Section: Community Medicine

Original Research Article

STATUS OF BIRTH DOSE VACCINES COVERAGE AND ITS ASSOCIATED FACTORS IN THE FIELD PRACTICE AREAS OF A TERTIARY CARE CENTER IN NORTHERN INDIA: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Under India's Universal Immunization Programme, immunization is started as soon as a child is born. This is done to protect the newborn against maternally transmitted infections like Hepatitis B and also against childhood tuberculosis (BCG) and polio (OPV). The objective is to assess the coverage of Birth dose vaccines among infants and to determine the socio-demographic factors affecting coverage of birth dose vaccines.

Materials and Methods: It was a cross-sectional study, done in the field practice area of the Department of Community Medicine, Santosh Medical College. A total of 401 children aged 0 to 6 months residing in the area on the days of the visits were enrolled for study. All socio-demographic and clinical birth related data of these children were collected through pretested semi-structured questionnaires. Statistical Analysis Used Data were collected and analysis was done by using IBM SPSS statistics for windows, version 26. Responses to questions were described in terms of frequency as well as percentages. Chi-square test was used for comparing qualitative data.

Results: Out of the total study subjects, 95.5% had received BCG, 95% had received OPV, and 94.5% had received Hepatitis B. The majority, approximately 87%, received the birth dose vaccine at their birthplace. Factors like religion, place of delivery, mode of delivery, and antenatal visits by healthcare workers were significantly associated with the status of immunization.

Conclusion: Birth dose immunization coverage was found to be more than 94% for all the three vaccines, which is more than the national coverage of 91% (WHO UNICEF estimates, 2022).

Keywords: Bacillus Calmette-Guérin(BCG); Birth dose Vaccination; Hepatitis-B; Immunization coverage; Oral polio vaccine(OPV).

INTRODUCTION

The Expanded Programme on Immunization (EPI) is an essential, cost-effective health intervention able to reduce child morbidity and mortality worldwide.[1]The World Health Organization (WHO) recommends administering three vaccines soon after birth, namely the hepatitis B virus (HBV) vaccine, Bacillus Calmette-Guerin (BCG), and oral

polio vaccine (OPV).[2-4] Their early administration aims at preventing both mother-to-child and early horizontal HBV transmission,[4] TB meningitis in childhood,[5] and at increasing OPV sero-conversion rates with subsequent doses.[3] Zero dose of Hepatitis B is only given within 24 hours after birth, and zero dose of OPV is given up to 15 days. If BCG is not given after birth, then it can be given up to 12 months of age.

Vaccine-preventable diseases have higher potential transmission rates in urban areas than in rural areas. Disease transmission can be interrupted with immunization coverage based on the density of populated areas.[6] Moreover, significant disparities exist in immunization coverage in urban areas, with lower coverage observed in the urban poor in many countries. Globally, there are 14.5 million children missing out on birth dose vaccination.[7]

According to the World Health Organization (WHO), the global coverage of BCG vaccination is 87% and about 89% in India. In 2023, globally, an estimated 10.8 million people suffered from tuberculosis, which included 1.3 million children. In 2023, TB caused 1.25 million deaths worldwide. TB once again has become the most common infectious agent-related cause of death worldwide. BCG Vaccine reduces the overall mortality due to TB by around 74%.[8]

According to the World Health Organization (WHO), the global coverage of OPV zero-dose vaccination is 83% and about 89% in India. After the introduction of the GPEI (Global Polio Eradication Initiative), the number of cases has been reduced by 99%. 3 doses of OPV reduced the risk of paralysis by 91%. WHO declared the Southeast Asia Region to be polio-free on March 27, 2014.[9]

With a target of 90% coverage of the birth-dose hepatitis B vaccine by 2030, it is critical to immediately incorporate WHO/SAGE recommendations for administering the hepatitis B vaccine birth dose into the National Immunization Schedule (NIS).[10]Hepatitis B vaccine has been introduced worldwide in 190 countries. According to the World Health Organization (WHO), the global coverage of zero dose hepatitis B vaccine is estimated at 83% and about 86.8% in India9.Hepatitis B caused an estimated 1.1 million deaths in 2022.[11] In India, it is estimated that about 4 crore people are suffering from hepatitis B, and there were 2,729 recorded virus-related deaths in the nation throughout the past five years.[12]

Assessing immunization coverage is essential for planning immunization programs, identifying vulnerable groups that require targeting of increased resources, and predicting likely vaccine-preventable disease epidemics. Hence, the objectives of the current study were to estimate the level of routine immunization coverage and the common factors impacting the birth dose vaccination coverage.

