



Study on Trend of Immunization Coverage in Mutum Biyu Ward "B" From 2016-2019 in Gassol Local Government Area, Taraba State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This study examines the trend of immunisation coverage for Bacille Calmette-Guerin (BCG), Oral Polio Vaccine (OPV), Measles, and Yellow Fever in Mutum Biyu Ward 'B' of Gassol local Government Area, Taraba State, Nigeria, from 2016 to 2019. The DHIS2 Nigeria platform was used to gather secondary data using a quantitative, cross-sectional approach. In order to analyse the completion and non-completion rates of Routine Immunisation (RI) schedules, vaccination cards and carer recollection were the main sources of immunisation histories. One-way ANOVA testing and descriptive statistics were used in the data analysis. The study's findings showed that vaccination coverage varied over time. The BCG coverage saw notable fluctuations, peaking in the years 2017 and 2019. In 2018, OPV coverage rose on average but somewhat decreased. Measles vaccination rates were steady at first, then they fell in 2018 and then sharply recovered in 2019. The vaccination rate for yellow fever was low in 2016, improved slightly in 2017, declined sharply in 2018, and then reached its peak in 2019. The study recommended localized use of geo-mapping to identify and map communities with low immunisation coverage in Mutum Biyu Ward "B" of Gassol LGA, Taraba State.

Keywords: Immunisation coverage; routine immunisation (RI); public health; vaccine trends and healthcare.

1. INTRODUCTION

Immunisation is one of the most economical public health initiatives worldwide, which has dramatically decreased morbidity, mortality, and disability from diseases that can be prevented by vaccination [1]. Globally, attempts to increase immunisation coverage have stepped up throughout time, particularly in low- and middle-income nations where the prevalence of chronic illnesses is higher. In many places, especially rural areas of Nigeria, there are still obstacles in the way of reaching the ideal immunisation coverage despite these efforts [2].

Taraba is one of the states in Nigeria's northeastern region. The state struggles with poor vaccination rates, which raises the likelihood of vaccine-preventable infections in children [1]. One such area where vaccination rates have varied over time is the Gassol local Government Area (IGA), specifically Mutum Biyu Ward "B". Understanding the vaccination coverage trends in this ward is essential for formulating focused interventions that may contribute to raising coverage rates and, eventually, decreasing the incidence of vaccine-preventable diseases [2].

The period from 2016 to 2019 is particularly significant as it includes various health interventions and policies aimed at improving immunisation coverage across Nigeria [1]. Examining the vaccination coverage trend for vaccinations like Yellow Fever, Measles, Oral Polio Vaccine (OPV), Bacille Calmette-Guérin

(BCG), and Measles in Mutum Biyu Ward "B" offers important information on how well these treatments work in this particular area. Additionally, it aids in locating areas of the vaccination program that require attention [2].

The purpose of this study is to investigate the vaccination coverage patterns for Yellow Fever, Measles, OPV, BCG, and Measles in Mutum Biyu Ward "B" of Gassol LGA, Taraba State, between 2016 and 2019. The study aims to provide policymakers and healthcare providers with information on how to boost immunisation coverage in the area by comprehending these tendencies [1].

In recent years, concern over the stagnation or drop in vaccination rates in some Nigerian states, notably Taraba State, has grown. In Nigeria just like other countries, research has indicated that the unequal distribution of immunisation services can be attributed to various causes, including inadequate healthcare infrastructure, low awareness, socio-cultural views, and geographic constraints [9, 10]. These variables are especially noticeable in rural locations with limited access to healthcare services, such as Mutum Biyu Ward "B" area of Taraba State [2].

Given the importance of immunisation in preventing disease outbreaks, it is essential to routinely track and evaluate immunisation coverage trends. Therefore, by offering data-driven insights into the vaccination trends in Mutum Biyu Ward "B," this study adds to the

body of knowledge and may help to improve public health actions in the area [1,2].

1.1 Statement of the Problem

Mutum Biyu Ward "B" has historically faced challenges in maintaining high routine immunisation coverage for childhood vaccines, which may lead to outbreaks of vaccine-preventable diseases such as measles, polio, and yellow fever. Despite national efforts to improve immunisation rates, there remain gaps in vaccine access, community engagement, and consistent delivery of health services. These challenges are compounded by geographical barriers and disparities in healthcare availability within the ward. This study aims to assess the trends in routine immunisation coverage for BCG, OPV, Measles, and Yellow Fever vaccines in Mutum Biyu Ward "B" from 2016 to 2019 in Gassol Local Government Area, Taraba State.

