ORIGINAL ARTICLE

Impact of COVID-19 Pandemic on Routine Immunization Among Tribal Children in Odisha: A Rapid Epidemiological Survey

G Alekhya, Dinesh Prasad Sahu, Binod Kumar Patro, Priyamadhaba Behera, Manish Taywade, Sankalp Suhag Dash

Department of Community Medicine and Family Medicine, AIIMS Bhubaneswar, Odisha, India

Correspondence to: Dr. Binod Kumar Patro, Professor, Department of Community Medicine and Family Medicine, AIIMS Bhubaneswar, Odisha, India.
cmfm_binodp@aiimsbhubaneswar.edu.in

Received: Jan 11, 2024; Initial review: Feb 02, 2024; Accepted: Apr 25, 2024

PII: S097475591600645

ABSTRACT

Objectives: To assess the impact of COVID-19 on immunization coverage and delayed vaccination among tribal children in the Khordha district of Odisha state.

Methods: A cross-sectional rapid epidemiological survey was conducted using a standard WHO (30 x 7) cluster survey with 30 tribal villages under the Community Health Centre (CHC), Mendhasala, Odisha, as clusters and seven children from each cluster. A total of 14 children from each cluster; seven each born in 2019 (2019 cohort) and 2020 (2020 cohort), amounting to 420 children were included. The dates of vaccination and related details were obtained from the mother and child protection cards alongside a pretested, semi-structured questionnaires administered to the mothers or primary caregivers. Immunization coverage and delayed vaccination rates were compared between the two cohorts.

Results: Full immunization coverage was 81.9% and 77.6% in the 2019 and 2020 cohorts, respectively. A significant decline in full immunization coverage was seen for 14 weeks vaccine in 2020 cohort (p value =0.01). The proportion of delayed vaccination for scheduled vaccines at birth, 6 weeks, 10 weeks, 14 weeks, and 9-12 months for 2019 cohort and 2020 cohort were 8.6%, 6.7%, 18.1%, 19.5%, 22.4%, and 21.9%, 26.7%, 30.5%, 19%, 16.2%, respectively. However, delayed vaccination rates among the 2019 and 2020 cohorts were not statistically significant.

Conclusion: Our study findings showed a little decline in immunization coverage in tribal areas during the pandemic.

Keywords: Delayed vaccination, Immunization, Pandemic, Tribal areas, Vaccination coverage

INTRODUCTION

The Universal Immunization Program (UIP) in India was launched in 1985, providing free-of-cost vaccines against 12 vaccine-preventable diseases [1]. In 2014, Mission Indra Dhanush (MI) was launched to vaccinate all unvaccinated and partially vaccinated children under UIP to achieve more than 90% of full immunization in the country [2]. The mission had a positive impact, with an increase in immunization coverage by 18.5% in 2018. Unfortunately, the healthcare delivery including immunization services were notably impacted by the COVID-19 pandemic in several countries including India. As per the World Health Organization (WHO) report, global vaccination coverage dropped from 86% in 2019 to 83% in 2020 [3]. India witnessed a 26% fall in immunization coverage in the first quarter of 2020 compared to 2019 [4]. A need assessment report by UNICEF stated that full immunization coverage was lowest among the tribal population in India (56%) when compared to the national average (62%) [5]. Odisha being a tribal-predominant state, the current study was aimed to assess the impact of COVID-19 pandemic on immunization coverage and delayed vaccination rates among tribal children in the Khordha district of Odisha, India.

METHODS

A rapid cross-sectional epidemiological survey was undertaken, employing the WHO-recommended standard 30 x 7 cluster sampling methodology [6]. 30 tribal villages under the Community Health Centre (CHC), Mendhasala, a field practice area of the Department of Community Medicine, All India Institute of Medical Sciences, Bhubaneswar, were considered as clusters. Within each village (cluster), a sample of seven children each born in 2019 (2019 cohort) and born in 2020 (2020 cohort) was selected. From each selected tribal village, a line list of children born in 2019 and 2020 was obtained from respective Anganwadi centers. If a tribal village had less than seven children in each 2019 and 2020 cohort, then it was combined with one or more geographically contiguous tribal villages to form a single cluster, while the villages with larger populations were divided to form multiple clusters. In villages with a larger number of eligible study participants, simple random sampling was done to select seven children each born in 2019 and 2020. In the combined villages study participants were selected using convenient sampling. Consequently, a total of 210 children from each birth year were included, resulting in an overall sample size of 420 children. The study duration was conducted in the month of March 2022. Prior approval was obtained from the Institutional Ethics Committee.

