

Estimating Vaccine Hesitancy in Kentucky Using Immunization Information System Data: Geographic and Socioeconomic Insights

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AIRA National Meeting | April 2026 | Pittsburgh, PA







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Disclosures and Conflicts of Interest

-  No commercial conflicts of interest to disclose
-  No industry funding or sponsorship
-  Analyses were conducted independently using Kentucky Immunization Registry (KYIR) data
-  This presentation is free of commercial bias

Learning Objectives

01

Describe

The shot-limiting framework used to estimate vaccine hesitancy from KYIR data

02

Interpret

Trends, geographic, & socioeconomic patterns in vaccine hesitancy in Kentucky

03

Explain

The relationship between hesitancy, vaccine type, & 35-month series completion

04

Identify

Ways IIS findings can support targeted public health action

Background

Why Vaccine Hesitancy Matters

- 🛡️ WHO identified vaccine hesitancy as a top global health threat in 2019
- 🛡️ In early childhood, hesitancy often shows up as delaying or spacing vaccines rather than outright refusal
- 🛡️ Because hesitancy is not directly observed in IIS data, it must be inferred from vaccination patterns
- 🛡️ IIS data provide population-level, near-real-time information that can help identify these patterns and support targeted public health action

Study Rationale and Objectives

- 🛡️ This study builds on the Colorado vaccine hesitancy analysis, which used immunization registry data to identify shot-limiting behavior as a marker of hesitancy
- 🛡️ We replicated and extended this approach to examine how vaccine hesitancy varies across geography, socioeconomic context, and over time in Kentucky

Objectives:

- 🛡️ Estimate vaccine hesitancy in Kentucky using KYIR data
- 🛡️ Assess associations between vaccine hesitancy and vaccine type, provider patterns, and series completion
- 🛡️ Examine how vaccine hesitancy varies over time, across geographic locations, and by socioeconomic context

Study Design and Methods

Study Design:

- 🛡️ Retrospective cohort design

Data Sources:

- 🛡️ Kentucky Immunization Registry (KYIR)
- 🛡️ CDC WONDER (county population estimates)
- 🛡️ Area deprivation index (ADI) data from the University of Wisconsin Neighborhood Atlas

Study Approach:

- 🛡️ Applied the Colorado shot-limiting framework to classify vaccine hesitancy
- 🛡️ Examined how hesitancy varied over time, geography, and socioeconomic context
- 🛡️ Assessed associations with vaccine type, provider patterns, and series completion

Analytic Methods:

- 🛡️ Analyses included descriptive statistics, chi-square tests, and logistic regression

Eligibility Criteria and Cohort Selection

Birth and Immunization Cohort:

- 🛡️ Children born in Kentucky between January 1, 2019, and December 31, 2024
- 🛡️ Vaccination records from January 1, 2019, to December 31, 2024

Inclusion:

- 🛡️ Doses administered at clinical sites
- 🛡️ Children with at least one non-influenza visit between ages 2 months and less than 9 months
- 🛡️ Only children with Kentucky addresses

Exclusion:

- 🛡️ Historic records entered manually or reported by the patient
- 🛡️ Influenza only vaccination records

Software:

- 🛡️ Stata, SAS, and Power BI

Measuring Hesitancy: The Shot-Limiting Classification Framework




Shot limiting measures how many actual needle injections or “shots” a child receives at each vaccination visit, regardless of whether the vaccine was a single-or combination-antigen vaccine

Consistent Limiter	Episodic Limiter	One-Time Limiter	Non-Limiter
Always received 1-2 shots per visit, across 2+ visits before 9 months	Received 1-2 shots per visit on some, but not all, visits	Received 1-2 shots on only one visit, and all others were higher	Always received ≥ 3 shots per visit on all visits
Likely Hesitant	Likely Hesitant	Likely NOT Hesitant	Likely NOT Hesitant

Source: Adapted from Campbell K, Severson R. Estimating Vaccine Hesitancy in Colorado by Using Immunization Information System Data. Public Health Reports. 2023;138(5):806-811.

