



COVID-19 in Tennessee: Vaccinations, Cases and Hospitalizations in the Delta Era

August 19, 2021

With the emergence of the Delta variant this summer, hospitalizations and serious illness associated with COVID-19 have increased in Tennessee. On July 4, 2021, there were 213 hospitalized COVID-19 patients across the entire state. **As of August 18, there were 2,497 hospitalized COVID-19 patients—a ten-fold increase in just over a month.**

The decline in COVID-19 hospitalizations in the spring was attributable, in part, to vaccination efforts targeted at the most vulnerable and elderly Tennesseans, who are at highest risk of hospitalization and death from COVID-19. Vaccination efforts began in January and were expanded to all adults as of April 5. All children aged 12 and over became eligible to receive the Pfizer/BioNTech vaccine in May. On July 4, 45% of Tennesseans aged 15 or older were fully vaccinated: since then, the percentage fully vaccinated has risen to about 50%.

In addition to immunity gained through vaccination, there have been (as of Aug. 18) 963,647 documented COVID-19 cases in Tennessee. This total constitutes approximately 14% of the state population, though the official count understates the true total number of infections since not every positive case is detected and reported to the state.

Throughout the early summer, the combination of higher vaccination rates among the most vulnerable and “natural” immunity acquired through prior infection was offered by some as evidence the state could keep infections, hospitalizations, and deaths in check. However, the emergence of the Delta variant of the COVID-19 virus, coupled with a return towards normalcy in mobility and behavior, has resulted in a surge in infections and hospitalizations. **Since mid-July, the rate of increase in COVID-19 hospitalizations has been higher than at any point in the pandemic.**



As the Delta variant became entrenched in neighboring Missouri and Arkansas, growth in hospitalizations first began in the Memphis region but has since spread to every region of the state. Hospitalizations also have been concentrated primarily among the unvaccinated.

Importantly, immunity acquired through prior infection provides some level of protection—though [emerging scientific evidence suggests](#) that unvaccinated individuals with prior COVID-19 are twice as likely to become infected by the Delta variant than those who have been vaccinated. ***(Please see the info box at right for more facts about natural immunity and vaccination.)***

In [previous reports](#), we looked at the relationships between mask requirements, hospitalizations, and deaths attributable to COVID-19. Masks continue to be important tools for mitigating COVID-19 in the face of the Delta variant and low vaccination rates. Vaccinations, however, are by far the most effective strategy for minimizing hospitalizations and serious illness. [Last week](#), we released charts demonstrating the recent rise in hospitalizations and comparing this rise to hospitalization waves that occurred earlier this year and last summer.

As Tennesseans and decision makers re-evaluate decisions and policies regarding vaccination and other virus mitigation strategies, this report aims to provide information on how rates of previous infections, community vaccination rates, and hospitalizations are distributed among different groups across the state.

Facts About Natural Immunity and Vaccination

To determine if someone has antibodies that inactivate the COVID-19 virus in their blood, a special test is performed in a laboratory in which a sample of a person's blood is combined with the virus and the amount of virus killed is measured. When such studies are done on blood samples from patients who have recovered from COVID-19, the levels of these antibodies are not as high as they are in samples from patients who were vaccinated. In fact, some infected patients make very little antibody at all. Those patients who have been infected without symptoms or with only mild symptoms will generally have low levels of antibody and may not be protected from another infection. We do know, however, that if those patients are given even just one dose of vaccine, [their bodies will make high levels of antibody that will inactivate the virus if they are exposed in the future](#). In fact, it has been [observed multiple times in several different scientific studies that](#) the antibody levels after infection plus one dose of vaccine are often higher than levels after two doses of vaccine in individuals who have not been previously infected.

What does this tell us about immunity?

1. Individuals who have tested positive for COVID-19 infection often do not make adequate levels of antibody to protect them from another bout of COVID-19 infection.
2. People who have had previous infection need at least one dose of vaccine to raise antibody to protective levels.
3. Regardless of prior infection, full vaccination with one dose of the J&J vaccine or two doses of the Pfizer or Moderna vaccines is recommended for everyone age 12 and over.
4. Recommendations for additional vaccine doses (known as boosters) are emerging now.

Our goal is to provide policymakers and Tennesseans with a clearer sense of where vaccinations and infections are concentrated, how vaccination and other virus mitigation strategies might assist hospitals facing capacity constraints, and guidance on vaccination for people who have recovered from COVID-19.

