Vanderbilt COVID-19 Modeling Report for Tennessee

April 16, 2020

This report updates the descriptive analyses and modeling projections using the Vanderbilt COVID-19 model, as initially presented on April 10. The results presented here reflect an additional week of data on new positive COVID-19 cases, as reported by the Tennessee Department of Health.

Over the past week, the transmission number in Tennessee has continued to decline as social distancing has remained in place. We reported last week that the case data through April 6 indicated a transmission number around 1.4. With an additional week of data included in our model, we now report that the transmission number has declined to around 1.0 across the state. As a reminder, a transmission number refers to the average number of additional people infected by one infected person. A transmission number below 1.0 for a sustained period is necessary to slow an epidemic.

Chart 1 below summarizes the transmission number for the entire state using data reported to the Department of Health through April 6 and through April 13. An important new feature of the way we are presenting data this week is the addition of confidence bands. This is especially important for regions that have fewer cases and in which there may be greater uncertainty due to testing availability, delays in the return of tests to people, and local clusters of cases (e.g., in nursing homes).

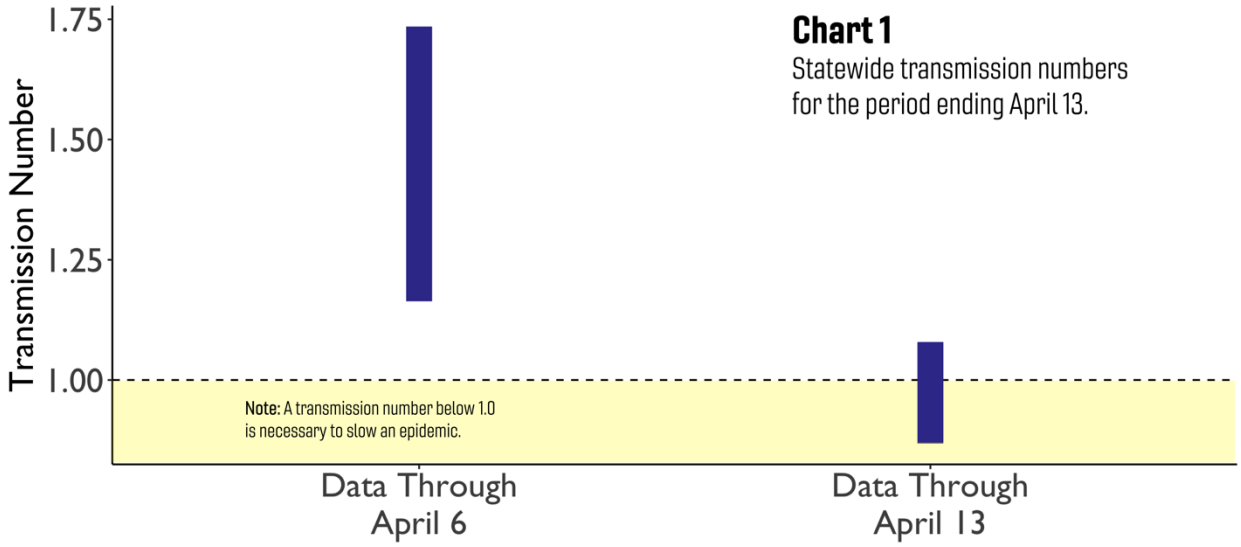
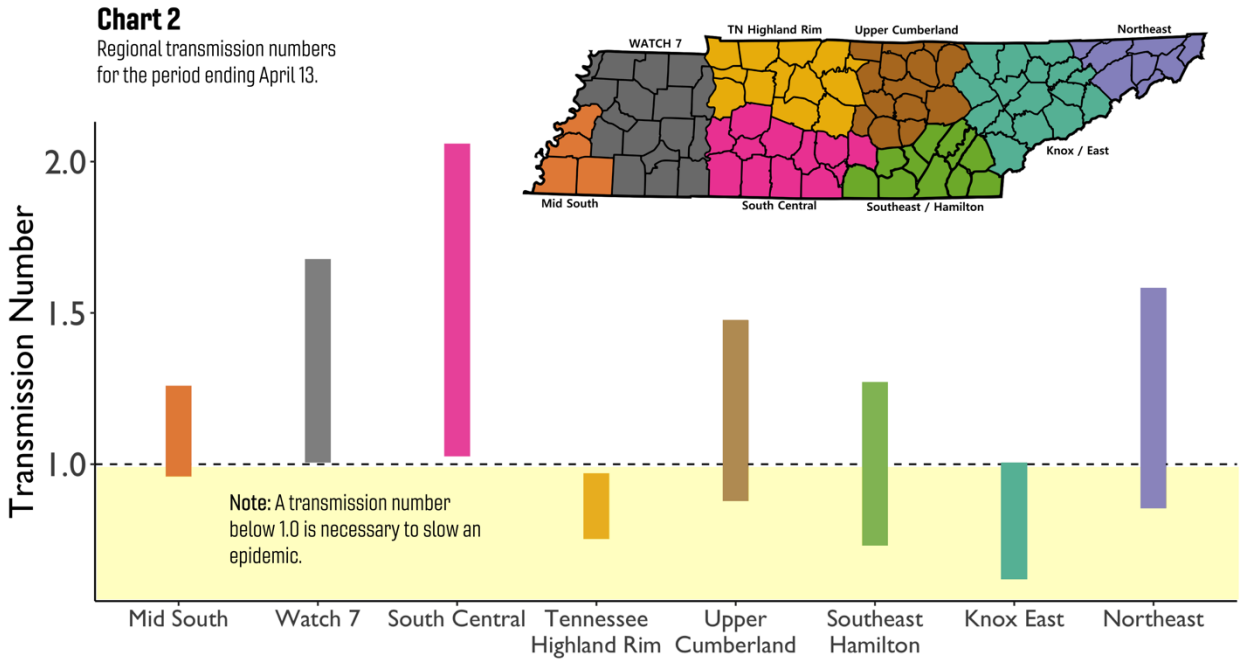


