Impact of COVID-19 on Routine Childhood Immunization Coverage in Plateau State Nigeria: A five-year retrospective study

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Abstract

Background: The COVID-19 pandemic disrupted 90% of essential health services globally with low-and middle-income countries worst affected. This study sought to compare the routine immunization coverage of children in Plateau State pre and post COVID-19 between January 2018 and December 2022 and whether the state had recovered from the impact of the pandemic.

Methods: We conducted secondary data analysis on monthly Penta-3 immunization coverage in Plateau State between January 2018 and December 2022. Local government areas were categorized as rural and urban. Data was analyzed using IBM Statistical Product and Service Solution version 25. Probability values of $p \leq 0.05$ were considered statistically significant.

Results: The mean immunization coverage for the years 2018 – 2022 was 72.1%, 76.5%, 57.1%, 55.5%, 66.5% respectively. The immunization coverage in the State pre COVID-19 was higher than the coverage post COVID-19 by 13.3% (p = 0.001). Among children resident in rural areas, the immunization coverage pre COVID-19 was higher than the coverage post COVID-19 by 12.7% (p = 0.001). Among children living in urban areas the immunization coverage pre COVID-19 was higher than the coverage post COVID-19 by 17.6% (p = 0.001).

Conclusion: The COVID-19 pandemic significantly decreased the routine childhood immunization coverage in Plateau State in both rural and urban settings how be it more in urban areas. There is an urgent need for the government to provide the required funding and human resource for health to manage the impact of the pandemic.

Key Words: Childhood, Immunization, Rural, Urban, Covid-19

Introduction

Childhood immunization is the most cost-effective lifesaving public health intervention, preventing more than four million deaths yearly. Immunization makes children and families come to health care facilities thereby creating an opportunity for the delivery of other basic health services. Immunizations can therefore be said to provide the critical link to universal health coverage.[1,2] The coronavirus disease 2019 (COVID-19) pandemic disrupted 90% of essential health services and routine childhood vaccinations globally with low- and middle-income countries worst affected.[3] Globally, immunization coverage fell from 86% in 2019 to 81% in 2021.[4] The WHO's proxy indicator for routine immunization program performance is the completion of three doses of a DPT-containing vaccine before the age of 12 months.[5]

In low- and middle-income countries (LMIC), there was an overall decline of 10.8% across all vaccines because of the COVID-19 pandemic. Upper-middle-income countries and lower-MICs (18.0%) showed greater declines than low-income countries (3.1%).[6] The United Nations Children's Fund (UNICEF) reported that 23 million children did not receive routine vaccinations in 2020; 3.7 million more than in 2019.[7] When evaluated, the disruption and recovery of services following the COVID-19 pandemic across 170 countries between January 2018 and June 2020, the lowest number of vaccine doses administered was observed in April, 2020 when DTP3 doses dropped by 33% globally. Recovery of vaccinations began by June, 2020, and continued into late 2020. Pulse survey analysis revealed that 45 (69%) of 65 countries showed disruption in outreach services compared with 27 (44%) of 62 countries with disrupted fixed-post immunization services.[8]

In 2020 Africa had a 10% rise in missed vaccinations as a result of disrupted health care services by the COVID-19 pandemic.[9] Nigeria was among the three African countries in the top ten countries globally to record the highest number of unvaccinated children.[9] The significant disruption to Nigerian essential health care services was caused primarily by fear and stigma associated with the disease and shortages of health supplies and workforce constraints.[10] Furthermore, social distancing measures and lockdowns made it challenging for families to access healthcare services.[11] In addition, misinformation, conspiracy beliefs about the pandemic and COVID-19 vaccines negatively influenced general vaccine confidence.[12] In Plateau State Nigeria, the index case of COVID-19 was recorded on the 23rd April 2020.[13] With the spate of the disruption of immunization services globally as a result of the COVID-19 pandemic, there is the need for ongoing assessment of recovery so as to determine implementation strategies for catch-up vaccinations. This study sought to determine the impact of COVID-19 on the routine immunization coverage of children in Plateau State and whether two years post 2020 was sufficient to recover from the impact of the COVID-19 on immunization coverage.

