

# Vanderbilt COVID-19 Modeling Team Report for Tennessee

May 28, 2020

This report analyzes anonymized cellular device data to describe patterns of mobility in Tennessee from January 2020 through the first three weeks of May.

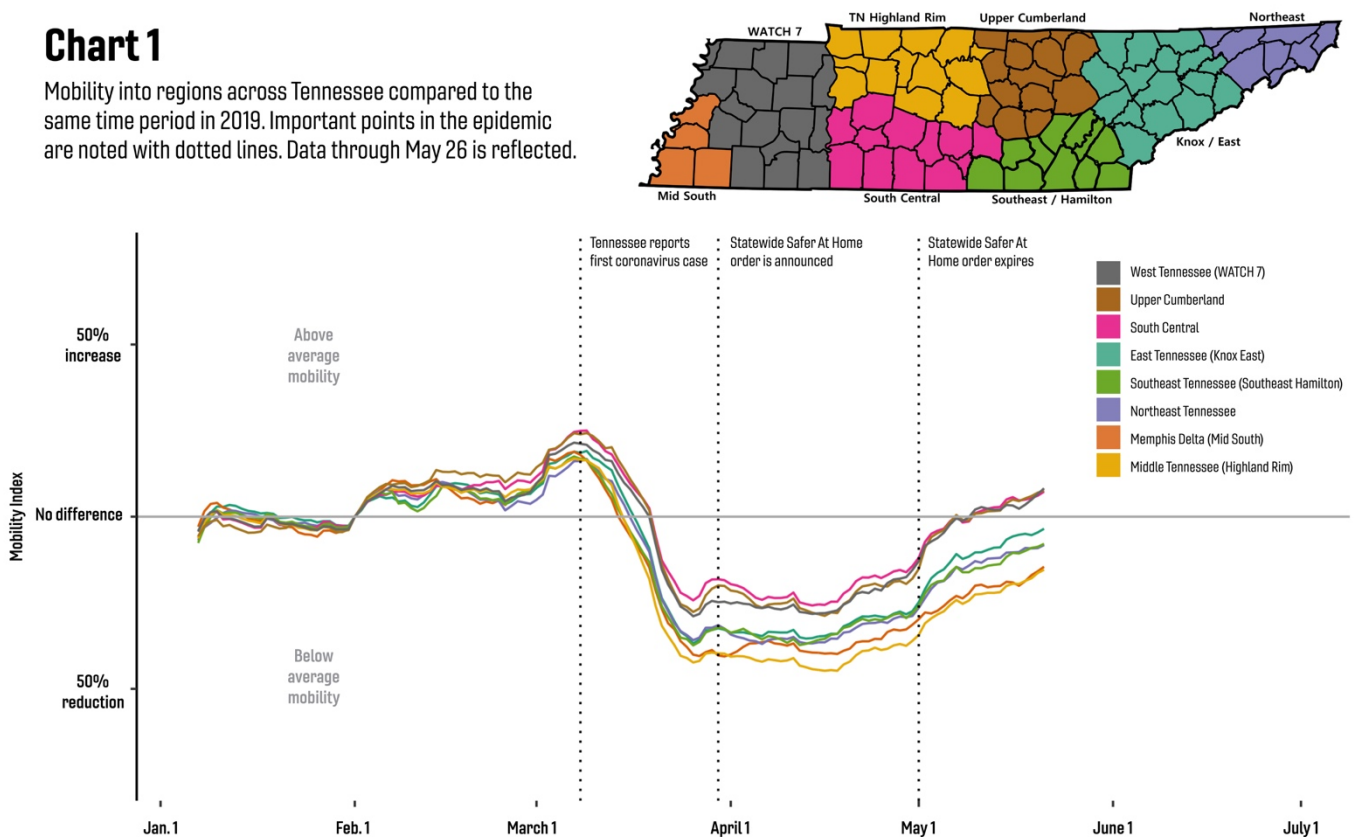
Our analyses show that mobility dropped right after the first Tennessee coronavirus (SARS-CoV-2) case was reported in early March. Indeed, travel fell and remained low in all regions prior to the announcement of the governor’s statewide Safer at Home policy in late March. Expiration of the Safer at Home order on May 1 was met with an increase in mobility into regions less affected by the virus. Nearly a month later, however, mobility remains suppressed across many sectors.

## Mobility by Region

Chart 1 summarizes changes in our mobility index (see Box 1) across regions of Tennessee through May 23. Tennesseans dramatically scaled back their movements just after the first coronavirus case was reported in Tennessee and as reports of transmission more broadly in the U.S. began to emerge in early March. Moreover, the chart makes clear that mobility decreased statewide 7-10 days before the statewide Safer At Home policy was announced on March 31. Finally, mobility began increasing in mid-April, and in some regions has now returned to levels last seen in February 2020. Non-metro areas of the state have seen larger increases in movement after the Safer at Home order expired on May 1.