The primary investigator collected data by visiting the households of study participants with the help of the Accredited Social Health Activist (ASHA) in the respective villages. A pretested, semi-structured questionnaire was used to collect information regarding variables such as sociodemographic details, birth weight, and birth order, after obtaining a written informed consent from the mother or primary caregiver through a face-to-face interview in vernacular language (Odia). In case the mother or primary caregiver was unavailable, the next household on the line list was approached. The immunization status of the child was verified using a mother and child protection card (MCP), and dates for vaccines given under the National Immunization schedule were recorded. Vaccination coverage was assessed by stating if the child was immunized for scheduled vaccines at any time before the survey. A child was considered fully immunized if the child was vaccinated with three doses of Oral Polio Vaccine (OPV), three doses of Rota Virus Vaccine (RVV), three doses of Pentavalent vaccine, two fractional doses of Inactivated Polio vaccine (IPV), the first dose of Measles-Rubella (MR 1) vaccine and the first dose of Japanese Encephalitis (JE-1) vaccine [7]. Vaccination was considered delayed if the vaccine was received 28 days after the scheduled date [8]. For assessing vaccination delay for six, ten, and fourteen-weeks Pentavalent vaccine was considered, and for 9 months MR-1 and JE-1 vaccines were considered.

Statistical analysis: Data collected through the questionnaire was entered manually into Microsoft Excel. Data was analyzed using Statistical Package for Social Sciences (SPSS) software version 26.0. The immunization coverage was estimated in proportion. Mann Whitney U test was used to compare the median number of days for delayed vaccination in the 2019 and 2020 cohorts. *P* value less than 0.05 was considered as significant.

RESULTS

Among the total 420 study participants, there were 200 (47.6%) boys and 220 (52.4%) girls. The mean (SD) birth weights of children born in 2019 and 2020 were 2562.71 (497.15) g and 2596.24 (401.22) g, respectively. The sociodemographic characteristics of the study population in both cohorts was comparable as seen in **Web Table I**.

The immunization coverage was more than 90% in both the 2019 and 2020 cohorts for all the vaccines except the birth dose of Hepatitis B. A significant decline in FIC was noted for 14 weeks vaccine in 2020 cohort. Full immunization coverage (FIC) was 81.9% in the 2019 cohort and 77.6% in 2020, as seen in **Table I**. The proportion of delayed vaccination rates for scheduled vaccines was similar in both cohorts with no statistically significant difference. However, overall delay, i.e., a child having delayed vaccination for any of the scheduled vaccines, was 66.2% in the 2019 cohort and 70% in the 2020 cohort. The median number of days to vaccinate in the 2019 cohort was highest for the ten-week vaccines, with 52 days of delay, and in the 2020 cohort, it was highest for the fourteen-week vaccines, with 62 days of delay. Delayed vaccination for any scheduled vaccines was seen in 286 (68%) out of 420 study participants. The most common reason for delayed vaccination was ill health of the child (46.8%), which included fever and upper respiratory tract infections, followed by the COVID-19 pandemic-related reasons such as fear of contracting COVID and restriction of transport facilities due to lockdown (25.5%), lack of awareness among mothers on scheduled vaccination sessions (12.7%), and other reasons such as travelling to home town, mother's ill health, non-availability of vaccine (15%).

DISCUSSION

The current study assessed the impact of the COVID-19 pandemic on immunization coverage and delayed vaccination among tribal children in Odisha. To our knowledge, our study is the only study that assessed immunization coverage among the tribal population during the COVID-19 pandemic in India. In the current study, FIC had a decline of about four percent in 2020 when compared to 2019 which was statistically insignificant. Likewise, the difference in proportion of delayed vaccination between the two cohorts (3.8%) was statistically insignificant.

