

ORIGINAL ARTICLE

IMMUNISATION STATUS OF CHILDREN UP TO 15 YEARS OF AGE

Kruti Dhaval Gandhi¹, Monali T Bhorge², Harshal Dhabe².

¹Department of Internal Medicine, Mount Sinai Health System, Icahn School of Medicine at Mount Sinai, New York, USA,

²Department of Pediatrics, A.I.M.S Hospital, Aurangabad, Maharashtra, India.

ABSTRACT

Aim: To determine the immunisation status of children up to 15 years of age and factors associated with incomplete immunisation.

Materials and Methods: Three hundred seventy-seven children in the age group 1 month to 15 years, attending regular outpatient department (OPD) were screened for their immunization status by direct questionnaire method and checking the immunization medical records. Children were divided based on their age in to 3 groups viz. <1yr, 1 to 5yr, >5yr. Information regarding their residence, education status of their parents, community, various vaccines, and whether immunization status was complete, or incomplete was recorded.

Results: The mean age of children ranged from 3.68 + 3.47 years. Twenty-three percent of the infants were incompletely immunised ($p=0.006$). Twenty seven percent of Muslims and 28% of Buddhists were incompletely immunised ($P=0.003$). Illiteracy in father and mother is associated with incomplete immunisation by 34.38% ($P=0.0004$) and 31.15% ($P<0.001$), respectively. Main reason for incomplete immunisation was non-availability of vaccine, as seen in 57.7% of cases. Other reasons include immunisation facility not available locally (32.7%), parents refusing immunisation for their children (30.8%), child unwell (5.8%), parent out of town (3.8%). We did not find any gender bias in our study. Also, in our study, no vaccine in universal immunization programme (UIP) had lower coverage as compared to other vaccines.

Conclusion: Immunization status in children in India needs to be improved. Religious beliefs, literacy rates in parents seem to affect the immunization completion in the child.

ARTICLE HISTORY

Received 23 June 2021

Accepted 20 August 2021

KEYWORDS

Introduction

Immunization is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine. Vaccines stimulate the body's own immune system to protect the person against subsequent infection or disease.¹ According to World Health Organization (WHO), immunization is a proven tool for controlling and eliminating life-threatening infectious diseases and is estimated to avert between 2 and 3 million deaths each year, but an estimated 18.7 million infants worldwide are still missing out on basic vaccines.¹ Every year in India, 500,000 children die due to vaccine-preventable diseases and another 89,00,000 children remain at risk, because they are either unimmunized or partially immunized against vaccine-preventable diseases.² India has one of the largest Universal Immunization Programs (UIP) in the world in terms of the quantities of vaccines used, number of beneficiaries covered, geographical

spread and human resources involved. Despite being operational for over 30 years, UIP has been able to fully immunize only 65% children in the first year of their life and the increase in coverage has stagnated.² To achieve full immunization coverage for all children, the Government of India launched Mission Indra Dhanush in December 2014. The goal of this program is to ensure full immunization with all available vaccines for children up to two years and pregnant women. Under this programme, all vaccines are available free of cost.² The Indian Government's UIP provides vaccines against six diseases to all infants free of charge: one dose of bacillus Calmette-Guerin (BCG; tuberculosis); three doses of DPT3; three doses of oral polio vaccine (OPV); and one dose of measles-containing vaccine (MCV). All these vaccine doses should be administered by age 12 months.² Indian children who receive all recommended doses of these four UIP vaccines are considered fully vaccinated by WHO; a child lacking any of the recommended doses is considered under-vaccinated, and children who have not received any vaccinations are considered non-vaccinated.³ We undertook this study to determine the immunization status of children in Maharashtra who used to visit a tertiary hospital for their health care needs.

Address for Correspondance: Dr Harshal Dhabe, Department of Pediatrics, A.I.M.S Hospital, Aurangabad, Maharashtra, India.

Email: drharshal101@gmail.com

©2021 Pediatric Oncall

Methods & Materials

The study was conducted at a tertiary care institute in an urban setting. It is a cross-sectional, single observer study done in a tertiary care institute over a period of two months. Three hundred seventy-seven children in the age group 1 month to 15 years, attending regular outpatient department (OPD) were screened for their immunization status by direct questionnaire method and checking the immunization medical records. Children were divided based on their age in to 3 groups viz. <1yr, 1 to 5yr, >5yr. Information regarding their residence, education status of their parents, community, various vaccines, and whether immunization status was complete, or incomplete was recorded. Immunization status was considered as complete if they had received the vaccination as per age as per the UIP schedule.⁴ Awareness regarding optional vaccines such as Hib vaccine, typhoid vaccine, chickenpox vaccine, MMR vaccine and Hepatitis A vaccine was determined. Parents were considered as educated if they had passed the secondary school certificate (SSC) exam or equivalent. Reasons for

un-immunized state were 5 groups- A: immunization facility not available locally, B: child was not well; C: vaccine not available; D: parents had gone out of town; E: parents did not want to get immunization done.

