

Technical Brief 3 – March 19, 2021

New Mobility Trend Insights in North Carolina

The Issue

The COVID-19 pandemic has transformed the daily life and travel patterns of North Carolina residents. To better understand this transformation and to gain insights into how future events may impact transportation and health in this state, the UNC Highway Safety Research Center analyzed multiple sets of mobility data and compared these data to COVID-19 trends.

Technical Brief 1: Initial COVID-19 Mobility Data Trend Analysis in NC (September 2020) showed interrelationships between COVID-19, executive actions intended to stall the transmission of the disease, and key metrics of travel, like vehicle miles of travel and work trips.

This **Technical Brief 3: New Mobility Trend Insights in North Carolina** (March 2021) presents analyses related specifically to new travel metrics and updates the trends of COVID-19 cases and deaths in North Carolina, using three new metrics of mobility, travel, and connectivity:

1. Median distance traveled per county per day, labeled as device distance (DD)¹.
2. Number of vehicle trips on state-owned roadways, as captured by active travel recorders (ATR)².
3. Number of people gathering in proximity of each other, as indicated by the Cuebiq data Contact Index(CCI)³.

Together, the DD and CCI indices indicate how far North Carolina residents have traveled during the pandemic, whether they are making these trips together or gathering together, and the impact executive actions have had on curbing connectivity and disease transmission.



Mobility and Contact Trends – New Findings

Key Mobility Findings

- Compared to 2019, the 2020 DD showed a significant drop in the state’s median travel distance on March 14th, following the State of Emergency Declaration (March 10th) and coinciding with the closure of public schools (March 14th). Statewide, the decrease in median device distance traveled per day was approximately equal to 9.9 kilometers.
- The median travel distance generally returned to pre-pandemic levels on June 12th, although the device distance varied by rural or urban designation.

These general trend changes are evident—to different degrees—across urban, suburban, and rural counties (*Figure 1*).

- Urban counties were the first to respond to the State of Emergency Declaration, with the median distance of travel declining on March 12th.
- Urban counties were the last for median distance of travel to begin trending back to baseline.
- The device distance returned to baseline for rural counties in early June. Suburban counties returned to nearly pre-pandemic levels, but urban county device distance remained slightly below pre-pandemic levels.

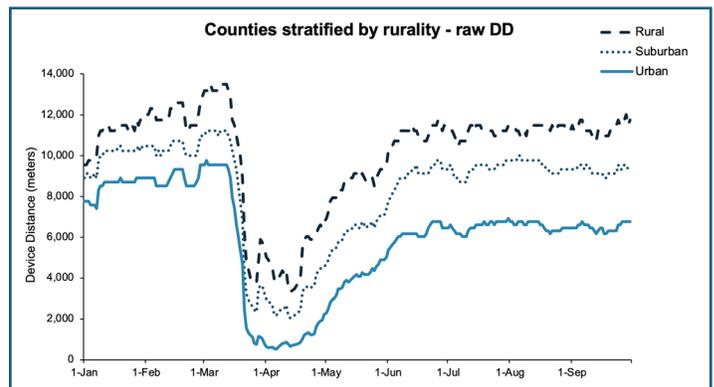


Figure 1. NC Device Distance Trends for Urban, Suburban, and Rural Counties, Data Source: Cuebiq

Trends in vehicle counts from ATR stations show similar results to the DD measure of mobility (Figure 2).

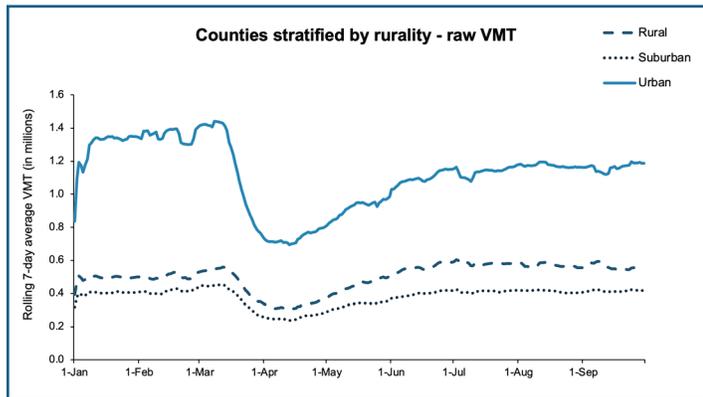


Figure 2. NC Vehicle Count Trends for Urban, Suburban, and Rural Counties, Data Source: NCDOT

- Both urban and suburban counties returned to near baseline 7-day average vehicle counts in late June, but vehicle counts stayed below before the State of Emergency Declaration. The change was approximately a 21% decrease for urban counties and a 10% decrease for suburban counties.
- In contrast, there was an increase of approximately 6% in the 7-day average vehicle counts in rural counties starting late June relative to pre-State of Emergency Declaration.

