

ORIGINAL RESEARCH ARTICLE

# Racial and Ethnic Trends in Recommended Vaccinations Among US Adults, National Health Interview Survey 2006–2021

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**Objectives:** Reducing racial/ethnic disparities in immunization rates is a significant goal of Healthy People 2030. There is a lack of clear understanding regarding the trends in vaccination rates for recommended vaccines among different racial/ethnic subgroups. This study aims to describe adult vaccination trends in the United States by race/ethnicity between 2006 and 2021.

**Study design:** This is a cross-sectional study using the National Health Interview Survey data.

**Methods:** Temporal trends in influenza, pneumococcal, herpes zoster (shingles), hepatitis A, and hepatitis B vaccination rates were examined by race/ethnicity between 2006 and 2021. Absolute annual changes in vaccine rates were estimated using joinpoint regression.  $P$ -values  $< 0.05$  were considered statistically significant.

**Results:** In 2021, Non-Hispanic Blacks (NHBs) and Hispanics had significantly lower influenza rates compared to Non-Hispanic Whites (NHWs). Similarly, NHBs, Hispanics, and Asians had significantly lower rates of pneumococcal and shingles vaccinations compared to NHWs. On the other hand, Asians had significantly higher hepatitis A and hepatitis B vaccination rates compared to NHWs. Since 2006, influenza vaccine rates have increased steadily across all race/ethnicity groups ( $P < 0.001$ ). However, pneumococcal vaccination rates increased only among NHBs and Asians ( $P = 0.01$ ). Shingles and hepatitis A vaccination rates increased for NHWs ( $P < 0.001$ ), NHBs ( $P < 0.001$  and  $P = 0.016$ , respectively), and Hispanics ( $P < 0.001$  and  $P = 0.043$ , respectively). Hepatitis B vaccination rates increased only for NHWs ( $P = 0.04$ ).

**Conclusion:** Racial/ethnic disparities in recommended vaccines continue to persist. This necessitates ongoing efforts to reduce disparities.

**Key Words:** vaccination ■ health disparities ■ National Health Interview Survey ■ race/ethnicity

Immunizations are a safe and cost-effective strategy to reduce morbidity and mortality associated with vaccine-preventable illness. Despite the established effectiveness of immunization, adult vaccination rates in the United States (US) continue to be low (1). Recognizing this challenge, the US Department of Health and Human Services (HHS) has made increasing vaccination rates as a major goal of Healthy People 2030 (2). Additionally, the Centers for Disease Control and Prevention (CDC) recommends vaccinations for adults based on age (i.e.  $\geq 60$  years: shingles;  $\geq 65$  years: pneumococcal), health conditions, prior vaccinations, and other considerations to prevent morbidity and mortality from vaccine-preventable diseases (3).

Moreover, the COVID-19 pandemic has brought about substantial societal and lifestyle changes, many of which have negatively impacted public health. Notably, routine preventive healthcare services, including screenings, vaccinations, and primary care provider (PCP) visits, have been disrupted (4). Fear of exposure to COVID-19 and overwhelmed healthcare systems led individuals to delay or miss their routine PCP appointments, potentially resulting in reduced vaccination rates (4). These disruptions have contributed to the overall decline in preventive healthcare during the pandemic.

Racial disparities in vaccination rates are of increasing concern. For instance, even though racial and ethnic minorities were disproportionately affected by COVID-

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### POPULAR SCIENTIFIC SUMMARY

- Vaccination coverage increased from 2006 to 2021 but remained suboptimal, with significant differences observed among racial and ethnic groups
- To address disparities in vaccination rates, targeted interventions tailored to the specific needs and concerns of different racial and ethnic communities are necessary

19-related morbidity and mortality, there continues to be a decreased uptake of COVID-19 vaccines among African Americans, Hispanics, and Asians compared to White Americans (5). Differences in recommended vaccines among adults by race and ethnicity were reported for the pre-pandemic years; however, racial disparities in these vaccines among adults after the pandemic have not been studied (1). Using National Health Interview Survey (NHIS) data, we examine the vaccination trends of five CDC-recommended vaccines before and during the pandemic, including influenza, pneumococcal, shingles, hepatitis A, and hepatitis B.

