

Disparities in Minnesota's COVID-19 Vaccination Rates



In a Race to Protect People from the Coronavirus, Data from Minnesota Electronic Health Record Consortium Show that Some Communities were Left Under-vaccinated Longer than Others

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Data provided by the Minnesota Electronic Health Record Consortium

This issue brief focuses on a project led by the Minnesota Electronic Health Record Consortium to examine disparities in COVID-19 vaccination in Minnesota. We present data on disparities from the end of 2022 to illustrate the recent landscape. However, we focus particularly on the length of time it took for population subgroups to reach a threshold of 50 percent (i.e., “most” of each subgroup) being “fully vaccinated.” That simple metric illustrates a critical way that inequities in health care in Minnesota manifested during the pandemic: Inequitable administration of vaccines left some marginalized groups vulnerable to COVID-19 for a longer period of time, likely contributing to a preventable disproportionate burden of severe disease and deaths.

Introduction

The breathtaking speed with which medical science produced vaccines against COVID-19 is widely considered a technological triumph. Researchers quickly sequenced and published the SARS-CoV-2 virus's genome, then deployed leading-edge technologies and tested their innovations with accelerated clinical trials. Within roughly 12 months of the first documented cases of the novel virus, the U.S. Food and Drug Administration (FDA) granted emergency use authorization to not only one but multiple vaccines. To do any good, though, those vaccines needed to find their way into people—a challenge that has proved daunting.

Infectious diseases have haunted humanity for millennia, and they will continue posing a serious threat for the foreseeable future. Scientific discoveries and medical breakthroughs have given us tools to fight back against pathogens, but stumbles in U.S. vaccination efforts have illustrated how technical ingenuity alone cannot protect us. We need to learn from the shortcomings in our COVID-19 vaccination campaigns to avoid repeating the same mistakes during our next public health crisis. A novel distributed data model, the Minnesota Electronic Health Record Consortium (the Consortium), was developed by Minnesota health systems and produced statewide data to examine the progress of COVID-19 vaccination.

Background

After emerging in late 2019, the SARS-CoV-2 novel coronavirus quickly spread across the globe. Since then, there have been hundreds of millions of confirmed infections and millions of reported deaths, surely an underestimate of the true toll.¹ In the U.S. alone, more than a million people have died of COVID-19—the highest count in the world.²

However, the harm has been distributed unevenly. For instance, elderly adults (age 65 or older) have much higher death rates than younger adults and children.³ Another realm of COVID-19 health disparities can be found by race and ethnicity. In the U.S., American Indian and Alaska Native people, Black people, and Latino people were more likely to be infected, be hospitalized, or die of COVID-19 during the pandemic.⁴ But a virus does not harbor prejudices. The disparities we see in COVID-19's impact are largely the result of social inequities that left some people more vulnerable—injustices perpetuated by social systems that humans created and that only humans can fix.

“ A virus does not harbor prejudices. The disparities we see in COVID-19's impact are largely the result of social inequities that left some people more vulnerable. ”

Using almost a year of experience with the pandemic and data showing which segments of the population were at greatest risk from the virus, Minnesota and other states developed plans for how to prioritize people for vaccinations and how to reach those people and administer shots.⁵ In the initial weeks after the first vaccines were authorized by the FDA, supply was in precious short supply, so beginning January 4, 2021, Minnesota first focused on relatively small groups with unique situations. First, the state prioritized health care workers, who faced regular occupational exposure to the virus and who were desperately needed to treat other people with COVID-19 and myriad other health conditions. At the same time, it also first prioritized residents of long-term

care facilities (i.e., nursing homes), which typically housed people who were at especially high risk of death and severe disease due to age and health conditions, and whose living conditions enabled uncontrollable spread of the virus from person to person.

The state then proceeded to prioritize different groups to be eligible for a COVID-19 vaccine according to both their risk of exposure and their risk of disease and death from COVID-19. Vaccines became available to more people and to people at decreasing risk for serious illness as vaccine supply grew. After focusing on health care workers and people in nursing homes, the state moved on to (in sequential order):



After those initially prioritized groups, Minnesota opened COVID-19 vaccines to the general public on March 30, 2021.ⁱ At that point, anyone age 16 or older was eligible to be vaccinated against COVID-19 in the state of Minnesota, although barriers remained. For instance, people needed to know that COVID-19 vaccines were available and that they were eligible—and they needed to be willing to be vaccinated, which has remained a persistent challenge during the pandemic. For example, one survey of U.S. adults from March 2021 found that roughly one-third of respondents voiced hesitance or refusal to be vaccinated.⁶

If someone was determined to get vaccinated, there were still other hurdles that placed the affluent at an advantage. Because vaccines in the early days of availability to the general public were still in relative short supply, it could be hard to find an appointment and might require access to the internet to find an appointment. A person without internet access might need to use a phone to call place after place. If a person found a vaccine site with availability, it might come in the middle of the day, perhaps necessitating time off work. Vaccine scarcity also advantaged people with access to a car, widening their geographic options for a vaccination site beyond those of people limited to walking or public transit.

Acknowledging the potential for social inequities to influence vaccination, the Minnesota Department of Health asserted equity as a critical component of its vaccination strategy. For instance, the state employed a “social vulnerability index” to help determine its allocation of vaccine to communities particularly vulnerable to the virus, considering factors such as poverty rates, crowded housing, and limited transportation access.⁷ The recognition of social risk factors’ role in moderating people’s access to COVID-19 raises questions about how well Minnesota performed in vaccinating different segments of the state’s population.