### Chart 1

Mobility into regions across Tennessee compared to the same time period in 2019. Important points in the epidemic are noted with dotted lines. Data through May 26 is reflected.



## Mobility by Virus Transmission Burden

While Chart 1 highlights dramatic changes in population movements and how they differ across regions, we know from our [earlier reports](#) that the burden of coronavirus has varied both within and across these areas. An important question is whether mobility changes are different in areas more affected by the virus relative to those less affected by the virus.

In Chart 2, we combine mobility data with data on the number of positive tests per 10,000 population by ZIP code to describe differences in mobility by areas of different COVID-19 burden. We compare mobility in the ZIP codes in the top 25% (Areas Most Affected) of COVID-19 cases to those in the bottom 25% (Areas Least Affected) statewide.

### Chart 2

Mobility into regions of Tennessee most affected and least affected by COVID-19. Data through May 26 is reflected.



The top region of Chart 2 shows that travel patterns are substantially lower into areas with the highest number of cases per 10,000 population. The lower region of Chart 2 (which shows the difference between most vs. least affected on any given day) shows that before the first reported case in early March, the most affected areas had nearly identical mobility dynamics as the areas that have been least affected. Sustained mobility differences between these areas emerged just after the first case, and differences became larger over time.

Our results underscore an important point about the virus and its impact on the Tennessee economy. Mobility changes in areas with the most COVID-19 cases occurred at the same time as changes in areas least affected by the virus to date. However, through May 26 the most affected areas continue to see substantially lower economic activity. A top priority for the state and for Tennesseans must be suppressing the virus to avoid further and prolonged negative economic effects across the state.

