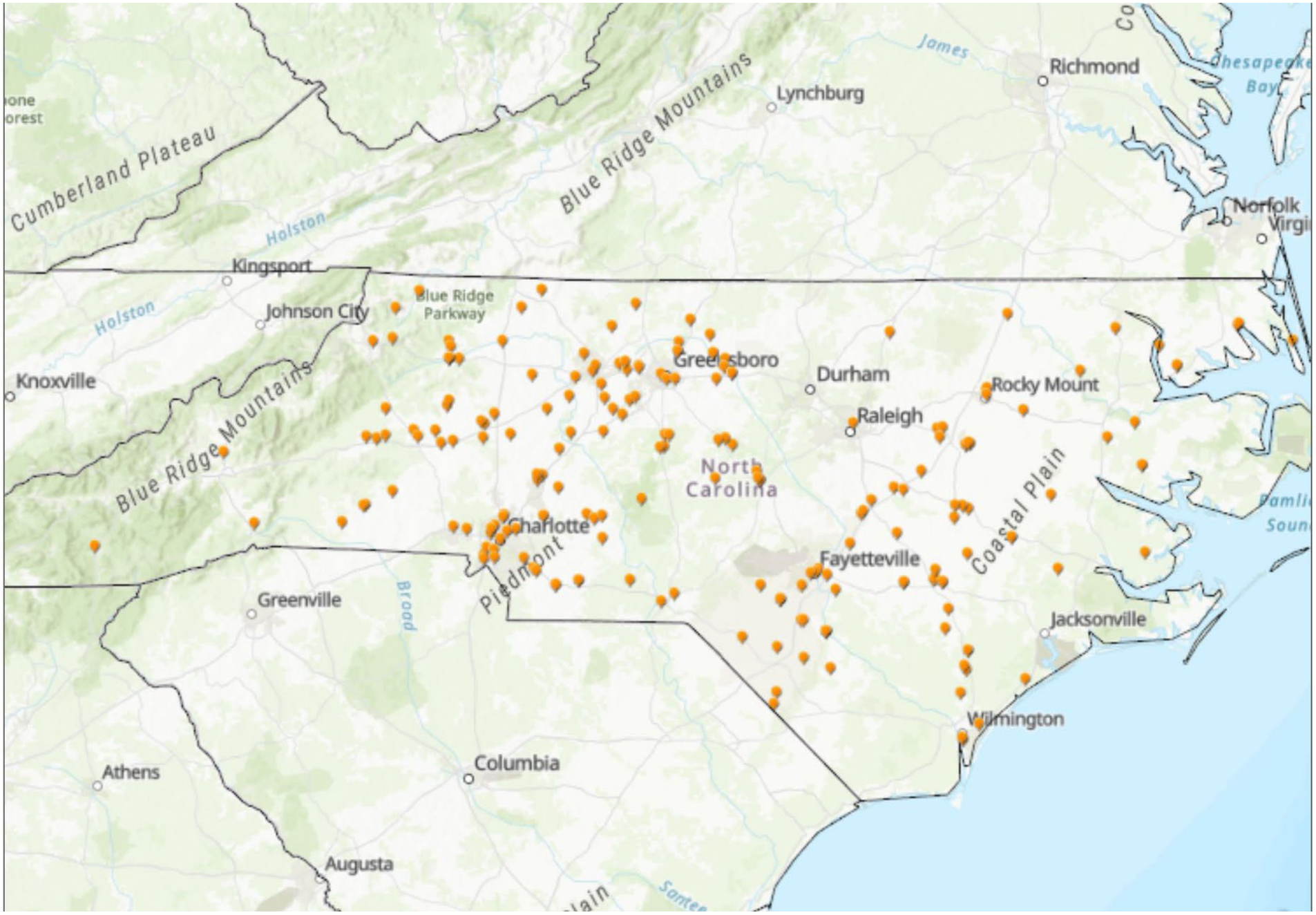
- Per the NC Department of Health and Human Services, there are outbreaks of COVID-19 associated with 23 meat processing plants across in Bertie, Bladen, Burke, Chatham, Duplin, Lee, Lenoir, Richmond, Sampson, Surry, Union, Wilkes, and Wilson counties.



