

Longitudinal Analysis of Routine Childhood Vaccination Coverage of Selected Vaccines in Nigeria (1980-2023) using the Global Burden of Disease Study (2023)

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Abstract

Background

Routine childhood immunization remains one of the most effective public health interventions for reducing morbidity and mortality from vaccine-preventable diseases. Despite global progress, vaccination coverage in many low- and middle-income countries remains suboptimal. This study examines long-term trends in routine childhood vaccination coverage in Nigeria from 1980 to 2023.

Methods

Using data from the Global Burden of Disease Study 2023, particularly annual national coverage estimates for five key vaccines: BCG, DTP3, Polio3, MCV1, and HepB3, trends were assessed using line plots and forest plots to evaluate changes in mean coverage and associated uncertainty intervals over time. The highest and lowest performing years for each vaccine were identified.

Results

Coverage for all vaccines was lowest in 1980, followed by expansion in the late 1980s and early 1990s, stagnation in the mid-1990s to early 2000s, and renewed improvement after 2005. Peak coverage occurred between 2019 and 2021 for most vaccines. However, national coverage remained below optimal thresholds throughout the study period. Confidence intervals narrowed over time, suggesting improved data reliability.

Conclusion

While Nigeria has made substantial progress in routine immunization over four decades, persistent structural and regional inequities limit universal coverage. Strengthened primary health care systems, targeted subnational strategies, and sustained community engagement are essential to achieve equitable and durable improvements.

INTRODUCTION

Across the globe, routine childhood vaccinations have been found to be the most cost-effective approach for reducing childhood disease burden, especially when compared with other interventions that may demand infrastructural investments. (1) About 2–3 million lives are saved worldwide every year contributing substantially to the reduction in global infant mortality rate from 65 per 1,000 live births in 1990 to 29 in 2018. (2) In the United States, these vaccinations have dramatically reduced morbidity, mortality, and disability caused by vaccine-preventable diseases, with estimated 21 million hospitalizations, 732,000 deaths, and 322 million cases of disease averted in the United States between

1994 and 2013. (3) Among infectious diseases targeted by vaccines recommended before 1980, polio, measles, and rubella, have achieved elimination status as defined by the World Health Organization (4) - and smallpox has been eradicated. (5). Diphtheria and tetanus have declined markedly in incidence with routine immunization and are well controlled whereas the incidence of pertussis and mumps has declined when compared with pre-vaccine levels but still fluctuates given periodic outbreaks since vaccination was introduced. (4, 5) Universally, the public health burden of diseases targeted in the childhood immunization program between 1980 and 2005 has decreased by more than 80%. (5) While it has been established that routine vaccination plays a key role in protecting children from preventable diseases, (6) vaccines can have several economic benefits. (7) By preventing an episode of the disease through a vaccine, the economic costs are averted. This is particularly important for low and middle-income countries (LMICs) where a large part of medical expenditure is out-of-pocket. Routine vaccination has a positive effect on social and health equity among populations. Infectious disease incidence and mortality are often associated with poverty, and exacerbated by lack of access to clean water, sanitation, and basic hygiene among the poor. Routine childhood vaccinations are, thus, estimated to avert the largest burden of diseases, associated medical expenses, and loss in economic productivity in the poorest segments of the society. (8)(9) A recent study in 41 Gavi-eligible LMICs found that universal coverage of the measles, rotavirus, and pneumococcal conjugate vaccines would avert a total of 12.6 million cases of catastrophic health expenditure which might have otherwise propelled patients into poverty. (8) In the absence of protection against infectious diseases, children may also incur early recurrent infections that may negatively impact cognitive ability and development. (10) The theoretical basis of the long-term benefits of vaccines is anchored in the widely accepted “fetal origins” hypothesis. (11) Malnutrition, infection, pregnancy and birth complications, and under-stimulation during the first 1000 days of life can have lasting impact on health, cognitive, and economic outcomes well into old age. A longitudinal study conducted by Nandi A et al among selected children each in India, Ethiopia and Vietnam showed that when measles vaccine is given at the age of 6–18 months of life, children develop higher anthropometric Z score, percentage points higher on standardized cognition tests(12). The association between National Immunization Programme of India and height-for-age and weight-for-age z-scores among children selected years has been found to be higher compared to other children. (13) In this study, we aim to examine the trends in routine childhood vaccination coverage in Nigeria from 1980 to 2023. This objective will focus on identifying how the coverage rates for key vaccines (BCG, DTP3, Polio3, MCV1, HepB3) have evolved over time, highlighting significant increases, plateaus, or declines in vaccination uptake. We also aim to determine which vaccines have achieved the highest and lowest coverage overall, as well as annually from 1980 to 2023.

METHODS

Data Source and Scope

The dataset used for this analysis is sourced from the Global Burden of Disease Study 2023 (GBD 2023) (14), which provides comprehensive data on vaccination coverage across various countries. Specifically,

this dataset includes routine childhood vaccination coverage estimates for multiple vaccines, including BCG, DTP3, Polio3, MCV1, and HepB3, from 1980 to 2023. The data covers Nigeria, providing annual coverage rates for each vaccine, along with confidence intervals for each year. Since this study uses an open-access, publicly available dataset from the Global Burden of Disease Study 2023, which does not involve the collection of personal or identifiable information, it does not require ethical approval. The dataset provides aggregated, de-identified data on vaccination coverage, making it suitable for analysis without any ethical concerns related to privacy or consent. As such, this research adheres to the guidelines for the use of secondary data from publicly accessible sources. For this analysis, we selected the following key routine childhood vaccines from the dataset: BCG, DTP3, Polio3, MCV1, and HepB3. These vaccines were chosen based on their critical role in global immunization programs and their relevance to public health.

Statistical Analysis

To analyze the trends in vaccination coverage, we used line plots to visualize how the coverage for key vaccines evolved from 1980 to 2023. These plots were created for each selected vaccine, including BCG, DTP3, Polio3, MCV1, and HepB3, with the mean vaccination coverage plotted against each year. This allowed us to clearly observe the overall trajectory of vaccine uptake, highlighting significant increases, plateaus, and declines. In addition to the trend visualization, we identified the highest and lowest performing years for each vaccine based on the mean coverage. The highest performing year for each vaccine represents the year with the greatest level of coverage, while the lowest performing year indicates the period with the least coverage. These years were highlighted in the analysis to pinpoint critical periods of success and challenge in vaccination efforts. Forest plots were also used to show the confidence intervals around the mean coverage, reflecting the uncertainty in the estimates for each year. This helped us to understand the reliability of the data and provided a clearer picture of trends over time. The latest version of R software was used.

RESULTS

This section describes the trends of each vaccine coverage between 1980 and 2023 whilst highlighting the years with the highest and lowest vaccination coverage.

Results for the BCG Vaccine

The highest performing year for the BCG vaccine was 2021, with a mean coverage of 0.736 (0.647 - 0.783) and marks the peak in vaccination coverage. Conversely, the lowest performing year was 1980, with a mean coverage of 0.319 (0.214 - 0.444). Figure 1 clearly shows that coverage steadily increased from 1980 through to 1990, with wider confidence intervals in the early years, indicating greater uncertainty in the estimates and the intervals narrowed as the years progressed, particularly after the early 2000s, suggesting more precise estimates of coverage. The confidence intervals in recent years are consistently narrow, reflecting higher certainty about the vaccination coverage, likely due to more consistent data and reporting practices but started getting wider from 2021. The trend plot in figure 2

corroborates figure 1 and demonstrates the yearly coverage rates over time, with notable peaks and valleys. The plot shows an initial rise in coverage from 1980 to the early 1990s, followed by a decline between 1990 - 2000 and subsequent gradual increase in coverage, with another steep rise from around 2017 to 2021. The last few years show the highest coverage rates, reaching 0.736 in 2021, highlighting the success of recent vaccination campaigns and improved immunization efforts.

Results for the third dose Diphtheria, Tetanus, and Pertussis (DTP3) Vaccine

The highest performing year for the DTP3 vaccine was 2021, with a mean coverage of 0.583 (0.522 - 0.645) and the lowest performing year was 1980, with a mean coverage of 0.21 (0.124 - 0.303). The confidence intervals in figure 3 are wider in the earlier years, particularly in the 1980s and 1990s, reflecting greater variability and uncertainty. As the years progress, the confidence intervals become narrower, particularly from the 1990s onward, indicating more precise estimates. Figure 4 shows a steady increase in coverage from 1980 to 2023, with peaks and valleys observed at different times. The coverage increased sharply after 1980, reaching a peak in the early 1990s, followed by a slight dip and a plateau to the early 2000s. From the mid-2000s, the coverage consistently improved, peaking again in 2010, and then again in 2021.