Our study findings are encouraging as they suggest a resilience of routine childhood immunization services in the tribal belt of Odisha in the face of the pandemic. It is also encouraging to note that the figures are similar to immunization coverage assessed through the Health Management Information System (HMIS) for Odisha state per se, which showed a decline of 3.4% from 2019 to 2020 [4]. As per the National Family Health Survey (NFHS-5) conducted in India between 2019 and 2021, FIC was 77% for children aged 12-23 months, which was similar to the FIC of the 2020 cohort in our study. From the survey findings FIC in Odisha state and Khordha district were 90.5% and 87.9%, respectively [7]. In the same report, FIC observed among scheduled tribes was 88.6%; 1.8% did not receive any vaccine [7]. The immunization coverage among children in the current study are less when compared to the coverage observed at the state level, district level, and among scheduled tribes in Odisha state in the NFHS-5 survey. The lower rates in our study are attributed to the difference in timelines. The NFHS-5 survey also included the year 2021, when MI 4.0 was launched to vaccinate the

children who were missed during the COVID-19 pandemic. During the pandemic, various initiatives were taken at the national and state levels to maintain the momentum of routine immunization services. This included the continuation of birth dose vaccinations at government-run health facilities such as District hospitals and community health centres; immunization sessions were carried out through outreach services at Anganwadi centres depending on feasibility. ASHAs raised awareness in communities regarding changes in the schedule, beneficiaries were followed up telephonically, and beneficiaries were mobilized in small batches of five per session [9]. Also, the Indian Academy of Pediatrics (IAP), Advisory Committee on Vaccines and Immunization Practices (ACVIP) provided various recommendations for vaccinating the child during the pandemic [10]. Compared to the previous NFHS and coverage evaluation surveys, vaccine hesitancy is very low in tribal regions of Odisha, and by implementing the above measures, immunization coverage among tribal children in our study was optimum.

A study assessed vaccination status among tribal children aged in 9 districts in nine different states (one of them being Odisha) between May 2020 and February 2021. The FIC was 52% in this study, which was lower than in our study. However, the study did not specify state-wise vaccination coverage and did not address the impact of COVID-19 [11]. Few studies assessed immunization coverage in tribal areas before the pandemic wherein the FIC ranged from 47% to 77.7% [12, 13,14]. All these studies had different sampling proportions, making it unlikely to assess immunization coverage over the years in tribal regions. In a retrospective analysis that assessed the impact of the COVID-19 pandemic on RI services by using NFHS-5 data, the decline in immunization coverages was significant, with a decline of 2%, 9%, and 10% for BCG, DPT-3, and OPV-3, respectively [15]. Also, in this retrospective analysis, the delayed vaccination rates were significant for only all three doses of OPV. With respect to delayed vaccination rates in our study, the rates were not statistically significant for any of the scheduled vaccines in both 2019 and 2020 cohorts. However, most of the study participants (68%) of both cohorts had delayed vaccination for any scheduled vaccine which is relevant as it could portend a possible infectious disease outbreak.

The current study is a rapid epidemiologic survey, and there are a few limitations. We could not capture the immunization details of those who did not have vaccination cards. Due to its inherent property, this rapid epidemiological survey is less precise than simple random sampling. While the pandemic did not significantly impact the coverage and timeliness in our study, the delayed vaccination rates were higher in both cohorts. As a part of future pandemic preparedness, there is a need for targeted interventions such as creating awareness among tribal mothers on timely vaccination despite mild illness of the child and maintaining robust immunization coverage tracking systems for the provision of optimum immunization services during infectious disease outbreaks.

Contributors: AG, DPS, BKP, PMB: Conceptualized the study; AG, SSD: Data collection; AG, DPS: Data analysis, interpretation and drafting of the manuscript; BKP, PMB, MT: Critical inputs and revised the manuscript:

BKP: Supervised the study and will act as the guarantor All authors approved the final version of the manuscript and are accountable for all aspects related to the study.

Ethics clearance: Institute Ethics Committee, AIIMS Bhubaneswar T/IM-NF/CM & FM/21/129 dated Feb 14, 2022.

Funding: None; *Competing interests*: None stated.

WHAT THIS STUDY ADDS?

- The current study highlights that COVID-19 pandemic did not affect the full immunization coverage rates significantly among the tribal children in Odisha.
- Overall, 68% of children had delayed vaccination for any scheduled vaccine, although the delayed vaccination rates did not differ significantly in both 2019 and 2020 cohort on account of the COVID-19 pandemic.