Statistical Analysis: Factors associated with incomplete immunization were analysed using Chi-square test and Fischer exact test. P value<0.05 was considered as significant.

Results

The baseline characteristics of all children is depicted in Table 1. Eighty-four (22.28%) children were from out of the city whereas 293 (77.72%) children were from the city. Fathers of 345 (91.51%) children were literate whereas mothers of 316 (83.82%) children were literate. Immunization coverage of 325 (86.21%) children was complete whereas immunization coverage of 52 (13.79%) children was incomplete. Reasons for incomplete immunization are depicted in table 1. Forty-seven (12.4%) were not aware of the optional vaccines. Individual vaccine coverage is depicted in Table 2. Factors associated with incomplete immunization are depicted in Table 3.

Table 1. Baseline Characteristics of all children

Baseline characteristics	Patients
Age (Years)	3.68 +- 3.47
Age group	
Group A (<=1 yr)	100 (26.52%)
Group B (1 to 5 yrs)	182 (48.28%)
Group C (>5 yrs)	95 (25.20%)
Male	242
Female	135
Community	
Hindu	299 (79.31%)
Christian	4 (1.06%)
Buddhist	25 (6.63%)
Muslim	47 (12.47%)
Sikh	2 (0.53%)
Reasons for incomplete immunisation	
A: immunization facility not available locally	17 (32.7%)
B: child was not well	3 (5.8%)
C: vaccine not available	30 (57.7%)
D: parents had gone out of town	2 (3.8%)
E: parents did not want to get immunization done	16 (30.8%)

Table 2. Individual Vaccine Coverage

Individual vaccine	No. of patients immunized
Bacillus Calmette–Guerin (BCG)	371 (98.41%)
Oral polio vaccine (OPV)	351/374 (93.85%)
Hepatitis B vaccine	297/314 (94.59%)
Measles vaccine	291/319 (91.22%)
Booster 1	226/243 (93%)
Booster 2	111/117 (94.87%)
Tetanus toxoid	32/33 (96.97%)

Optional vaccines	270 (71.62%)
HiB vaccine	60 (15.92%)
Hepatitis A vaccine (HAV)	11 (2.92%)
Typhoid vaccine	30 (7.96%)
Chickenpox vaccine	11 (2.92%)
Measles-mumps-rubella (MMR) vaccine	249 (66.05%)

Table 3. Factors associated with incomplete immunisation

	COMPLETE IMMUNISATION	INCOMPLETE IMMUNISATION	P value
Age group			
< 1 year	77 (77%)	23 (23%)	0.006
1-5 years	161 (88.46%)	21 (11.54%)	
> 5years	87 (91.58%)	8 (8.42%)	
Gender			
MALE	210 (86.78%)	32 (13.22%)	0.667
FEMALE	115 (85.19%)	20 (14.81%)	
Community			
HINDU	267 (89.3%)	32 (10.7%)	0.003
MUSLIM	34 (72.34%)	13 (27.66%)	
BUDDHIST	18 (72%)	7 (28%)	
CHRISTIAN	4 (100%)	0	
SIKH	2 (100%)	0	
Residence			
WITHIN CITY	252 (86%)	41 (14%)	0.833
OUT OF CITY	73 (86.90%)	11 (13.10%)	
Education of Father			
Father educated	304 (88.12%)	41 (11.88%)	0.0004
Father not educated	21 (65.62%)	11 (34.38%)	
Education of Mother			
Mother educated	283 (89.56%)	33 (10.44%)	0.000018
Mother not educated	42 (68.85%)	19 (31.15%)	

Discussion

In our study, the immunization coverage was 86.21% for the UIP schedule which is much higher than that reported in India by [District Level Household Survey \(DLHS-3\)](#) which is 53.5%.⁵ This may be due to disparities between geographies and population groups. As per NHFS - 3 data, nine states are below the national average for vaccination coverage including Madhya Pradesh, Uttar Pradesh, Bihar, Jharkhand. Maharashtra had an immunization coverage of 70-90% which is similar to that in our study.⁵

Urban areas have higher vaccination coverage as compared to rural areas and this gap exists for all vaccines.⁵ Within urban areas, slum populations have a lower coverage. Migrants coming to urban areas to have a lower coverage level as compared to the resident population. Urban and rural poor populations have a lower coverage as compared to the wealthier one.⁵ However, in our study we did not find any difference in immunization coverage between children

who were residents of Maharashtra as compared to children who were residents of other areas.

