IMMUNIZATION STATUS AND ITS DETERMINANTS - A HOSPITAL BASED STUDY IN CHILDREN AGED 1-6 YEARS.

Paediatrics

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ABSTRACT

BACKGROUND: Immunization, a powerful and cost effective intervention against vaccine preventable diseases needs to be sustained with high coverage for desired benefits. Despite the ongoing Universal Immunization Programme, the immunization coverage in India is low. **OBJECTIVES:** To determine the immunization status of children aged 1-6 years, to study its association with various sociodemographic factors and the reasons for partial and no immunization. **METHODS:** This prospective study was conducted from September 2019 to February 2020 at a tertiary care hospital in Ahmedabad, India. Sociodemographic data and immunization history were recorded in a structured proforma. Children were classified as being completely, partially or unimmunized based on the vaccines (as per National Immunization Schedule) received as applicable for age. **RESULTS:** Of the 608 enrolled children, 467 (76.8 %) were fully immunized, 134 (22 %) partially immunized and 7 (1.2 %) were unimmunized. 87.8 % children had complete primary immunization up to first measles containing vaccine. Lower socioeconomic status, home delivery, birth order more than 2, low maternal education and occupation status were found to be significant risk factors ($p < 0.05$) for incomplete immunization. With increasing age, immunization coverage decreased ($p = 0.047$). The most common causes for incomplete immunization and no immunization were lack of knowledge about subsequent doses (31.8%) and lack of awareness of immunization (55.6%) respectively. **CONCLUSION:** The immunization coverage of children attending a tertiary care hospital needs to be improved. Special attention on increasing the coverage of booster doses and creating awareness in the groups who are at high risk of being incompletely immunized is required.

KEYWORDS

Complete Immunization, Immunization Status, Partial Immunization, Vaccine Coverage

INTRODUCTION

Infectious diseases are a major cause of morbidity and mortality in children especially in the developing countries. Immunization is a powerful and cost effective medical strategy to control infectious diseases. It has delivered excellent results in the last 50 years and there has been a substantial reduction in the incidence of many vaccine preventable diseases.¹ A sustained high vaccine coverage is required to control or eradicate a disease.

The Universal Immunization Programme in India has a primary objective of reducing morbidity and mortality due to vaccine preventable diseases.² In spite of immunization services being available free of cost in the public sector, vaccine coverage in our country is far from satisfactory. As per National Family Health Survey- 4 (2015-16) data, 62% of children aged 12 - 23 months in India are fully immunized (BCG, measles and 3 doses each of polio and DPT). In the state of Gujarat this rate is 50.4 % which is much lower than the national average.³

There is a wide disparity in the vaccine coverage in different parts of the country and different sections of society, indicating the influence of various demographic, social, economic and cultural factors. A knowledge of these factors helps to frame future policies to improve immunization coverage.

Hence, this study was undertaken to determine the immunization status among children aged 1-6 years attending a tertiary care hospital and to study its association with various sociodemographic factors and the reasons for partial and no immunization.

MATERIALS AND METHODS

This prospective study was conducted from September 2019 to February 2020 at a tertiary care hospital in Ahmedabad, Gujarat, India. Children between 1 to 6 years, attending the outpatient department or

admitted in the pediatric wards were included in the study. The study was approved by the Institutional Ethical Committee and informed consent was taken from the parents of the study subjects.

Demographic and socioeconomic data consisting of age, gender, socioeconomic status, maternal education and occupation were recorded in a structured proforma. Place of delivery and birth order of the child were also noted. Modified Kuppuswamy classification was used for socio economic classification of the families.⁴ The immunization status was determined by the information given by the parents and confirmed wherever possible by immunization cards. If the child was partially immunized or unimmunized, the reasons for the same were recorded using open-ended questions.