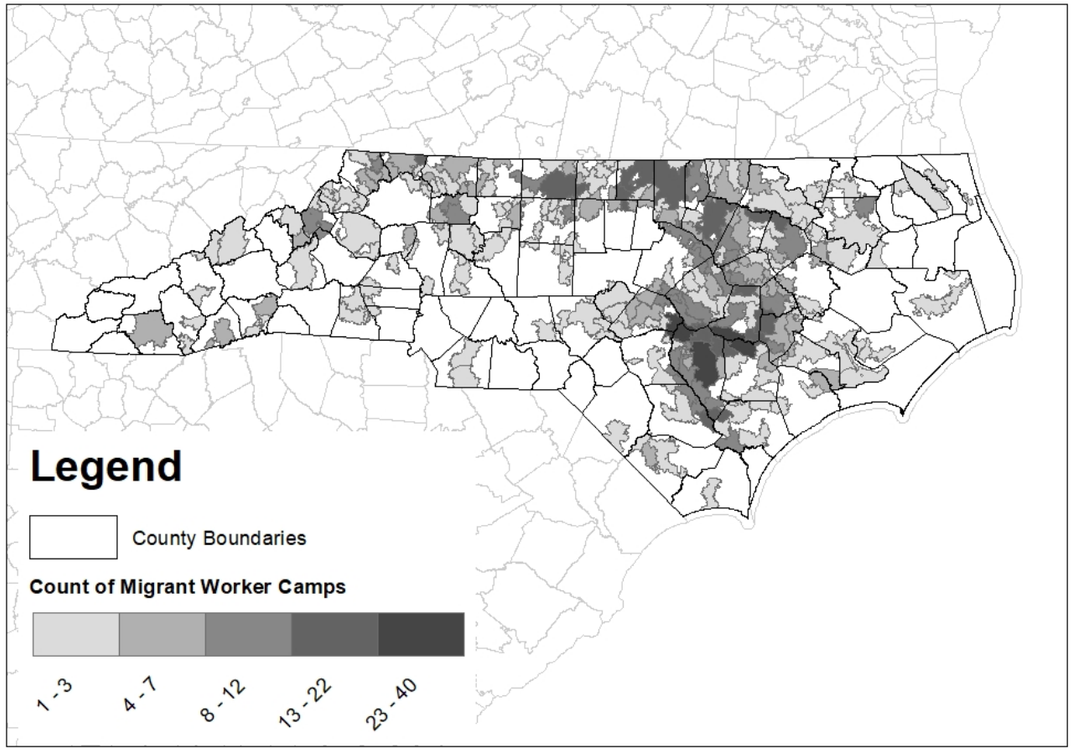
Source: Bureau of Labor Statistics, https://www.bls.gov/oes/2018/may/oes513023.htm