The main reasons for incomplete immunization in India reported are did not feel the need (28.2%), not knowing about vaccines (26.3%), not knowing where to go for vaccine (10.8%).⁵ In our study the main reason for not giving the vaccine was that the vaccine was not available followed by not having a facility for immunization locally and parents not wanting to give the vaccine. Vaccine not available has been reported to be 6.2% as per national survey.⁵ Thus, supply chain must be maintained in to ensure proper immunization. Proper education of parents regarding positive effects of vaccines is also required to maintain adequate immunization in children.

In our study, we found incomplete immunization most significant in infants. In India, an estimated 38% of children fail to receive all basic vaccines in the first year of life.⁶ The factors limiting vaccination



coverage include large mobile and isolated populations that are difficult to reach, and low demand from underinformed and misinformed populations who fear side effects and are influenced by anti-vaccination messages.⁶ However, process monitoring data showed that many eligible children on due lists were not brought to vaccination sessions. For those not attending, the key reason for almost half was lack of awareness, and for another quarter, concerns about the adverse effects of vaccines.⁶ In Nepal, as in most low-income countries, infants are immunized with standard WHO recommended vaccines. However, 16.4% of children did not receive complete immunization by 12 months of age in Nepal in 2011. The significant predictors of incomplete immunization were the home delivery of a child, the family residing on rent, a primary caretaker with poor knowledge about the schedule of vaccination and negative perception towards vaccinating a sick child, conflicting priorities, and development of abscess following immunization.⁷ Another study conducted in India found that higher birth order infants have lower vaccination coverage. Urban infants have higher coverage than rural infants and those living in urban slums.⁸ There is an almost direct relationship between household wealth and vaccination rates. In Ethiopia, about two-thirds (62.8%) of children were not fully immunized by 1 year of age and 36.4% were partially and incorrectly immunized. Reasons for incomplete vaccination were associated with accessibility to the vaccination sites, no schooling of mothers and children born at home, disagreement, or concern about safety.⁹ In West Bengal, the data set showed that at the age of 12-23 months, only 45.8% of children had undergone full immunisation, and this proportion was 49.4% in children aged 24-35 months. There was more coverage of each type of vaccine in urban than in rural areas. Approximately 49% of the children in rural areas had received all the recommended vaccinations by the age of 12-35 months, compared to 63.9% in urban areas.¹⁰

Also, incomplete immunization was seen in Muslims and Buddhists in our study. In India, religion is highly predictive of a child's vaccination status; relative to Hindus, Muslim children had 2.2 times greater odds of being non-vaccinated versus fully vaccinated and 1.42 times higher odds of being under-vaccinated compared with fully vaccinated.³ Lower birth order (OR 0.57, 95% CI 0.34-0.96) and belonging to Muslim religion (OR 2.63, 95% CI 1.28-5.26) were found to be factors associated with incomplete immunization status in Kerala, India.¹¹ Haryana's Muslim-dominated Mewat district has the lowest immunisation rate among children under the age of 6 years. The immunisation rate here is 13 per cent, much lower than the state average of 62.2 per cent, according to the National Family Health Survey which may be due to the rumours that the vaccines being administered under the Central government's Indra Dhanush programme would have a sterilising effect on the children.¹²

Education of parents also affected the immunization status of their children. Maternal education is an important factor as children belonging to mothers with secondary or higher education have high coverage (67%) than those without formal education.

(52%).¹³ Factors such as mother's literacy, and socioeconomic status explain the disparities in immunisation coverage.¹⁴ The dropout rate is an indicator of continued utilization of immunization services in the specified geographic area. Dropout rates are higher among children of mature mothers, might be due to poor educational status, higher in children of birth order 3 and above, tribal groups.¹⁵ Another study from the state of Kerala, India also has reported that education of the mother improves the vaccination probability of a child. Mothers with lower educational status could be a group for greater care and motivation in this area.¹¹ Another national study showed that lower maternal education was associated with a higher odd of delayed vaccination like previous studies from India and other Low and middle-income countries (LMICs), as most of these women are married early and the awareness and receptiveness to health messages and uptake of health services including vaccination is lower among these women.¹⁶ A study conducted in Assam, showed that parents literacy plays an important role in the children's immunization ($p < 0.001$).¹⁷ Lack of information among the parents was one of the major causes of drop out in the vaccination coverage. The drop out pattern between the first dose and third doses of DPT and OPV vaccines seem to be different in different background characteristics and revealed mother's literacy played an important role on the drop out of DPT and OPV vaccines.¹⁷ Approximately 54 percent of children in West Bengal were covered for immunisation. The educational level of the parents was found to have a significant influence on child immunisation coverage. Low rates of coverage were found among the vulnerable groups.¹⁰

In our study, no vaccine in UIP had lower coverage as compared to other vaccines. Most surveys reported Updated data that were used to select districts and urban areas in which at least 13000 children were estimated to have missed diphtheria, tetanus, pertussis 3 (DPT3)/pentavalent 3 in the previous year.⁶ Another study in Nepal also found that majority of the partially immunized children were not immunized with measles vaccine and third dose of pentavalent vaccines.⁷ The major reason might be the development of an abscess in the vaccination site which is also one of the predictors of incomplete immunization identified in this study. The caretaker may not want to continue vaccination of the child.⁷ Nationally, 23.1%, 29.3% and 34.8% of children aged 10 to 23 months had delayed vaccination for BCG, DPT-1st dose and Measles respectively. The proportion of children with delayed vaccination across different states and union territories in India ranged from 1.4% to 76.3% for BCG, 6.14% to 44.2% for DPT-1st dose and 20.9% to 46.7% for Measles.¹⁶ However, no such bias was found in our study.