Methodology

Study area: Plateau State is located in the North Central region of Nigeria. It is the twelfth largest state by land mass (26,899 square kilometers) and has a population of about 4.2 million people.[14] Children less than one year constitute 4% of the State population. The State is located between latitude 80° 24'N and longitude 80° 32' east and 100° 38' east.[14] The altitude ranges between 1,200 meters to 1,829 meters above sea level.[14] The mean monthly temperature is between 18 and 22° C with the coldest months between December and February and the warmest months in March and April.[14] The mean annual rainfall ranges between 132cm in the southern part of the State to 146cm in the northern part. Rainfall is heaviest in the months of July and August.[11] As a result of the tin mining industry on the Plateau, many individuals from the northern and southern parts of the country came to work and do business in the State.[15] Jos North and Jos South Local Government Areas (LGAs) are metropolitan and categorized as urban while the remaining fifteen LGAs are categorized as rural. This classification is also capture in the State Laws governing revenue and taxation.[16]

Study setting: Plateau State has 17 LGAs and there are 991 primary health care facilities that offer routine immunization services. This health facilities should be manned by clinicians, community health officers, community health extension workers, medical laboratory workers,

medical records officers, pharmacy technicians and attendants but several of these facilities have only two or three staff. Services provided at the health facilities include routine immunization, antenatal care and delivery, nutrition, laboratory services and treatment and prevention of common medical conditions. Routine immunization services are offered at least once a week in all health care facilities and every day in urban areas and this is supervised by the Routine Immunization Officer (RIO). Routine immunization forms are completed by the staff in the facility and these are collated by the RIO at the LGA secretariat. The monitoring and evaluation officers enter this data electronically and upload same to the State National and District Health Information System databases.

During the study period, the State had a three to four-fold reduction in human resource for health and this negatively affected health services. The State has areas where the terrain is bad making access to such regions difficult. There have also been on-going security challenges that affected the administration, monitoring and evaluation of immunization services. Appropriate health funding, also worsened by the pandemic, required for logistics to manage the immunization process would also have affected the State's immunization coverage. The State was innovative in giving support to immunization teams to intensify outreaches in 2022, health education and communication, mobile immunization clinics, health worker trainings, health system strengthening and leveraging on technological tools. These interventions resulted in improvements in the immunization coverage across the State in the COVID-19 era.

Study population: Children between the ages of 0 – 12 months within the study period in the 17 LGAs in the State.

Study design: We conducted a secondary analysis of Penta-3 immunization data of Plateau State between January 2018 and December 2022.

Data collection: Data was extracted from the District Health Information System Two database which is available for public use. The extractor selected the variables of interest over the duration for the study and downloaded the data to an excel format. Permission to use the data was obtained from the Plateau State Primary Health Care Board. The data was anonymized and did not have any socio-demographic variables but was adequate to answer the research questions after it was cleaned.

Data analysis: Monthly Pentavalent 3 vaccine coverage in the 17 LGAs of Plateau State between 2018-2022 were expressed in percentages and categorized as adequate or inadequate based on the WHO recommendation of a minimum of 90% coverage for all vaccines.[17] For this study, the pre-COVID era was between January 2018 and December 2019 while the post-COVID era was between January 2021 and December 2022. The Mann Whitney U and test was used to test for significance between the level of Pentavalent 3 coverage in the State pre COVID-19 (2018-2019) and post COVID-19 (2021-2022) and this was further segregated into urban and rural areas. A p value of ≤ 0.05 was considered significant.

Ethical consideration

An approval for the use of the data was obtained from the Plateau State Primary Health Care Board. Data was secured using a password to the file. Ethical clearance was obtained from the Research and Ethics Committee of the Jos University Teaching Hospital. (JUTH/ DCS/ IREC/127/XXX1/2698)

Results

The extrapolated population of Plateau State with the corresponding infant population as obtained from the DHIS2 are as shown in Table 1. The mean immunization coverage in the State over the study period is as shown on Table 2. Table 3 shows the immunization coverage based on the categorization of LGAs into rural and urban areas. Figures 1 and 2 shows the immunization coverage in rural and urban areas of Plateau State between 2018-2022 and in 2020 alone for emphasis. The mean immunization coverage for the period 2018 – 2022 was 72.1%, 76.5%, 57.1%, 55.5%, 66.5% respectively. The overall immunization coverage of 65.5% in the study period was less than the recommended global standard. There was a statically signaficant difference in the immunization coverage in the State between children two years pre COVID-19 (74.3%) and two years post COVID-19 (61.0%) of (13.3%); z = -

4.578, p = 0.001.