Data and analytic approach

For this report, we measure COVID-19 vaccination rates in Minnesota, including how they developed over time, to assess whether and how disparities developed. To do that, we use data from the Minnesota Electronic Health Record Consortium, a group of 11 large health care provider organizations in the state.⁸ The group also includes the Minnesota Department of Health (MDH) and organizations dedicated to measuring and improving health care quality in the Minnesota.

This unique partnership was developed in 2020 to improve pandemic surveillance and shares summary information from member organizations’ electronic health records (EHRs), as well as certain data from MDH. The Consortium uses a distributed data model, which allows member organizations to retain their own EHR data rather than combining it in a single data repository. By linking data to records from MDH’s electronic system that tracks vaccines delivered in the state (called the Minnesota Immunization Information Connection [MIIC]), the Consortium developed a dataset that covers nearly all people who have received a COVID-19 vaccine in the state.ⁱⁱ And because that combined dataset includes details such as people’s self-reported race and ethnicity, as well as when they received COVID-19 vaccine doses, we were able to estimate vaccination rates for different demographic groups and how they changed over time.

ⁱ While the Moderna and Janssen (Johnson & Johnson) vaccines were initially authorized for adults age 18 or older, the Pfizer-BioNTech vaccine was initially authorized for people age 16 and older.

ⁱⁱ To calculate COVID-19 vaccination rates by demographics, our analysis uses COVID-19 vaccination data from the Consortium as the numerators and population data from the U.S. Census Bureau’s American Community Survey as our denominators.

Our analysis used two approaches: First, we present the rates of people who were “fully vaccinated” by the end of 2022, approximately two years after the first COVID-19 vaccines became available. By fully vaccinated, we mean that a person received a complete series of COVID-19 vaccine doses as originally authorized by the FDA: For adults, that is a two-dose regimen of Moderna or Pfizer-BioNTech vaccines or single-dose Janssen (i.e., Johnson & Johnson) vaccine.^{iii,iv} Second, we present data on the length of time it took to reach a threshold of 50 percent of people being fully vaccinated across demographic groups, described in weeks since FDA authorization of the first vaccine (presented visually in months for charts). We chose that 50 percent threshold to represent the point at which a small majority of people in each demographic group were vaccinated.

Age

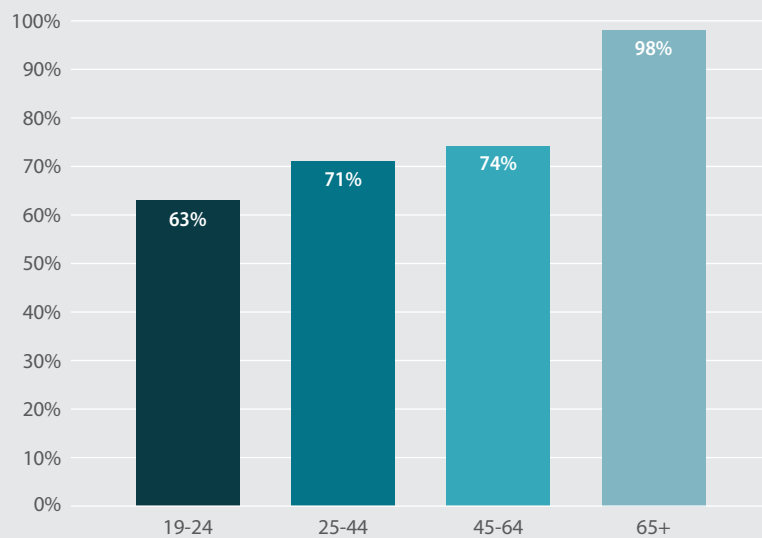
This report begins with vaccination disparities by age categories because, to some extent, disparities in the time it took to vaccinate different age groups occurred by design. In the early days of COVID-19 vaccine availability, U.S. and state public health officials prioritized certain populations at high-risk for exposure to or serious illness from the virus, including health care workers, elderly adults, and people with certain chronic conditions such as diabetes—a group that tends to skew older.

At the end of 2022, there was a wide range of vaccination rates among adults by age group. At 98 percent, elderly adults (age 65 and older) had the highest rate of people fully vaccinated, while young adults age 19-24 had the lowest rate of full vaccination, at 63 percent (Figure 1). Adults age 25-44 and 45-64 had similar rates between those groups, at 71 percent and 74 percent, respectively.

The time it took for Minnesota to fully vaccinate 50 percent of people in those subgroups with an initial vaccine series also varied substantially. Elderly adults reached a threshold of 50 percent fully vaccinated in March 2021, taking only 14 weeks after the FDA authorized the first COVID-19 vaccine (Figure 2). Adults age 25-44 and 45-64 both reached a threshold of 50 percent fully vaccinated in May 2021, taking only 24 weeks and 21 weeks, respectively. For young adults age 19-24, the 50 percent threshold wasn't achieved until August 2021, 37 weeks after the first vaccine received authorization.