The children enrolled were divided into 3 groups based on their age to assess their immunization status with regard to the vaccines given under the National immunization schedule at different ages.^{1,2,5}

Vaccines considered in various age groups were:

Group 1 (age $1 \geq 2$ years) - BCG and OPV zero dose given soon after birth, three primary doses of pentavalent (combination of diphtheria, pertussis, tetanus, haemophilus influenza B and hepatitis B vaccines) and oral polio vaccine and one dose of measles containing vaccine.

Group 2 (age $2 \geq 5$ years) - All of the above vaccines plus second dose of measles containing vaccine and first booster doses of DPT and OPV.

Group 3 (age $5 \geq 6$ years) - All the vaccines mentioned in the above two groups plus the second booster doses of DPT and OPV.

Complete immunization was defined as having received all the vaccines mentioned in the respective age groups and partial immunization (incomplete immunization) as having received one or more doses but not all the doses of vaccines mentioned in the respective groups. No immunization was defined as not having

received any of the vaccines listed in the respective age groups. Data entry was done in Microsoft excel 2010 and data analysis was done using Epi info software. Chi square and Fisher exact test were applied to determine the association between various sociodemographic variables and immunization status. A p value < 0.05 was considered significant.

RESULTS

Of the 608 enrolled children, 467 (76.8 %) were completely immunized, 134 (22 %) were partially immunized and 7 (1.2 %) were unimmunized. 534 (87.8 %) patients had complete primary immunization up to first dose of measles containing vaccine.

The relation of various variables with immunization status is shown in Table 1 and 2. A significant association (p value < 0.05) was noted between immunization status and variables like age, socioeconomic status, maternal education and occupation, place of delivery and birth order. Lower socioeconomic status, home delivery and birth order more than 2 were risk factors for incomplete / no immunization. Also, poor immunization status was noted in children whose mothers were illiterate or with low educational qualifications or who were unskilled workers. There was no association between gender and immunization status.

With increasing age, immunization coverage decreased which was statistically significant (p value = 0.047). Maximum vaccine coverage (97 %) was noted for BCG and zero dose OPV. Lowest coverage rate (69.2 %) was noted for second booster dose of DPT. The coverage rates of individual vaccines are shown in Table 3.

The most common cause for incomplete immunization was lack of knowledge about subsequent doses of vaccines, cited by 31.8 % parents. Other common causes given were that the child was unwell when the vaccination was due (16.2 %) and fear of side effects (12.2 %). The reasons for incomplete immunization are shown in Table 4. The most common reason for no immunization was lack of knowledge of immunization (55.6 %). Some parents gave more than one reason for incomplete / no immunization.

DISCUSSION

Immunization is an effective tool for controlling and even eradicating infectious diseases. A successful immunization programme is of particular relevance to India as the country contributes to one fifth of the global under 5 mortality with a significant number of deaths attributable to vaccine preventable diseases. There is no doubt that substantial progress has been achieved in India with wider use of vaccines resulting in prevention of several infectious diseases. However, the progress has not been sustained and coverage rates are still low in many parts of the country.¹

Most studies on immunization status of children have studied the coverage of primary vaccines given in first year of life (up to measles vaccine) as per National Immunization Schedule.^{6,7,8,9,10} We have tried to assess the coverage of booster doses of DPT vaccines also.

In our study, 76.8 % children were completely immunized for age. Primary immunization (up to first dose of measles containing vaccine) was complete in 87.8 % children. Other studies have shown complete primary immunization rates varying from 70.3 % to 83 %.^{6,7,8,11} The variations in immunization rates can be attributed to different settings (urban, rural, hospital) in different parts of country where the studies have been carried out. Sociodemographic characteristics, availability and efficiency of health services and awareness and attitude of people play an important role in determining the immunization status of children.

We noted that children belonging to upper and middle socioeconomic class had better immunization status compared to those belonging to lower socioeconomic class. This is because of better affordability and accessibility of immunization services by the higher income population. Also, the immunization status of children whose mothers had higher educational qualification was better. Educated mothers understand the importance of immunization and are more likely to get their children fully immunized.

