

Geographic Variation in Routine Childhood Vaccination Using Real-World Evidence: Pre- and Post- Pandemic

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Introduction

- Vaccine surveillance has been a longstanding priority and is currently highlighted as a goal in Healthy People 2030. Vaccinating children within the first 24 months of life promotes wellbeing at this critical developmental period, while reducing the incidence of vaccine preventable diseases and disease outbreaks.
- In the United States, there is a rising rates of vaccine exemptions for kindergarteners, which reflects the growing number of vaccine hesitant parents.

Objectives

- To investigate the geographic variation in routine vaccination during the first two years of life among children born during the COVID-19 pandemic compared to children born in the two years prior.

Methods

- A cross-sectional study design was employed using the Inovalon closed claims database for medical, pharmacy, and enrollment data from January 1, 2018 to December 31, 2023. Children with commercial covered lives were included in this analysis. Avalere spatially aggregated data to the ZIP-3 level for the Inovalon closed claims prior to calculating area-specific period prevalence.
- Two separate sets of geographic heatmapping were generated for children born after the pandemic (2022-2023), during the pandemic (2020-2021), children born prior to the COVID-19 pandemic (2018-2019).
- ZIP-3 level was mapped to ZIP-5 level for geographic mapping in Tableau, in which the area-specific period prevalence was averaged across ZIP5 and over years in the pre-pandemic, pandemic, and post-pandemic period.
- Geographic heatmapping was performed to visualize the prevalence of children that had completed the 7-vaccine series by 24 months. For this dataset, we looked each vaccine separate for 6 out of 7 primary vaccine series including at least one dose of DTaP, poliovirus (polio) vaccine, Hib, HepB, Var, and PCV. Linear mixed model was performed to conduct an unadjusted ecological analysis to compare mean vaccine rates between urban, suburban and rural regions, with a random effect for state. 2020 population density measures were used to classify urbanicity (urban: > 1,000, suburban: 500-1,000, rural: <500 people per square mile).

Table 1: The Proportion of Urban, Rural, and Sub-Urban Infants From Commercial Plans In An Administrative Claims Database That Receive Vaccines in 2020-2021, By Vaccine Type

Vaccine	Pre-Pan, Urban (2018/2019)	Pan, Urban (2020/2021)	Post, Urban (2022/2023)	Pre-Pan, Rural (2018/2019)	Pan, Rural (2020/2021)	Post, Rural (2022/2023)
PCV	0.84 0.87	0.88 0.92	0.92 0.92	0.83 0.87	0.90 0.92	0.91 0.91
HepB	0.58 0.56	0.57 0.59	0.60 0.62	0.52 0.51	0.53 0.55	0.56 0.58
DTAP	0.68 0.65	0.63 0.65	0.63 0.64	0.65 0.65	0.66 0.65	0.62 0.64
HIB	0.70 0.71	0.70 0.70	0.70 0.70	0.69 0.71	0.70 0.70	0.70 0.71
VAR	0.69 0.72	0.72 0.73	0.71 0.72	0.66 0.69	0.72 0.70	0.68 0.69
Polio	0.81 0.82	0.85 0.89	0.89 0.91	0.79 0.81	0.87 0.88	0.87 0.91