Chart 1
Statewide transmission numbers for the period ending April 13.

Chart 2 Reports current transmission numbers by region. Here we highlight that progress is not uniform across the state. Certain health care coalition regions (e.g., the Highland Rim region, which includes metropolitan Nashville) have greater evidence that the epidemic has become more controlled, while other regions continue to exhibit transmission numbers above 1.0 — indicating that case numbers may continue to climb.



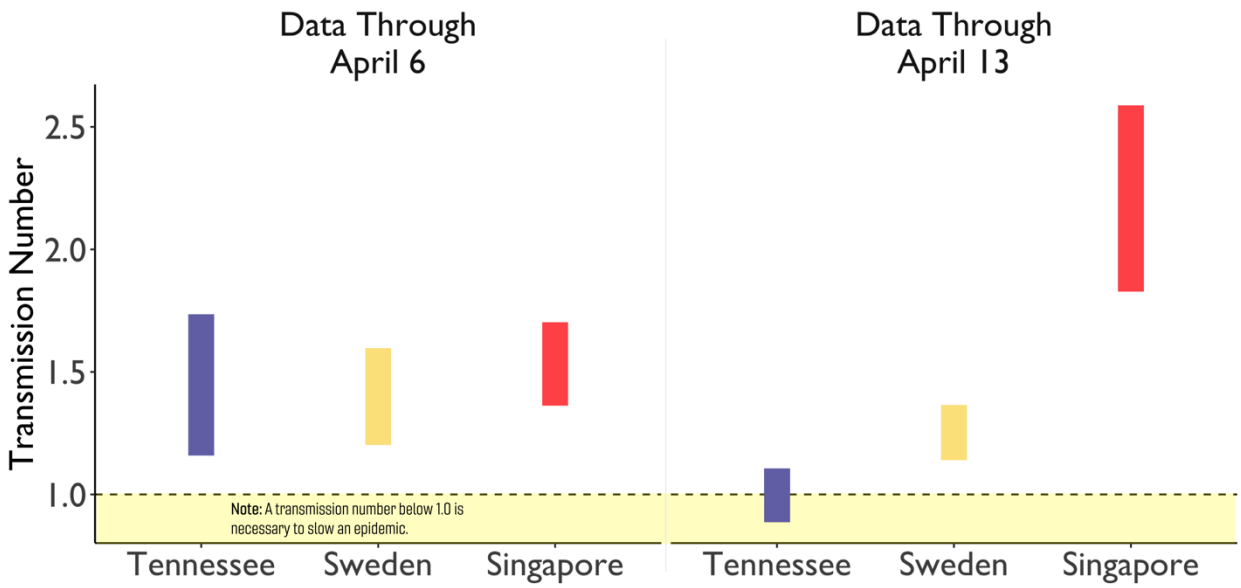
Policy discussions over the past week have centered around relaxing social distancing policies and comparisons of Tennessee's experience to other countries. One point of comparison is Sweden, which has stressed voluntary – rather than mandatory – social distancing practices. Another is Singapore, which initially kept virus spread contained but recently imposed mandatory social distancing orders as a result of a spike in cases.