Meat & Poultry Processing Facility Locations

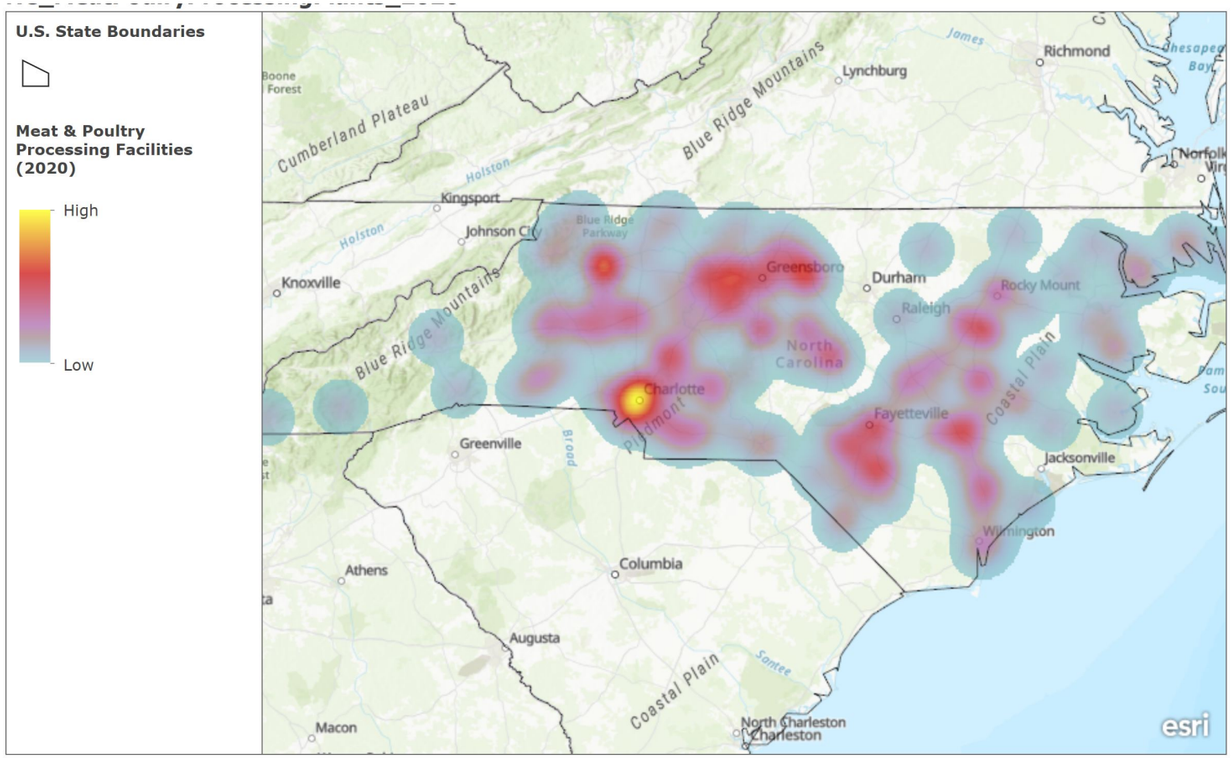
There are n = 209 federally-inspected meat and poultry processing facilities in North Carolina