Results for the third dose of Poliovirus (Polio3) Vaccine

The highest performing year for the Polio3 vaccine was 2020, with a mean coverage of 0.586 (0.527 - 0.639), marking the peak of vaccination efforts for this vaccine. In contrast, the lowest performing year was 1980, with a mean coverage of 0.253 (0.164 - 0.367). Figure 5 shows wider confidence intervals in the earlier years, especially in 1980s and early 1990s and as time progresses, the intervals become narrower, particularly after the late 2000s, suggesting that vaccination coverage estimates have become more reliable over time. Figure 6 illustrates an initial increase in coverage from 1980 to the early 1990s, followed by a decline and stagnation in coverage during the mid-1990s to early 2000s. After the early 2000s, there was a steady upward trend in vaccination coverage, culminating in the 2020 peak. The overall trajectory indicates a consistent increase in coverage, with some fluctuations in the early years.

Results for the first dose of the Measles-containing Vaccine

The highest performing year for the MCV1 vaccine was 2019, with a mean coverage of 0.622 (0.541 - 0.697), in contrast, the lowest performing year was 1980, with a mean coverage of 0.248 (0.117 - 0.445). The figure 8 illustrates that the confidence intervals were wider in the earlier years, particularly from 1980 to the early 1990s, reflecting greater uncertainty and less reliable data. As the years progressed, the confidence intervals began to narrow, particularly after the late 1990s, indicating more precise estimates of vaccination coverage. The plot shows a steady upward trend from the early 2000s to 2019, with a slight increase in precision in recent years, suggesting better data quality and consistent reporting. Figure 7 shows an initial increase in coverage from 1980, reaching a peak in the early 1990s, followed by a decline to 2000 with gradual increase to around 2009, there is a consistent rise in coverage, culminating in the 2019 peak of 0.622.

Results for the third dose of Hepatitis B (HepB3) Vaccine

The highest performing year for the HepB3 vaccine was 2021, with a mean coverage of 0.582 (0.522 - 0.645), which was matched again in 2023, also with a coverage of 0.582 (0.495 - 0.664). This indicates a steady peak in vaccination efforts for HepB3 in the most recent years. The lowest performing years occurred from 1980 to 2003, as the vaccine was not yet available during this period. The first recorded coverage for HepB3 began in 2004, when the mean coverage was at its lowest, marking the start of vaccination efforts for Hepatitis B third dose in Nigeria. Figure 10 shows a significant increase in coverage starting in 2004, with the confidence intervals widening at the start, reflecting uncertainty in the data due to the vaccine's introduction. As years progress, the confidence intervals narrow significantly, indicating that estimates of coverage became more reliable with the establishment of stronger immunization programs. The plot also shows a gradual upward trend in coverage over time, peaking in 2021 and continuing to maintain a high level in 2023. Figure 2 illustrates the steady increase in vaccination coverage starting from 2004 and also corroborates that there was no coverage before this period, followed by a slow climb in the first decade after introduction. From around 2015, the coverage starts to show a more consistent rise, with the highest coverage recorded in 2021 and 2023.

DISCUSSION

This longitudinal analysis demonstrates that routine childhood vaccination coverage in Nigeria from 1980 to 2023 followed a trajectory characterized by early low uptake, expansion in the late 1980s and early 1990s, stagnation during the mid-1990s to early 2000s, and renewed improvement after 2005. These trends are broadly consistent with patterns observed across many low- and middle-income countries (LMICs), although Nigeria's experience reflects important contextual disruptions.

The low baseline coverage observed in 1980 aligns with global evidence showing that immunization systems in many sub-Saharan African countries were still underdeveloped during the early years of the Expanded Programme on Immunization. WHO global coverage reports indicate that DTP3 coverage across Africa remained below 40% throughout much of the 1980s due to weak primary health care infrastructure and limited cold-chain capacity (15). Nigeria's similarly low early coverage therefore reflects structural health system limitations rather than antigen-specific challenges. The increase in coverage observed through the late 1980s and early 1990s parallels the global scale-up associated with the Universal Childhood Immunization initiative. International coordination and outreach expansion during this period resulted in marked increases in coverage across LMICs (1). Nigeria's upward trajectory during this phase appears consistent with that broader global momentum.

However, the stagnation and fluctuations observed between the mid-1990s and early 2000s contrast with the steady progress reported in some other LMICs during the same period (16). A key contextual explanation is Nigeria's documented vaccine resistance episode during the 2003–2004 polio vaccine boycott in Northern Nigeria. Yahya (17) described how mistrust in government and misinformation significantly reduced polio vaccine uptake. Subsequent analyses confirmed that this resistance extended

beyond polio vaccination and disrupted routine immunization systems more broadly (18). The plateau in DTP3 and Polio3 coverage observed in this study aligns with those findings, suggesting that sociopolitical factors undermined broader immunization performance during that period. The renewed upward trend after 2005 corresponds with intensified immunization strengthening efforts and expanded global financing mechanisms. Nigeria's engagement with Gavi, the Vaccine Alliance, has been associated with improvements in cold-chain infrastructure, vaccine introduction, and routine immunization strengthening (19). The introduction and steady increase of HepB3 coverage in this study mirrors patterns observed in other Gavi-supported countries, where new antigen introduction is followed by gradual system consolidation (19). These improvements likely reflect both financial investment and enhanced programmatic oversight.

Despite long-term progress, vaccination coverage in Nigeria remained below optimal thresholds across the study period. This finding is consistent with Nigeria Demographic and Health Survey (NDHS) data, which show persistent regional disparities in full immunization coverage, particularly between northern and southern states (20). Broader LMIC analyses demonstrate that socioeconomic status, maternal education, and rural residence remain strong predictors of incomplete immunization (21). Wiysonge et al. further identified contextual barriers including poverty, geographic inaccessibility, and weak health facility distribution as major determinants of low coverage in sub-Saharan Africa (22). These structural inequalities likely explain why national-level improvements did not translate into universal coverage. Several vaccines reached peak coverage around 2019–2021. This period coincided with Nigeria's certification as wild polio-free in 2020, which may have strengthened immunization systems and surveillance. However, global modelling studies suggest that the COVID-19 pandemic caused significant disruptions to routine immunization services worldwide, with declines in DTP3 coverage observed in many countries during 2020 (23). Nigeria's relative stability or rebound during this period may therefore reflect catch-up campaigns or intensified outreach rather than uninterrupted system resilience. Slight widening of uncertainty intervals in recent years suggests continuing vulnerability and the need for sustained monitoring.

Overall, these findings reinforce the understanding that immunization coverage is shaped by health system capacity, political stability, financing mechanisms, and community trust. Nigeria's trajectory reflects both the gains achievable through sustained investment and the fragility of progress when governance or public confidence is disrupted. Continued strengthening of primary health care systems, targeted interventions in underserved regions, and strategies to rebuild and sustain community trust will be critical to achieving equitable and durable vaccination coverage.

RECOMMENDATIONS

The findings of this longitudinal analysis suggest that although Nigeria has achieved measurable improvements in routine childhood vaccination coverage over the past four decades, progress has been uneven and remains below optimal thresholds. To accelerate gains and ensure sustainability, several targeted interventions are warranted. First, immunization strengthening efforts should prioritize

subnational equity rather than focusing solely on national averages. Persistent disparities between northern and southern states require geographically targeted strategies. The National Primary Health Care Development Agency (NPHCDA) should implement ward-level microplanning using routine immunization data to identify and track zero-dose and under-immunized children. States consistently performing below national averages should receive conditional funding tied to measurable improvements in DTP3 and MCV1 coverage. Performance-based grants could incentivize local government areas (LGAs) to improve outreach delivery and reporting accuracy.