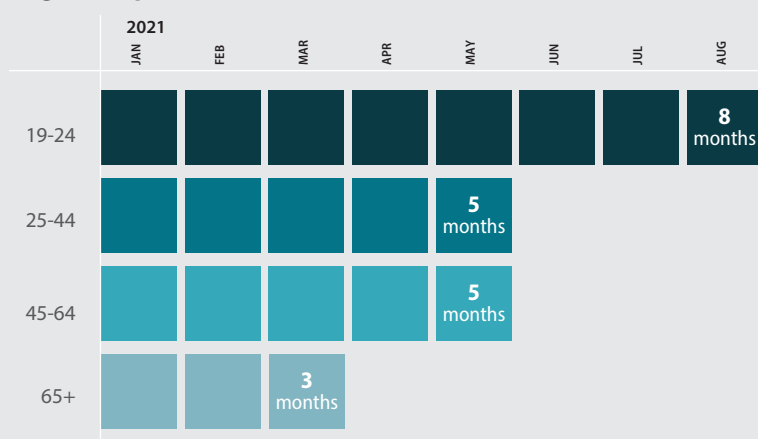
As noted earlier, these disparities in the time it took to vaccinate 50 percent of differing age groups against COVID-19 occurred partly by design. Policymakers prioritized the vaccination of older people because they had substantially higher risk of severe disease and death. But these data also indicate that isn't the whole story.

Figure 1: Minnesota COVID-19 Vaccination Rates by Age, Final Week of 2022



Source: SHADAC analysis of Minnesota EHR Consortium data.

Figure 2: Months to Reach 50% COVID-19 Vaccination Rates by Age Groups, Minnesota



Source: SHADAC analysis of Minnesota EHR Consortium data.

ⁱⁱⁱ Although booster doses have since been developed and are recommended for most adults, we do not include them in our definition of fully vaccinated. At the end of 2022, just over 40 percent of the Minnesota population had received a booster vaccination, compared to almost 70 percent who met our definition of fully vaccinated.

^{iv} While children are not a core focus of this analysis, we do report some limited data on COVID-19 vaccination rates. For that section on children, fully vaccinated is defined as receiving a complete series of vaccine doses as originally authorized by the FDA: For the Moderna vaccine, that is two doses for children 6 months to 17 years of age; for Pfizer-BioNTech, that is two doses for children age 5 to 17 or three doses for children age 6 months to 4 years. As with adults, recommended booster doses are not included in our definition of fully vaccinated.

For instance, most people age 19-24 and 25-44 became eligible to receive COVID-19 vaccines at the same time, as part of the general population after priority groups such as health care workers and elderly people had a chance to be vaccinated. But it took 13 more weeks to vaccinate 50 percent of people age 19-24 than people age 25-44. And by the close of 2022, people age 25-44 still had a higher vaccination rate than people age 19-24.

Race and ethnicity

By the end of 2022, all racial and ethnic sub-groups in Minnesota had exceeded a 50 percent fully vaccinated threshold. They ranged from a high of 80 percent for Asian and Native Hawaiian or Pacific Islander people to a low of 53 percent for American Indian and Alaska Native people (Figure 3). Other groups had relatively similar rates—61 percent for Latino people, 61 percent for Black people, and 65 percent for White people. Those disparities offer one indication that the state's COVID-19 vaccination campaign entailed inequities, but examining the time it took to reach a 50 percent threshold across those groups illustrates more disparities.

In June 2021, Minnesota's Asian and Native Hawaiian or Pacific Islander population became the first sub-group to reach a threshold of 50 percent fully vaccinated, 25 weeks after vaccines were first authorized (Figure 4). One week later, White people became the next to reach a 50 percent fully vaccinated threshold, at 26 weeks after authorization (also June 2021).

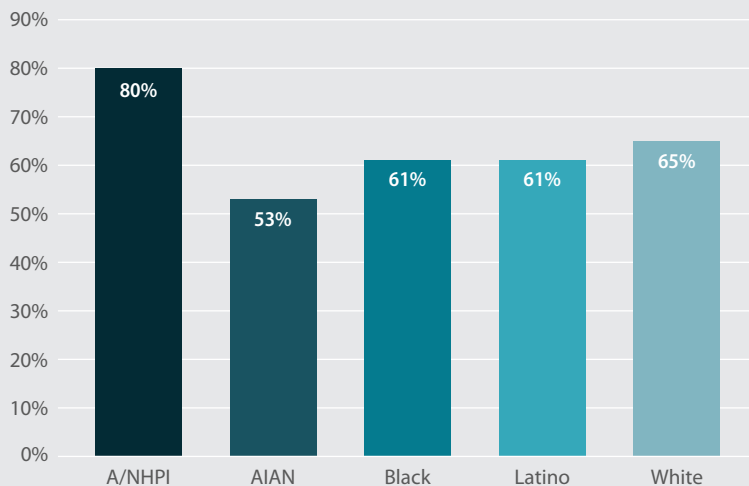
There was a stark disparity for Latino and Black populations, however. It took Minnesota roughly twice as long to vaccinate 50 percent of those populations. The state's Latino population reached a 50 percent vaccination threshold 51 weeks after authorization, and the state's Black population reached that threshold 53 weeks after authorization—both in December 2021, approximately a full year after vaccines became available.

The disparity was largest for Minnesota's American Indian and Alaska Native population. The state didn't achieve a 50 percent fully vaccinated threshold for American Indian and Alaska Native people until March 2022—66 weeks after vaccines were first authorized, or well over a year.