These two countries are also useful points of comparison because, during the week that ended April 6, their transmission numbers were very similar to Tennessee's. However, the experience of these three geographies diverged dramatically in just one week. Sweden remained relatively stable with a transmission number around 1.2 – meaning cases are still increasing. Tennessee, as noted above, continued to have a decline in new cases and now has a transmission number around 1.0. Singapore saw its transmission number increase to above 2.0 and took steps to tighten its social distancing policies as a result.

Chart 3 highlights these comparisons.

Chart 3

Transmission number comparison week-to-week between Tennessee, Sweden and Singapore.



Outlook for Tennessee

The descriptive analyses above highlight an essential takeaway: Tennessee's recent progress, while real and positive, is fragile.

Our analysis of the recent data indicates that without further changes to the transmission number, Tennessee may be settling into a "simmer." Should the transmission number not increase or decrease, the number of statewide hospitalizations would remain stable moving forward. Should the transmission number increase to above 1.0, hospitalizations would increase. And if the transmission number declines, hospitalizations would fall further.

We stress the current situation is delicate and uncertain. This is underscored by the divergent experiences of Sweden and Singapore highlighted earlier. Both countries avoided mandatory social distancing at first, and only one continues along this path. Singapore, as shown above, saw its progress unravel quickly and instituted widespread mandatory social distancing on March 26. Sweden maintained a transmission number between 1.1 and 1.4. If that continues, case, hospitalizations, and deaths in Sweden will not moderate. Indeed, with a population of 10.2 million — 50 percent larger than that of Tennessee (6.8 million) — Sweden, on April 15, reported 1,203 deaths overall. Tennessee, by comparison, has reported a total of 135 deaths as of April 15.

APPENDIX: How Accurate is the Vanderbilt Model?

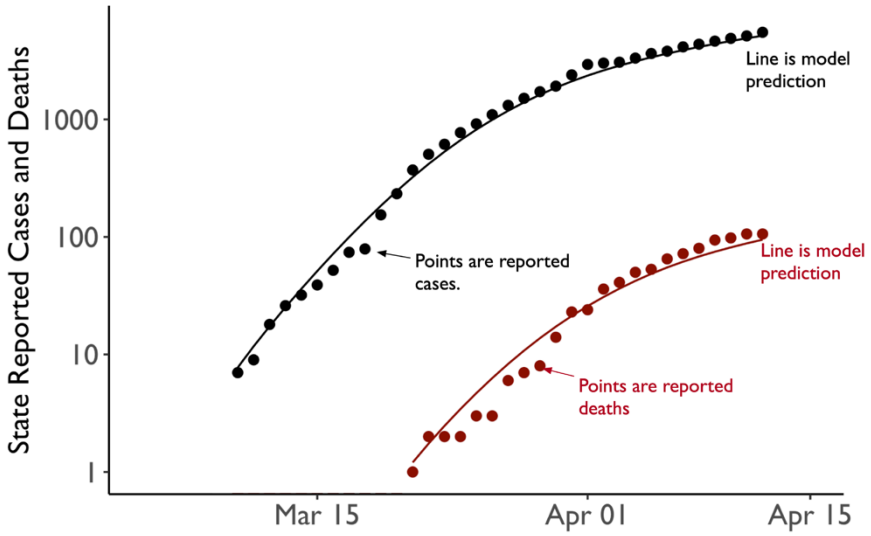
The Vanderbilt model was built on a principle that if a model cannot track what is known through the present, it cannot be relied upon to predict into the future. As explained in last week's report, the underlying model is a susceptible, exposed, infectious, and recovered (SEIR) epidemiologic model that has been adapted to specific features of COVID-19 and the current testing environment. The model also incorporates data on positive cases from the state of Tennessee.

Appendix Chart 1 provides a snapshot of how well "tuned" our model is to the experience of Tennessee. The chart illustrates that on any given day through April 13, our model predictions are very close to positive case totals and deaths reported to the state.

Having passed that test, we ask how can we use the model to generate information to help plan for the future? A second key principle of our modeling approach is to not assume we know the future. No one knows what Tennessee's experience with COVID-19 will be. Therefore, a model is not useful if it only assumes one path forward.

Appendix Chart 1

Calibration of the Vanderbilt model to reported cases and reported deaths by the state.



Our approach is to use the model to trace a range of possible outcomes given what we currently know. Recent experiences in other countries remind us that a second wave of infections is not only a threat, but progress can unravel quickly. A model that predicts a single "peak" and then a decline obscures that threat.

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. Statistical and epidemiological support was provided by Shawn Garbett, MS, assistant in the Department of Biostatistics and Peter Rebeiro, PhD, MHS, assistant professor of medicine and biostatistics at VUMC, and the team received input from Vanderbilt's Health Policy and Public Health Advisory Panel.