Boys generally have a higher vaccination coverage than girls as reported by most surveys conducted across the country.⁵ However, we did not find any gender bias in our study.

Conclusion

Immunization status in children in India needs to be improved. Religious beliefs, literacy rates in parents seem to affect the immunization completion in the child.

Compliance with Ethical Standards

Funding None

Conflict of Interest None

References:

1. World Health Organization (WHO). Vaccines and Immunisation 2018. Available from URL: <https://www.who.int/health-topics/vaccines-and-immunization>. Accessed on 15th August 2021
2. National Health Portal (NHP) India. Immunization. Available from URL: https://www.nhp.gov.in/Immunization_ms. Accessed on 15th August 2021
3. Shrivastwa N, Gillespie BW, Kolenic GE, Lepkowski JM, Boulton ML. Predictors of Vaccination in India for Children Aged 12-36 Months. *Am J Prev Med*. 2015;49(6 Suppl 4):S435-S444.
4. Universal Immunisation Programme. Available at URL : https://en.wikipedia.org/wiki/Universal_Immunization_Programme. Accessed on 15th August 2021
5. Universal Immunization Program. Multi Year Strategic Plan 2013 - 17. Department of Health and Family Welfare Ministry of Health and Family Welfare Government of India. Available at URL : https://www.who.int/immunization/programmes_systems/financing/countries/cmyp/india_cmyp_2013-17.pdf. Accessed on 15th August 2021
6. Gurnani V, Haldar P, Aggarwal MK, Das MK, Chauhan A, Murray J, et al. Improving vaccination coverage in India: lessons from Intensified Mission Indradhanush, a cross-sectoral systems strengthening strategy. *BMJ*. 2018;363:k4782
7. Shrestha S, Shrestha M, Wagle RR, Bhandari G. Predictors of incompleteness of immunization among children residing in the slums of Kathmandu valley, Nepal: a case-control study. *BMC Public Health*. 2016;16:970
8. Mathew JL. Inequity in childhood immunization in India: A systematic review. *Indian Pediatrics*. 2012;49:203-223.
9. Yismaw AE, Assimamaw NT, Bayu NH, Mekonen SS. Incomplete childhood vaccination and associated factors among children aged 12-23 months in Gondar city administration, Northwest, Ethiopia 2018. *BMC Res Notes*. 2019;12:241.
10. Som S, Pal M, Chakrabarty S, Bharati P. Socioeconomic impact on child immunisation in the districts of West Bengal, India. *Singapore Med J*. 2010;51:406-412.
11. Joy TM, George S, Paul N, Renjini BA, Rakesh PS, Sreedevi A. Assessment of vaccine coverage and associated factors among children in urban agglomerations of Kochi, Kerala, India. *J Family Med Prim Care*. 2019;8:91-96.
12. Rumours hit immunisation programme in Muslim-dominated Mewat. Available from URL: <https://indianexpress.com/article/india/rumours-hit-immunisation-programme-in-muslim-dominated-mewat-4639955/>. Accessed on 15th August 2021
13. Vikram K, Vanneman R, Desai S. Linkages between Maternal Education and Childhood Immunization in India. *Soc Sci Med*. 2012;75:331-339
14. Srivastava S, Fledderjohann J, Upadhyay AK. Explaining socioeconomic inequalities in immunisation coverage in India: new insights from the fourth National Family Health Survey (2015-16). *BMC Pediatrics*. 2020;20:295.
15. Geddam JB, Kommu PR, Ponna SN, Mamidi RS, Kokku SB, Dudala SR, Veerraju BB. Immunization uptake and its determinants among the internal migrant population living in non-notified slums of Hyderabad city, India. *J Family Med Prim Care*. 2018;7:796-803.
16. Choudhary TS, Reddy NS, Apte A, Sinha B, Roy S, Nair NP, et al. Delayed vaccination and its predictors among children under 2 years in India: Insights from the national family health survey- 4. *Vaccine*. 2019;37:2331-2339.
17. Phukan RP, Barman MP, Mahanta J. Factors Associated with Immunization Coverage of Children in Assam, India: Over the First Year of Life. *J Trop Pediatr*. 2009;55:249-252.