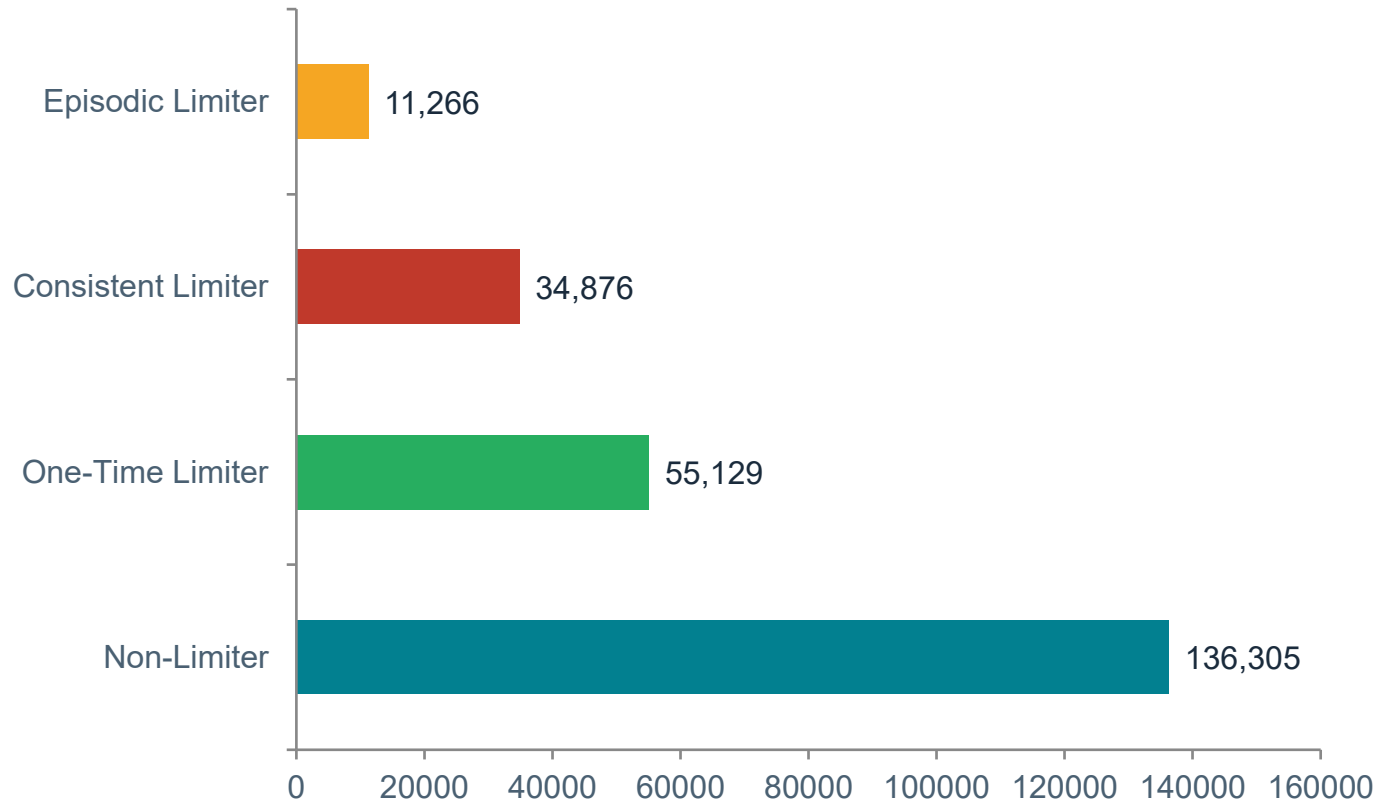
Results

Cohort Overview:

-  KYIR included about 6.5 million immunization records of children from 2019 to 2024
-  Before applying eligibility criteria, the dataset included 986,082 unique children and 709 providers
-  After applying study eligibility criteria, 237,576 children were included in the final analytic cohort

Shot-Limiting Categories and Hesitancy Prevalence

Children by Shot-Limiting Category



Likely Vaccine Hesitant

19.42%

(n = 46,142 of 237,576)