Results

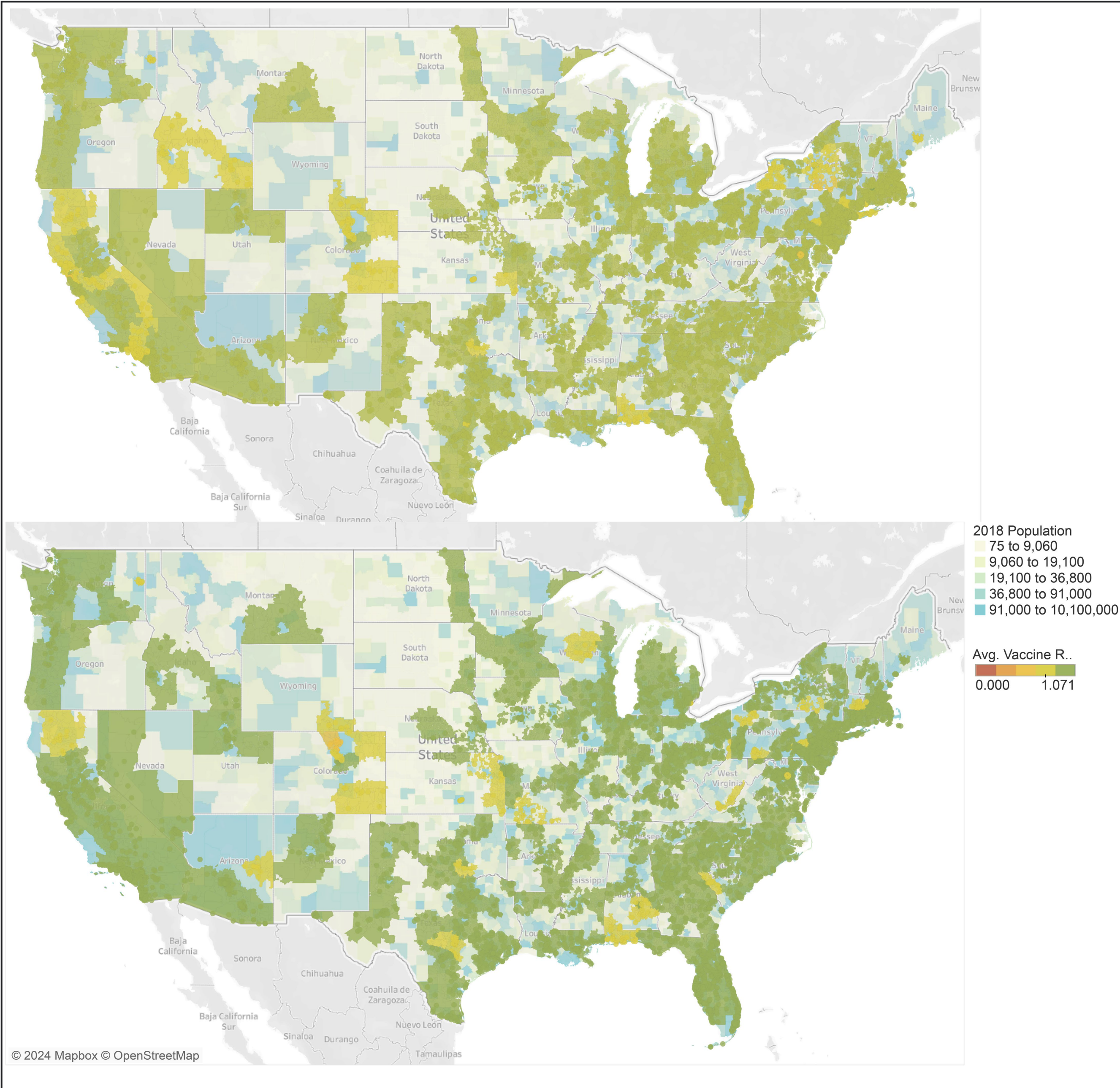
- Overall, vaccine rates for the primary 6/7 vaccine series are similar between urban, suburban and rural regions. Some difference is seen in prevalence rates for vaccination among one year infants between urban and rural.
- Polio, VAR, HIB, and mostly DTAP vaccine rates are relatively similar between pre-pandemic, pandemic, and post-pandemic periods.
- HepB vaccine rates had slightly higher rates seen in urban populations compared to sub-urban and rural, but with greatest difference seen with rural ($p < 0.001$).
- In 2020, lower vaccine rates for PCV was seen in urban regions compared to rural regions, whereas lower vaccine rates in rural regions as compared to urban regions in 2021 and 2022 ($p < 0.001$). 2023 vaccine rates similar for PCV.
- Slightly higher vaccine rates seen for urban in 2019 for DTAP compared to rural ($p < 0.001$).
- Slightly higher VAR rates in post-pandemic period among urban compared to rural regions ($p < 0.001$).

References

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Figure 1: Select Vaccine Heat Map Example (Pandemic/Post Pandemic)

PCV (Top Panel=Pandemic, Bottom Panel=Post-Pandemic)



HepB (Top Panel=Pandemic, Bottom Panel=Post-Pandemic)