Second, cold-chain infrastructure and vaccine logistics management systems must be strengthened at the peripheral facility level. While vaccine availability has improved over time, stock-outs and equipment breakdowns remain common in rural areas. A national preventive maintenance system should be institutionalized, including scheduled equipment servicing, solar-powered refrigeration expansion in off-grid communities, and real-time stock monitoring through digital logistics platforms. Investment should focus not only on procurement but also on maintenance and accountability mechanisms. Third, community trust-building must be sustained and institutionalized. The historical polio vaccine resistance episode demonstrated how misinformation can undermine immunization programs. Structured engagement with religious leaders, traditional rulers, and women's associations should become a permanent component of routine immunization strategy rather than an emergency response measure. Risk communication units within state health ministries should proactively monitor vaccine misinformation trends and deploy evidence-based messaging campaigns before resistance escalates.

Fourth, immunization services should be integrated with other maternal and child health interventions to reduce missed opportunities. Combining routine vaccination with antenatal care visits, nutrition programs, and child growth monitoring services can increase uptake, particularly among hard-to-reach populations. Health facilities should implement a "no missed opportunity" policy, ensuring that every child encounter with the health system includes vaccination status assessment. Fifth, resilience planning should be formalized. The COVID-19 pandemic illustrated the vulnerability of routine immunization to systemic shocks. Nigeria should establish a national immunization contingency framework that includes rapid catch-up protocols, emergency outreach funding mechanisms, and mobile vaccination teams that can operate during public health crises or conflict-related disruptions.

Finally, future research should prioritize subnational analysis and implementation science. Understanding why certain states consistently outperform others could generate replicable best practices. Linking vaccination data with socioeconomic indicators would also help policymakers design more targeted interventions. Sustained political commitment, targeted resource allocation, and community-centered strategies will be essential if Nigeria is to transition from incremental progress to universal and equitable vaccination coverage.

CONCLUSION

In conclusion, this longitudinal analysis demonstrates that Nigeria has made measurable progress in routine childhood vaccination coverage from 1980 to 2023, transitioning from very low baseline levels to more stable and improved uptake in recent years. However, the trajectory has not been linear, with periods of stagnation and vulnerability reflecting the influence of political instability, health system weaknesses, and community trust dynamics. Although peak coverage was achieved between 2019 and 2021 for several vaccines, national levels remain below optimal targets, and disparities across regions persist. The narrowing uncertainty intervals over time suggest improvements in data systems and program monitoring, yet sustaining and accelerating coverage gains will require deliberate investment in primary health care strengthening, equitable resource allocation, and proactive community engagement. Achieving universal and durable immunization coverage in Nigeria will depend not only on vaccine availability, but on building resilient systems capable of withstanding sociopolitical and public health shocks.

Declarations

ETHICS APPROVAL AND CONSENT TO PARTICIPATE.

Not Applicable

ACKNOWLEDGEMENTS.

Not Applicable

CONSENT FOR PUBLICATION

Not Applicable

FUNDING STATEMENT.

No funding was obtained for this research project.

DECLARATION OF INTERESTS

All authors declare no competing interest.

CLINICAL TRIAL NUMBER

Not applicable

DATA AVAILABILITY STATEMENT

We used data from the Global Burden of Disease Study 2023, and can be found below.

Institute for Health Metrics and Evaluation (IHME). Global Burden of Disease Study 2023 (GBD 2023) Routine Childhood Vaccination Coverage Estimates and Forecasts 1980-2030. Seattle, United States of

AUTHORS CONTRIBUTION STATEMENT

Adewunmi Akingbola conceptualized the study, did the data analysis and wrote the methodology, results recommendations, conclusion, Olajumoke Adewole and Joshua Alabi wrote the Discussion, Emmanuel Nwaeze wrote the Introduction, Abiodun Adegbesan and Adewunmi Akingbola edited the manuscript. All authors have agreed to this manuscript.

Corresponding Author: Petra Mariaria is a population health scientist who graduated with a first class in her undergraduate degree and also completed a Master of Philosophy (MPhil) in Population Health Sciences at the University of Cambridge, United Kingdom and is currently working at the Infectious Diseases institute, Makerere University Uganda.

References

1. Ozawa S, Mirelman A, Stack ML, Walker DG, Levine OS. Cost-effectiveness and economic benefits of vaccines in low- and middle-income countries: a systematic review. *Vaccine*. 2012;31:96–108. doi:10.1016/j.vaccine.2012.10.103.
2. World DataBank: World Development Indicators. The World Bank; 2017. <http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators>(open in a new window).
3. Whitney CG, Zhou F, Singleton J, Schuchat A; Centers for Disease Control and Prevention (CDC). Benefits from immunization during the vaccines for children program era - United States, 1994-2013. *MMWR Morb Mortal Wkly Rep*. 2014;63(16):352–355
4. Dowdle WR. The principles of disease elimination and eradication. *Bull World Health Organ*. 1998;76(Suppl 2):22–25
5. Roush SW, Murphy TV; Vaccine-Preventable Disease Table Working Group. Historical comparisons of morbidity and mortality for vaccine-preventable diseases in the United States. *JAMA*. 2007;298(18):2155–2163
6. Joe, W., & Kumar Verma, A. Association of basic vaccination with cognitive and learning ability among children: Insights from the India Human Development Survey, 2004–05 and 2011–12. *Journal of Biosocial Science*. 2022;54(2), 243-256.
7. Ozawa S, Clark S, Portnoy A, Grewal S, Stack ML, Sinha A, Mirelman A, Franklin H, Friberg IK, Tam Y. Estimated economic impact of vaccinations in 73 low- and middle-income countries, 2001–2020. *Bull World Health Organ*. 2017;95:629–38. doi:10.2471/BLT.16.178475.
8. Riumallo-Herl C, Chang AY, Clark S, Constenla D, Clark A, Brenzel L, Verguet S. Poverty reduction and equity benefits of introducing or scaling up measles, rotavirus and pneumococcal vaccines in low-income and middle-income countries: a modelling study. *BMJ Global Health*. 2018;3:e000613.

9. Megiddo I, AR C, Nandi A, Chatterjee S, Prinja S, Khera A, Laxminarayan R. Analysis of the universal immunization programme and introduction of a rotavirus vaccine in India with IndiaSim. *Vaccine*. 2014;32(Supplement 1):A151–61.
10. Currie J, Vogl T. Early-life health and adult circumstance in developing countries. *Annu Rev Econom*. 2013;5:1–36. doi:10.1146/annurev-economics-081412-103704.
11. Barker DJ. The fetal and infant origins of adult disease. *BMJ*. 1990;301:1111–1111. doi:10.1136/bmj.301.6761.1111.
12. Nandi A, Shet A, Behrman JR, Black MM, Bloom DE, Laxminarayan R. Anthropometric, cognitive, and educational benefits of measles vaccination: longitudinal cohort analysis in Ethiopia, India, and Vietnam; 2018. CDDEP Working paper
13. Anekwe TD, Kumar S. The effect of a vaccination program on child anthropometry: evidence from India's Universal Immunization Program. *J Public Health (Oxf)*. 2012;34:489–97
14. Institute for Health Metrics and Evaluation (IHME). Global Burden of Disease Study 2023 (GBD 2023) Routine Childhood Vaccination Coverage Estimates and Forecasts 1980-2030. Seattle, United States of America: Institute for Health Metrics and Evaluation (IHME), 2025.
DOI:<https://doi.org/10.6069/JCH3-FT68>
15. National Research Council (US) Working Group on the Effects of Child Survival and General Health Programs on Mortality, Ewbank DC, Gribble JN. Immunization programs. Washington, D.C., DC: National Academies Press; 1993.
16. Restrepo-Méndez MC, Barros AJ, Wong KL, Johnson HL, Pariyo G, França GV, et al. Inequalities in full immunization coverage: trends in low- and middle-income countries. *Bull World Health Organ* [Internet]. 2016;94(11):794-805B. Available from: <http://dx.doi.org/10.2471/BLT.15.162172>
17. Yahya M. Polio vaccines—"no thank you!" barriers to polio eradication in Northern Nigeria. *Afr Aff (Lond)* [Internet]. 2007;106(423):185–204. Available from: <http://dx.doi.org/10.1093/afraf/adm016>
18. Ghinai I, Willott C, Dadari I, Larson HJ. Listening to the rumours: what the northern Nigeria polio vaccine boycott can tell us ten years on. *Glob Public Health* [Internet]. 2013;8(10):1138–50. Available from: <http://dx.doi.org/10.1080/17441692.2013.859720>
19. Gavi.org. [cited 2026 Mar 1]. Available from: <https://www.gavi.org/news/media-room/nigeria-launches-historic-integrated-vaccination-campaign-targeting-100-million#:~:text=In%20its%20next%20strategic%20period,to%20rollout%20vaccines%20at%20scale>.
20. Org.ng:8443. [cited 2026 Mar 1]. Available from: <https://ngfrepository.org.ng:8443/bitstream/123456789/3145/1/NDHS%202018.pdf>
21. Ali HA, Hartner A-M, Echeverria-Londono S, Roth J, Li X, Abbas K, et al. Vaccine equity in low and middle income countries: a systematic review and meta-analysis. *Int J Equity Health* [Internet]. 2022;21(1):82. Available from: <http://dx.doi.org/10.1186/s12939-022-01678-5>
22. Wiysonge CS, Uthman OA, Ndumbe PM, Hussey GD. Individual and contextual factors associated with low childhood immunisation coverage in sub-Saharan Africa: a multilevel analysis. *PLoS One* [Internet]. 2012;7(5):e37905. Available from: <http://dx.doi.org/10.1371/journal.pone.0037905>