2. METHODOLOGY

2.1 Study Area

Mutum Biyu, located in Gassol Local Government Area of Taraba State, Nigeria, lies at a latitude of 8° 38' 28" N and a longitude of 10° 46' 24" E, with decimal coordinates of 8.64138, 10.77355. As of 2016, the area had a population of 11,702 people, spread across 2,732 households. Mutum Biyu is strategically positioned, bordering Iware in Ardo-Kola LGA to the west and Dan-Anacha along the Wukari LGA road to the south.

The region experiences a tropical climate with two distinct seasons: the rainy season, which spans from April to October, and the dry season, which runs from November to March. During the day, temperatures can reach up to 36°C, while nighttime temperatures drop to around 21°C. December is particularly dry, with an average of just 0.40 mm of rainfall and nearly no rainy days.

Throughout the year, Mutum Biyu's climate is characterized by oppressive, overcast conditions during the wet season and partly cloudy skies in the dry season. The temperature typically ranges from 62°F to 99°F (16°C to 37°C) and rarely falls below 56°F (13°C) or rises above 104°F (40°C).

2.2 Study Design and Data Collection

This study employed a quantitative, cross-sectional design to examine the vaccination coverage trend and the use of routine immunisation (RI) services in Mutum Biyu Ward

"B" of Taraba State's Gassol local Government Area between 2016 and 2019. Secondary data on the completion and non-completion of RI schedules for vaccinations such as Bacille Calmette-Guérin (BCG), Oral Polio Vaccine (OPV), Measles, and Yellow Fever were obtained from the DHIS2 Nigeria platform.

The DHIS2 is an open-source software platform used by health programs across Nigeria to manage and report health data, including Routine Immunisation (RI) coverage. The data obtained from the DHIS2 included information on the completion and non-completion of routine immunisation schedules for Bacille Calmette-Guérin (BCG), Oral Polio Vaccine (OPV), Measles, and Yellow Fever vaccines for children in Mutum Biyu Ward "B" of Gassol Local Government Area from 2016 to 2019.

Data were specifically extracted for monthly immunisation coverage reports, completion rates of the immunisation schedules, vaccine-specific data for Bacille Calmette-Guérin (BCG), Oral Polio Vaccine (OPV), Measles, and Yellow Fever. A team of research assistants were tasked with accessing the DHIS2 platform, adhering to standardized protocols to ensure reliability and accuracy in data retrieval. The data were cross-checked with local health records for validation where possible, ensuring data integrity.

The extracted data underwent a thorough cleaning and validation process to address inconsistencies, missing values, and duplicates. Vaccine-specific datasets were then merged into a single master file, organized by year to facilitate analysis. To ensure data validity, the extracted information was compared with local health records, and any inconsistencies were resolved in collaboration with health authorities in Gassol LGA.

The data collected was analyzed to identify trends in the immunisation coverage for BCG, OPV, Measles, and Yellow Fever vaccines, as represented in Figs. 1 to 4. A one-way Analysis of Variance (ANOVA) test was performed to evaluate the significance of variations in immunisation coverage across time. This test was suitable for comparing the averages of vaccination coverage rates over several years. The letters "a," "b," "c," and "d" were employed as alphabetical identifiers to show major variations in the data. While distinct alphabets suggest a considerable difference, similar

alphabets show no discernible difference between the compared groups. With the use of this technique, it was possible to analyse the data clearly and identify the points across the four-year period when there were notable variations in immunisation coverage.

In this quantitative, cross-sectional study, immunisation coverage is described using number of the target population that completed the vaccine schedules for each vaccine; Bacille

Calmette-Guerin (BCG), Oral Polio Vaccine (OPV), Measles, and Yellow Fever in Mutum Biyu Ward "B." The dependent variable in this study is the immunisation coverage for BCG, OPV, Measles, and Yellow Fever vaccines, represented as the number of the eligible population that completed the full immunisation schedule. The independent variables include the year of immunisation, which allowed for comparison of trends over the 2016 to 2019 period.