Race and ethnicity by age

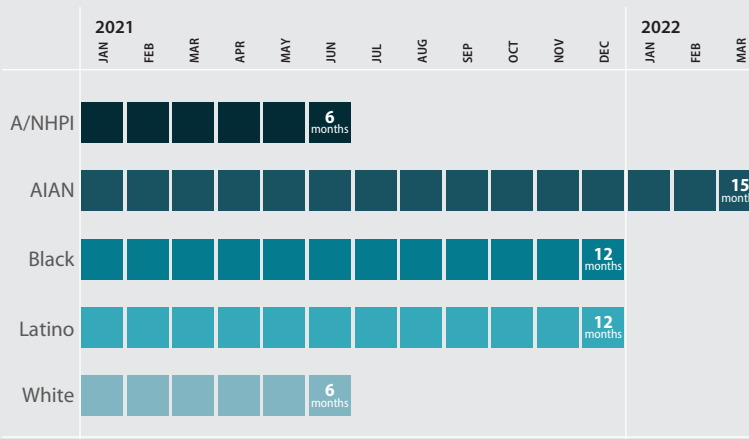
In Minnesota, racial and ethnic populations have different age profiles, with the state's White population in particular skewing older. The U.S. Census Bureau estimates that about 20 percent of the state's White population is age 65 or older, while less than 10 percent of other racial and ethnic groups are age 65 or older. For that reason, we also stratified COVID-19 vaccination rates by age category across racial and ethnic groups. By doing that, we can begin to untangle whether COVID-19 vaccination disparities are driven by differences in age demographics—considering the policy decision to prioritize older people—or if other factors also contributed.

Figure 3: Minnesota COVID-19 Vaccination Rates by Race and Ethnicity, Final Week of 2022



Source: SHADAC analysis of Minnesota EHR Consortium data. A/NHPI: Asian and Native Hawaiian or Pacific Islander. AIAN: American Indian or Alaska Native.

Figure 4: Months to Reach 50% COVID-19 Vaccination Rates by Race and Ethnicity Groups, Minnesota



Source: SHADAC analysis of Minnesota EHR Consortium data. A/NHPI: Asian and Native Hawaiian or Pacific Islander. AIAN: American Indian or Alaska Native.

For Minnesota's population age 65 and older, there were relatively limited disparities across racial and ethnic groups. At the end of 2022, elderly Asian and Native Hawaiian or Pacific Islander people, Black people, Latino people, and White people each had fully vaccinated rates over 90 percent. Only American Indian and Alaska Native people had a vaccination rate below that, at 80 percent (Figure 5).^v There were similarly minimal disparities in the time it took to vaccinate different racial and ethnic sub-groups. Elderly American Indian and Alaska Native people experienced the shortest time to a 50 percent fully vaccinated threshold (13 weeks), while elderly Black and Latino people experienced the longest time, at 16 weeks—only a three week difference (Figure 6).

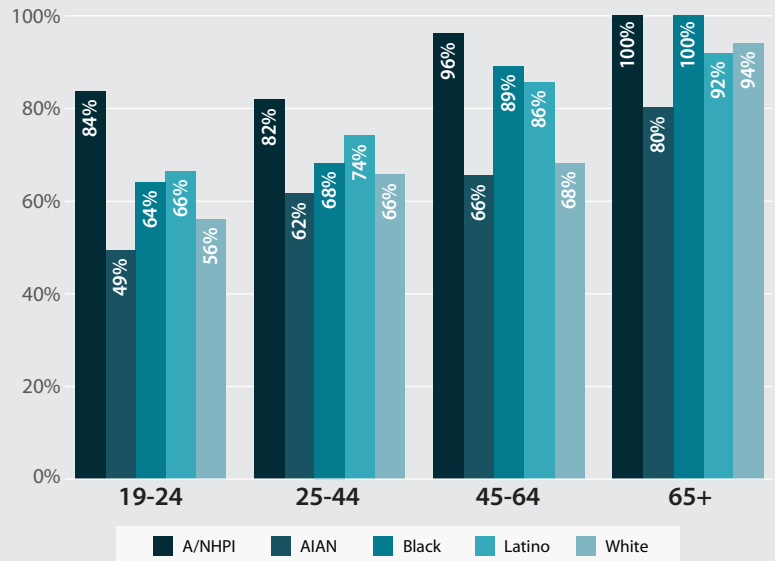
On the other end of the age spectrum, there were wide disparities among people 19-24 years old. At the end of 2022, Asian and Native Hawaiian or Pacific Islander young adults had the highest fully vaccinated rate, at 84 percent, while American Indian and Alaska Native young adults had the lowest rate, at 49 percent. Notably, American Indian and Alaska Native young adults were the only group of adults in our analysis that hadn't reached a threshold of 50 percent fully vaccinated by 2022.

There also were large disparities by race and ethnicity in the amount of time it took for Minnesota to fully vaccinate young adults. Asian and Native Hawaiian or Pacific Islander young adults were the first to reach the 50 percent vaccination threshold, 24 weeks after the first vaccine was authorized. Latino young adults reached the 50 percent threshold after 39 weeks, White young adults reached the threshold after 44 weeks, and Black young adults reached it after 48 weeks. Meanwhile, at the end of 2022—roughly two years after the first COVID-19 vaccine was authorized—Minnesota had not yet reached 50 percent of American Indian and Alaska Native young adults being fully vaccinated.