### METHODS

The NHIS is a continuous, cross-sectional national household survey of the non-institutionalized US civilian population conducted by the US Census Bureau for CDC's National Center for Health Statistics (6). Our study used publicly available NHIS data harmonized by the Integrated Public Use Microdata Service (IPUMS) (7). We included individuals aged  $\geq 19$  years who belong to one of the following racial/ethnic groups: non-Hispanic white (NHW), non-Hispanic Black (NHB), Hispanic, and Asian.

We analyzed the trends of five CDC recommended vaccines: influenza (2006–2021), pneumococcal (2006–2021), shingles vaccines (2008–2021), hepatitis A (2008–2018, 2021), and hepatitis B (2006–2018, 2021) by race/ethnicity. For the pneumococcal, shingles, hepatitis A, and hepatitis B vaccines, ever receipt of the vaccine was recorded by NHIS and used for analysis. For the influenza vaccine, participants were asked if they received the vaccine in the last 12 months. We examined the shingles vaccination trends among those aged  $\geq 60$  years and the pneumococcal vaccination trends among adults aged  $\geq 65$  years as per CDC recommendations (3).

A joinpoint regression model (version 4.9.0.0) was used to characterize the trends in vaccination rates within each racial/ethnic group (8). We used the average annual percent change (AAPC) to characterize the temporal trends in vaccination rates. The AAPC represents the weighted average of all the percent changes in the vaccination rates between 2 years. The AAPCs reported

in the analyses were obtained from the final models chosen by the joinpoint regression software. All analyses were performed using R version 4.2.3 and incorporated the NHIS strata, primary sampling unit, and sample adult weights to produce nationally representative estimates.

### RESULTS

#### Influenza vaccine

Influenza vaccination rates increased for all groups between 2006 and 2021. Hispanics (AAPC = 5.9; 95% confidence interval [CI] = 5.0, 6.9) and Asians (AAPC = 5.2; 95% CI = 4.0, 6.4) had the fastest increase in the rate of influenza coverage. Although slightly lower, NHBs (AAPC = 3.9; 95% CI = 3.0, 4.9) and NHWs (AAPC = 3.6; 95% CI = 2.6, 4.7) also had an increase in the influenza vaccine coverage between 2006 and 2021 (Fig. 1).

In 2021, approximately 52.7% (95% CI: 51.8 – 53.6%) of NHWs, 37.1% (34.9 – 39.4%) of NHBs, 37.1% (35.2 – 39.0%) of Hispanics, and 56.0% (53.0 – 58.8%) of Asians reported receiving an influenza vaccine in the past year. NHBs and Hispanics were significantly less likely to be vaccinated for influenza in 2021 than NHWs ( $P < 0.05$ ).