Key Contact Findings

Contact trends in 2020 were also remarkably different than those in 2019, but they also differ from mobility trends in important ways. While most mobility measures show a return to near baseline conditions in early June, the contact index, CCI, a ratio that signifies the number of people within 50-feet of each other, remained lower than it was in 2019 after a sharp decline in March. These results, shown in Figure 3, may indicate that messaging around

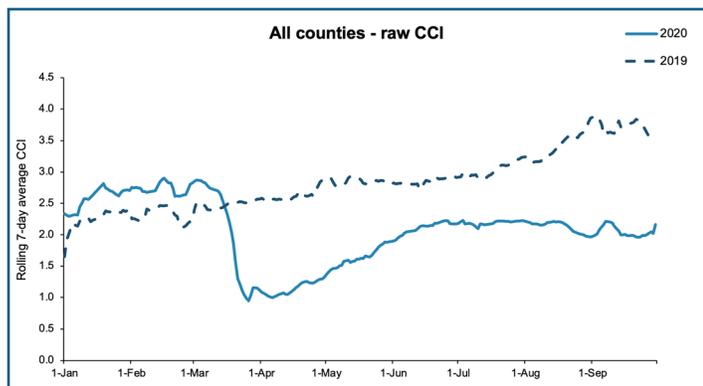


Figure 3. NC Statewide Contact Index, Data Source: Cuebiq

social distancing and the corresponding executive actions that restricted gatherings caused a noticeable decrease in contacts between North Carolina residents. Taken together with the mobility trends (in urban counties, especially), the results demonstrate that travel patterns can change in response to large-scale disruptions.

The statewide trends generally hold for rural, urban, and suburban counties as well (Figure 4).

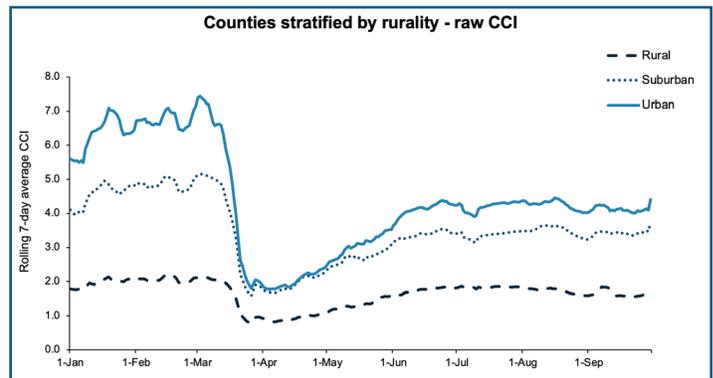


Figure 4. NC Contact Index Trends for Urban, Suburban, and Rural Counties, Data Source: Cuebiq

- Urban counties were the first to see a drop in contact between residents (on March 11th), and the contact index never returned to pre-pandemic conditions.
- Rural counties were the last to see a drop in contact between residents (on March 13th), and the contact index returned to an approximate baseline value on June 29th.



COVID-19 Trends – New Findings

From March 3rd (the date of the first confirmed COVID-19 case) through September 30th, 2020, there have been 211,091 confirmed COVID-19 cases (molecular and antigen test results combined) (Figure 5) and 3,565 confirmed COVID-19 deaths (Figure 6). Similar to the mobility and connectivity data, there were clear differences in COVID-19 case and fatality time trends across urban, suburban, and rural North Carolina counties.

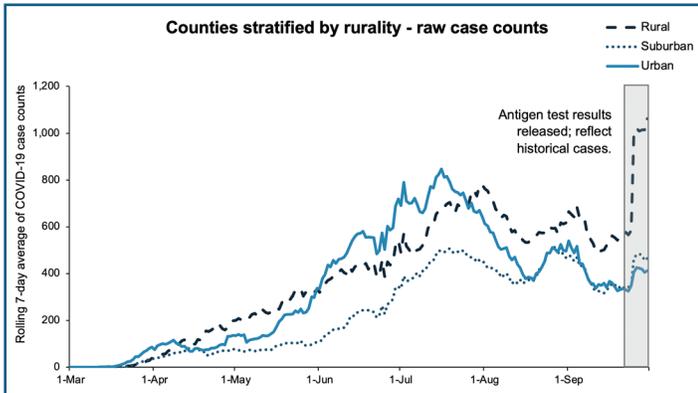


Figure 5. NC COVID-19 Case Counts for Urban, Suburban, and Rural Counties, Data Source: New York Times

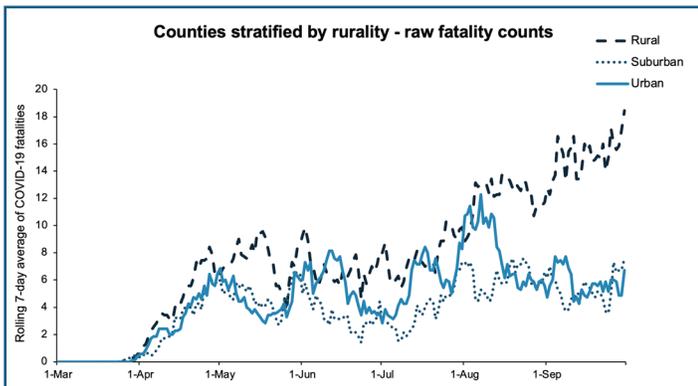


Figure 6. NC COVID-19 Fatality Counts for Urban, Suburban, and Rural Counties, Data Source: New York Times