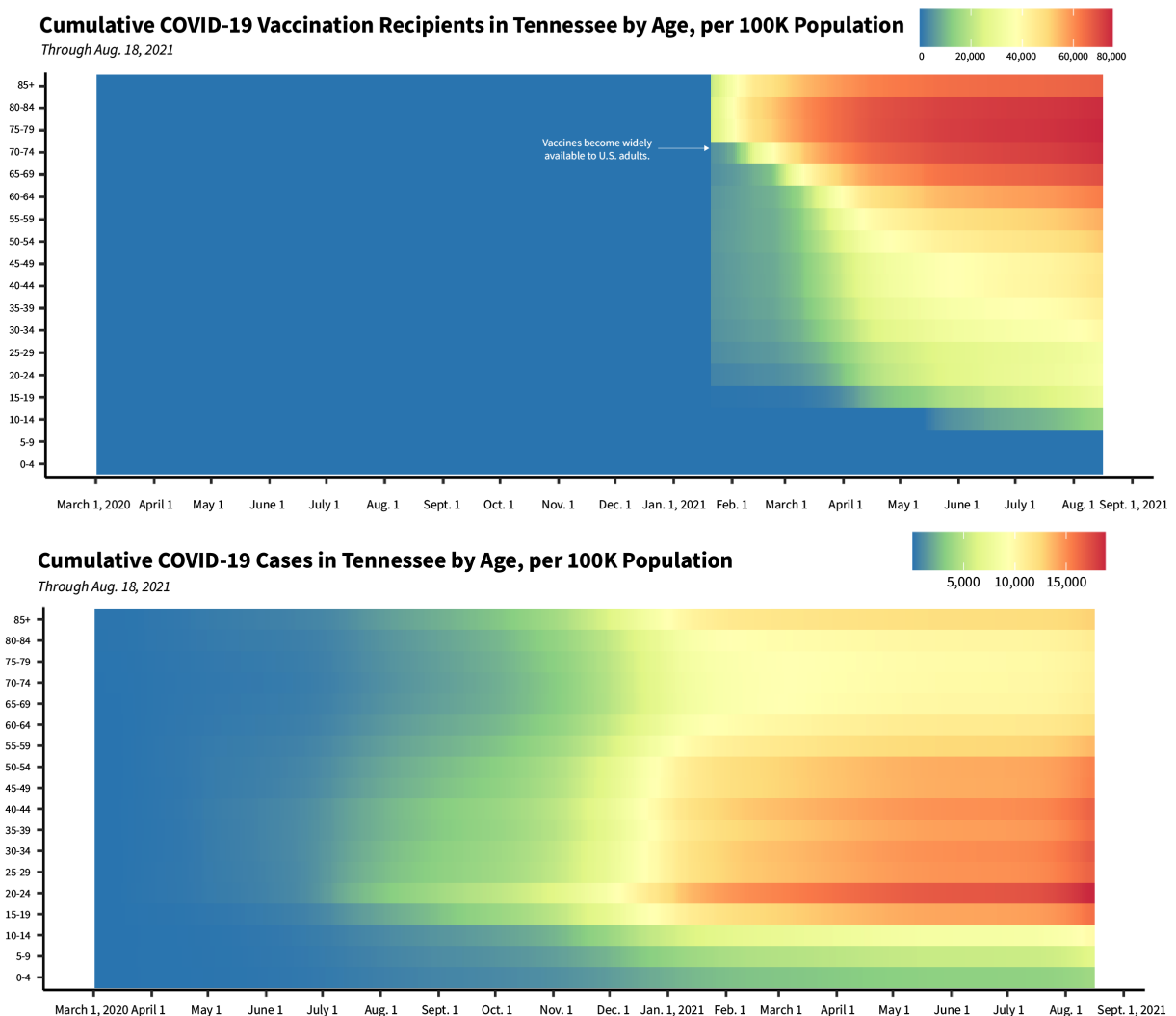
Vaccination and Infection Rates in Tennessee

Vaccination against COVID-19 provides protection at both an individual and community level. Although “breakthrough cases” do occur in vaccinated individuals, very few of these cases reach the severity seen in unvaccinated individuals. Having fewer high severity illnesses within a community can help prevent hospital capacity challenges.