MATERIALS AND METHODS

Study Design: This was a cross-sectional study conducted over a period of 6 months from March 2024 to August 2024.

Study Setting and Participants: The study was done in the urban field practice area of the Department of Community Medicine, Santosh Medical College, Ghaziabad, and Uttar Pradesh using convenience sampling. Mothers/guardians of children between 0 and 6 months who were present on the day of the visit were included as study participants.

Inclusion Criteria:

- All mothers/guardians having children less than 6 months old present in the field practice area were included in the study.
- Those who had been residing in the same area for at least 1 year were included in the study.

Exclusion Criteria:

- Those not available during the study period and not given consent were excluded from the study.

Method of Data Collection: The list of children who were under 6 months of age was collected from the ASHA worker of the area, and then each study subject was visited at their address, and a pretested questionnaire was used which consisted of questions related to socio-demographic details, characteristics of delivery, antenatal visits by healthcare workers and details related to the status of immunization and place of immunization. The status of vaccination was confirmed by the MCP card. The total number of children available during the study period was 401.

Ethical Consideration: Ethical approval was obtained from the institutional ethical committee, and informed consent was taken from the mother/guardian.

Data Analysis: The data was collected and entered in MS Excel 2016. Analysis was done with the appropriate statistical method using SPSS software trial version 20.0. The chi-square test was used between the variables, with a significance P value <0.05.

RESULTS

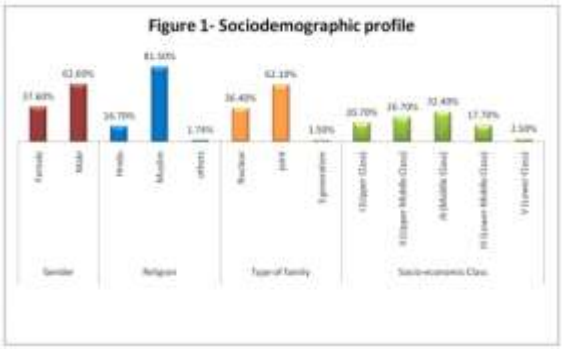

Figure 1: Sociodemographic Profile of Study Participants.

[Figure 1] shows the sociodemographic profile of the study participants. Of the total study participants, 251 (62.6%) study subjects were male and 150 (37.4%) were female. Majority of the study participants were Muslims 327(81.5%), and had joint families 249 (62.10%).Almost one-third of the participants were middleclass 130 (32.4%).

[Figure 2] shows the characteristics of delivery and antenatal visits by healthcare workers. It was found that the majority, 246 (61.3%), of the study participants had delivered at a government facility. Most had delivered by normal vaginal delivery 281 (70.1%). The majority 180 (44.9%) of infants were of the birth order 2. Regarding the number of antenatal visits made by health workers, the majority had 3 visits 169(42.10%) and only 26 (6.5%) had more than 3 antenatal visits.

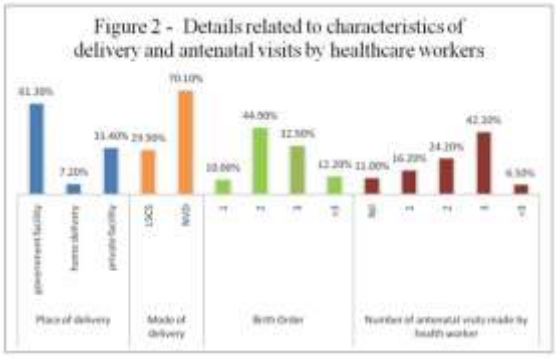

Figure 2: Details related to characteristics of delivery and antenatal visits by healthcare workers.