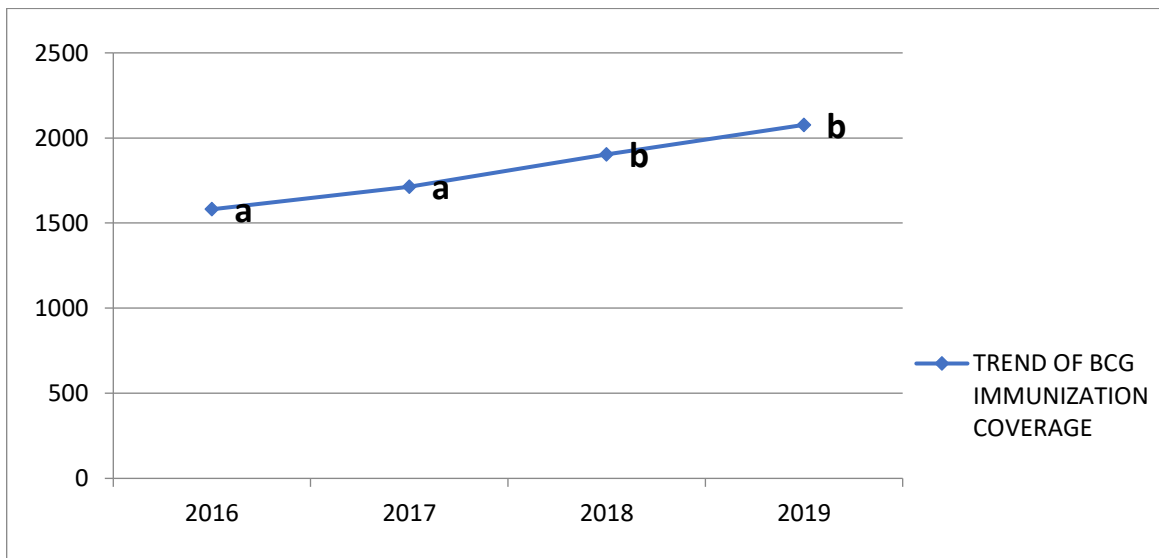


Fig. 1. Trend of BCG Immunisation Coverage in Mutum Biyu Ward 'B' from 2016-2019 in Gassol Local Government Area, Taraba State

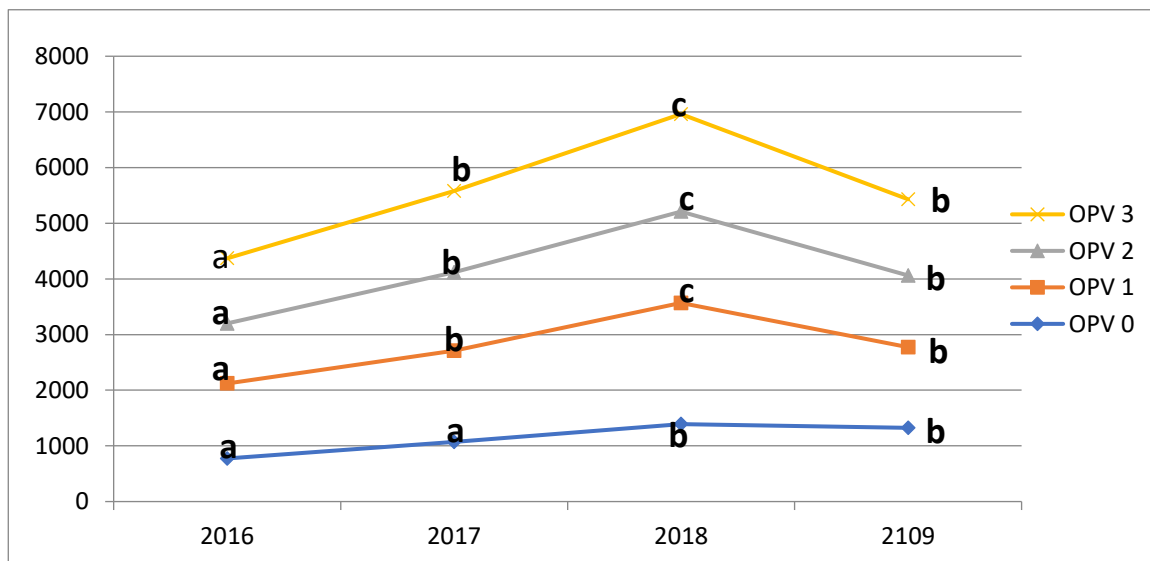


Fig. 2. Trend of OPV Immunisation Coverage in Mutum Biyu Ward 'B' from 2016-2019 in Gassol Local Government Area, Taraba State