23. Causey K, Fullman N, Sorensen RJD, Galles NC, Zheng P, Aravkin A, et al. Estimating global and regional disruptions to routine childhood vaccine coverage during the COVID-19 pandemic in 2020: a modelling study. *Lancet* [Internet]. 2021;398(10299):522–34. Available from: [http://dx.doi.org/10.1016/S0140-6736\(21\)01337-4](http://dx.doi.org/10.1016/S0140-6736(21)01337-4)

Figures

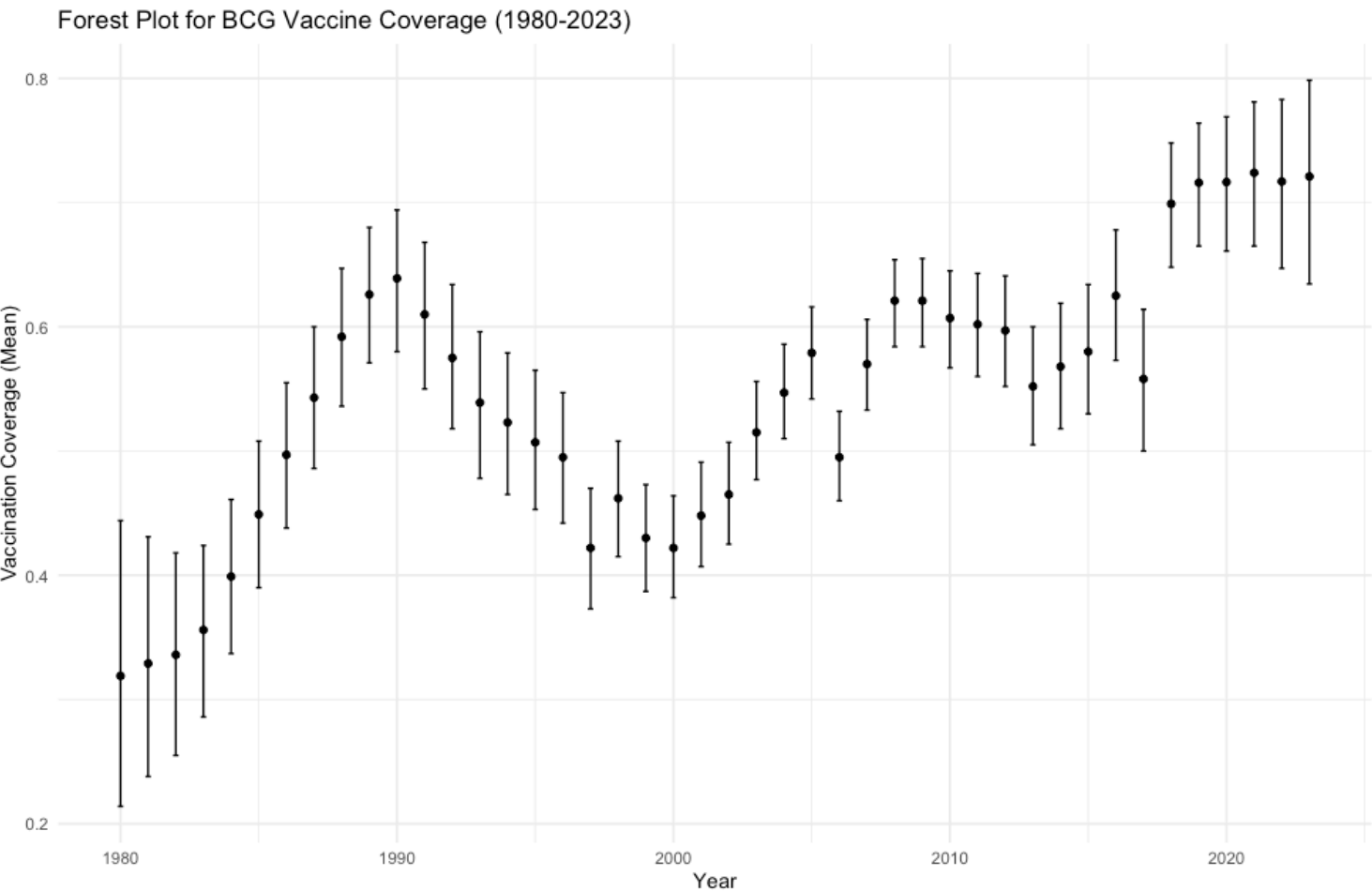


Figure 1

Forest Plot of Bacillus Calmette–Guérin Vaccine Vaccine Coverage (1980 - 2023)