REFERENCES

1. Immunization. National Health Mission. Accessed January 7, 2022. Available from: *https://nhm.gov.in/index1.php?lang=1&level=2&sublinkid=824&lid=220*
2. Gurnani V, Haldar P, Aggarwal MK, Das MK, Chauhan A, Murray J, Arora NK, Jhalani M, Sudan P. Improving vaccination coverage in India: lessons from Intensified Mission Indradhanush, a cross-sectoral systems strengthening strategy. BMJ. 2018;363:k4782.
3. World Health Organization. Immunization coverage. Accessed on Jan 7, 2022. Available from: *https://www.who.int/news-room/fact-sheets/detail/immunization-coverage*
4. National Health Mission. Government of India, Ministry of Health & Family Welfare, Statistics division. HMIS 2020-21 & 2021-22 (An Analytic Report). Accessed November 17, 2023. Available from: *https://hmis.mohfw.gov.in/downloadfile?filepath=publications/Other/HMIS%20Annual%202020-21_2021-22%20Report.pdf*
5. UNICEF. Immunization among Tribal Population in India: A Need Assessment Report -UNICEF. Accessed Jan 7, 2022. Available from: *https:/Immunization+among/Tribal/Population/in/India*
6. World Health Organization Vaccination Coverage Cluster Surveys: Reference Manual. Accessed on Oct 24, 2023. Available from: *https://www.who.int/publications/i/item/WHO-IVB-18.09*
7. Release of NFHS-5 (2019-21) - Compendium of Factsheets | Ministry of Health and Family Welfare | GOI Accessed on Sep 06, 2022. Available from *https://main.mohfw.gov.in/basicpage-14*
8. Marefiaw TA, Yenesew MA, Mihirete KM. Age-appropriate vaccination coverage and its associated factors for pentavalent 1-3 and measles vaccine doses, in northeast Ethiopia: A community-based cross-sectional study. PLoS One. 2019;14:e0218470.

9. Ministry of Health and Family Welfare. Immunization Services during and post COVID-19 Outbreak. 2020. Accessed on Feb 14, 2024. Available from: *https://www.mohfw.gov.in/pdf/3ImmunizationServicesduringCOVIDOutbreakSummary150520202.pdf*
10. Kasi SG, Dhir SK, Verma S, et al; Advisory Committee on Vaccines and Immunization Practices (ACVIP), 2020-21, Indian Academy of Pediatrics, India. Immunization During the COVID-19 Pandemic: Recommendations From Indian Academy of Pediatrics Advisory Committee on Vaccines and Immunization Practices. Indian Pediatr. 2020;57:1147-52.
11. Kusuma YS, Kumari A, Rajbangshi P, et al. Vaccination and associated factors among tribal children of 1 year age in nine Indian districts: A cross-sectional study. Trop Med Int Health. 2023;28:530-40.
12. Varma GR, Kusuma YS. Immunization coverage in tribal and rural areas of Visakhapatnam district of Andhra Pradesh, India. Journal of Public health. 2008;16:389-97.
13. Parmar R, Prajapati N, Shringarpure K. Vaccination coverage of children in tribal Narmada district of Gujarat: a cross sectional study. Int J Community Med Public Health. 2020;7:609-14.
14. Mithrason AT, Vikas A, Thomas AM. Immunisation status of under five children in a tribal colony of Northern Kerala. Indian Journal of Public Health Research & Development. 2021;12:23-7.
15. Summan A, Nandi A, Shet A, Laxminarayan R. The effect of the COVID-19 pandemic on routine childhood immunization coverage and timeliness in India: retrospective analysis of the National Family Health Survey of 2019-2021 data. Lancet Reg Health Southeast Asia. 2023;8:100099.

Table I Immunization Coverage in the Study Cohorts (*n* = 420)

Vaccine	*2019 Cohort* (*n* = 210)	*2020 Cohort* (*n* = 210)	*P value*
BCG at birth	207 (98)	205 (97. 6)	0.47
Hepatitis B vaccine birth dose	184 (87. 6)	178 (84. 7)	0.39
OPV birth dose	193 (91. 9)	187 (89. 0)	0.31
OPV-1	208 (99)	203 (96. 6)	0.09
OPV-2	206 (98)	201 (95. 7)	0.15
OPV-3	205 (97. 6)	198 (94. 2)	0.08
Pentavalent 1	208 (99)	203 (96. 6)	0.09
Pentavalent 2	206 (98)	201 (95. 7)	0.15
Pentavalent 3	205 (97. 6)	194 (92. 3)	0.01
RVV-1	206 (98)	203 (96. 6)	0.35
RVV-2	206 (98)	201 (95. 7)	0.15
RVV-3	203 (96. 6)	198 (94. 2)	0.24
fIPV-1	208 (99)	203 (96. 6)	0.09
fIPV-2	203 (96. 6)	198 (94. 2)	0.24
MR1	199 (94. 7)	196 (93. 3)	0.53
JE1	199 (94. 7)	196 (93. 3)	0.53
Fully immunized	172 (81. 9)	163 (77. 6)	0.27
Partially immunized	35 (16. 6)	42 (20)	0.37
Did not receive any single vaccine	3 (1.5)	5 (2. 4)	0.47