#### Pneumococcal vaccine

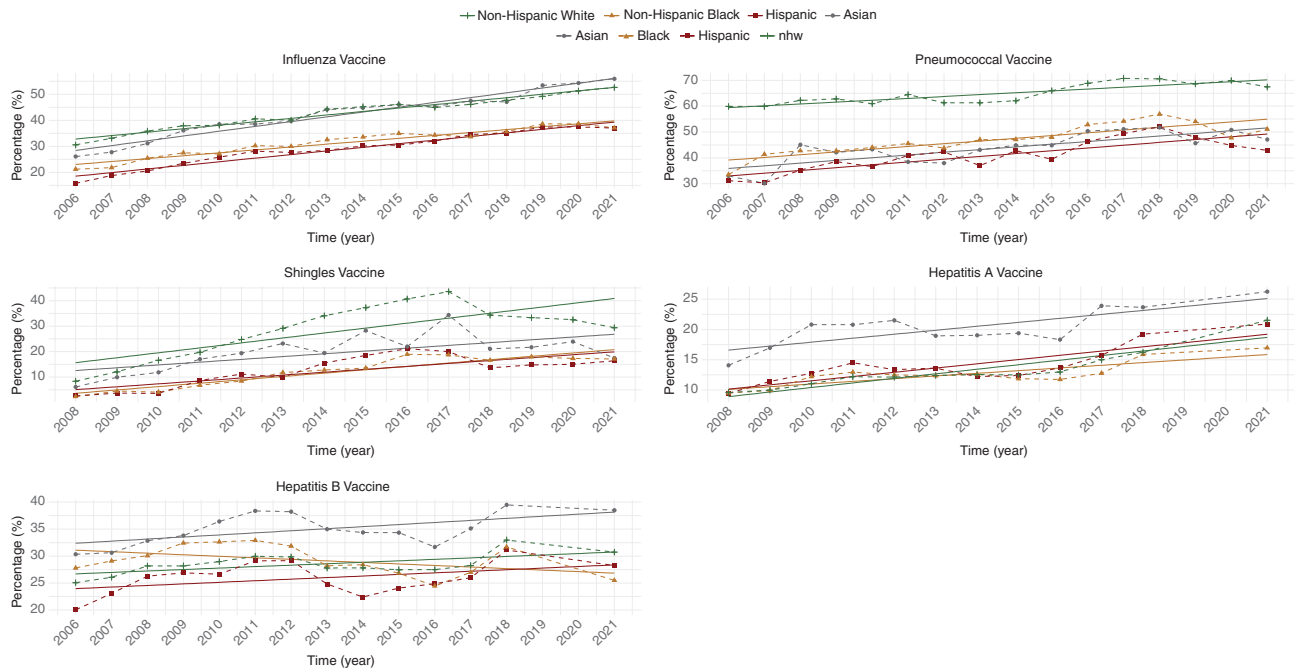
The pneumococcal vaccination rates increased for NHBs (AAPC = 1.8; 95% CI = 0.4, 3.2) and Asians (AAPC = 2.1; 95% CI = 0.9, 3.2) between 2006 and 2021. However, there was a non-significant increasing trend for NHWs (AAPC = 0.7; 95% CI = -0.6, 2.0) and Hispanics (AAPC = 2.0; 95% CI = -0.1, 4.1) (Fig. 1).

In 2021, approximately 67.4% (66.2 – 68.7%) of NHWs, 51.1% (47.1 – 55.0%) of NHBs, 47.1% (37.9 – 48.1%) of Hispanics, and 42.9% (40.6 – 53.7%) of Asians reported ever receiving a pneumococcal vaccination. NHBs, Hispanics, and Asians were significantly less likely to be vaccinated for pneumonia in 2021 compared to NHWs ( $P < 0.05$ ).

#### Shingles vaccine

The shingles vaccination rates increased for NHWs (AAPC = 9.3; 95% CI = 4.5, 14.3), NHBs (AAPC = 13.4; 95% CI = 9.5, 17.4), and Hispanics (AAPC = 12.8; 95% CI = 6.5, 19.5) between 2008 and 2021. However, there was a non-significant increasing trend for Asians (AAPC = 4.1; 95% CI = -2.4, 11.1) (Fig. 1).

In 2021, approximately 24.6% (23.5 – 25.7%) of NHWs, 13.5% (11.5 – 15.9%) of NHBs, 14.4% (11.9 – 17.2%) of Hispanics, and 14.2% (11.0 – 18.1%) of Asians reported ever receiving the shingles vaccine.



**Figure 1.** Trends of recommended vaccination rates in NHWs, NHBs, Hispanics, and Asians, National Health Interview Survey 2006–2021.

NHBs, Hispanics, and Asians were significantly less likely to be vaccinated for shingles in 2021 compared to NHWs ( $P < 0.05$ ).

### Hepatitis A vaccine

Hepatitis A vaccination rates increased for NHWs (AAPC = 6.6; 95% CI = 5.3, 68.0), NHBs (AAPC = 4.8; 95% CI = 0.9, 8.9), and Hispanics (AAPC = 6.4; 95% CI = 0.2, 12.9) between 2008 and 2021. However, there was a non-significant increasing trend for Asians (AAPC = 5.2; 95% CI = -0.5, 11.2) (Fig. 1).

In 2021, approximately 21.5% (20.7 – 22.4%) of NHWs, 17.0% of NHBs (15.4 – 18.6%), 20.9% (19.2 – 22.8%) of Hispanics, and 26.3% (23.7 – 28.9%) of Asians reported ever receiving a hepatitis A vaccine. Asians were the only group that were significantly more likely to have been vaccinated for hepatitis A in 2021 compared to NHWs ( $P < 0.05$ ).