These results suggest three points: First, Minnesota performed relatively well at vaccinating middle-age and elderly people against COVID-19 quickly and with limited disparities by race and ethnicity. Second, Minnesota did not perform as well in avoiding disparities for younger groups of adults.

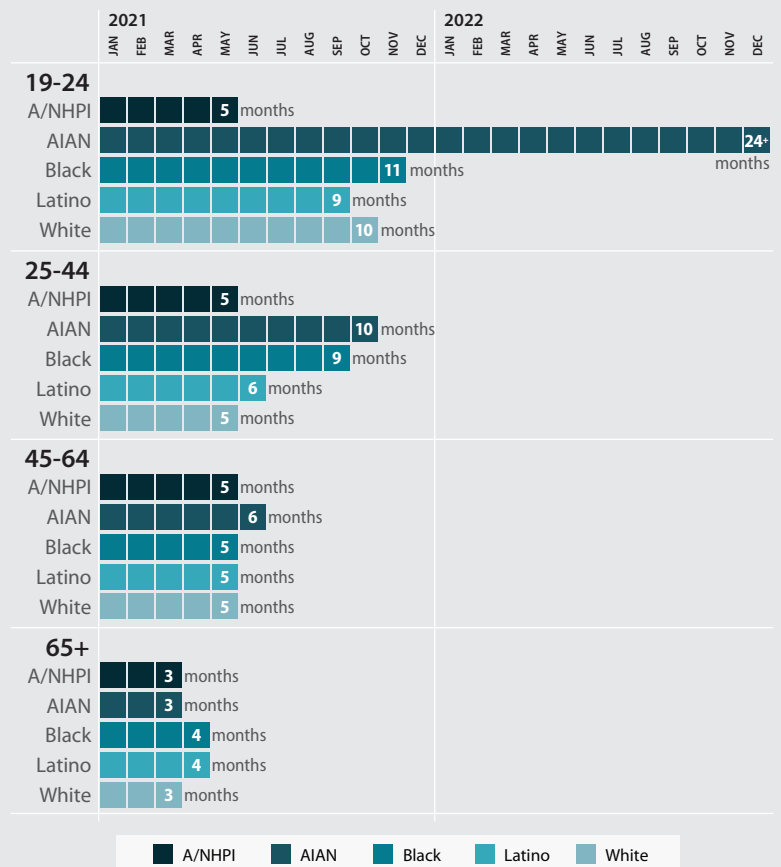
^v Our analysis produced vaccination rate estimates of slightly more than 100 percent for elderly Asian and Native Hawaiian or Pacific Islander people and Black people, but we truncate them as 100 percent in the chart for ease of interpretation.

Figure 5: Minnesota COVID-19 Vaccination Rates by Age Category and Race and Ethnicity, Final Week of 2022



Source: SHADAC analysis of Minnesota EHR Consortium data. A/NHPI: Asian and Native Hawaiian or Pacific Islander. AIAN: American Indian or Alaska Native.

Figure 6: Months to Reach 50% COVID-19 Vaccination Rates by Age Category and Race and Ethnicity Groups, Minnesota



Source: SHADAC analysis of Minnesota EHR Consortium data. A/NHPI: Asian and Native Hawaiian or Pacific Islander. AIAN: American Indian or Alaska Native.

Disparities were especially wide for young adults, age 19-24. Finally, together these results suggest the policy decision to prioritize elderly adults for COVID-19 vaccination gave the state's White population a head start in the vaccination race, but that wasn't the only factor in driving disparities. There were wide disparities in vaccination rates by race and ethnicity even when comparing within the same age categories.

Gender

The Centers for Disease Control and Prevention (CDC) has reported persistent COVID-19 vaccination disparities by gender at the national level since the early days of availability, and our study shows a similar pattern and trend for Minnesota.⁹ At the end of 2022, Minnesota females had a vaccination rate of 71 percent, higher than the rate of 64 percent for males (Figure 7). Additionally, while 50 percent of Minnesota females were vaccinated by July 2021, males didn't reach that threshold until October 2021—10 weeks later (24 weeks after the first vaccine was authorized versus 34 weeks, respectively) (Figure 8).

Urban/rural geography

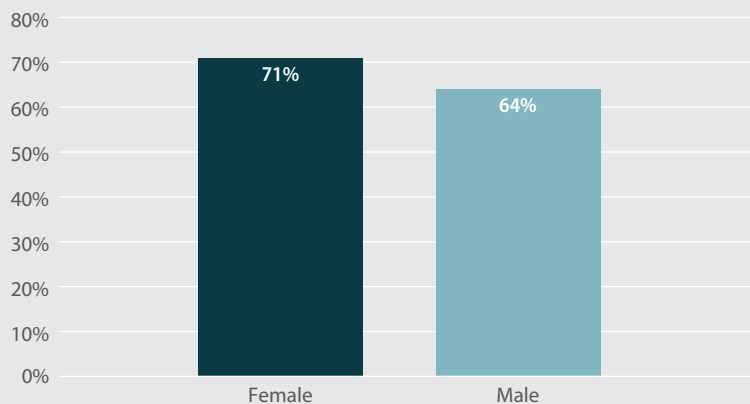
To understand how vaccination rates differed across communities, we classified the places in which people lived into four categories. Using people's ZIP Codes, we grouped individuals by community type and estimated vaccination rates for those categories of communities.^{vi} Defined by community population and commuting patterns, the categories we used are:

