COVID-19 hospitalization and ICU admission trends in younger patients and the pediatric population

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Media reports this week are suggesting a potential spike up in COVID-19 genetic variants-associated intensive care unit (ICU) admissions for younger patients from the continents of North America¹⁻³, South America^{4,5}, and Europe^{6,7}.

Here, we conducted an observational study on the health records of 60,539 patients (March 1-28, 2021) and 60,256 patients (February 1-28, 2021) from the multi-state Mayo Clinic health system for whom the SARS-CoV-2 PCR test results were also available. Interestingly, we note a significant drop in the ICU admission rates during March (1.45%; 87 of 6017 COVID_{pos} patients) compared to February (1.99%; 121 of 6078 COVID_{pos} patients) with a Rate Ratio of 0.78 (p-value = 0.0002; **Figure 1**). In this study population, there is a slight shift in the peak of ICU admissions towards the younger population in March relative to February (**Figure 2**). While this trend is not statistically significant at this time, this requires close monitoring over the coming weeks. Restricting the study population to younger COVID_{pos} patients (age < 55), we observe a drop in the number of ICU admissions in March compared to February (not statistically significant; **Figure 3**).

Consistent with the drop in the ICU admission rate, we also see a statistically significant drop in the hospitalization rate in March 2021 (10.97%; 660 of 6017 COVID_{pos} patients) compared to February 2021 (13.64%; 829 of 6078 COVID_{pos} patients) with a rate ratio of 0.8 (p-value: 2.34e-12; **Figure 4**). Focusing the study population to the younger COVID_{pos} patients (age < 55), we observe a drop in the number of hospitalizations in March compared to February (not statistically significant; **Figure 5**).

Independently, the national data from the US government (<https://healthdata.gov/>)⁸ also shows a steady drop over recent months in hospitalized pediatric patients with confirmed or suspected COVID-19 (**Figure 6a**). We observe similar trends in the top-10 states by population as well (**Figure 6b**).

This preliminary analysis shows that there is a decreasing trend in ICU admissions and hospitalization of COVID-19 patients across a large multi-state health system as of March 2021. Furthermore, there is no apparent nation-wide spike in pediatric hospitalizations in March compared to February 2021. Decreased hospitalizations and ICU admission rates may be reflective of advances in early diagnosis and intervention. As the proportion of circulating viruses shift towards more variants, these results may change. Overall, amidst recent concerns about emergent SARS-CoV-2 strains, there is an imminent need to develop a real-time system that integrates various national surveillance efforts in order to guide public health policies.

Figure 1. Summary of patient electronic health records across the Mayo Clinic health system sites (*boxed insert*) for patients diagnosed with COVID-19 shows a significantly lower level of ICU admissions in the first four weeks of March 2021 ($n = 87$ ICU patients from March 1 to March 28; *blue*) compared to the comparable four week period of February 2021 ($n = 121$ ICU patients from February 1 to February 28; *red*). This significant decline in COVID-induced ICU admissions in March relative to the comparable period of February 2021 has an associated Rate Ratio of 0.73. The ICU admission rate is computed as a proportion of positive COVID diagnosis.

Figure 2. Slight shift in the peak towards younger patients seen in ICU admissions for COVID-positive ($\text{COVID}_{\text{pos}}$) patients in March (*blue*) relative to February (*red*). Data from **(A)** all sites constituting Mayo Clinic health system, and **(B)** restricted to the Rochester MN and Mayo Clinic health system sites (without considering the Arizona and Florida sites). This minor shift requires further monitoring over the coming weeks.

Figure 3. Comparing March and February ICU admissions for younger (age <55) COVID_{pos} patients at the Mayo Clinic and associated health system shows a drop in the ICU admission rate in March relative to February 2021 (not statistically significant). The ICU admission rate is computed as a proportion of positive COVID diagnosis.

Figure 4. Comparing March and February hospitalization rate for COVID-positive (COVID_{pos}) patients at the Mayo Clinic and associated health system shows a statistically significant drop in March compared to February. The hospitalization rate is computed as a proportion of positive COVID diagnosis.

Figure 5. Comparing March and February hospitalization for younger (age <55) COVID_{pos} patients at the Mayo Clinic and associated health system shows a drop in the hospitalization rate in March relative to February 2021 (not statistically significant). The ICU rate is computed as a proportion of positive COVID diagnosis.

A) Overall USA

B) Top-10 states

Figure 6. National and state-level counts of hospitalized pediatric patients with confirmed or suspected COVID-19 from January 1, 2021 to March 27, 2021. **Panel A:** Overall trend for USA. **Panel B:** Trends for the top-10 most populous states, including: California, Florida, Georgia, Illinois, Michigan, North Carolina, New York, Ohio, and Texas.

Study design

This is a retrospective study of individuals who underwent polymerase chain reaction (PCR) testing for suspected SARS-CoV-2 infection at the Mayo Clinic and hospitals affiliated with the Mayo Clinic Health System. This study was reviewed by the Mayo Clinic Institutional Review Board (IRB) and determined to be exempt from the requirement for IRB approval (45 CFR 46.104d, category 4). Subjects were excluded if they did not have a research authorization on file.

Data availability

After publication, the data will be made available to others upon reasonable requests to the corresponding author (venky@nference.net). A proposal with a detailed description of study objectives and the statistical analysis plan will be needed for evaluation of the reasonability of requests.

Declaration of interests

ADB is a consultant for Abbvie, is on scientific advisory boards for Nference and Zentalis, and is founder and President of Splissen therapeutics. One or more of the investigators associated with this project and Mayo Clinic have a Financial Conflict of Interest in technology used in the research and that the investigator(s) and Mayo Clinic may stand to gain financially from the successful outcome of the research. This research has been reviewed by the Mayo Clinic Conflict of Interest Review Board and is being conducted in compliance with Mayo Clinic Conflict of Interest policies. The authors from nference have financial interests in the company.

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