Likely NOT Hesitant

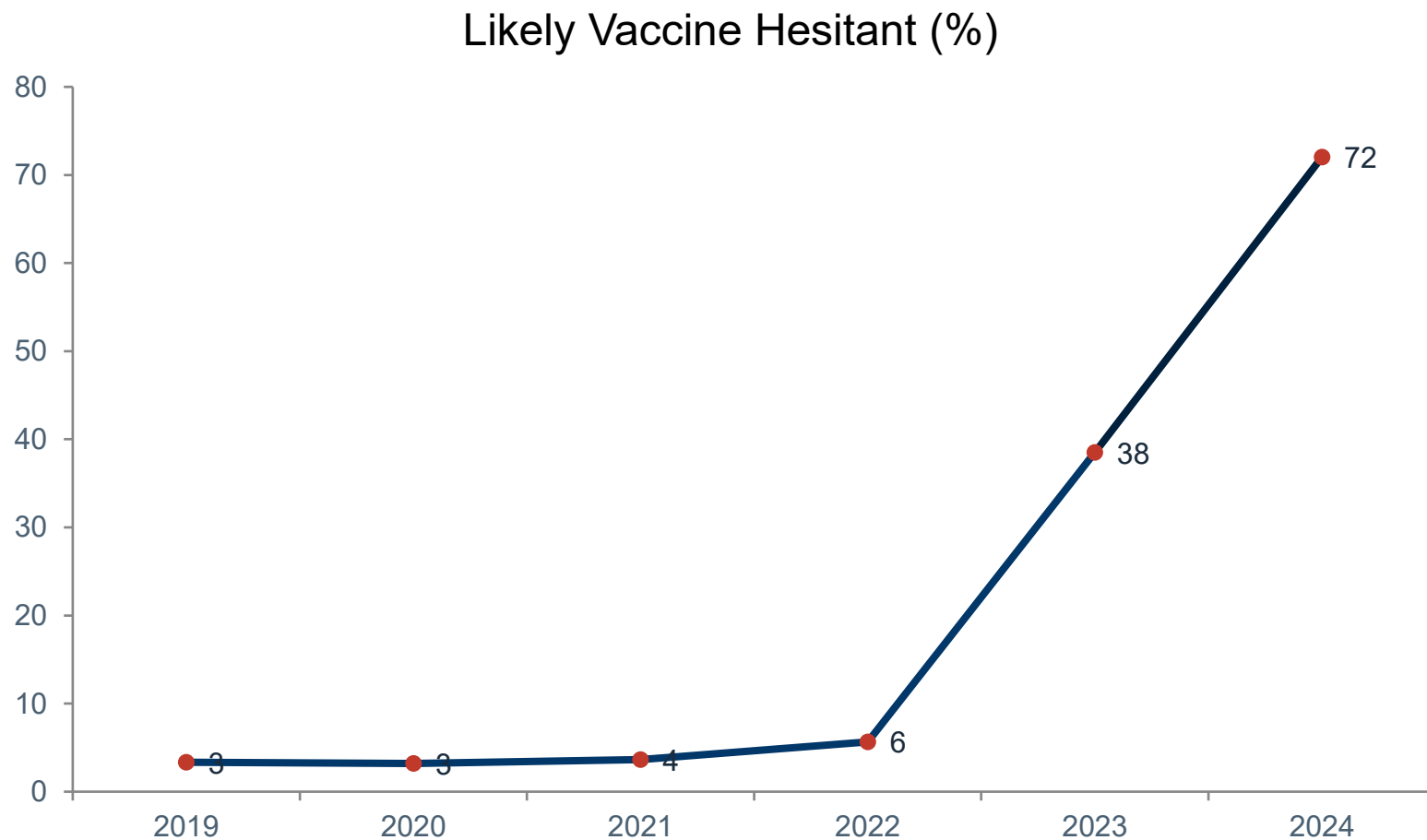
80.58%

(n = 191,434 of 237,576)

Source: Authors' analysis of Kentucky Immunization Registry (KYIR) data, 2019-2024; shot-limiting classification adapted from Campbell & Severson (2023).

Results: Temporal Trends

Vaccine Hesitancy Prevalence by Year (2019-2024) in KY



Key Observations

2019-2022:

Low and relatively stable (3.2-5.7%)

2023:

Increased sharply to 38.5%

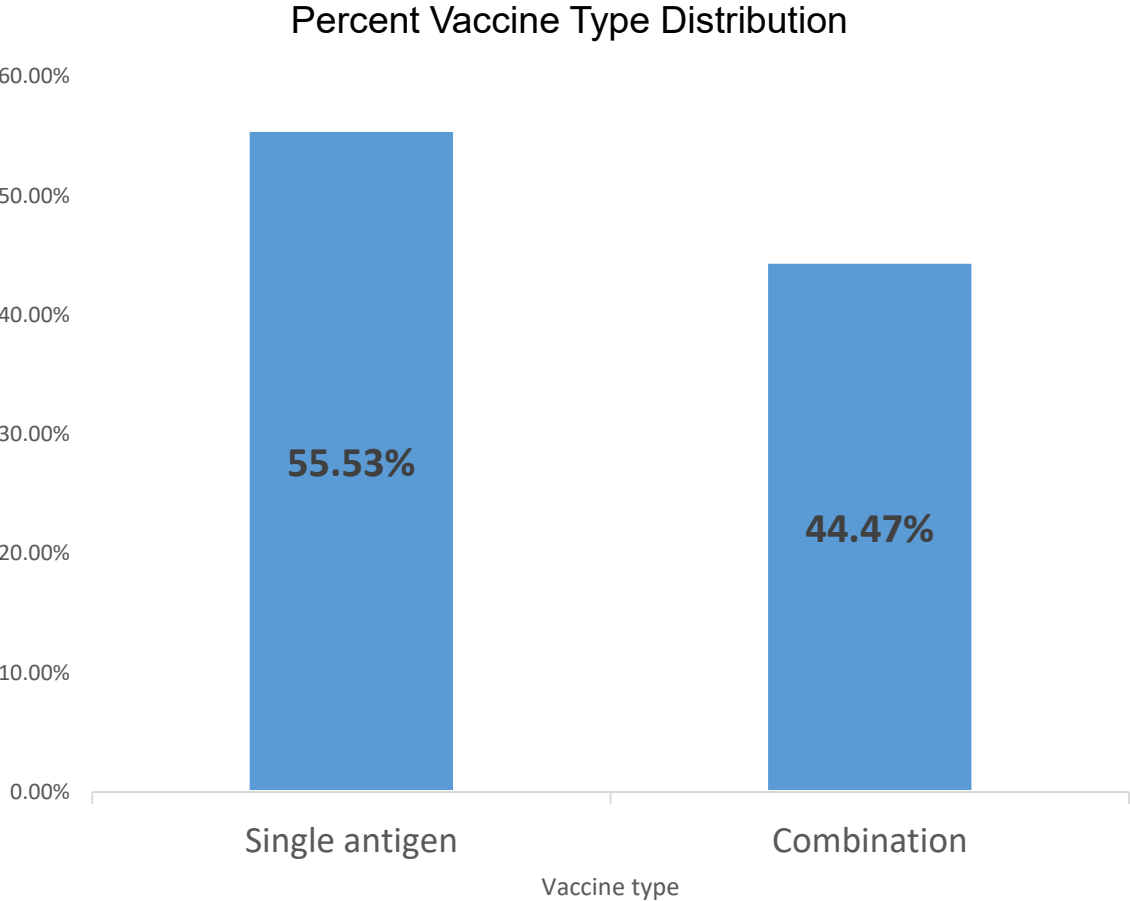
2024:

Reached 72.0%

The sharp increase in later years should be interpreted cautiously and may reflect post-pandemic disruptions, misinformation, fragmented catch-up schedules, and differences in follow-up time

Source: Authors' analysis of Kentucky Immunization Registry (KYIR) data, 2019-2024.