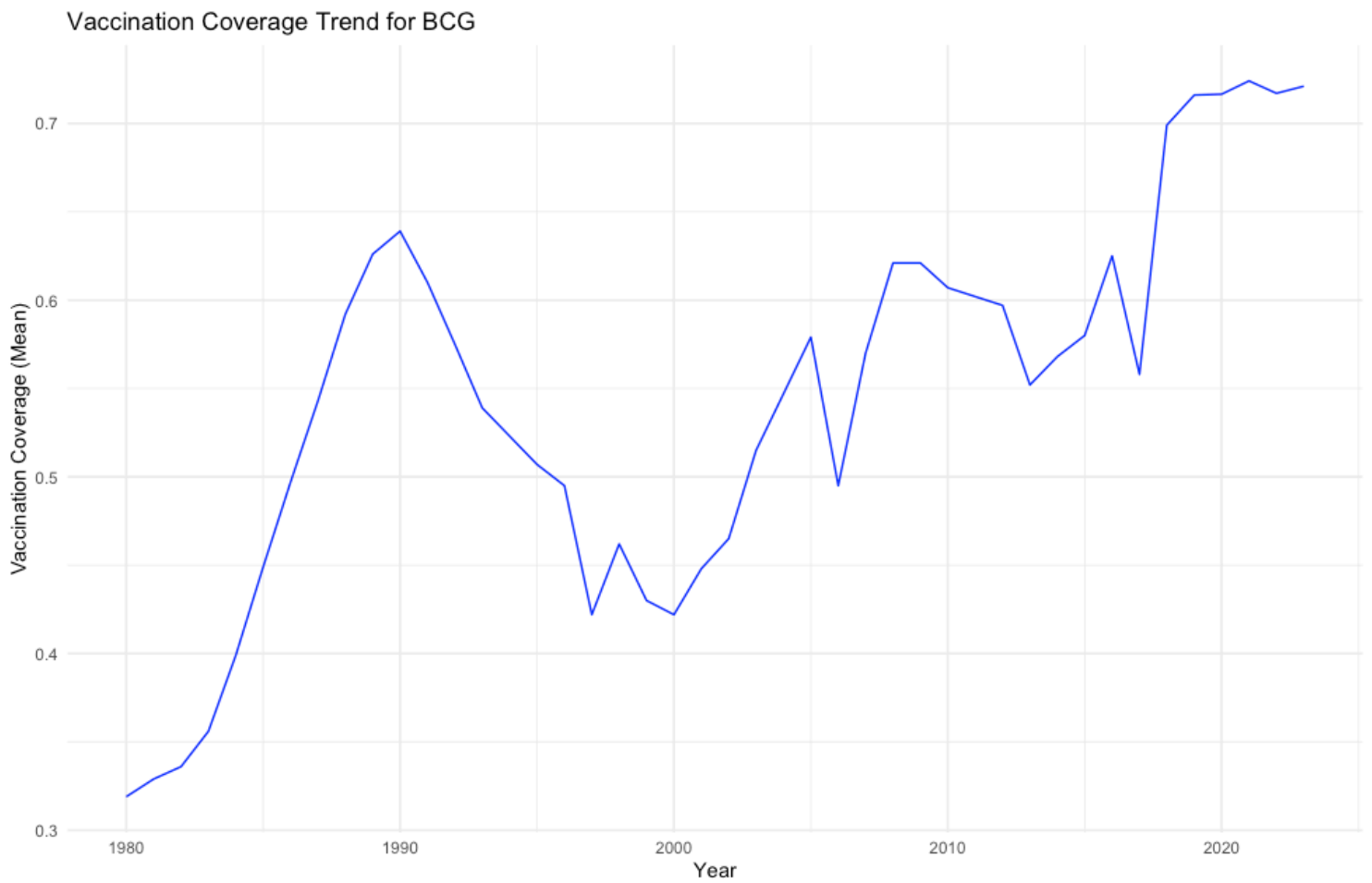


Figure 2

Trends in vaccination coverage for Bacillus Calmette–Guérin Vaccine (1980 - 2023)

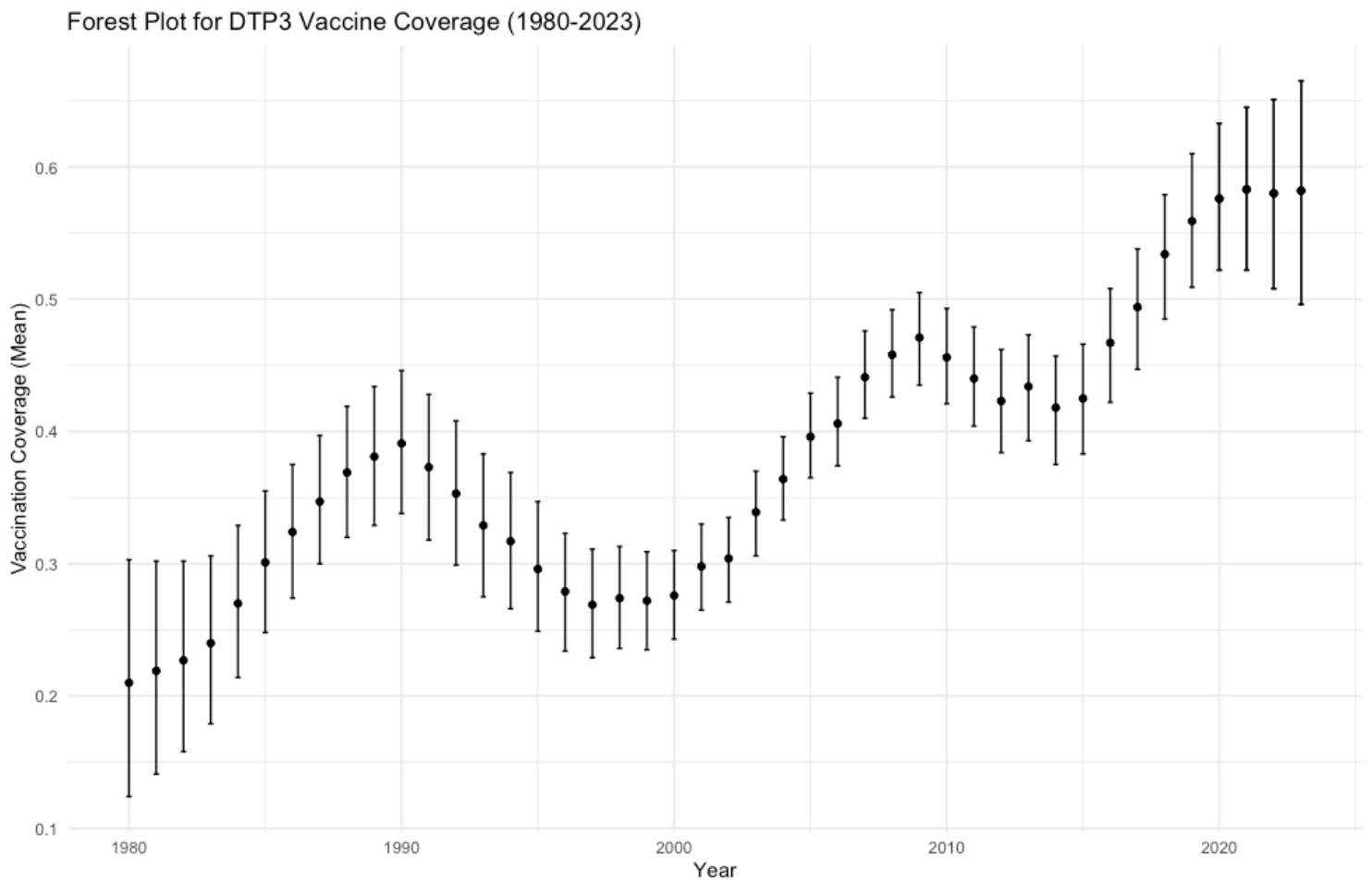


Figure 3

Forest Plot of the third dose Diphtheria, Tetanus, and Pertussis Vaccine Coverage (1980 - 2023)

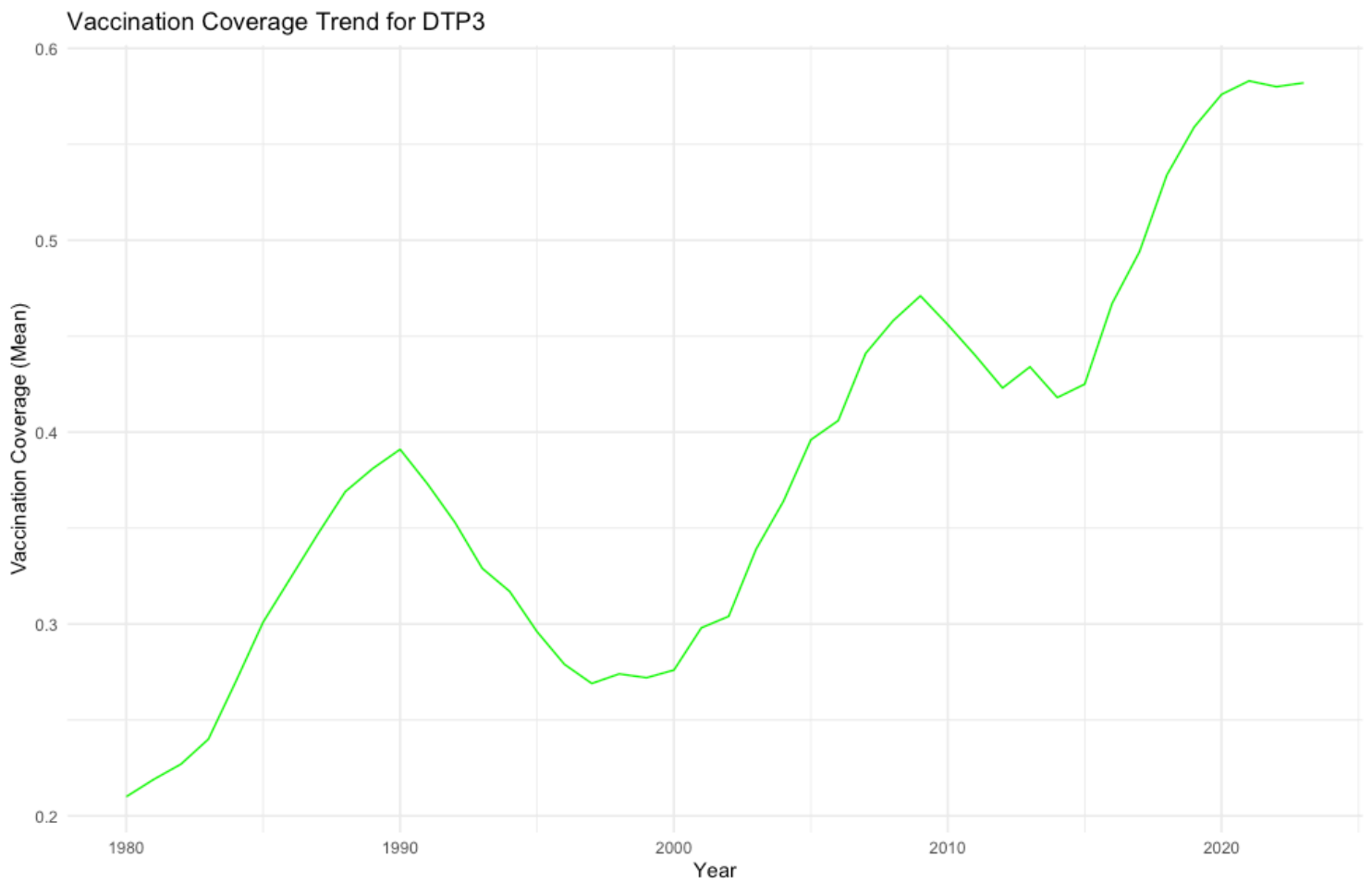


Figure 4

Trends in vaccination coverage for the third dose Diphtheria, Tetanus, and Pertussis (1980 - 2023)