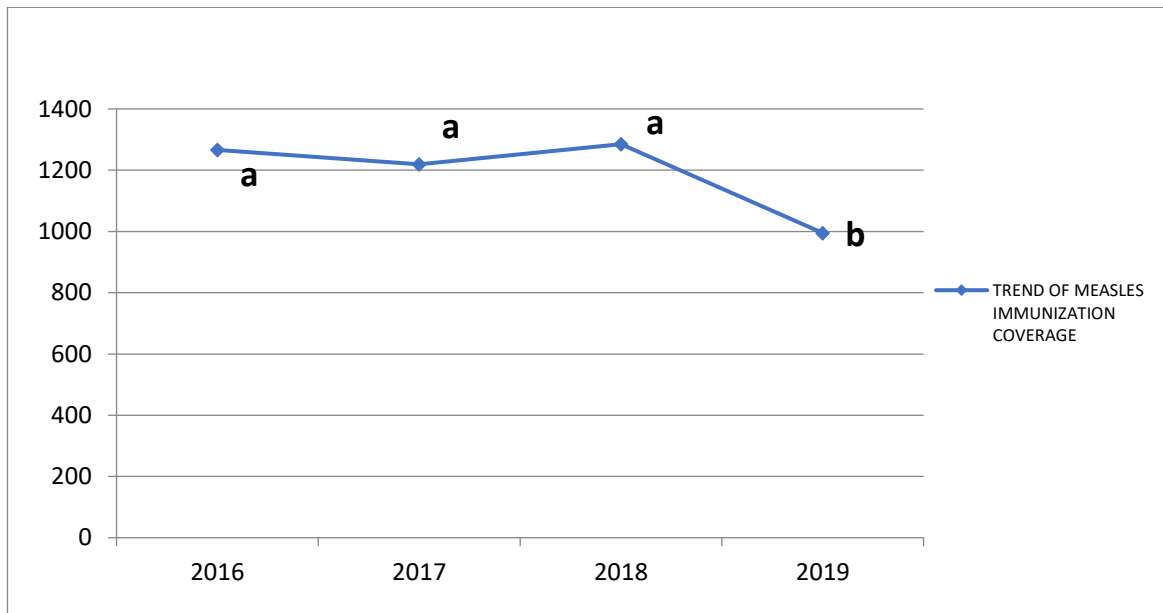


Fig. 3. Trend of Measles Immunisation Coverage in Mutum Biyu Ward 'B' from 2016-2019 in Gassol Local Government Area, Taraba State

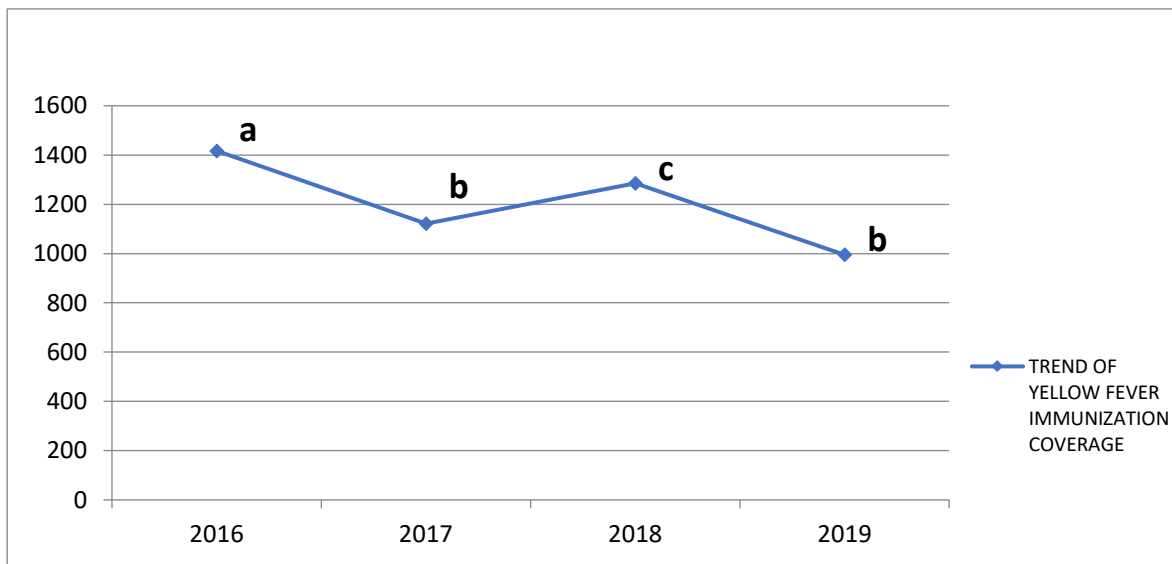


Fig. 4. Trend of Yellow Fever Immunisation Coverage in Mutum Biyu Ward 'B' from 2016-2019 in Gassol Local Government Area, Taraba State