There was a difference in the immunization coverage between children resident in rural areas two years pre COVID-19 (73.9%) and two years post COVID-19 (61.2%) of (12.7%); z = -4.371, p = 0.001. There was a difference in the immunization coverage between children resident in urban areas two years pre COVID-19 (77.6%) and two years post COVID-19 (60.0%) of (17.6%); z = -4.743, p = 0.001. Pre COVID-19, there was a difference in the immunization coverage between children resident in rural areas (73.9%) and children resident in urban areas (77.6%) of (3.7%); z = -1.114, p = 0.265. Post COVID-19, there was a difference in the immunization coverage between children resident in rural areas (61.2%) and children resident in urban areas (60.0%) of (1.2%); z = -1.206, p = 0.228.

Table 1. Estimated population of Plateau State with Infant population over the study period.

	2018	2019	2020	2021	2022
Plateau State Population	4,376,193	4,494,350	4,615,699	4,740,322	4,868,310
Infant Population	175,048	179,774	184,628	189,613	194,732

Table 2. Penta 3 immunization coverage across LGAs in Plateau State 2018-2022

	Yearly immunization coverage						
LGA	2018	2019	2020	2021	2022	MEAN	STDEV (±)
Bassa	85.6	94.0	72.5	55.2	71.2	75.7	14.8
Mikang	84.8	92.2	72.0	53.2	54.7	71.4	17.5
Jos North	92.0	94.8	61.4	48.8	59.6	71.3	20.8
Barkin Ladi	64.9	68.7	54.2	65.7	96.0	69.9	15.6
Qua'an Pan	80.0	78.9	67.9	55.0	62.5	68.8	10.7
Bokkos	69.6	84.2	64.0	56.0	66.4	68.0	10.3
Mangu	73.5	70.4	58.6	60.4	75.9	67.8	7.8
Shendam	78.8	77.2	63.9	53.5	63.7	67.4	10.5
Kanam	65.6	68.1	40.4	66.1	95.1	67.1	19.4
Langtang North	81.3	77.4	60.3	52.3	56.1	65.5	13.1
Langtang South	70.3	74.7	52.3	60.5	61.4	63.8	8.8
Jos East	51.0	72.1	60.0	64.1	67.8	63.0	8.1
Jos South	63.9	59.8	52.4	58.3	73.2	61.5	7.7
Wase	81.8	82.6	42.8	43.5	55.7	61.3	19.8
Riyom	56.5	71.8	47.5	53.8	71.7	60.3	11.0
Pankshin	65.5	68.4	51.0	48.7	47.9	56.3	9.8
Kanke	60.7	65.5	49.6	49.2	51.3	55.2	7.4
MEAN	72.1	76.5	57.1	55.5	66.5	65.5	
STDEV (±)	11.4	10.2	9.4	6.3	13.5		

Table 3. Penta 3 immunization coverage across rural and urban LGAs in Plateau State 2018-2022

Rural LGA	2018	2019	2020	2021	2022	MEAN	STDEV(±)
Bassa	85.6	94.0	72.5	55.2	71.2	75.7	14.8
Mikang	84.8	92.2	72.0	53.2	54.7	71.4	17.5
Barkin Ladi	64.9	68.7	54.2	65.7	96.0	69.9	15.6
Qua'an Pan	80.0	78.9	67.9	55.0	62.5	68.8	10.7
Bokkos	69.6	84.2	64.0	56.0	66.4	68.0	10.3
Mangu	73.5	70.4	58.6	60.4	75.9	67.8	7.8
Shendam	78.8	77.2	63.9	53.5	63.7	67.4	10.5
Kanam	65.6	68.1	40.4	66.1	95.1	67.1	19.4
Langtang North	81.3	77.4	60.3	52.3	56.1	65.5	13.1
Langtang South	70.3	74.7	52.3	60.5	61.4	63.8	8.8
Jos East	51.0	72.1	60.0	64.1	67.8	63.0	8.1
Wase	81.8	82.6	42.8	43.5	55.7	61.3	19.8
Riyom	56.5	71.8	47.5	53.8	71.7	60.3	11.0
Pankshin	65.5	68.4	51.0	48.7	47.9	56.3	9.8
Kanke	60.7	65.5	49.6	49.2	51.3	55.2	7.4
MEAN	71.3	76.4	57.1	55.8	66.5	65.4	
STDEV(±)	10.7	8.7	10.0	6.5	14.2		
Urban LGA	2018	2019	2020	2021	2022	MEAN	STDEV(±)
Jos North	92.0	94.8	61.4	48.8	59.6	71.3	20.8
Jos South	63.9	59.8	52.4	58.3	73.2	61.5	7.7
MEAN	77.9	77.3	56.9	53.6	66.4	66.4	
STDEV(±)	19.9	24.7	6.3	6.7	9.6		