### Hepatitis B vaccine

The hepatitis B vaccination rate increased for only NHWs (AAPC = 0.9; 95% CI = 0.1, 1.6) between 2006 and 2021. There were no significant changes in the hepatitis B vaccine rate for NHBs (AAPC = -1.1; 95% CI = -2.4, 0.2), Hispanics (AAPC = 2.4; 95% CI = -1.9, 7.0), and Asians (AAPC = 1.9; 95% CI = -0.4, 4.3) (Fig. 1).

In 2021, approximately 30.7% (29.8 – 31.7%) of NHWs, 25.5% (23.5 – 27.5%) of NHBs, 28.2% (26.3 – 30.2%) of Hispanics, and 38.5% (35.5 – 41.6%) of

Asians reported ever receiving a hepatitis B vaccine. Asians were the only group that were significantly more likely to have been vaccinated for hepatitis B in 2021 compared to NHWs ( $P < 0.05$ ).

## DISCUSSION

Overall, adult vaccination coverage in the US steadily increased between 2006 and 2021 but remained suboptimal. The 2021 data indicate that many adults in the US remained unprotected against vaccine-preventable diseases. Vaccination coverage was <40% for hepatitis A, hepatitis B, and shingles, <60% for influenza, and <70% for pneumococcal vaccines among US adults. Racial and ethnic differences in vaccination coverage were present for all adult-recommended vaccines in 2021. We found that NHBs and Hispanics had significantly lower vaccination rates for the influenza vaccine compared to NHWs and Asians. Moreover, NHBs, Hispanics, and Asians had lower pneumococcal and shingles vaccination rates compared to NHWs. On the other hand, NHWs, NHBs, and Hispanics had lower hepatitis A and hepatitis B vaccination rates compared to Asians.

When comparing vaccination rates between 2021 and the pre-pandemic year of 2018, we observed that most vaccine rates remained similar, with a few exceptions. Among NHWs, we noted an increase in influenza and hepatitis A vaccination rates in 2021 (vs. 2018) but a decrease in pneumococcal, shingles, and hepatitis B vaccination rates. In the case of NHBs, there

was a decrease in pneumococcal and hepatitis B vaccination rates in 2021 (vs. 2018). Furthermore, Asians experienced a decrease in influenza vaccination rates in 2021 (vs. 2018). However, it is worth noting that there were no changes in vaccination rates for Hispanics between 2021 versus 2018.

Multiple factors may contribute to the racial/ethnic disparities in vaccination rates. For instance, varying healthcare utilization patterns across racial/ethnic groups, especially during the pandemic, have been observed and could be an underlying factor (9). Additional factors such as limited access to healthcare facilities, financial constraints, language barriers, and cultural beliefs may have contributed to disparities in healthcare utilization (9). Some communities, particularly racial and ethnic minority groups, may have faced increased difficulties in accessing healthcare services due to socioeconomic constraints and systemic barriers (9). Specifically, structural barriers such as inability to take time off of work, inability to afford child care, poor access to transportation, lack of mass vaccination sites or publicly accessible sites, and fear of interrogation about one's immigration status might be barriers to vaccination (5, 10). These structural differences could affect vaccination opportunities and subsequently affect vaccination rates. Factors like nativity status may further shape vaccination uptake in specific groups. Studies have indicated robust associations between nativity status and vaccination rates among distinct racial/ethnic groups, underscoring culturally agnostic access issues rooted in a lack of structural knowledge within the US healthcare system (10). Addressing these multifaceted challenges is essential for developing targeted interventions to enhance vaccination access and uptake, promoting health equity across diverse communities.

However, these results should be considered with a few limitations. Vaccination status was based on self-report and was not validated with medical records. Also, NHIS only includes English- and Spanish-speaking participants, limiting our ability to understand groups that speak other languages. Moreover, although trends in vaccination rates can be assessed for Asian subgroups from 2006 to 2018 using NHIS data, disaggregated race/ethnicity information for Asian and Native Hawaiian and Pacific Islander subgroups is not publicly available post-2018 and thus was not assessed in this analysis (11). Finally, NHIS data from 2021 were obtained by telephone rather than in-person interviews, and the impact of that change is unknown.