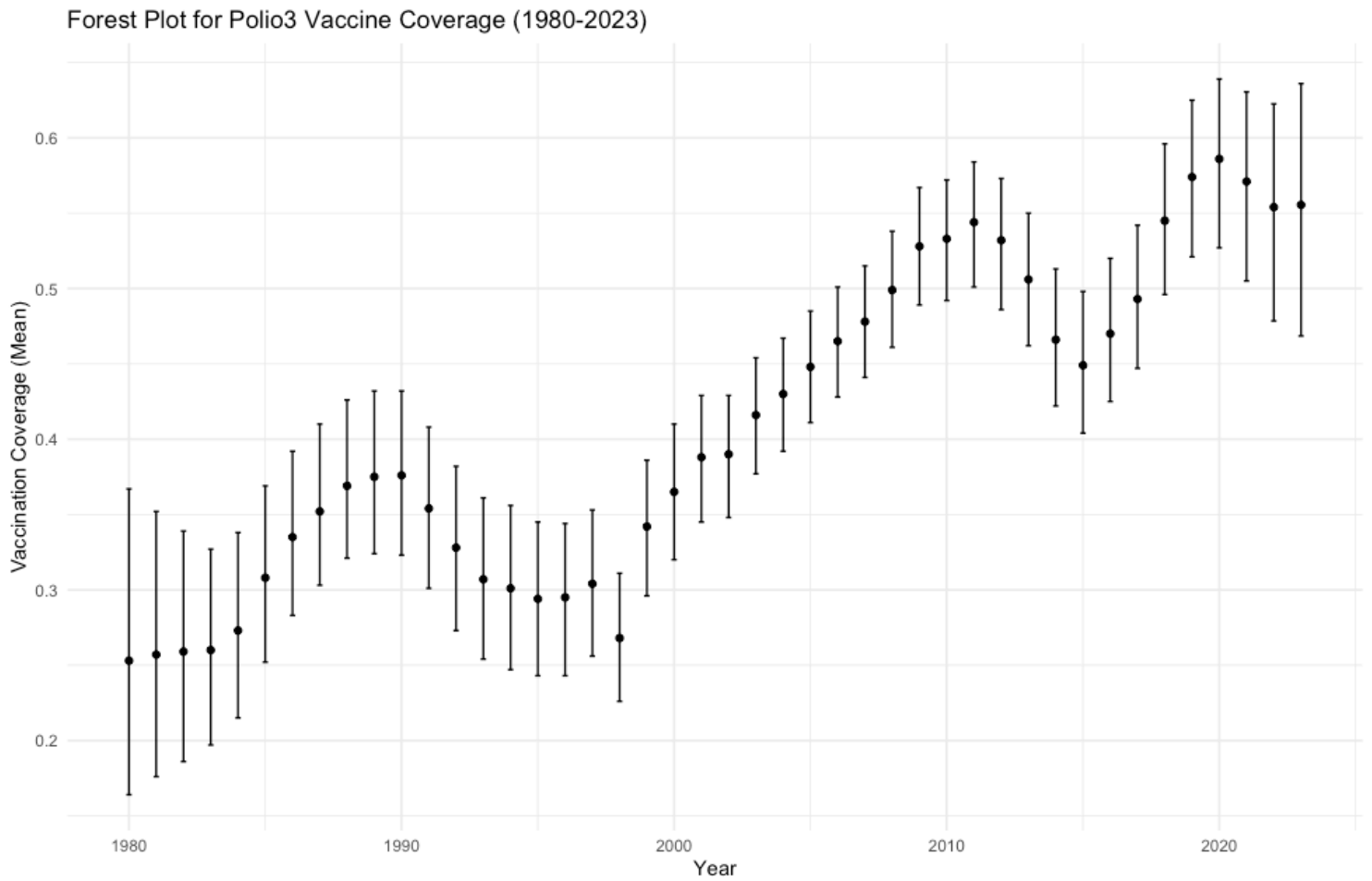


Figure 5

Forest Plot for third dose of Poliovirus Vaccine Coverage (1980 - 2023)

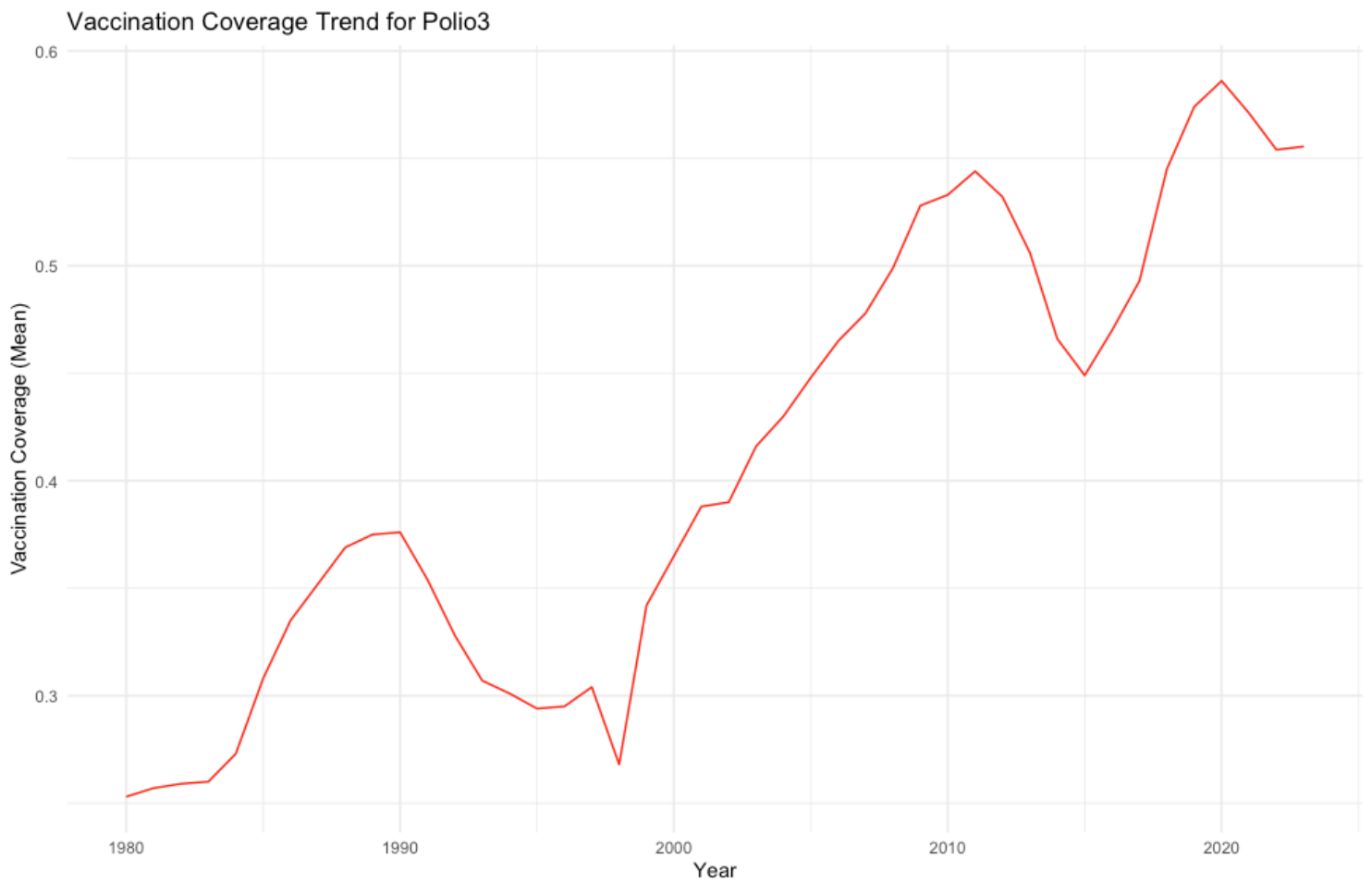


Figure 6

Trends in coverage for the third dose of Poliovirus vaccine (1980 - 2023)