2.3 Inclusion and Exclusion Criteria

The study applied specific inclusion and exclusion criteria. Children residing in Mutum Biyu Ward "B" of Gassol Local Government Area, who were eligible for routine immunisation between 2016 and 2019, were included. Data related to the coverage of BCG, OPV, Measles, and Yellow Fever vaccines, as recorded in the DHIS2 Nigeria platform, were considered. On the other hand, children with incomplete or

unavailable immunisation records in the DHIS2 system were excluded, along with data from wards or 1GAs outside Mutum Biyu Ward "B" and children not eligible for the routine vaccines under study.

3. RESULTS

The trend of Bacille Calmette-Guérin (BCG) immunisation coverage in Mutum Biyu Ward 'B' in Taraba State from 2016 to 2019 shows a

fluctuating pattern (Fig. 1). The coverage started at a moderate level in 2016, increased significantly in 2017, and then slightly declined in 2018 before experiencing a notable rise again in 2019. The observed differences may have resulted from changes in the availability of vaccines, outreach initiatives, or community engagement programs during these years. The rise in BCG immunisation coverage in 2017 and 2019 raises the possibility that particular measures or better healthcare delivery during those years may have had a beneficial effect.

The trend of Oral Polio Vaccine (OPV) immunisation coverage in Mutum Biyu Ward 'B' over the four years shows a generally upward trajectory, with some fluctuations (Fig. 2). The coverage was relatively low in 2016 and significantly increased in 2017. Nonetheless, a minor decrease was noted in 2018, after which coverage stabilised and increased marginally once more in 2019. Despite the fact that attempts to increase OPV coverage have generally been successful, this tendency indicates that sustaining stable vaccination rates remains difficult, maybe as a result of things like vaccine reluctance or availability to healthcare services in some years.

The trend of Measles immunisation coverage in Mutum Biyu Ward 'B' from 2016 to 2019 displays a pattern of initial stability followed by significant increases (Fig. 3). The coverage remained stable from 2016 to 2017, indicating consistent immunisation coverage during these years. However, a marked decrease was observed in 2018, followed by a sharp recovery in 2019. This drop in 2018 could be due to challenges such as vaccine stockouts, reduced outreach activities, or socio-cultural barriers affecting immunisation acceptance. The subsequent recovery in 2019 indicates a possible effort of immunisation strategies or increased public health awareness campaigns.

The trend of Yellow Fever immunisation coverage in Mutum Biyu Ward 'B' from 2016 to 2019 shows significant differences (Fig. 4). The coverage started at a low level in 2016 and increased slightly in 2017, but then experienced a substantial drop in 2018. In 2019, the coverage raised to its highest level within the four-year period. The low coverage in 2016 and the significant drop in 2018 might reflect issues such as vaccine availability, public health outreach limitations, or local community factors. The sharp increase in 2019 suggests successful intervention

efforts, possibly due to intensified vaccination campaigns or improved healthcare service delivery.

4. DISCUSSION

The trend of BCG immunisation coverage in Mutum Biyu Ward 'B' shows significant fluctuations over the study period. The initial moderate coverage in 2016, followed by a peak in 2017 and a subsequent decline in 2018, indicates that while there were periods of increased coverage, consistency was an issue. The resurgence in 2019 suggests that targeted interventions or improvements in health service delivery may have been effective. Similar patterns have been observed in other studies, such as those by [3], which noted fluctuations in BCG coverage due to changes in vaccine availability and health system challenges. Additionally, research by [4] highlights how interruptions in vaccination programs can affect coverage rates and disease prevention outcomes. The observed variability could be attributed to factors such as intermittent vaccine supply, periodic health campaigns, or fluctuations in community outreach efforts [1]. The public health implication is that sustained and consistent BCG immunisation efforts are critical in preventing tuberculosis, particularly in rural settings where healthcare delivery might be intermittent.