- **Urban or suburban:** core cities and their surrounding communities, such as Minneapolis and Bloomington in the Twin Cities metro area, and cities such as Duluth, Moorhead, and Rochester in Greater Minnesota
- **Exurban:** less-densely populated communities on the outskirts of metropolitan areas, such as Waverly and Oak Grove
- **Small town:** urbanized communities, located apart from larger metropolitan areas, that are smaller and generally less-densely populated than cities, such as Northfield and Crookston
- **Rural:** least densely populated and centralized communities, such as Big Stone County and Cook County

At the end of 2022, three of the four community types we examined had COVID-19 vaccination rates slightly over 50 percent (Figure 9). In rural communities, 53 percent of the population was fully vaccinated against COVID-19. In exurban communities, 55 percent of the population was fully vaccinated, and in small town

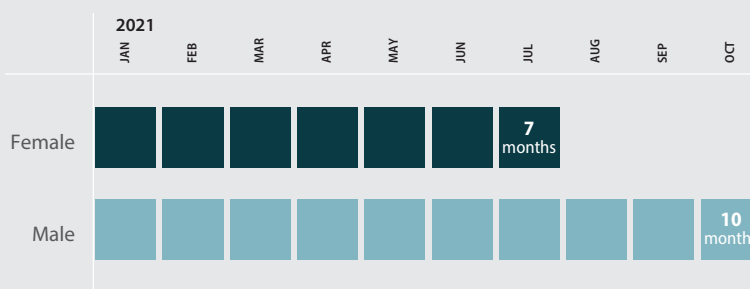
^{vi} The map in Appendix A shows how these community types are distributed across the state.

Figure 7: Minnesota COVID-19 Vaccination Rates by Gender, Final Week of 2022



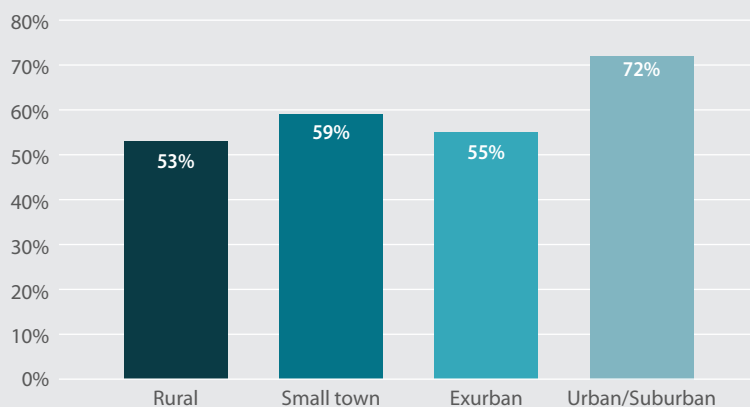
Source: SHADAC analysis of Minnesota EHR Consortium data.

Figure 8: Months to Reach 50% COVID-19 Vaccination Rates by Gender, Minnesota



Source: SHADAC analysis of Minnesota EHR Consortium data.

Figure 9: Minnesota COVID-19 Vaccination Rates by Urbanization, Final Week of 2022



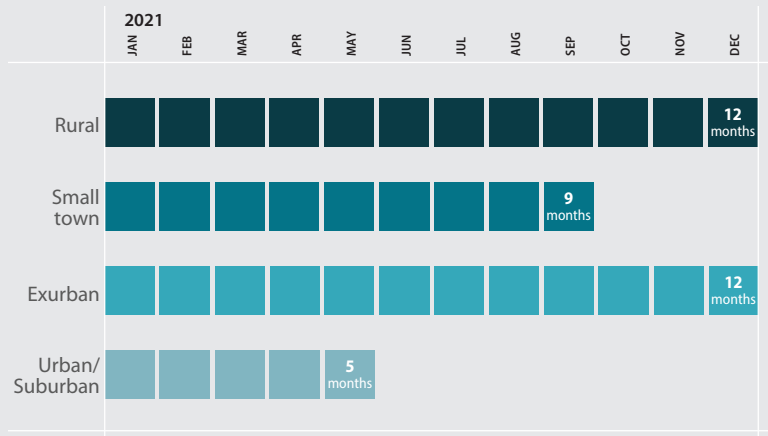
Source: SHADAC analysis of Minnesota EHR Consortium data.

communities, 59 percent of the population was fully vaccinated. The vaccination rate was higher in urban and suburban communities, where 72 percent of the population was fully vaccinated against COVID-19.

The patterns were similar in the time it took to reach a 50 percent vaccination threshold for those communities. Urban and suburban communities were the first to reach a 50 percent vaccination threshold, just 24 weeks after vaccines were first authorized, in May 2021 (Figure 10). In September 2021, people in smaller towns were the next type of community to reach a 50 percent threshold, at 39 weeks after vaccines were authorized.

People in exurban and rural communities didn't reach a 50 percent threshold until December 2021, approximately a year after COVID-19 vaccines were first authorized. For people in exurban communities, it took 51 weeks after vaccines were first authorized to reach a 50 percent vaccination threshold, and it took 55 weeks for people in rural communities.

Figure 10: Months to Reach 50% COVID-19 Vaccination Rates by Urbanization, Minnesota



Source: SHADAC analysis of Minnesota EHR Consortium data.