Table 1: Distribution of Study Participants according to status of Immunization.

Variables	Children Who Received BCG	Children Who Received OPV-Zero Dose	Children Who Received Hep-B Birth Dose
	Frequency	Frequency	Frequency
Yes	383 (95.5%)	381(95%)	379 (94.5%)
No	18 (4.5%)	20 (5%)	22 (5.5%)
Total	401 (100%)	401(100%)	401(100%)

[Table 1] shows the distribution of study subjects according to the status of immunization. Of the total participants, 383 (95.5%), 381 (95%), and 379 (94.5%) had received BCG, OPV-zero dose, and Hepatitis B (birth dose) vaccines, respectively.

Table 2: Association between Socio-demographic profile with status of Birth Dose Immunization.

Variables		BCG			OPV – Zero dose			Hepatitis B-Birth Dose		
		Yes	No	Chi-Square value (P Value)	Yes	No	Chi-Square value (P Value)	Yes	No	Chi-Square value (P Value)
Gender	Male	144(96%)	6(4%)	2.236 (P=0.135)	143(95.3%)	7(4.7%)	2.314 (P=0.128)	142(94.7%)	8(5.3%)	3.342 (P=0.068)
	Female	247 (98.4%)	4 (1.6%)		246(98%)	5(2%)		246(98%)	5(2%)	
Religion	Hindu	63(94%)	4(6%)	10.41 (P=0.005)	62(92.5%)	5(7.5%)	10.89 (P=0.004)	61(91%)	6(9%)	13.69 (P=0.001)
	Muslim	323(98.8%)	4(1.2%)		322(98.5%)	5(1.5%		322(98.5)	5(1.5%)	
	Others *	6(85.7%)	1(14.2%)		6(85.7%)	1(14.2%)		6(85.7%)	1(14.2%)	
Type of Family	Nuclear	142(97.3%)	4(2.7%)	0.057 (P=0.811)	141(96.6%)	5(3.4%)	0.148 (P=0.701)	141(96.6%)	5(3.4%)	0.024 (P=0.876)
	Joint#	249(97.6%)	6(2.4%)		248(97.3%)	7(2.7%)		247(96.9%)	8(3.1%)	
Socio-economic Class	I (Upper Class)	81(97.6%)	2(2.4%)	0.826 (P=0.935)	81(97.6%)	2(2.4%)	2.611 (P=0.625)	81(97.6%)	2(2.4%)	9.992 (P=0.041)
	II (Upper Middle Class)	104(97.2%)	3(2.8%)		103(96.3%)	4(3.7%)		103(96.3%)	4(3.7%)	
	III (Middle Class)	126(96.9%)	4(3.1%)		126(96.9%)	4(3.1%)		126(96.9%)	4(3.1%)	
	IV (Lower Middle Class)	70(98.6%)	1(1.4%)		70(98.6%)	1(1.4%)		70(98.6%)	1(1.4%)	
	V (Lower Class)	10(100%)	0		9(90%)	1(10%)		8(80%)	2(20%)	

*Others- Sikh and Christian were combined and made into the others category.
- Joint and 3-generation families were combined to make joint families.

[Table 2] shows the association of Socio-demographic factors with status of Birth dose immunization. It was found that Gender and Type of family were not associated with status of BCG, OPV or Hepatitis B (P > 0.05) whereas the chi-square test shows that Religion was significantly associated with administration of BCG, OPV and Hepatitis B (P<0.05) with Muslims being the highest number of beneficiaries. Socio-economic status was significantly associated with administration of Hepatitis-B (P< 0.05) with maximum beneficiaries among lower middle class and minimum among lower class. However, it was not associated with administration of BCG or OPV (P > 0.05).

Table 3: Association between Characteristics of delivery and antenatal visits by healthcare workers with status of Birth Dose Immunization.