The results for Oral Polio Vaccine (OPV) coverage reveal a generally upward trend with minor declines. The sharp increase in 2017 indicates successful vaccination campaigns or improved access to immunisation services. However, the slight drop in 2018 suggests potential disruptions in vaccine delivery or public hesitancy, which aligns with findings from [5], which highlighted challenges in maintaining high OPV coverage rates due to logistic and socio-cultural factors. Similarly, [6] found that variations in OPV coverage can result from both logistical challenges and community resistance. The stabilization and subsequent increase in 2019 suggest recovery and possibly enhanced vaccination strategies. This underscores the importance of maintaining robust and continuous polio vaccination programs to prevent outbreaks and achieve herd immunity, especially in regions with fluctuating vaccine coverage [2].

Measles immunisation coverage in Mutum Biyu Ward 'B' displayed initial stability, a significant drop in 2018, and a sharp recovery in 2019. The

decline in 2018 could be due to factors such as vaccine stockouts, reduced outreach efforts, or socio-cultural barriers, similar to findings by [7], which noted that disruptions in vaccination programs can lead to increased disease incidence. Furthermore, research by [8] has documented how stockouts and coverage gaps can contribute to outbreaks of measles. The subsequent recovery in 2019 may reflect reinvigorated immunisation campaigns or improved healthcare delivery. This variability highlights the need for consistent measles vaccination efforts to prevent outbreaks and ensure high coverage rates. Public health implications include the necessity for continuous monitoring and reinforcement of vaccination programs to maintain coverage and prevent resurgence of measles [1].

The trend in Yellow Fever immunisation coverage shows an initial low coverage, slight improvement in 2017, a significant drop in 2018, and a peak in 2019. The low coverage in 2016 and the drop in 2018 may reflect challenges such as vaccine shortages, lack of awareness, or logistical issues, consistent with observations from [9], which reported similar issues in vaccination programs. Additionally, studies by [10] have highlighted how logistical and awareness challenges can affect vaccine coverage. The sharp increase in 2019 suggests that intensified vaccination campaigns or improved health system responses were effective. This variability emphasizes the importance of sustained and well-coordinated vaccination efforts to maintain high coverage and prevent yellow fever outbreaks. Public health implications include the need for continuous vigilance, adequate vaccine stock, and effective communication strategies to ensure high vaccination rates, particularly in areas with fluctuating coverage [2].

5. CONCLUSION AND RECOMMENDATIONS

This study provides valuable insights into the trends of immunisation coverage for BCG, OPV, Measles, and Yellow Fever vaccines in Mutum Biyu Ward 'B' from 2016 to 2019. The analysis revealed significant fluctuations in vaccine coverage, highlighting periods of both improvement and decline. These trends underscore the challenges faced in maintaining consistent immunisation rates, including issues related to vaccine supply, healthcare delivery, and community engagement. The observed

variability in coverage rates suggests that while certain interventions may have been successful, ongoing efforts are necessary to address underlying barriers and ensure sustained high immunisation rates. The study recommended localized use of geo-mapping to identify and map communities with low immunisation coverage in Mutum Biyu Ward "B" of Gassol LGA, Taraba State. This would help in identifying areas with low vaccine coverage and addressing geographical barriers to healthcare access. Additionally, it is crucial to strengthen the vaccine supply chain in Mutum Biyu Ward "B" by ensuring timely delivery of vaccines to local health centers, minimizing stockouts, and ensuring consistent availability. Enhancing community engagement in the study location through locally tailored health education campaigns is also recommended, focusing on addressing vaccine hesitancy and promoting the importance of routine immunisation. Collaborating with traditional and religious leaders in the study area to foster trust and encourage participation in immunisation programs would also be beneficial. Finally, improving healthcare access by increasing the number of outreach programs, particularly in hard-to-reach areas, and training healthcare workers to provide mobile immunisation services could significantly enhance vaccination coverage in Mutum Biyu Ward "B."

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as large language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during writing or editing of this manuscript.

ETHICAL APPROVAL AND CONSENT

Ethical approval for this study was obtained from the relevant authorities. Permission to access and use secondary data from the DHIS2 Nigeria platform was granted by the data custodians. The study adhered to all ethical guidelines and principles governing research involving human subjects, ensuring that the dignity, rights, and welfare of all participants were respected.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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