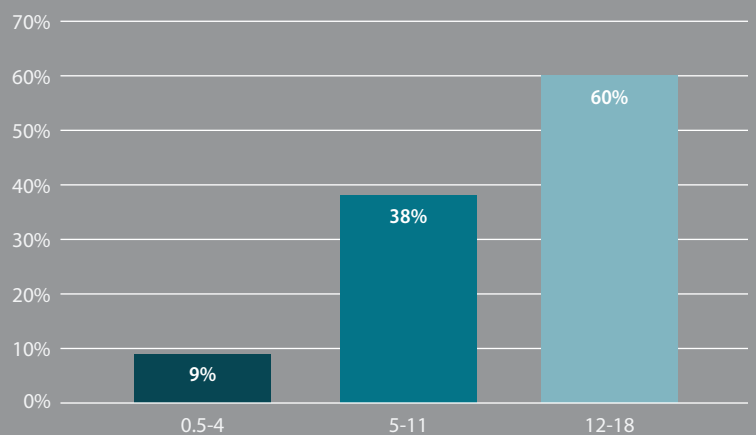
Child vaccination rates

Despite now having FDA-authorized vaccines for all children age 6 months and older, COVID-19 vaccination rates remain lower for children than for adults—particularly among younger kids.

In Minnesota, adolescents age 12-18 had the highest vaccination rate among children, at 60 percent by the end of 2022, roughly the same as young adults (Figure 11). Adolescents have been eligible for FDA-authorized vaccines longer than younger children, with kids age 16 and older eligible for the first dose since December 2020 and kids age 12-15 eligible since May 2021.

Less than half (38 percent) of younger school-age children, age 5-11, were vaccinated against COVID-19 by the end of 2022, despite having been eligible for vaccination for over a year, since October 2021. Only 9 percent of children 6 months to 4 years old were vaccinated by the end of 2022, despite having been eligible for roughly 6 months, since June 2022.

Figure 11: Minnesota COVID-19 Vaccination Rates for Children by Age, Final Week of 2022



Source: SHADAC analysis of Minnesota EHR Consortium data.

Conclusion and discussion

Research has shown that COVID-19 vaccines greatly reduce the risk of people developing serious illness or dying from the SARS-CoV-2 virus, reinforcing the importance of immunizing the population as rapidly as possible. The longer it takes to vaccinate people against COVID-19, the more people will fall seriously ill or die from the virus. For that reason, unnecessary delays in vaccinating people can be a matter of life or death—and disparities in the time it takes to vaccinate groups against COVID-19 are likely to result in disproportionate burdens of severe disease and deaths.

Our analysis using data from the Minnesota Electronic Health Record Consortium found clear disparities in the length of time it took for Minnesota to reach different demographic groups, some of which are unsurprising because they occurred by design. For instance, national and state public health officials prioritized vaccination of elderly adults because data found them to have much higher rates of severe illness and death from COVID-19 than younger adults and children. As a result, Minnesota's elderly population was vaccinated more quickly than younger people.

However, decisions such as those can have unintended consequences. Because Minnesota's White population skews older and is more likely than other racial and ethnic groups to be age 65 or older, the decision to prioritize elderly people effectively advantaged the state's White population over other groups. Our analysis largely bears out that point, since the state vaccinated 50 percent of its White population much more quickly than its American Indian and Alaska Native, Black, and Latino populations.

Our study also highlighted other disparities that may have resulted as the result of intentionally prioritizing people most vulnerable to the virus. For instance, research has shown that American Indian and Alaska Native people, Black people, and Latino people experienced higher risks for infection, hospitalization, and death.¹⁰ But in stratifying data by age groups, we found clear disparities among younger adults. For adults younger than 45, Minnesota took notably longer to reach 50 percent of American Indian and Alaska Native, Black, and Latino people than White people. Vaccine hesitancy among those undervaccinated groups does not appear to fully explain these findings, as vaccination rates for Black and Latino adults were no lower than for White peers by the end of 2022.

“Health inequities in the U.S. are longstanding and pervasive, and the pandemic brought those issues to prominence.”

The patterns were somewhat different for Minnesota's American Indian and Alaska Native population. As with younger Black and Latino adults, Minnesota failed to keep pace in vaccinating American Indian and Alaska Native adults under age 45, compared to White peers. But unlike with younger Black and Latino adults, the state never made up that lost ground. Ultimately, Minnesota has continued to under-perform in vaccinating American Indian and Alaska Native people, which barely exceeded a threshold of 50 percent fully vaccinated at the end of 2022.

There were other disparities in Minnesota COVID-19 vaccination rates, such as by gender and community type, but the low rates for children were stark. By the end of 2022, almost 70 percent of Minnesotans were fully vaccinated against COVID-19, but the rate was less than 40 percent for children age 5 to 11 and less than 10 percent for children age 6 months to 4 years. The disparities for children may be partly driven by misconceptions that COVID-19 is not a health risk for children, an idea with roots in the fact that children have substantially lower death rates from the virus than adults. However, recent research has found COVID-19 to be a “top 10” cause of death for U.S. children during the pandemic, as well as common cause of hospitalization and severe disease among children.¹¹

The rapid development of lifesaving COVID-19 vaccines serves as a testament to the marvel of modern medical science, but disparities in the distribution of those vaccines highlights shortcomings, as well as longstanding and pervasive inequities, in the U.S. health care and public health systems.