The top panel of Figure 1 shows cumulative COVID-19 vaccine recipients by age, per 100,000 people. The redder or “hotter” areas show the age groups with the highest levels of protection due to receiving at least one vaccination shot against COVID-19. These data make clear that the oldest Tennesseans have considerably higher vaccination rates than younger age groups. Appendix Figure A1, shown at the end of this report, breaks down vaccination rates by region and age and shows that the Nashville, Knoxville, and Memphis regions have the highest vaccination rates in almost every age group; the Upper Cumberland region (i.e., the counties including and surrounding Cookeville) has the lowest.

Figure 1

The following charts show the cumulative reported COVID-19 cases by age group per 100,000 population and statewide vaccine recipients by age group per 100,000 population since March 1, 2020 through Aug. 18, 2021.



The bottom panel of Figure 1 shows cumulative COVID-19 cases per 100,000 people by age group since the beginning of the pandemic. This panel shows an inverse relationship between age and cumulative infections: **the highest rates of documented COVID-19 cases (per 100,000 population) are concentrated among younger age groups that are less likely to be vaccinated.** We note, however, in the info box on page 2 that current guidelines recommend vaccination of all eligible individuals regardless of prior infection status.

Recent Trends in Cases, Vaccinations and Hospitalizations

We next consider trends since July 1, 2021. Figure 2 shows a heatmap summarizing week-over-week changes in reported COVID-19 cases (per 100,000 population) by age group. Here we

see that, across many regions of the state, the largest growth in cases (adjusted for population) has been concentrated among young adults—and in particular among teenagers—many of whom returned to school beginning in late July and early August.

Figure 2

Week-over-Week Change in New Cases in Tennessee by Age and Region, per 100K Population

The following chart shows week-over-week change in new COVID-19 cases by age group per 100,000 population by hospital regions in Tennessee. The heat maps represent data reported by the state through Aug. 16, 2021.