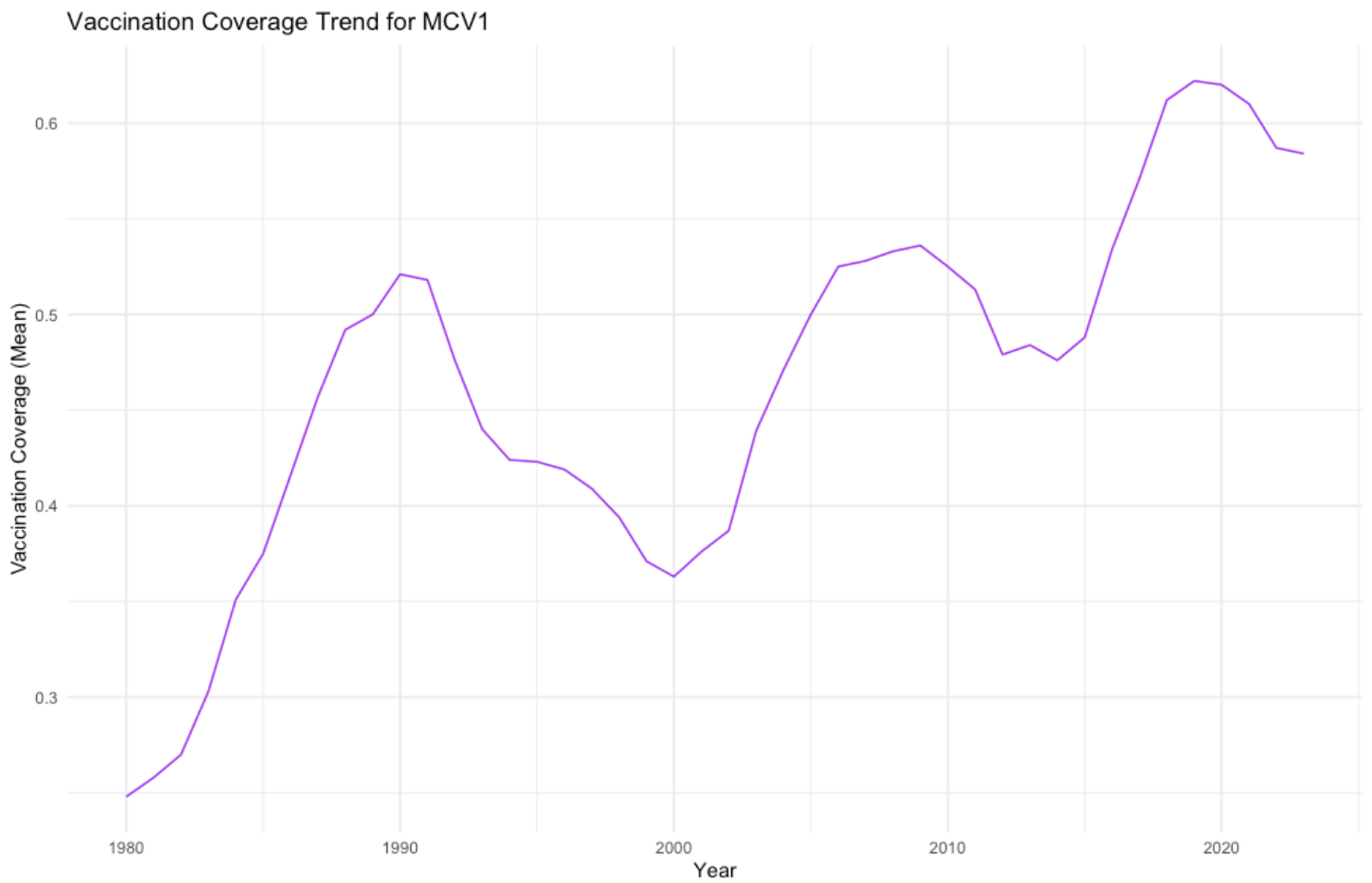


Figure 7

Trends in vaccination coverage for first dose of Measles-containing Vaccine (1980 - 2023)

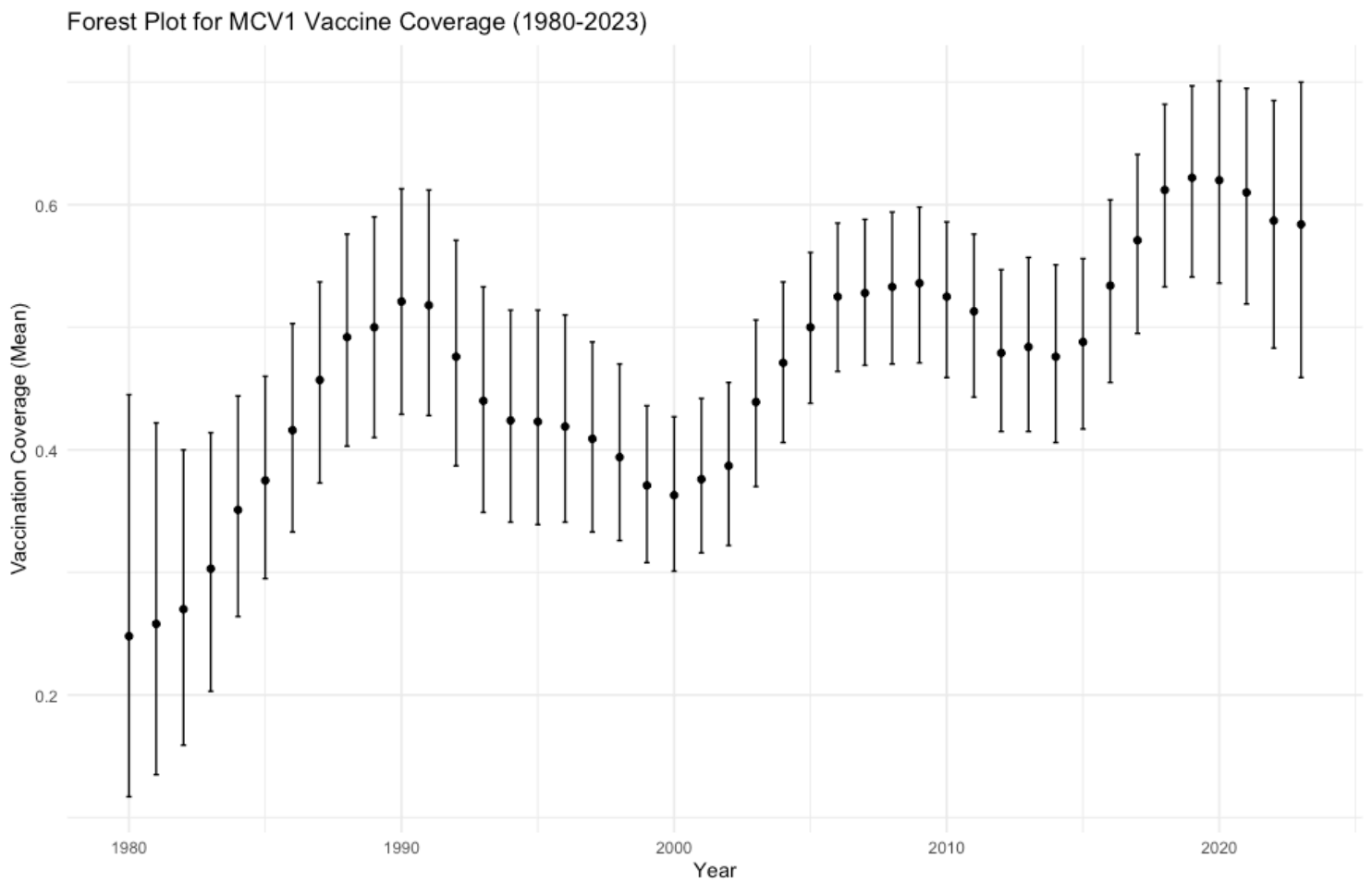


Figure 8

Forest Plot of first dose of Measles-containing Vaccine Coverage (1980 - 2023)