Key Health Findings

- Beginning in early August, rural COVID-19 case and fatality counts started to exceed urban and suburban case counts, likely indicating widespread community transmission of the disease in North Carolina. This trend continued to hold for the remainder of the study period.
- By September 30th, rural North Carolina counties were averaging 18 COVID-19 deaths and 1,000 cases per day. In contrast, urban counties were averaging approximately 7 deaths and 400 cases per day.
- COVID-19 cases were moderately correlated with NCDOT ATR data and both the Cuebq mobility measures. There was less correlation between the mobility measures and fatalities, likely related to the considerable period that elapses from COVID-19 exposure to death (Table 1).

Correlation Matrix of Mobility & Health

One of the main motivations for this analysis was to determine if changes in travel behaviors also affect the spread of COVID-19. To assess this question, in addition to examining mobility trends, correlations between mobility data and COVID-19 cases and deaths were calculated. As can be seen in Table 1, there were moderate correlations between COVID-19 cases and all three mobility measures, indicating similar trends in the data. While these correlations do not explicitly indicate a link, they may show that reducing travel and limiting the number of contacts, in addition to other factors, can curb the spread of SARS-CoV-2 and similar viruses.

Variables	ATR Vehicle Counts	Device Distance	Contact Index	COVID-19 Cases	COVID-19 Deaths
ATR Vehicle Counts	1.00	0.96	0.96	0.64	0.36
Device Distance		1.00	0.97	0.67	0.48
Contact Index			1.00	0.61	0.34
COVID-19 Cases				1.00	0.71
COVID-19 Deaths					1.00

Table 1. Correlations between Mobility and Health Data in NC; Variables included are 7-Day Rolling Averages (March 7th-September 24th)

What does this mean for North Carolina?

The results of the mobility and contact indices presented in this Technical Brief confirm the findings of **Technical Brief 1** – The public responded to the State of Emergency Declaration and that travel trends changed significantly for a period after March 10th. The new results reveal insights into how residents may be connecting with each other. While travel has generally returned to prepandemic levels, the contact between residents in much of the state has not.

This Technical Brief also highlights notable differences between rural, suburban, and urban areas in North Carolina. In urban and suburban areas, contact remains lower than it was pre-pandemic, even if the median distance traveled mostly recovered to pre-pandemic levels, especially in rural counties. From these findings, new hypotheses can be studied to better understand the potential link found between the spread of COVID-19 and travel and contact patterns. These questions include:

- Did urban and suburban travelers take more single-vehicle trips and avoiding congregating out of concern for public health?

- Are residents in rural areas likely to have less capacity for reducing travel distances and minimizing contact due to fewer mobility and social options, less access to telecommuting, and live further from trip destinations?
- Can the impacts of future pandemics be mitigated by improving the resilience and availability of mobility options in rural areas?

For all areas, messaging around health and mobility issues can affect public behavior. In the short-term, it is important to support efforts to minimize the transmission of COVID-19 during essential trips, especially in rural areas. These efforts include continuing to promote adherence to social distancing guidelines, performing widespread community testing, distributing masks and sanitizing solutions, and partnering with healthcare and community-based organizations for the dissemination of information.

Suggested Citation

Kumfer, W., Harmon, K., Radwan, R., Combs, T., Ma, C., and Srinivasan, R. (2021). New Mobility Trend Insights in North Carolina (Technical Brief No. 3; C19 Mobility and Health). Highway Safety Research Center.

References

- 1 DD is computed from the Cuebiq Mobility Index (CMI), a logarithmic unitless number.
- 2 Vehicle trips are aggregated daily and summed at the county level in which the counters were present, providing a measure of travel on major roadways.
- 3 CCI is a location-specific ratio of the number of device users to other cell phone signals in a fifty-foot radius at a five-minute resolution.

About the Project

The NC COVID-19 Mobility and Health Impacts Study is investigating COVID-19 data trends in NC. Led by the [UNC Highway Safety Research Center](#), this project brings together an impressive team of multidisciplinary research partners from across the UNC System, including UNC-CH's Cecil G. Sheps Center for Health Services Research, Gillings School of Global Public Health, Odum Institute for Research in Social Science, and the NC State University Department of Statistics, to research the interrelationships of public health policies, mobility changes, and the transmission of COVID-19 to inform policy decisions in North Carolina. This project is supported by the North Carolina Policy Collaboratory at the University of North Carolina at Chapel Hill with funding from the North Carolina Coronavirus Relief Fund established and appropriated by the North Carolina General Assembly.



For more information, please contact [Randa Radwan, Ph.D.](#), Principal Investigator | radwan@hsrc.unc.edu and visit www.C19mobilityandhealth.unc.edu