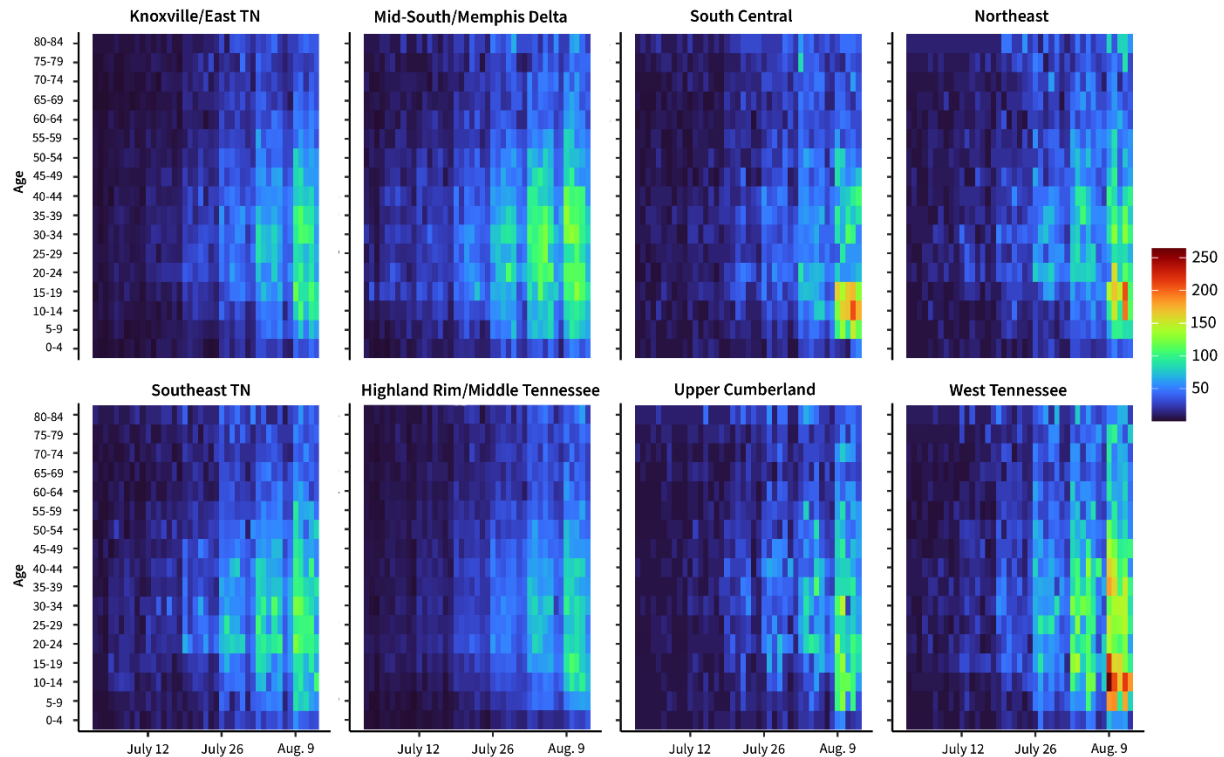
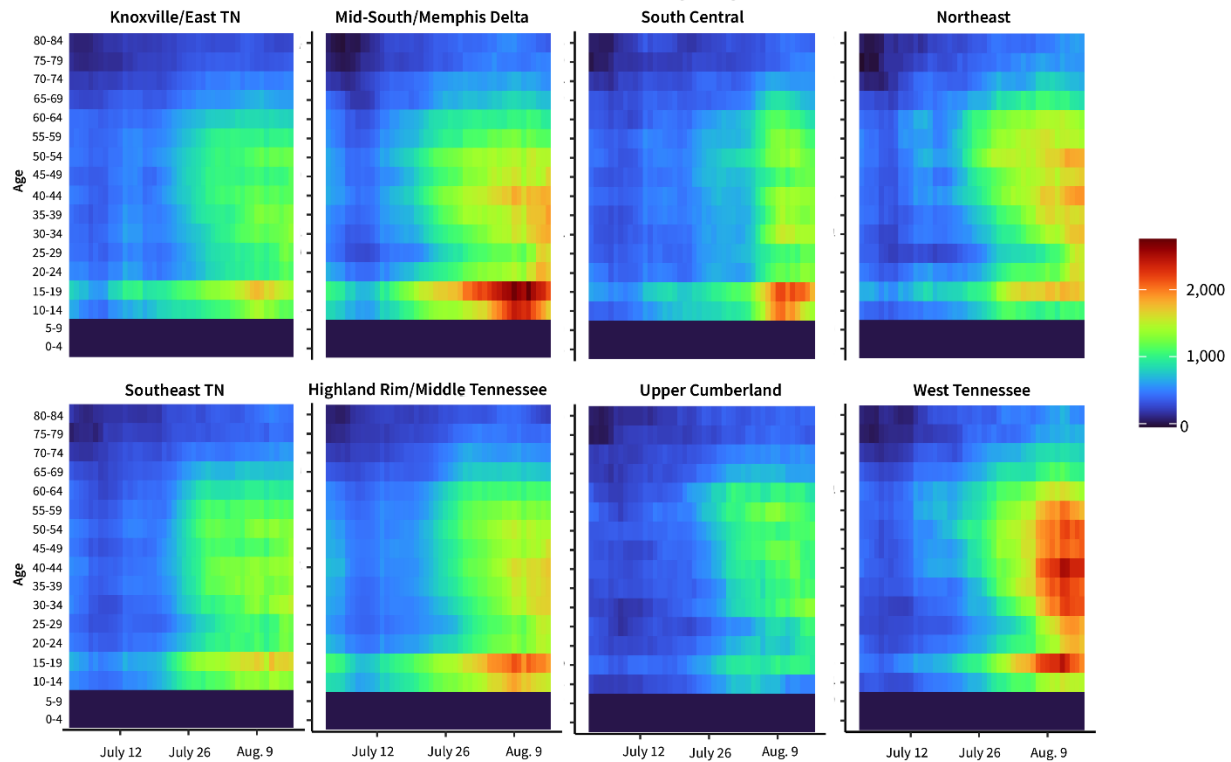


Figure 3 shows week-over-week growth in new COVID-19 vaccination recipients (per 100,000 population) by age group. There is a clear pattern here as well: since mid-July when information about the Delta variant was hitting the news, vaccination rates have grown among the groups experiencing growth in cases. In west Tennessee there has also been a marked increase in vaccination. We view this as encouraging evidence that people are responding to the threat of the Delta variant by seeking vaccinations.