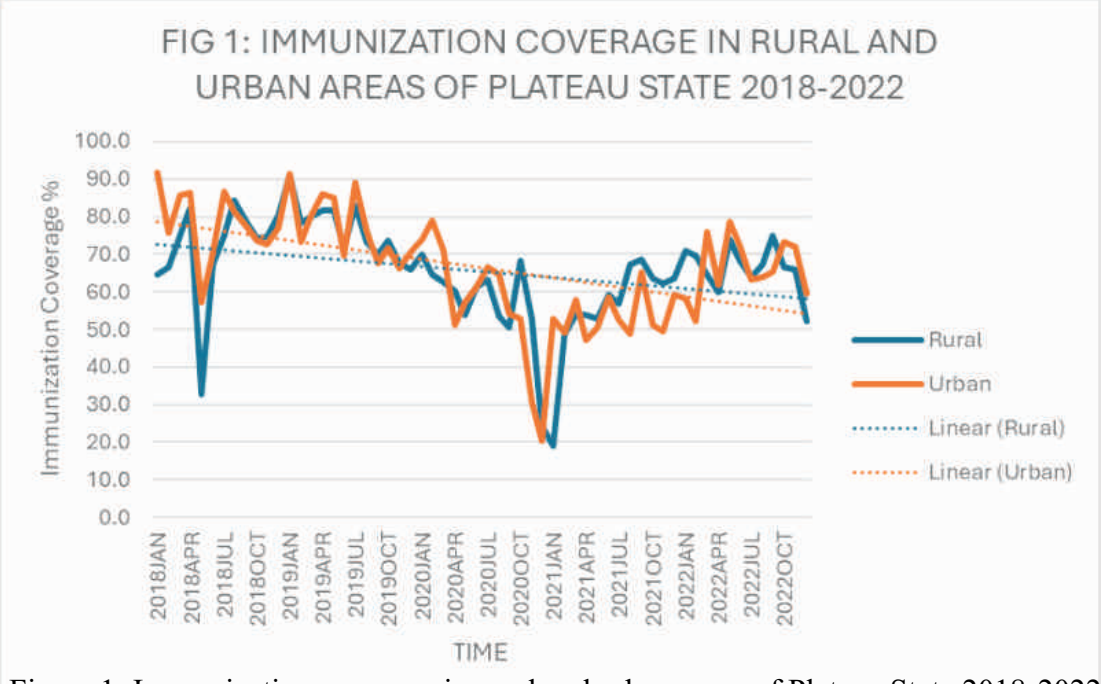

Figure 1: Immunization coverage in rural and urban areas of Plateau State 2018-2022