Association Between Hesitancy and Vaccine Type

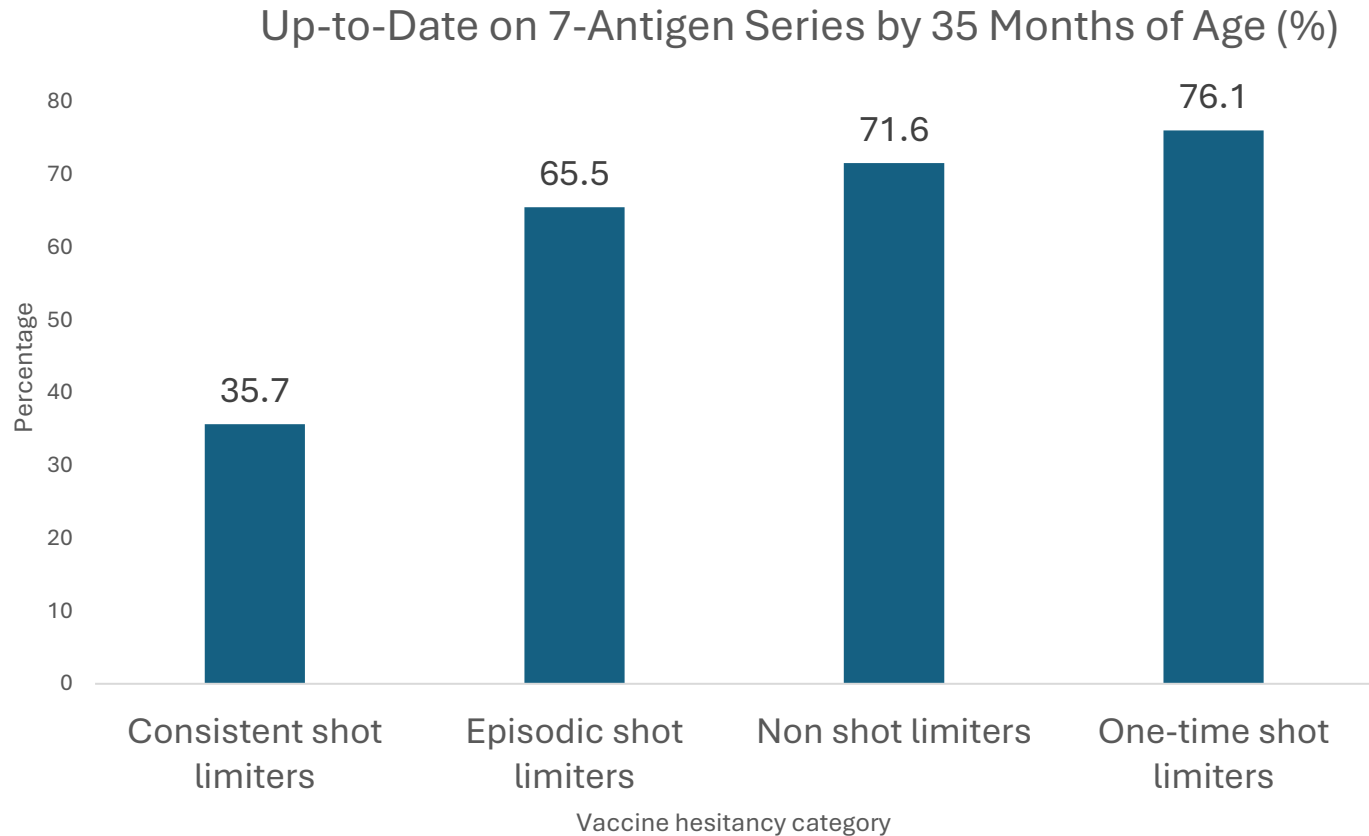


Overall, 55.53% of doses in the analytic cohort were single-antigen.

Likely vaccine hesitant children had 4.6 times the odds of receiving single-antigen vaccines compared with likely non-hesitant children, after adjusting for provider, ADI, and metro status [AOR = 4.61; 95% CI: 4.56-4.67].

Source: Authors' analysis of Kentucky Immunization Registry (KYIR) data, 2019-2024.

7-Antigen Series Completion By 35 Months



Key Findings

Likely hesitant group:
53.78% UTD by 35 months

Likely not-hesitant group:
72.59% UTD by 35 months

18.81 percentage point gap

$\chi^2(1) = 684.82$
 $p < 0.001$

Source: Authors' analysis of Kentucky Immunization Registry (KYIR) data, 2019-2024.

Geographic Distribution of Likely Hesitant Children Linked to Providers by County