Variables		BCG			OPV			Hepatitis B		
		Yes	No	Chi-Square value (P Value)	Yes	No	Chi-Square value (P Value)	Yes	No	Chi-Square value (P Value)
Place of Delivery	Government facility	238(99.2%)	2(0.8%)	9.185 (P=0.010)	238(99.2%)	2(0.8%)	15.724 (P<0.01)	238(99.2%)	2(0.8%)	19.396 (P<0.01)
	Home delivery	65(92.9%)	5(7.1%)		63(90.0%)	7(10.0%)		62(88.6%)	8(11.4%)	
	Private facility	88(96.7%)	3(3.3%)		88(96.7%)	3(3.3%)		88(96.7%)	3(3.3%)	
Mode of Delivery	LSCS	103(100%)	0	4.276 (P=0.039)	103(100%)	0	4.276 (P=0.039)	103(100%)	0	4.644 (P=0.031)
	NVD	286(96.0%)	12(4.0%)		286(96.0%)	12(4.0%)		285(95.6%)	13(4.4%)	
Birth Order	1	38(95.0%)	2(5%)	1.828 (P=0.609)	37(92.5%)	3(7.5%)	4.641 (P=0.200)	36(90%)	4(10%)	7.887 (P=0.048)
	2	186(98.4%)	3(1.6%)		186(98.4%)	3(1.6%)		186(98.4%)	3(1.6%)	
	3	128(97.0%)	4(3.0%)		128(97.0%)	4(3.0%)		128(97.0%)	4(3.0%)	
	>3	39(97.5%)	1(2.5%)		38(95.0%)	2(5%)		38(95.0%)	2(5%)	
Antenatal Visits by HealthCare Workers	Nil	38(86.4%)	6(13.6%)	30.735 (P<0.01)	37(84.1%)	7(15.9%)	38.767 (P<0.01)	37(84.1%)	7(15.9%)	34.078 (P<0.01)
	<3	160(98.8%)	2(1.2%)		160(98.8%)	2(1.2%)		160(98.8%)	2(1.2%)	
	3	169(100%)	0		169(100%)	0		168(99.4%)	1(0.6%)	
	>3	24(92.3%)	2(7.7%)		23(88.5%)	3(11.5%)		23(88.5%)	3(11.5%)	

[Table 3] shows the association of birth related factors with status of birth dose immunization. It was found that place of delivery, mode of delivery, and number of antenatal visits was significantly associated with administration of BCG, OPV and Hepatitis B (P< 0.05). Birth order was significantly associated with administration of Hepatitis-B (P< 0.05) and not associated with administration of BCG or OPV (P > 0.05).

DISCUSSION

The study was conducted in the urban field practice area of Santosh Medical College and found that around 5% of children had not received the birth dose vaccination. It was found that the majority, 251 (62.6%), of the study subjects were males, of Muslim religion 327(81.5%) and belonged to joint families, 249 (62.1%), and the middle class 130(32.4%) according to the modified B. G. Prasad scale 2024 [Figure 1]. Pertaining to characteristics of delivery of the study subjects, it was found that the majority 246 (61.3%) were delivered at a government facility through normal vaginal delivery 281(70.1%). Out of the total study participants, 180 (44.9%) of the study participants were of birth order 2. Predominantly, 169 (42.1%) study participants received 3 antenatal visits by healthcare workers [Figure 2].Around 95% of the study participants received all the birth dose vaccines [Table 1].

According to WHO, the immunization status in India is 89%, 89%, and 86.8% for BCG, OPV, and Hepatitis B, respectively. The full immunization coverage as per NFHS-5 has shown an increase of 14.4 percentage points from 62% in NFHS-4 (2015-16) to 76.4% in NFHS-5 (2019-2021), and as per the Health Management Information System, the full immunization coverage (2020-21) was 87.8%. As per the Ministry of Health and Family Welfare, India, the National Full Immunization coverage for FY 2023-24 is 93.5%. The Universal Immunization Program aims to achieve 90% full immunization

coverage throughout the country. Our study found that the birth dose vaccination status was 95.5%, 95%, and 94.5% for BCG, OPV, and Hepatitis B, respectively, which was better than the national status and more than the proposed targets.