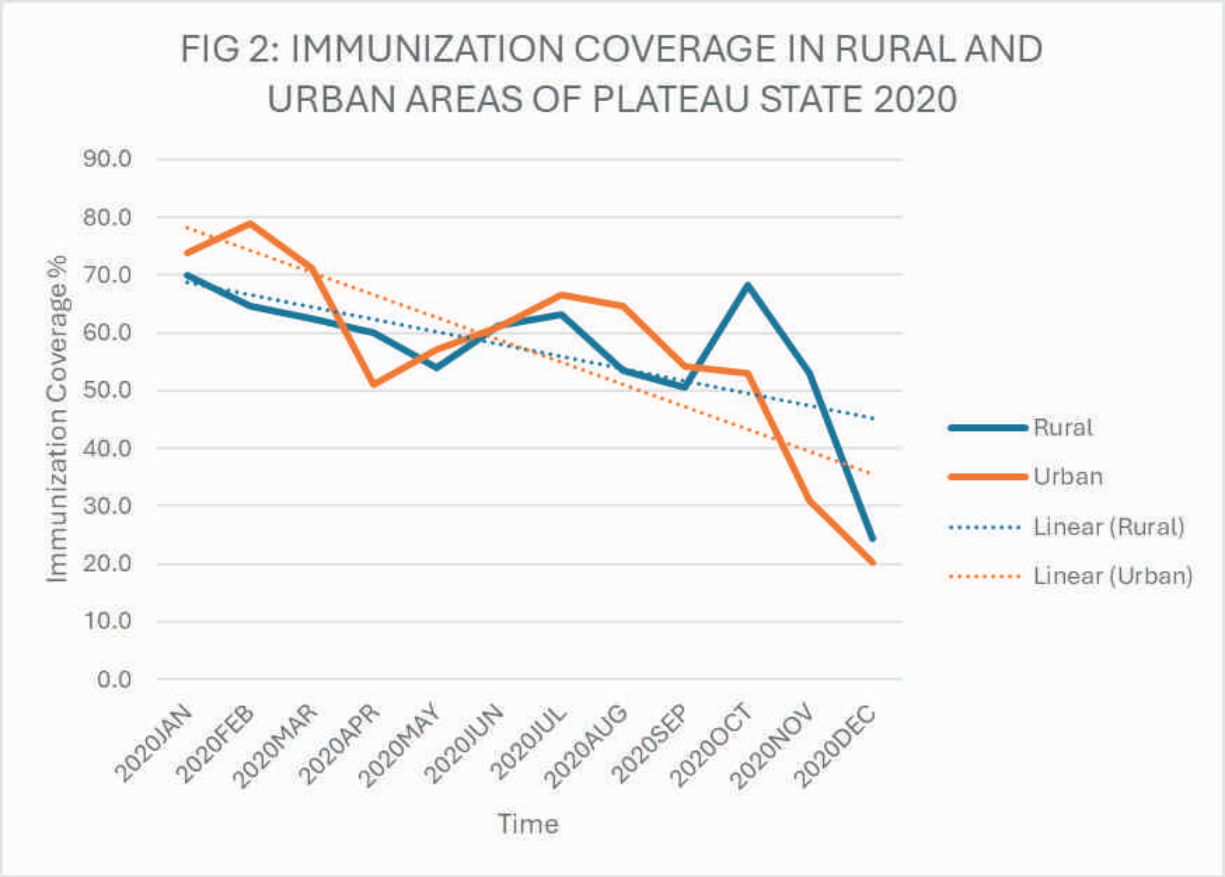

Figure 2: Immunization coverage in rural and urban areas of Plateau State 2020

Discussion

We found that the mean immunization coverage for the years 2018 – 2022 was 72.1%, 76.5%, 57.1%, 55.5% and 66.5% respectively. There was a significant difference in the State immunization coverage rates pre and post COVID-19. The difference in the immunization coverage rates between rural and urban areas pre and post COVID-19 was also statistically significant. The rural areas had significantly higher immunization coverage rates than the urban areas. Studies where immunization coverage was better in urban setting compared to rural setting attributed this to better maternal and paternal education, access to prenatal, access to vaccination and awareness about the safety, efficacy, importance and schedule of the vaccine.[18, 19] Immunization coverage rates of less than 90.0% in the pre-COVID era indicate that there are barriers to achieving the optimal coverage and this was worsened by the pandemic.

Immunization coverage in both rural and urban areas was on a decline in the covid era but coverage was significantly higher in rural areas. Plausible explanations to this are that the negative publicity and conspiracy theories carried by the social media on the COVID-19 disease affected urban more than rural areas resulting in a decreased uptake in immunizations in the urban areas compared to rural. The effort and interventions made to mitigate the impact of the pandemic on immunization services could have been focused more in rural areas compared to urban areas. Related to this also is the fact that the lock down affected residents in urban areas more compared to rural areas and rural areas were better mobilized using existing traditional leadership who serve as the gateway to the community.

In Oyo State, Nigeria, immunization coverage of Penta 3 vaccine dropped from 76.1% in 2019 to 72.0% in 2020.[20] The 76.1% coverage rate in Oyo is similar to 76.5% obtained in our study in 2019. However, the difference of 4.1% between 2019 and 2020 compared to a difference of 19.4% obtained in our study may be because of barriers to immunization access such as the terrain and security challenges amongst other challenges.

In a report on long-term trends in vaccination coverage between 2010 and 2021 in Burkina Faso, the proportion of age-appropriate complete vaccination was 69.8% in 2010, 55.4% in 2015, 50.5% in 2019-2020 and 64.8% in 2021 indicating a significant increase in the COVID-19 pandemic era.[21] Our study had a further decrease in immunization coverage by 2021 and this may have been due to the relative delay in commencing outreach intensification in the COVID-19 era in Plateau State.