Figure 3

New COVID-19 Vaccinations in Tennessee by Age and Region, per 100K Population

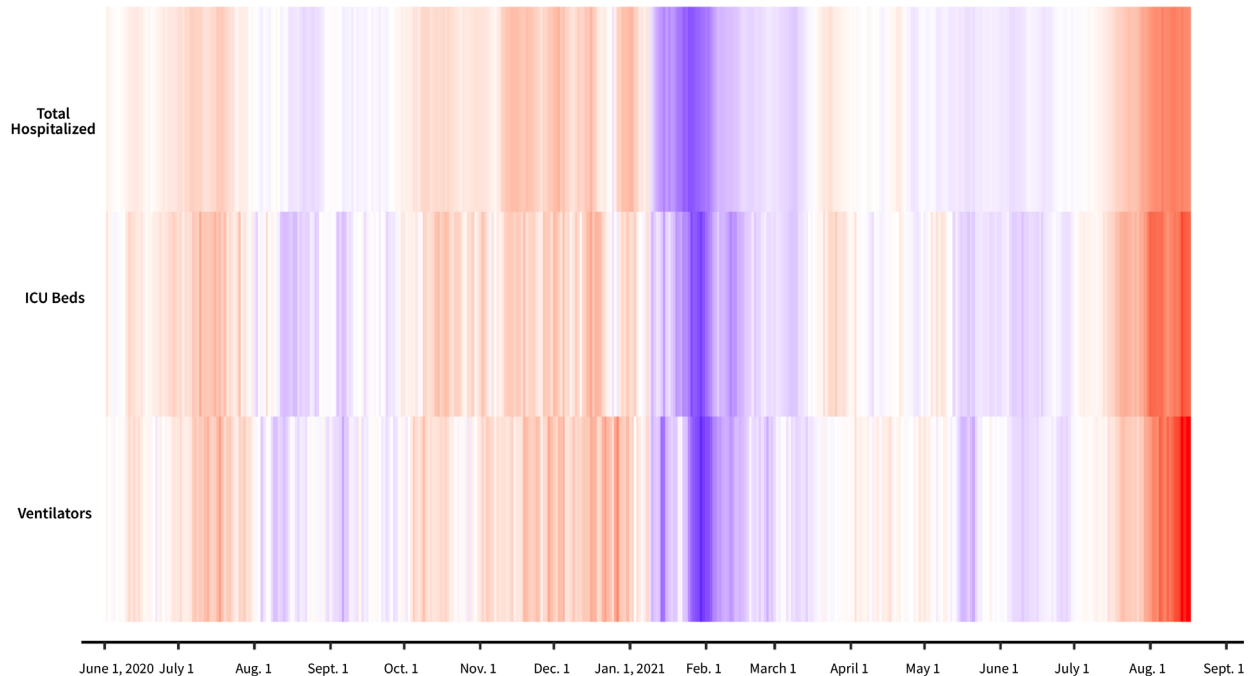
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Finally, we consider growth in hospital resource use as measured by the total number of COVID-19 patients who are hospitalized, requiring intensive care, and receiving mechanical ventilation. Figure 4 is a heatmap showing week-over-week growth in each measure during the COVID-19 pandemic: dates shaded in red indicate periods where hospitalizations were growing, while those in blue highlight periods of hospitalization declines.

Figure 4**Week-Over Week Change in Hospital Resource Usage**

The following chart shows week-over-week change in usage of hospital resource usage. Darker shades of blue represent declines in resource usage while darker shades of red show increased usage, relative to the previous week. The heat maps represent data reported to the state by hospitals from June 1, 2020 through Aug. 16, 2021.