Migrant Worker Camps in NC

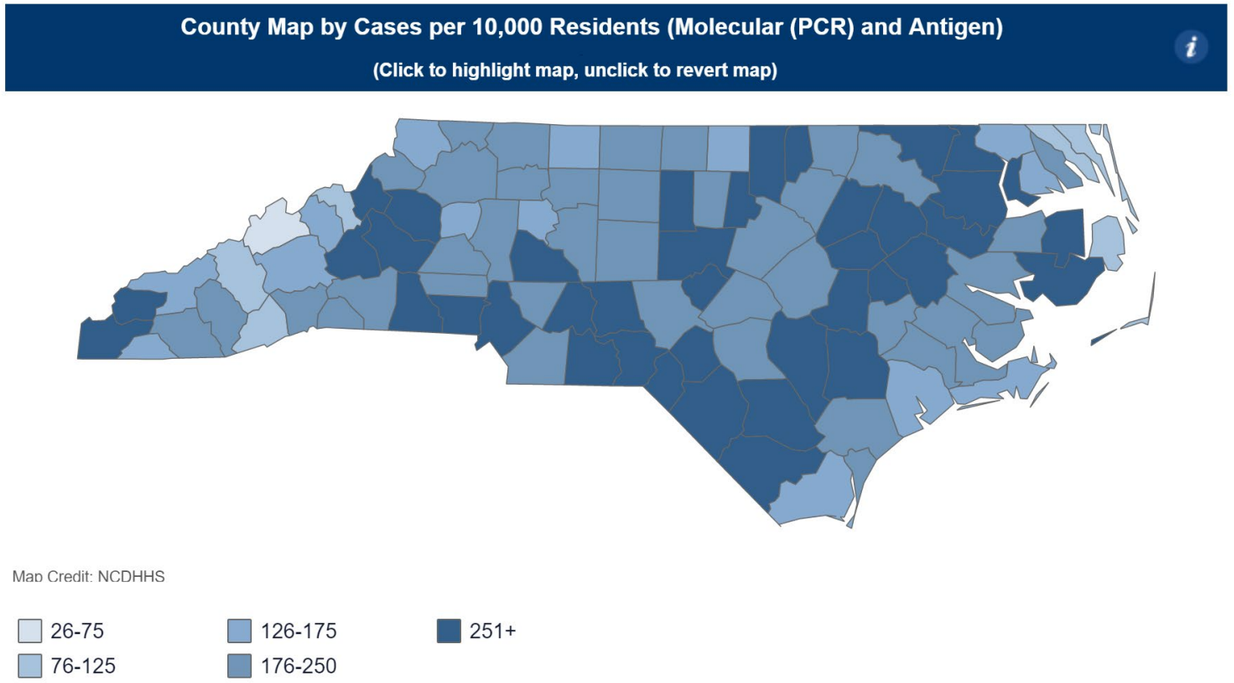


Density of Meat & Poultry Processing Plants in NC

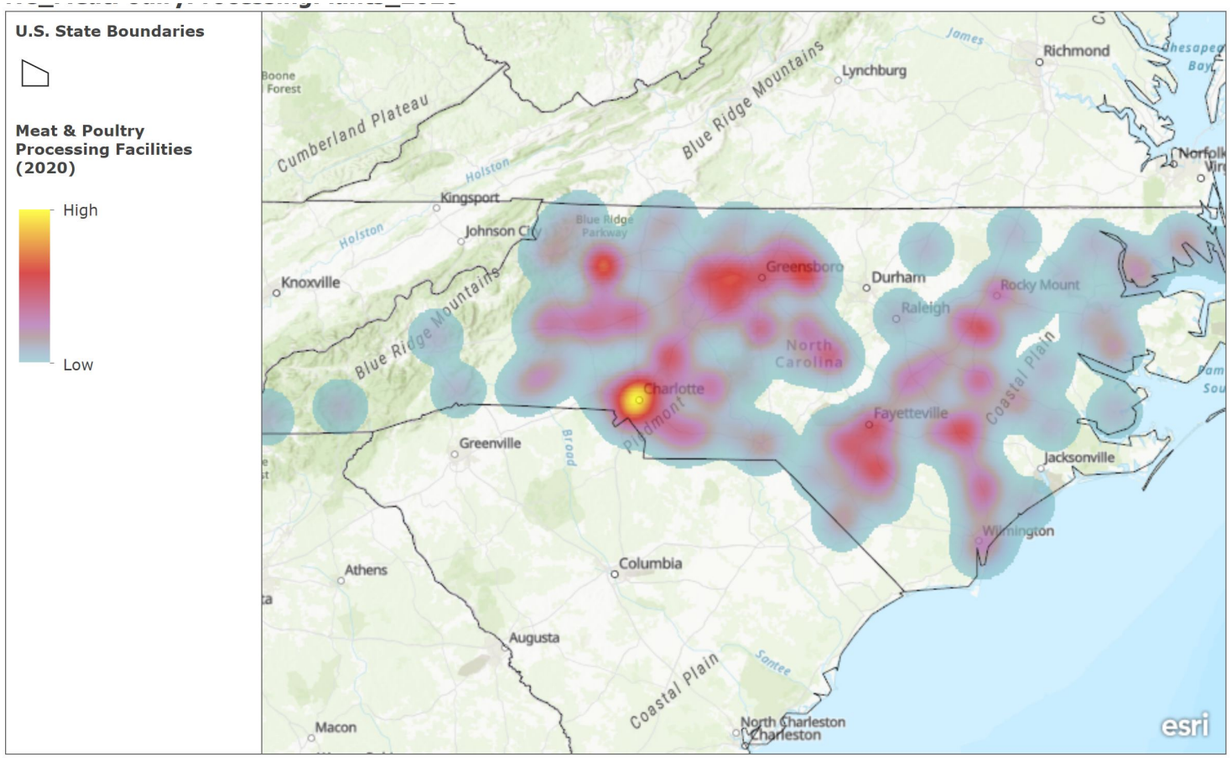


Esri, USGS | Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS

County-level COVID-19 prevalence (15 Oct 2020)