Values expressed as n (%)
BCG Bacille Calmette Guerin, OPV Oral Polio vaccine, RVV Rotavirus vaccine, fIPV Fractional inactivated Polio vaccine, JE Japanese encephalitis vaccine, MR Measles Rubella vaccine

Table II Delayed Vaccination for Scheduled Vaccines in the Study Cohorts (*n* = 420)

Vaccine	*Delayed vaccination*[a]		*P value*	*Duration of delay (days)*[b]		*P value*
	2019 Cohort	*2020 Cohort*		*2019 Cohort*	*2020 Cohort*	
BCG vaccine	18 (8. 6)	14 (6. 7)	0.56	46 (35, 77)	53 (44, 69)	0. 24
Six wks vaccine (Pentavalent-1)	38 (18. 1)	48 (22. 9)	0.80	51 (35, 65)	61 (43, 105)	0. 13
10 wks vaccine (Pentavalent-2)	46 (21. 9)	47 (22. 4)	0.90	52 (37, 62)	60 (43, 81)	0. 36
14 Wks vaccine (Pentavalent-3)	56 (26. 7)	64 (30. 5)	0.32	39 (32, 61)	62 (42, 114)	0. 07
Nine months vaccine (MR-1, JE-1)	32 (15. 2)	35 (16. 7)	0.44	49 (34, 75)	52 (38, 71)	0. 71
Any vaccine delay	139 (66.2)	147 (70.0)	0.40	50.5 (34, 62.25)	57 (40, 80)	0.173

BCG Bacille Calmette Guerin, JE Japanese encephalitis vaccine, MR Measles Rubella Vaccine
Values expressed as [a]n (%) or [b]median (IQR)

Web Table I Socio-Demographic Characteristics of the Children and their Households (*n* = 420)

Variables	***Categories***	***Total***	***2019 Cohort* (*n* = 210)**	***2020 Cohort* (*n* = 210)**
Gender of the child	Male	200 (47. 6)	99 (49. 5)	101 (50. 5)
	Female	220 (52. 4)	112 (51%)	108 (49%)
Mother education	Illiterate	33 (7. 9)	18 (8. 18)	15 (7. 1)
	Primary	257 (61. 2)	134 (63. 8)	123 (58. 5)
	Secondary	98 (23. 3)	48 (22. 8)	50 (23. 8)
	High School	27 (6. 4)	8 (3. 8)	19 (9. 0)
	Graduate	5 (2. 4)	2 (0. 9)	3 (1. 4)
Father education	Illiterate	10 (2. 4)	7 (3. 3)	3 (1. 4)
	Primary	100 (23. 8)	47 (22. 4)	53 (25. 2)
	Secondary	236 (56. 2)	121 (57. 6)	115 (54. 8)
	High School	48 (11. 4)	20 (9. 5)	28 (13. 3)
	Graduate	26 (6. 2)	15 (7. 1)	11 (5. 2)
Occupation of mother	Homemaker	355 (84. 5)	177 (84. 3)	178 (84. 8)
	Unskilled worker	45 (10. 7)	25 (11. 9)	20 (9. 5)
	Skilled worker	15 (3. 6)	6 (2. 9)	9 (4. 3)
	Clerical/Shop/Worker	5 (1. 2)	2 (0. 9)	3 (1. 4)
Occupation of father	Unemployed	4 (1. 9)	3 (1. 4)	1 (0. 5)
	Unskilled worker	285 (67. 9)	137 (65. 3)	148 (70. 5)
	Semi-skilled worker	65 (15. 5)	31 (14. 8)	34 (16. 2)
	Skilled worker	20 (4. 8)	11 (5. 2)	9 (4. 3)
	Clerical/Shop/Worker	46 (10. 9)	27 (12. 9)	19 (9. 0)

Values expressed as n (%), P > 0.05 for all comparisons between 2019 cohort and 2020 cohort