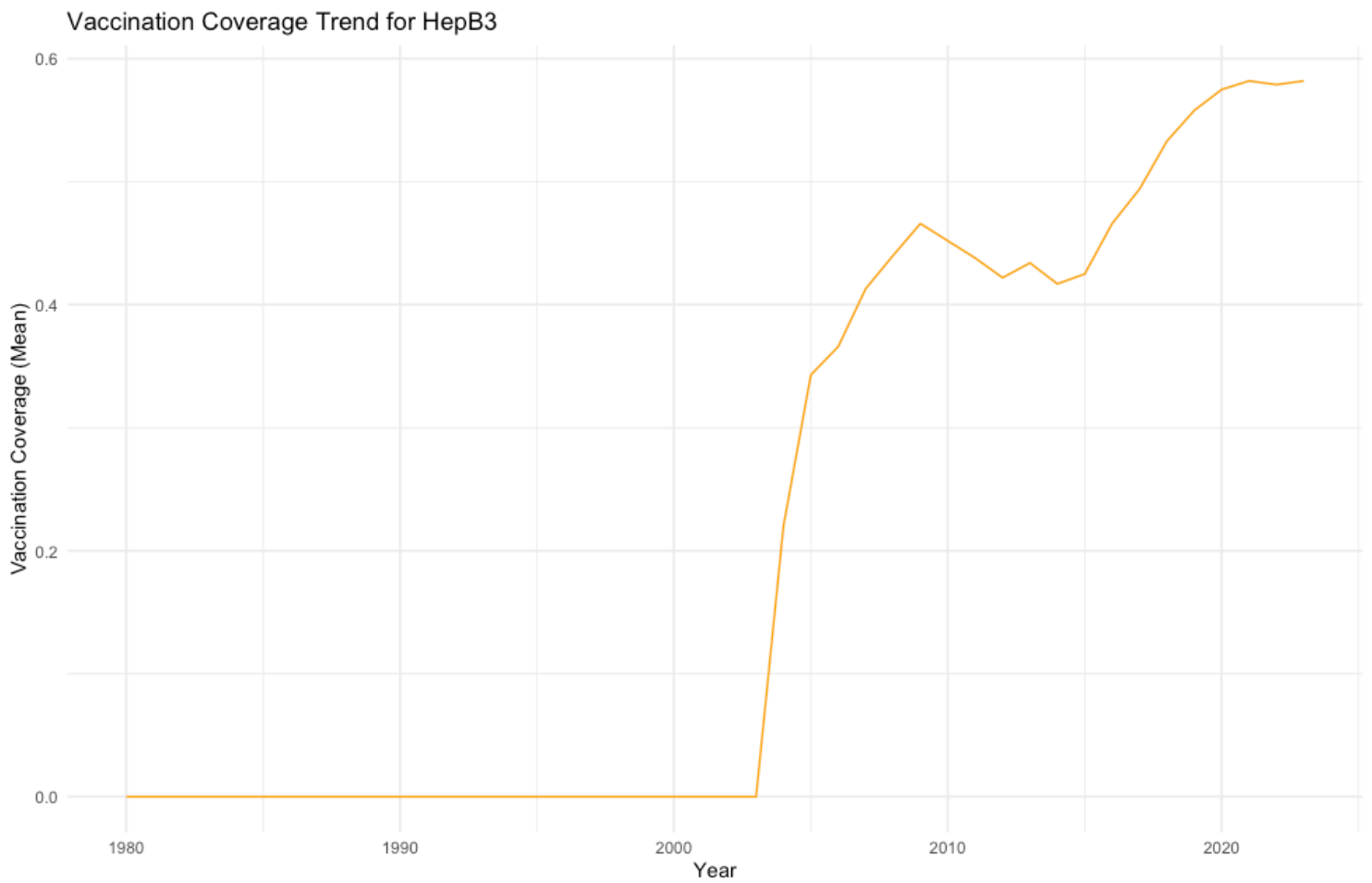


Figure 9

Trends in vaccination coverage for third dose of Hepatitis B Vaccine (1980 - 2023)

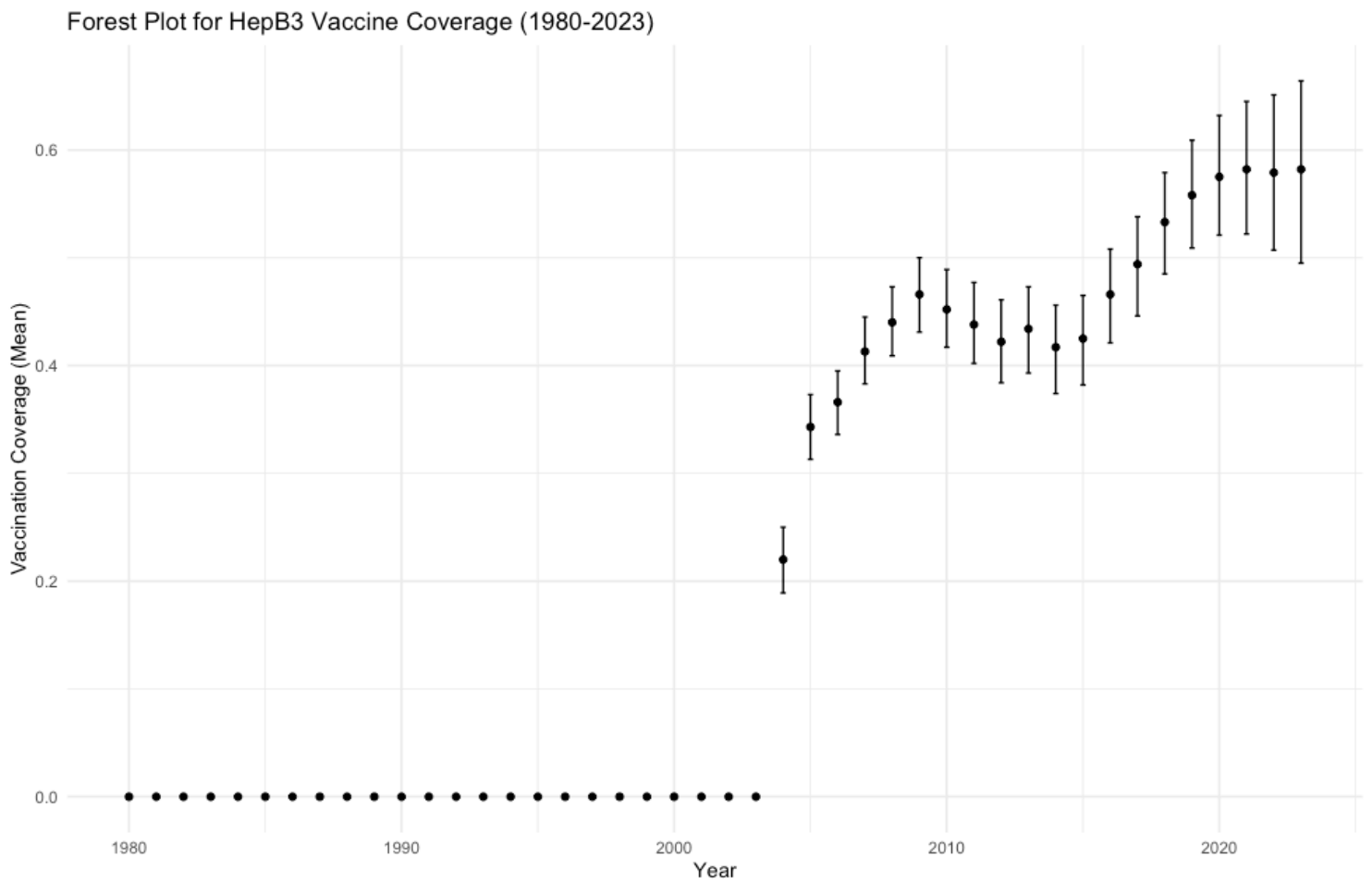


Figure 10

Forest Plot of the third dose of Hepatitis B Vaccine Coverage (1980 - 2023)