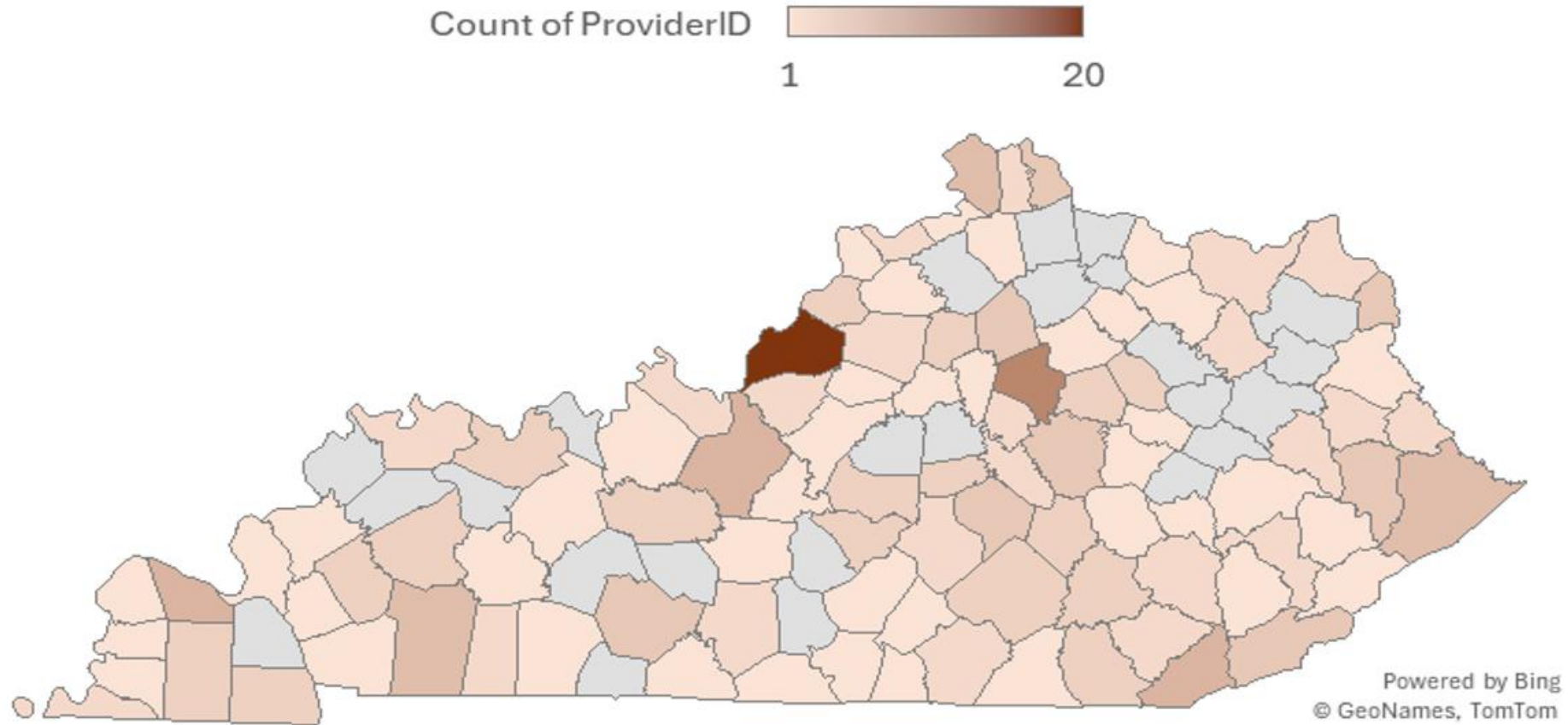
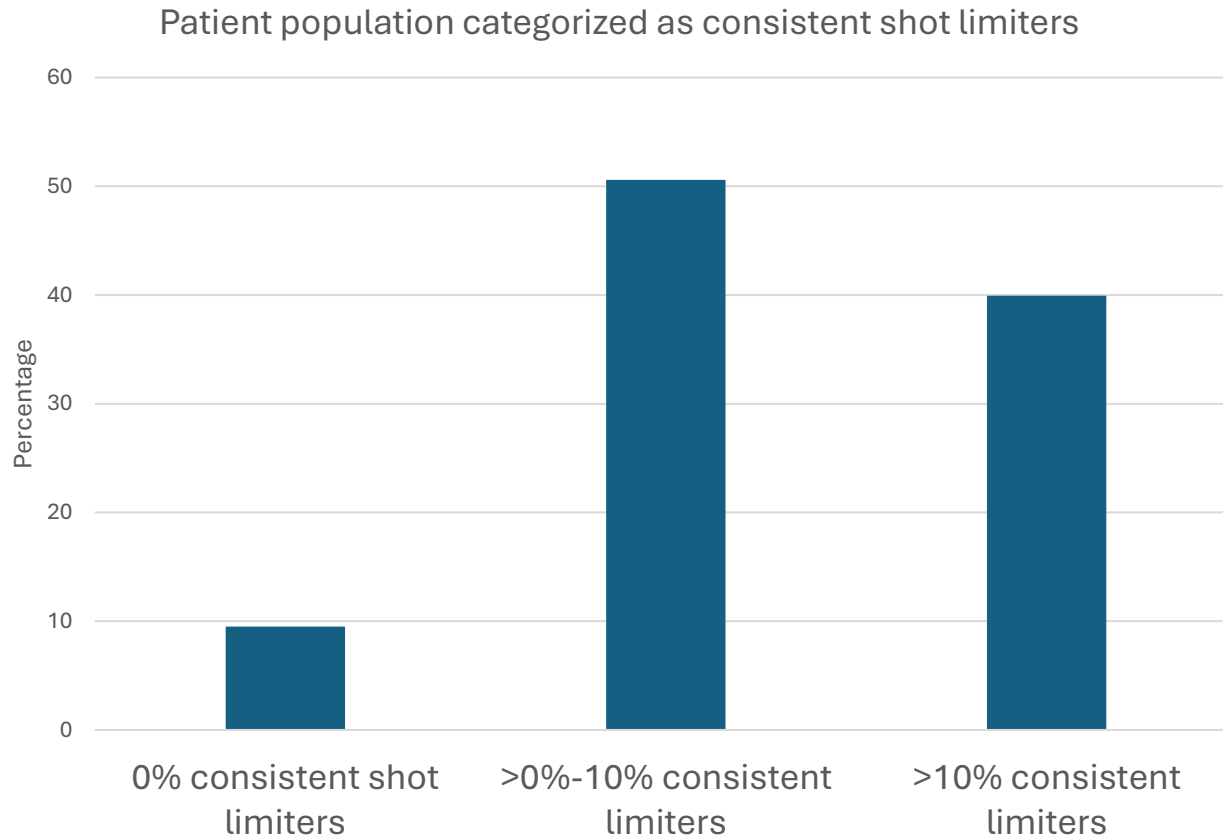