In the pursuit of health equity, it is important to identify and understand the disparities that resulted from Minnesota's COVID-19 vaccination efforts. Tracking vaccination rates across sub-populations is one important gauge of our response to public health crises, but monitoring metrics of “time to vaccine” across different groups as this report does is also a crucial tool to catch and intervene in health inequities. In future public health emergencies, policymakers should consider monitoring such metrics to make midstream course corrections.

The lessons we glean may be used to improve our response to future health crises—a regrettable but predictable inevitability, as human history has been repeatedly punctuated by epidemics and pandemics—and to ensure that future public health responses don't continue to marginalize vulnerable segments of the population and leave their health at risk.

About the Minnesota Electronic Health Record Consortium

The Minnesota Electronic Health Record Consortium is a group of researchers, clinicians, and analysts from health systems across the state of Minnesota (principal investigators, or “project leaders,” of each organization listed in parentheses):

- Allina Health (Victor Melendez)
- CentraCare (Lynn McFarling)
- Children's Minnesota (Anupam Kharbanda)
- Essentia Health (Steve Waring)
- HealthPartners (Karen Margolis)
- Hennepin Healthcare (Tyler Winkelman)
- M Health Fairview/ University of Minnesota (Paul Drawz)
- Mayo Clinic & Mayo Clinic Health System (Alanna Chamberlain)
- Minneapolis VA (Steve Fu)
- Minnesota Community Measurement (Julie Sonier)
- Minnesota Department of Health (Karen Soderberg & Miriam Muscoplat)
- Minnesota EHR Consortium consultant (Claire Neely)
- North Memorial Health (Chuck Anderson)
- Sanford Health (Roxanna Lupu)

Since May 2020, the Consortium has produced reports using electronic health record (EHR) data to be used by public health professionals, policymakers, and researchers in Minnesota to monitor the pandemic and other related issues. The Consortium's COVID-19 project is funded by MDH. For more information about the Consortium and its work, visit its website at <https://mnehrconsortium.org/> or contact Tyler Winkelman, MD, MSc, Hennepin Healthcare/ Hennepin Healthcare Research Institute (tyler.winkelman@hcmcd.org).

References

- ¹ World Health Organization. (n.d.). *WHO Coronavirus (COVID-19) Dashboard*. <https://covid19.who.int/>
- ² World Health Organization. (n.d.) *Situation by Region, Country, Territory & Area*. <https://covid19.who.int/table>
- ³ Centers for Disease Control and Prevention. (2023, April 5). *Risk for COVID-19 Infection, Hospitalization, and Death By Age Group*. <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-age.html>
- ⁴ Centers for Disease Control and Prevention. (2023, April 24). *Risk for COVID-19 Infection, Hospitalization, and Death By Race/Ethnicity*. <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html>
- ⁵ Minnesota Department of Health. (2022, October 5). *COVID-19 Vaccine Phases and Planning*. <https://www.health.state.mn.us/diseases/coronavirus/vaccine/plan.html>
- ⁶ Hamel, L., Lopes, L., & Kearney, A. (2021, March 30). *KFF COVID-19 Vaccine Monitor: March 2021*. KFF. <https://www.kff.org/coronavirus-covid-19/poll-finding/kff-covid-19-vaccine-monitor-march-2021/>
- ⁷ Minnesota Department of Health. (2022, November 7). *COVID-19 Vaccine Equity in Minnesota*. <https://www.health.state.mn.us/diseases/coronavirus/vaccine/mnsvi.html>
- ⁸ Hennepin Healthcare. (n.d.). *MN EHR Consortium*. <https://www.hennepinhealthcare.org/ehrconsortium/>
- ⁹ Centers for Disease Control and Prevention. (2023, May 11). *COVID Data Tracker*. <https://covid.cdc.gov/covid-data-tracker/#vaccination-demographics-trends>
- ¹⁰ Centers for Disease Control and Prevention. (2023, April 24). *Risk for COVID-19 Infection, Hospitalization, and Death By Race/Ethnicity*. <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/hospitalization-death-by-race-ethnicity.html>
- ¹¹ Flaxman, S., Whittaker, C., Semenova, E., Rashid, T., Parks, R. M., Blenkinsop, A., Unwin, H. J. T., Mishra, S., Bhatt, S., Gurdasani, D., & Ratmann, O. (2023, January 30). *Assessment of COVID-19 as the Underlying Cause of Death Among Children and Young People Aged 0 to 19 Years in the US*. JAMA Network. <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2800816>

Appendix A

To assign the type of community in which individuals lived, we used peoples ZIP Codes to determine where they resided. Then we classified those ZIP Codes to define the type of community, using definitions and data from the U.S. Census Bureau's American Community Survey (ACS) and rural-urban commuting area (RUCA) codes from the U.S. Department of Agriculture's Economic Research Service:

- **Urban/ suburban:** ZIP Code classified as urban by RUCA, and with more than 50 percent of the population classified as urban by the ACS
- **Rural:** ZIP Code classified as rural by RUCA, and with equal to or more than 50 percent of the population classified as rural by the ACS
- **Small town:** ZIP Code classified as rural by RUCA, but with equal to or more than 50 percent of the population classified as urban by the ACS
- **Exurban:** ZIP Code classified as urban by RUCA, but with less than 50 percent of the population classified as urban by the ACS

Figure A1: Minnesota ZIP Codes by community type

Dark gray – Rural
 Light gray – Urban/ suburban
 Red – Exurban
 Blue – Small town

