![C19 Mobility and Health — Investigating COVID-19 data trends in North Carolina]

North Carolina COVID-19 Mobility and Health Impacts Study
Interim Research Progress Report to the NC Collaboratory
August 15, 2020

This interim report describes the activities under the "North Carolina COVID-19 Mobility and Health Impacts Study" supported by the North Carolina Policy Collaboratory at the University of North Carolina at Chapel Hill (UNC-CH) for the period May 4 through December 2020.

Study Motivation: The study objectives are to investigate the interrelationships amongst public health policies, mobility changes, traffic safety, and the transmission and impacts of COVID-19. This research study can help inform policy decisions in North Carolina, specifically if there is resurgence of infections due to cyclical outbreaks throughout the year. The study will also 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.

Study Progress: Headway has been made in all the tasks. A project wide kick-off meeting was held. The internal research teams for the nine tasks were formed with designated team leads from the Highway Safety Research Center (HSRC), Cecil G. Sheps Center for Health Services Research (Sheps), Gillings School of Global Public Health, Howard W Odum Institute for Research in Social Science (Odum). The research team leads developed work plans for all the tasks. The initiated activities are summarized below.

Task 1: Data Identification and Acquisition
Substantial progress has been made toward the objective of identification of and acquisition of both mobility and health data to support the proposed analysis under this grant. For the mobility data, the following datasets have been obtained: (1) Origin-Destination data from Teralytics (available only through April 21, 2020), (2) NCDOT Traffic Counts (to date available through June 15, 2020), and (3) Streetlight Vehicle Miles Traveled Data- VMT (acquired for January 2019-current, with monthly continued updates). A Data Use Agreement were established for Terlaytics, Waze Traffic Incident data, and SafeGraph Foot Traffic data. Acquisition of Cuebiq Mobility Flow Data (January 2019 -current) is in progress. The Cuebiq data is based on GPS signals from cell phone devices and includes the Cuebiq Mobility Index Data Feed (Date, County, State, dwell time, place id, place name (venue name which could be the brand, retailer, name of location), and the Cuebiq Contact Index: (# of devices with contact / # devices seen), and Shelter-In-Place Analysis (percentage of users staying at home in any given state/county).

For the health data, confirmed Covid-19 case counts, confirmed deaths, and patient county of residence by date have been acquired (scrubbed) from New York Times (NYT) data. Two Institutional Review Board (IRB) approvals have been requested for health data. The first was submitted by HSRC for the use of aggregate dataset from the UNC Sheps Center and includes de-identified North Carolina health data (confirmed Covid-19 cases, deaths, emergency department visits, hospitalizations, total positive and percent positive Covid-19 tests) to examine the relationship between Covid-19 health outcomes and changing mobility trends following the implementation (and associated relaxation) of local, state, and

federal guidelines and physical distancing measures. A companion IRB request to govern the direct analysis of record-level data was submitted by the UNC Sheps Center.

Task 2: Literature Review and Synthesis of On-going and Recently Completed Synergetic Studies
A search strategy and reference management were developed. Given the prevalence of ongoing related studies, a running literature search is planned. However, an initial literature search and synthesis of 49 sources was completed. The initial synthesis converged around the following subtopics: COVID-19 Prevalence and Incidence by Age, Mobility Patterns Amid the COVID-19 Pandemic, Policy Effects on Mobility Amid COVID-19, Mobility and Occupational Sorting/Risk, Meat and Poultry Processing Plants, Military Personnel, and Occupational Sorting by Racial & Ethnic Disparities. This synthesis will be used to develop an initial Technical Brief to deliver to the Collaboratory in late August.

Task 3: Base Analyses for COVID-19 Mobility and Health Impacts
The base analysis task is near completion. A limited time series analysis using JoinPoint regression was performed. Data preprocessing was performed for NCDOT ATR, Teralytics, and Streetlight datasets. The rationale for using three sources of mobility data was to triangulate in on a consensus of travel behavior in the state by examining three different measures. Simulations of Streetlight VMT data, NCDOT ATR data, NYT Health data, and Teralytics trips data were conducted and analyzed. The most appropriate models for explaining the link between mobility and health during the Covid-19 pandemic were selected. Key trend changes in both mobility data and health data were identified amongst rural, suburban, and urban counties. We were able to compare statistically significant trend changes to expected inflection points caused by policy actions regarding Emergency Declarations and Shelter in Place orders. Results will be highlighted in an initial Technical Brief to deliver to the Collaboratory in late August.

Task 4: Expanded Analyses COVID-19 Mobility and Health Impacts
This Task is planned to start on September 1 and will build on the results from Task 3 and provide further insight toward our research questions. This work will include explicit considerations of inter-relationships between the trends in the different data sets including health and mobility data. More flexible and robust statistical and machine learning methods will be explored to properly account for program time lags and intervention points. Causally-based precision health Artificial Intelligence technology recently developed by UNC-Gillings and NC State researchers will also be considered. Such analyses and modeling approaches can help identify contextually-dependent optimal policies. In addition, more robust spatial methodologies for identifying areas within the State with the highest risk will be considered.

Task 5: Study of the Effect of COVID-19 on Young Drivers and Implications for Policy
A detailed workplan was developed to examine crash data, driver licensing data, driver education completion and self-report data from parents of teen drivers in North Carolina. Teen driver licensing data from January-June 2020 were compared with historical averages. Preliminary crash data through April 2020 was requested and received from NCDOT. The constructs to be covered in the online questionnaire have been identified and a first draft was developed.

Task 6: Analysis of Effects of COVID-19 on Transportation Safety Sector

This Task is planned to start on September 1 and will perform statistical analyses using the crash and exposure data to obtain insight into the effects of Covid-19 on transportation safety. The workplan highlighted that there is some anecdotal evidence that Covid-19 has increased speeding. In addition, analysis from the North Carolina Department of Transportation (NCDOT) has indicated that the percentage of crashes that are fatal have increased during the pandemic although the number of crashes has reduced. Hence, the investigation will examine the effect of Covid-19 on single and multi-vehicle crashes, crashes by severity, pedestrian crashes, bicycle crashes, and speeding related crashes. The investigation will be conducted at both the county level and corridor/segment level using crash data from NCDOT. Exposure data will include vehicle miles traveled at the county level and traffic volume data from the permanent count stations in North Carolina.

Task 7: Data Management and Storage

A workplan was developed towards the objective of evaluating, testing, and implementing the storage and preservation environment needed by the project as information and specifics of the study data are discovered. The workplan included developing a data management system that will facilitate the use and reuse of project data as well as enable the visualization of project findings. Coordination of metadata needs across the project tasks and facilitating ingest of final products into the preservation environment will also be addressed. Initial data management planning and organization was performed.

Task 8: Data visualization and Prototype Dashboard

A workplan was developed towards the objective of providing the results of Tasks 3 through 6 in the form of plots, graphs, and charts that can be understood by individuals without a background in scientific research. The workplan included task outlines for the design and development of visualization prototypes as well as publishing such visualization prototypes on the project website.

Task 9: Website Design and External Communication

Progress was made towards developing a content-based website to serve as a focal point for research updates, dissemination of results, and linking to synergetic studies. Website sitemap and content have been drafted. Website logo, branding, and graphic designs/templates for technical briefs are underway.