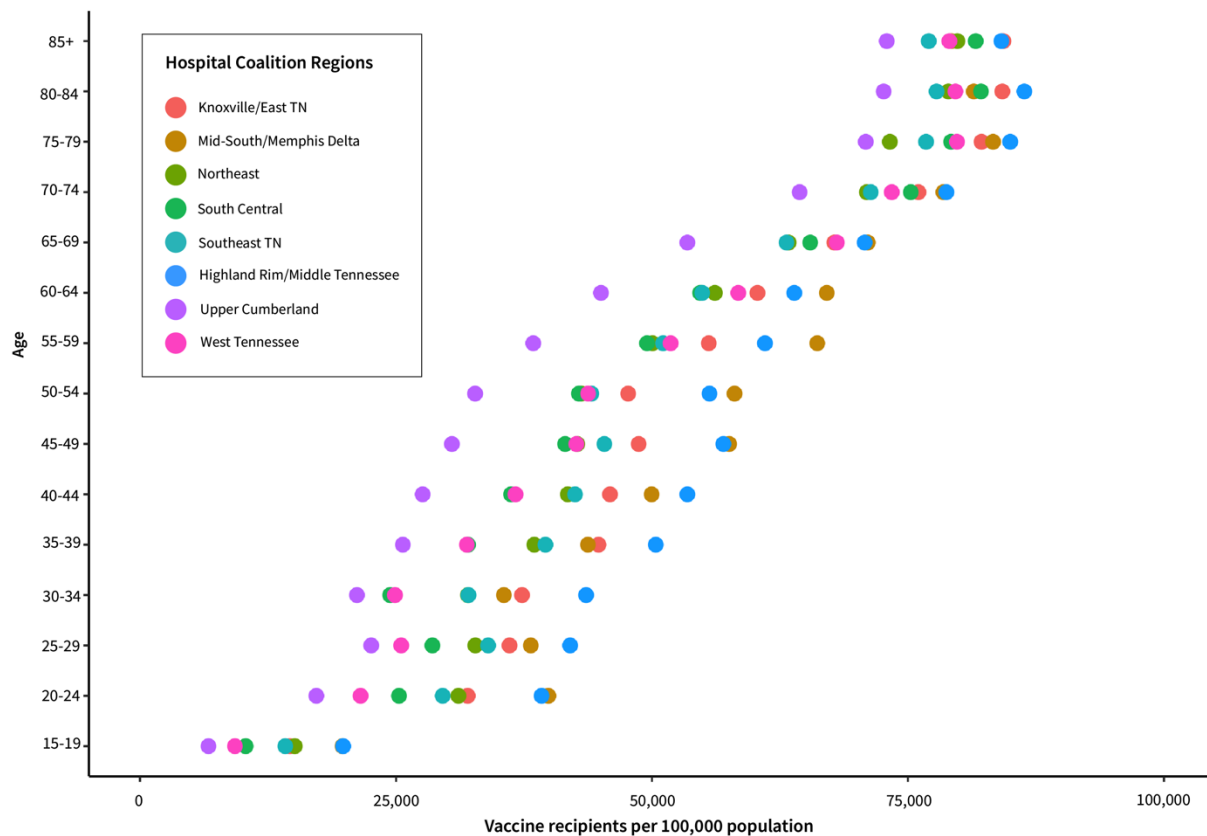
The rightmost region of Figure 4 highlights the ongoing acute hospital capacity crunch in Tennessee. It is noteworthy that this surge in hospitalizations has occurred despite much higher rates of vaccination among the elderly and vulnerable (who are at highest risk of needing hospitalization in the absence of vaccination). Critically, reports from individual hospitals are consistent with our data showing case growth concentrated primarily in younger, less-vaccinated, populations—and despite a higher cumulative case burden (as measured by total cases per 100,000) in younger adults.

Tennessee is now experiencing its highest growth in hospitalizations than at any point in the pandemic. Moreover, as of this writing intensive care resource use for COVID-19 patients is at 91% of its previous peak. These trends suggest that if recent growth continues, Tennessee may soon eclipse high-water marks in ICU and ventilation use last seen in January.

Unlike early January 2021, safe and effective vaccines against COVID-19 are now widely available to the public that could stem the spread of the virus and the surge in hospitalizations that is now threatening the health of all Tennesseans due to staffing shortages, hospital diversions, and stretched resources. Especially when cast against a background of considerably higher vaccination rates among the oldest Tennesseans, the recent surge in hospitalizations underscores that severe COVID-19 can and does afflict anyone, including adults who may feel they are young and healthy enough to forego vaccination. We hope this information will serve to inform public health promotion efforts across the state.

**Appendix Figure A1****COVID-19 Vaccinations in Tennessee by Age and Region, per 100K Population**

The following chart shows the cumulative COVID-19 vaccinations by age group per 100,000 population by hospital regions in Tennessee.



This report was prepared by John Graves, PhD, associate professor of Health Policy and director of the Center for Health Economic Modeling, Melinda Buntin, PhD, Mike Curb Professor of Health Policy and Chair, Department of Health Policy, Khrysta Baig, MSPH, doctoral student in Health Policy, and Kathy Edwards, MD, professor of pediatrics in the division of infectious diseases at Vanderbilt University School of Medicine. Editorial support provided by Jake Lowary.