Image Source: Authors' analysis of Kentucky Immunization Registry (KYIR) data, 2019-2024. Map generated using Excel/Bing Maps.

Provider-Level Patterns in Likely Hesitant Children



62.3%

Non-metro providers

62.3% of hesitant-linked providers were in non-metro areas

56.1%

High-deprivation areas

56% of hesitant-linked providers served in high-deprivation communities

67.5%

Private provider

67.5% of hesitant-linked providers were private providers

31.5%

Local health departments

31.5% of hesitant-linked providers were local health departments

Source: Authors' analysis of Kentucky Immunization Registry (KYIR) data, 2019-2024.

Limitations




- 🛡️ Vaccine hesitancy is inferred, not directly observed
- 🛡️ Reporting to KYIR is not mandatory, and IIS data may not capture children who moved or got vaccinated elsewhere
- 🛡️ Pandemic-era disruptions may have affected vaccination visit patterns
- 🛡️ Later-year estimates may also be influenced by differences in follow-up time
- 🛡️ Observed patterns may reflect both parental preference and provider vaccine availability or practice style

Implications for Public Health Practice

- 🛡️ **IIS data can help identify vaccine hesitancy:** Shot-limiting behavior detected in KYIR is consistent with previously published approaches from Colorado and Oregon
- 🛡️ **Post-pandemic surge is real:** Hesitancy nearly doubled 2022-2023 and continued in 2024, likely driven by misinformation, missed well-child visits, and supply disruption
- 🛡️ **Provider-level variation offers intervention targets:** About 40% of providers had more than 10% consistent shot-limiters, suggesting opportunities for targeted outreach
- 🛡️ **Completion gaps are actionable:** There was an 18.8 percentage-point gap in 7-antigen series completion between likely hesitant and likely not hesitant children. Prioritize children at risk of falling behind on 35-month series completion
- 🛡️ **Geography and socioeconomic context may guide outreach:** Non-metro location and high deprivation areas may help identify where additional program support is needed

Conclusion

Key findings:

-  KYIR can support registry-based identification of patterns consistent with vaccine hesitancy
-  Likely hesitant children were more likely to receive single-antigen vaccines and less likely to complete the 7-antigen series by 35 months
-  These findings can help target outreach and strengthen immunization program planning in Kentucky

Next Steps

- 🛡️ Validate later-year hesitancy trends with longer follow-up and sensitivity analyses
- 🛡️ Use KYIR to routinely flag higher-burden providers and communities
- 🛡️ Pilot and evaluate targeted outreach to improve 35-month series completion

Questions?



Thank you.

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