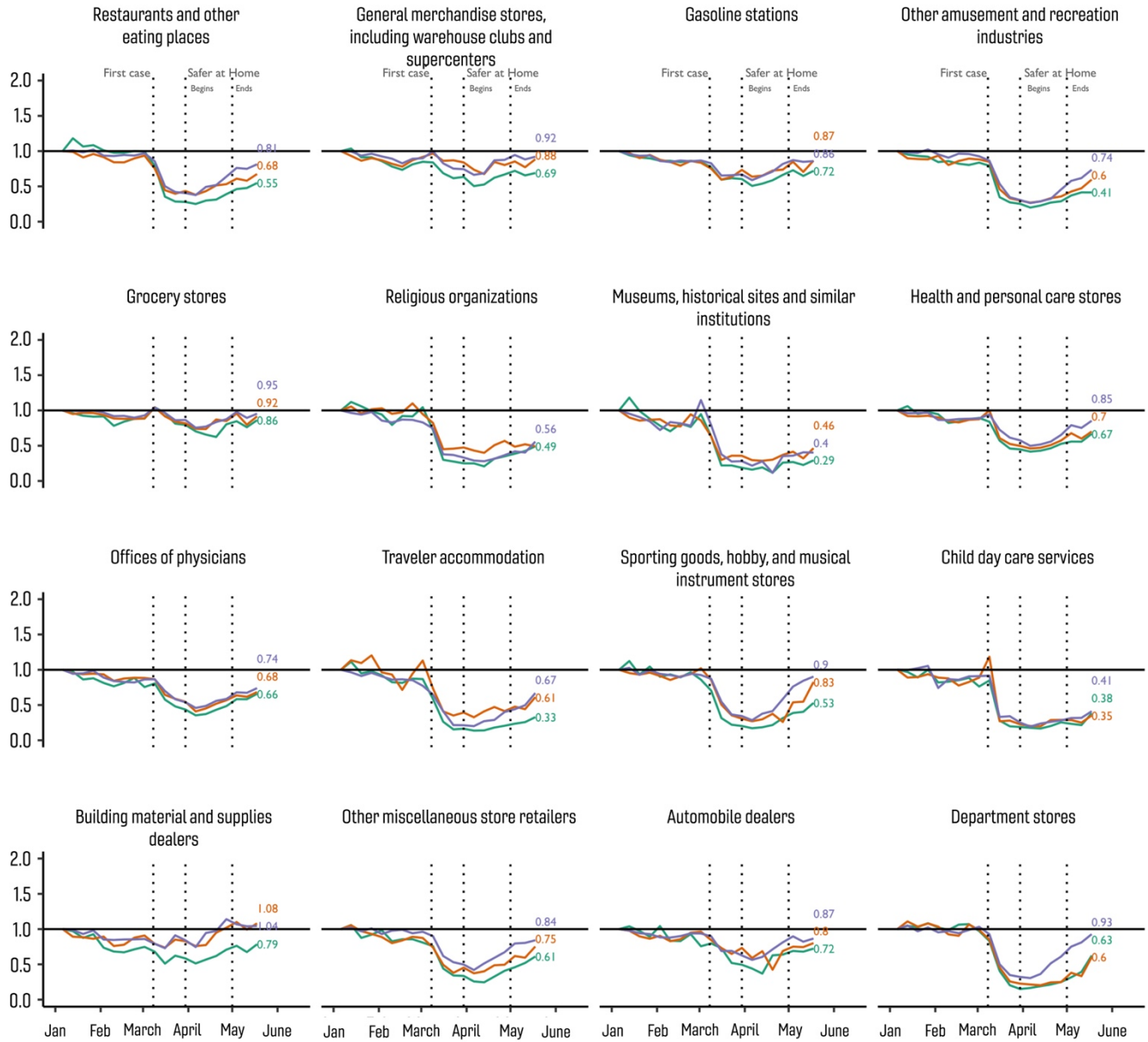
## Mobility to Types of Places

Charts 1 and 2 summarized overall mobility into areas of Tennessee, but did not describe the type of economic activity people engage in when they move outside their home neighborhood. Chart 3 shows travel to commercial or industry locations in Tennessee defined by their North American Industry Classification (NAIC) code category. Sixteen of the top categories by volume are organized by the most-visited (upper left) to least-visited (lower right) based on visits in the pre-pandemic period.

Chart 3 again illustrates that visits to many places across Tennessee began a steep decline just after the first COVID-19 case was announced in early March. These declines leveled out in mid-April, but visits to some types of places have recovered to the levels observed for the same week in 2019. Even outside of Davidson and Shelby counties, visits to restaurants remain 20% below comparable amounts from the same week in 2019, while across all areas visits to churches remain 40-50% below their usual levels for mid-May, presumably due to limits on large gatherings.

### Chart 3

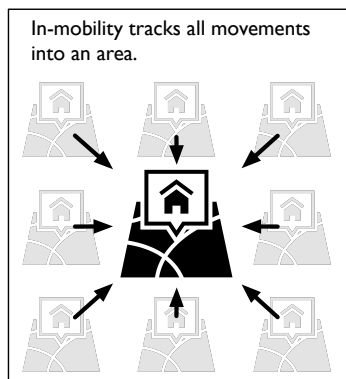
Mobility to specific types of businesses or industries based on their North American Industry Classification (NAIC) code. Index values of 1.0 indicate equivalent mobility for the same time period in 2019.



## About the mobility data

Our mobility measures are based on anonymized and privacy-protected cellular device data from SafeGraph, a data analytics firm. Each of the 40 million smartphone devices tracked by SafeGraph is assigned a “home” based on its most common location at night. Location movements are recorded in terms of travel among census block groups, which are geographic areas containing between 600 and 3,000 people. Our mobility measures track aggregate movements from these home locations to other places, like restaurants and doctors’ offices, in Tennessee. The SafeGraph data only contain aggregate visit counts by census block group pairs—and thus we do not track individuals’ movements across the state.

We present measures of in-mobility, or movements into an area. In-mobility is a useful diagnostic because it captures people’s willingness to engage in economic activity outside their home neighborhood. In-mobility is also useful for measuring transmission risk because it captures movements into an area from all other areas—not just movements out of a single location. In other words, the data can be helpful in tracking transmission to an area that had not yet been affected by the virus. We also examined measures of out-mobility, or movements out of the home area. These measures produced very similar results, and for this reason we do not include them in this report.



For aggregate movements (Charts 1 and 2), for which data were only available from January 2020 onwards, we index each mobility measure so that the value on any given day tells us whether mobility increased or decreased relative to the amount of mobility observed in the first week of February. The place indices shown in Chart 3 are further standardized by visitation volume for the same week in 2019. This adjustment helps us understand how much travel has increased or decreased relative to the same week in 2019.

*This report was prepared by John Graves, PhD, associate professor of Health Policy and director of the Center for Health Economic Modeling, Melissa McPheeters, PhD, research professor in the Department of Health Policy and co-director of the Center for Improving the Public’s Health Through Informatics, Melinda Buntin, PhD, Mike Curb Professor of Health Policy and Chair, Department of Health Policy. Data analysis and presentation support were provided by Jake Lowary, Leonce Nshuti, and Zilu Zhou; the team received input from Vanderbilt’s Health Policy and Public Health Advisory Panel.*