We found significant differences in post-pandemic vaccination rates among US adults by race/ethnicity in 2021. Addressing the significant differences in post-pandemic vaccination rates is integral to achieving the overarching goals outlined in Healthy People 2030. To improve coverage and eliminate racial/ethnic disparities in adult vaccination, culturally tailored communication

strategies should be implemented to address specific beliefs, attitudes, and concerns within different racial and ethnic communities. This may involve collaborating with community leaders, local healthcare providers, and cultural influencers to disseminate accurate information. Addressing logistical challenges, such as providing flexible vaccination hours, reducing financial barriers, and offering incentives, could also contribute to improved coverage. Future research should focus on ascertaining evidence-based methods for community interventions to improve vaccination rates. Additionally, future work should estimate the trends in vaccination rates using other data sources, such as the Behavioral Risk Factor Surveillance System and the Immunization Information Systems, to expand our understanding of vaccination trends in racial/ethnic groups in the US and mitigate the limitations posed by the NHIS dataset.

## ARTICLE INFORMATION

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### Author contributions

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by AJ. The first draft of the manuscript was written by AJ, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

### Ethics approval

NHIS was approved by the IRB of the National Center for Health Statistics. Additionally, this study was considered not human subject research by Stanford IRB.

### Conflict of interest and funding

All authors have no conflicts of interest. The authors have not received any funding or benefits from industry or elsewhere to conduct this study.

## References

1. Kawai K, Kawai AT. Racial/ethnic and socioeconomic disparities in adult vaccination coverage. *Am J Prevent Med*. 2021;61(4):465–73. doi: 10.1016/j.amepre.2021.03.023
2. Vaccination – Healthy People 2030 | health.gov. Available from: <https://health.gov/healthypeople/objectives-and-data/browse-objectives/vaccination> [cited 17 June 2023].
3. Recommended Vaccines for Adults. CDC; 2023. Available from: <https://www.cdc.gov/vaccines/adults/rec-vac/index.html> [cited 17 June 2023].
4. Moynihan R, Sanders S, Michaleff ZA, Scott AM, Clark J, To EJ, Jones M, Kitchener E, Fox M, Johansson M, et al. Impact of COVID-19 pandemic on utilisation of healthcare services: a systematic review. *BMJ Open*. 2021;11(3):e045343. doi: 10.1136/bmjopen-2020-045343
5. Siegel M, Critchfield-Jain I, Boykin M, Owens A, Muratore R, Nunn T, Oh J. Racial/Ethnic Disparities in State-Level COVID-19 Vaccination Rates and Their Association with Structural Racism. *J Racial Ethn Health Disparities*. 2022;9(6):2361–74. doi: 10.1007/s40615-021-01173-7
6. NHIS - About the National Health Interview Survey, 2022. Available from: [https://www.cdc.gov/nchs/nhis/about\\_nhis.htm](https://www.cdc.gov/nchs/nhis/about_nhis.htm) [cited 17 June 2023].

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7. Ruggles S, Flood S, Sobek M, Backman D, Chen A, Cooper G, Richards S, Rodgers R, Schouweiler M. IPUMS USA: Version 13.0 [National Health Interview Survey]. Minneapolis, MN: IPUMS; 2023.
  8. Joinpoint Regression Program. Version 4.9.0.0 Statistical Methodology and Applications Branch, Surveillance Research Program, National Cancer Institute; 2022. Available from: <https://surveillance.cancer.gov/joinpoint/> [cited 27 March 2024].
  9. Adepoju OE, Chae M, Ojinnaka CO, Shetty S, Angelocci T. Utilization gaps during the COVID-19 pandemic: racial and ethnic disparities in telemedicine uptake in federally qualified health center clinics. *J Gen Intern Med.* 2022;37(5):1191–7. doi: 10.1007/s11606-021-07304-4
  10. Jang SH, Kang J. Factors associated with influenza vaccination uptake among U.S. adults: focus on nativity and race/ethnicity. *Int J Environ Res Public Health.* 2021;18(10):5349. doi: 10.3390/ijerph18105349
  11. Jamal A, Srinivasan M, Kim G, Huang RJ, Palaniappan L. Why are we going backward? Barriers to disaggregated racial information in federal data sets. *Am J Public Health.* 2023;113(8):852–5. doi: 10.2105/AJPH.2023.307339