Density of Meat & Poultry Processing Plants in NC



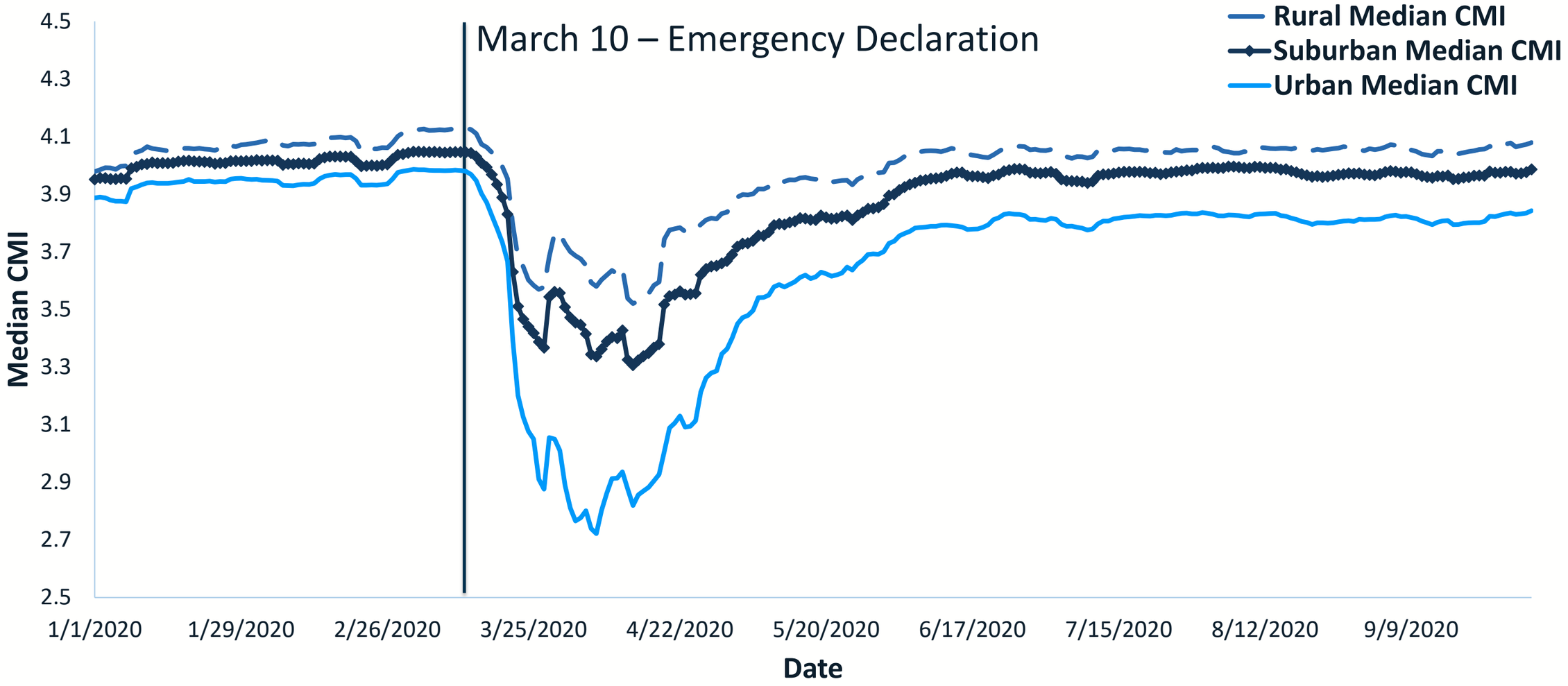
Esri, USGS | Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NPS