The better results may be due to Intensified Mission Indradhanush, the Universal Immunization Programme (UIP), the U-WIN Portal (a digital platform that helps to track immunization status, identify potential gaps, and improve monitoring and evaluation), community engagement, public awareness campaigns, setting up urban PHCs, and efforts by the healthcare workers and government. Higher vaccine coverage at government facilities indicates that strengthening public health infrastructure in underserved rural and urban areas is crucial.

It was found that Gender and Type of family were not associated with the status of BCG, OPV, or Hepatitis B ($P > 0.05$). Lack of association with gender suggests that both males and females have similar access to immunization services, indicating alignment with the national immunization goal of gender equality. Religion was significantly associated with administration of BCG, OPV, and Hepatitis B with P= 0.005, 0.004 and 0.001 respectively. Socio-economic status was significantly associated with administration of Hepatitis-B (P= 0.041) and not associated with administration of BCG or OPV ($P > 0.05$) [Table 2]. There was a higher percentage of non-administration of the birth dose of BCG, OPV, and Hepatitis B in home deliveries compared to deliveries in government hospitals and private facilities. This difference was statistically significant with $P < 0.010$, 0.01, 0.01 respectively. Mode of delivery (P= 0.039, 0.039 and 0.031) and number of antenatal visits (P<0.01, 0.01 and0.01) were significantly associated with administration of BCG, OPV, and Hepatitis B ($P< 0.05$). Birth order was significantly associated with administration of Hepatitis-B (P= 0.048) and not associated with administration of BCG or OPV ($P > 0.05$) [Table 3].

Our study found a significant association between place of birth and immunization status, consistent with the findings of Kumar Verma R, et al. (2022) in Sonepat, Haryana,[13] and Gupta P, et al. (2015) in Lucknow.[14]However, a cross-sectional study by Praful Bansod V, et al. (2021) in western Maharashtra found that place of delivery was significantly associated with delayed BCG vaccination, differing from our findings.[15]

Our study found a significant association between mode of delivery and immunization status, consistent with the findings of Praful Bansod V, et al. (2021) in western Maharashtra.[15] However, a cross-sectional study by M. Joy Tet al. (2019) in Kochi, Kerala found no significant association between mode of delivery and immunization status, differing from our findings.[16]

Our study found no significant association between socioeconomic status and immunization status, consistent with the findings of M. Joy Tet al. (2019) in Kochi, Kerala.[16]In other study conducted by Mondal J, et al. (2018) in West Bengal found a significant positive correlation between socioeconomic status and immunization status, suggesting that children from higher socioeconomic backgrounds were more likely to be fully immunized.[17]

Our study found a vaccine coverage rate similar to that reported by Kumar Verma R, et al. (2022) in Sonepat, Haryana.[13]Our study found no significant association between gender and immunization status. This finding is consistent with a study by Ndirangu et al. (2018),[18] which reported no significant difference in immunization coverage between male and female children. However, a study by Odusanya et al. (2008) found that male children were more likely to be fully immunized than female children.[19] The discrepancy in findings may be attributed to differences in study settings and populations. Our study revealed no significant association between birth order and immunization status. This finding is in contrast to a study by Singh et al. (2013), which reported that children with higher birth orders were less likely to be fully immunized.[20] Our study found a significant association between mode of delivery and immunization status. This finding is consistent with a hospital-based cross-sectional study conducted by Praful Bansod V, et al. (2021) in western Maharashtra, which found that place of delivery was significantly associated with and an independent predictor of delayed BCG vaccination.[15] Similarly, a cross-sectional study conducted by Gupta P et al. (2015) in Lucknow found that 74.7% of children were fully immunized, 83.3% were delivered at a government/private hospital, and place of birth was significantly associated with the status of immunization.[14] These findings suggest that mode of delivery is an important factor influencing immunization status.

CONCLUSION

Our findings indicate that of the total study subjects, 95.5% received BCG, 95% received OPV, and 94.5% received Hepatitis B. The study findings indicate a notable achievement in newborn vaccination coverage, surpassing expectations. By consolidating our gains and addressing remaining gaps, we can strive for even higher vaccination coverage, ultimately reducing mortality from vaccine-preventable diseases.

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