Data from the 2022 WHO and UNICEF estimates of national immunization coverage of the African region reported that DPT3 coverage was 72.0%. Only 13 of the 47 countries (28.0%) achieved the global target coverage of 90.0% or above with DPT3 in 2022.[22] This is in contrast with the coverage rate of 66.5% in 2022 obtained in our study, a difference of 5.5 %.

Globally, in 2020, estimated vaccine coverage was 76·7% for DTP3 representing a relative reduction of 7·7%.[23] Our study recorded 19.6% below this report which may be related to the already established higher pre pandemic levels of coverage and the relative levels of fall as a result of the pandemic where, in 2019, the worldwide DPT3 coverage stood at 86%, but by 2021, it had dropped to 81 per cent. In 2022, there was a slight recovery, with DTP3 coverage increasing to 84 per cent.[24] Our study found a coverage rate of 76.5 in 2019, 55.5% in 2021 and an increase to 65.5% by 2022.

In India, a cross-sectional study comparing immunization coverage one-year pre-covid 19 and a year post, reported a 9% reduction for DPT3. Children from rural areas had the highest reduction in vaccine coverage.[12] Itimi and colleagues found that the immunization coverage for children in rural communities was significantly better than those in urban communities.[25] Communities that have greater mobilization and participation in immunization coverage will have better coverage irrespective of whether they are rural or urban.[25] Incomplete immunization in urban areas has been associated with lack of motivation, relocation, and the adverse rumour about childhood immunization while the reasons in the rural community were health facility related and include the absence of the vaccinator and non-availability of vaccines.

Our study has a lot of implications for policy considering that the overall immunization rates even in the pre COVID-19 era had not attained the benchmark of at least 90.0%. Implications also stem from the delay in recovering from the pandemic and on how to respond to similar crisis or event that may present in the future. Increased investment in health is essential: increased government attention on health systems would result in essential investment in the health workforce and health infrastructure.

The finding in our study of a higher immunization coverage in the rural areas compared to the urban areas in the COVID-19 era is at variance with most other studies and this may have been fostered by the existing partnership with communities and health-care providers.[26] We recommend that strategies should be adopted to ensure that immunization services are people centred, respectful, compassionate and designed in partnership with the community. Measures should be taken to make urban settings more community oriented.

A further reduction in immunization coverage a year after the COVID-19 pandemic year implies that adequate measures to curtail the pandemic were not in place. There was a delay in supporting teams for mop-up outreaches. We recommend that such outreaches be commenced immediately in the event of a future epidemic. To avoid overcrowding, a goal of the lockdown measures, mothers should be scheduled for appointments. The State health system resilience needs to be developed and prepared ahead of time to absorb the shock of crisis situations. Adequate funding, strategies and plans to mitigate the impact the pandemic should be provided and engagement with a multidisciplinary public sector is essential.[26,27]

Inadequate human resource for health though not a direct finding in our study is cardinal to recovering from the impact of pandemic and for the long-term sustainability of optimal immunization coverage. We recommend that renumeration for health workers in the state be improved, new employment be made, and retired health workers who are found fit and fitting be hired as contract workers. Health facilities built by the government and managed by

the private sector with well drafted memoranda of understanding would be helpful in managing the inadequate human resource for health.

Our study was retrospective with the use of secondary data and many variables to describe the sociodemographic status of the study population were not obtainable from the data source. A few errors existed in the data obtained warranting the data to be cleaned. The reporting of the data during the pandemic may have resulted in some missing data. The use of completed three doses of the pentavalent vaccine is a standard for assessing immunization coverage and this is what was used in our study. However, determining the dropout rates for penta3 would have better shown the impact of the pandemic on accessing immunization services.

Conclusion

There was a significant difference in the State immunization coverage pre and post COVID-19. There was a difference in the immunization coverage between children resident in rural areas two years pre COVID-19 and two years post COVID-19.There was a difference in the immunization coverage between children resident in urban areas two years pre COVID-19 and two years post COVID-19. The immunization coverage two years post COVID-19 is still lower than the pre COVID-19 rate. There is an urgent need for the government to provide the required funding and human resource for health to manage the impact of the pandemic. All stakeholders should adopt innovative patient centered, State owned, partnership based and data guided strategies to recover from the impact of the pandemic.

Competing interests

The authors declare no competing interests.

Authors' contribution

MG, AM and MD conceived and designed the study. MG received the data. MG, SM and MD analyzed the data. All authors contributed to the interpretation of results, writing of the manuscript and approved the final version of the manuscript.

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