Source: https://covid19.ncdhhs.gov/dashboard

RECAP

Katie Harmon

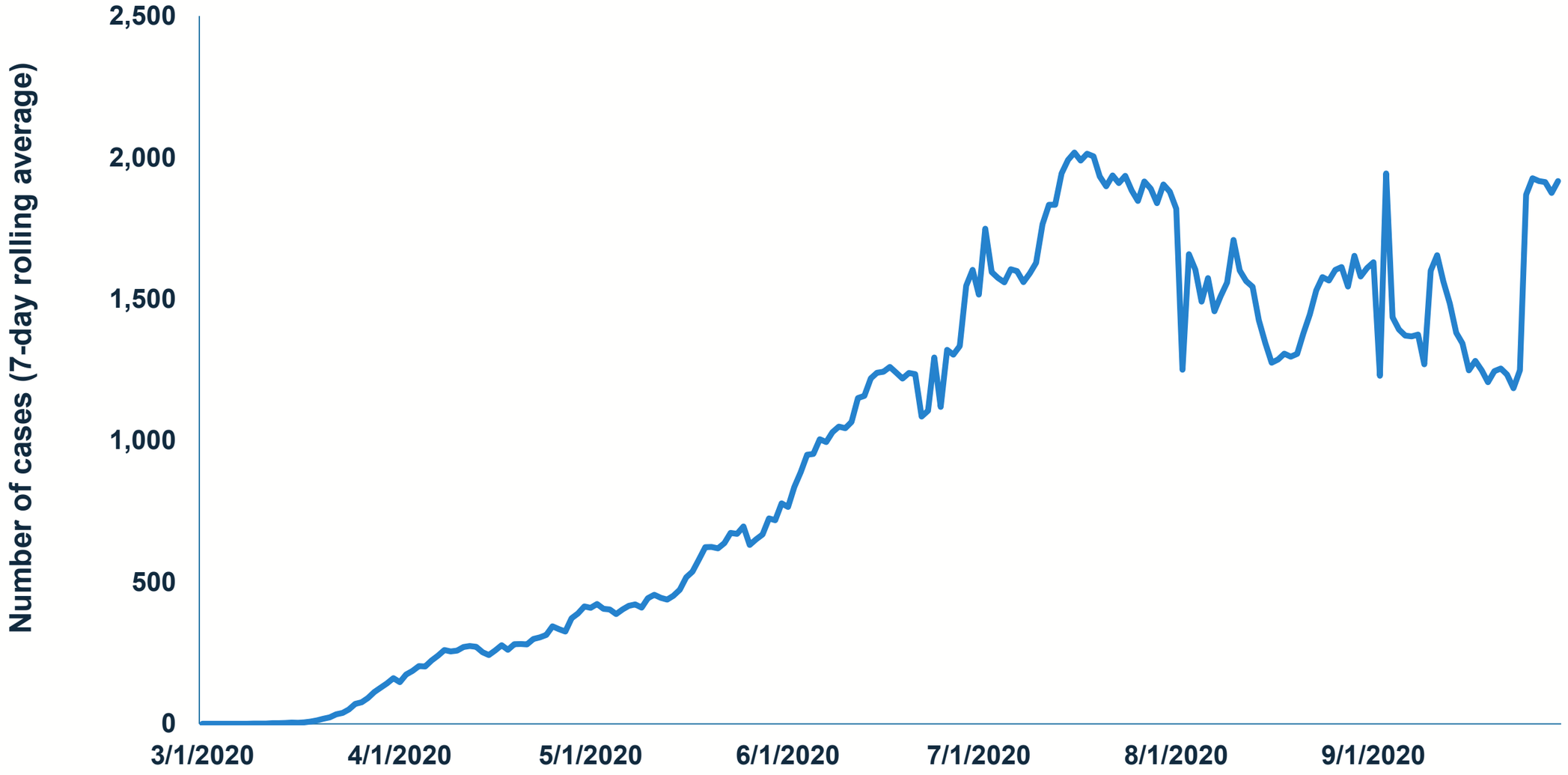
Mobility Index (7-Day Rolling Average)



NC Statewide Mobility Index Trends (7-day Rolling Average) for Urban, Suburban, and Rural Areas: January 1, 2020-October 2, 2020, ***Data Source: Cuebiq***

7-Day Rolling Average of New COVID-19 Cases

North Carolina, March 1 – September 30, 2020*



Further Discussion: COVID-related Mobility Considerations

- The closure of schools and the stay-at-home order had a substantial effect on young drivers. However, we need to continue tracking licensing and crashes during the second half of 2020 to assess the longer-term effect of COVID-19 and legislative actions on young driver safety and mobility.
- On average, travelers are responsive to policy measures, but the impact is greater in places where travelers have more mobility options.
- The relationship between mobility and pandemics/natural disasters is complicated but important to understand.
- Mobility disruptions to travel patterns will affect budgeting and resource allocations for NCDPH, NCDOT, and other state/local governmental organizations.
- There is a need for resilience modeling.

Questions?

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