Similarly, children whose mothers were skilled workers or professionals had better vaccine coverage and in spite of their jobs, the

mothers managed to find time to get their children immunized. Housewives had the convenience of time for the immunization sessions. However, mothers who were unskilled labourers did not want to lose their daily wages and found the immunization session timings during their working hours inconvenient resulting in lower immunization coverage of their children. Studies by Engade MB et al¹⁰, Agarwal K et al¹² and Kurane AB et al¹³ have also observed that maternal attributes like education and occupation have a significant association with immunization status of children.

The rate of complete immunization was significantly more in children born in a hospital (79.4 %) compared to those who were delivered at home (10 %). Studies by Natu SA et al⁶, Babu VDV et al⁷ and Khargekar NC et al⁸ have also noted that children delivered in a hospital are more likely to be completely immunized as vaccination is started at birth and parents are educated regarding subsequent vaccination. Therefore, institutional deliveries should be promoted to improve vaccine coverage.

Children belonging to lower birth order had a better immunization status in our study. Other studies have also noted that as birth order of child increases, immunization level declines as mothers with a bigger household and other children find it more difficult to bring their children for immunization.^{6,9,10,12,13}

Like most other studies, no significant association of gender with immunization status was noted in our study.^{7,10,12,14}

In our study, complete immunization rate was highest in $1 \geq 2$ years age group (83.6 %) and lowest in $5 \geq 6$ years age group (67.5 %) which was statistically significant (p value = 0.047) and was due to lack of booster doses in the older age groups. Other studies have also shown that an inverse correlation exists between age of child and vaccine coverage.^{11,14,15}

BCG and zero dose OPV had highest coverage of 97 %. Measles containing vaccine was the most frequently missed vaccine in primary vaccines (coverage of 88.3 %). Significant drop out rate (16.2 %) from first to second dose of measles containing vaccine was noted.

Although immunization coverage of primary vaccines has increased in the past few decades, booster doses are still neglected. Our study showed a coverage of 78.2 % and 69.2 % for first and second DPT boosters respectively. Elliot C et al in their study showed that while 77.2 % children received primary vaccination, coverage rates of first and second DPT boosters were 73.1 % and 58.4 % respectively.¹⁴ They concluded that parents are more particular about primary doses and lesser importance is given to booster doses. There is a need to create awareness about the importance of booster doses. Catch up immunization campaigns like Mission Indradhanush and Measles Rubella campaigns help in improving vaccine coverage. There is also a need that immunization should cover places like schools for better coverage of booster doses.

The most common reason for incomplete immunization was lack of knowledge about subsequent doses of vaccines (31.8 %). Parents did not have adequate knowledge regarding the immunization schedule and the vaccines available. Many had a belief that children should not be immunized even during mild illness and so did not take the child for immunization. In some cases, the health care worker did not administer the vaccine. Parents and health care personnel should be educated that minor illness like mild fever, upper respiratory tract infection and diarrhea are not contraindications to vaccination and such misconceptions should be cleared. Many parents did not have faith in vaccines while others were apprehensive of the adverse effects. Parents need to be explained that serious adverse effects after immunization are extremely rare and benefits of vaccination far outweigh the risk. In some cases parents were preoccupied to earn their livelihood and immunization was not given priority.

The most common cause for no immunization was lack of knowledge about immunization (55.6%). Many parents thought that pulse polio was the only vaccine to be given or that the health worker would come home to immunize their child.

As there is a lack of information and motivation for immunization, it is necessary to create awareness regarding the various vaccines

available, their schedule and the importance of timely and complete vaccination. Every visit to the health centre should be utilized to check the child's immunization status, educate the mother and to provide vaccines to the child. To reduce the drop out rate, mother child tracking system should be used. Increasing health care facilities in rural areas and slums, training of health care workers, education of women, small family norms, institutional deliveries, media promotion and political will power are steps which can help increase vaccine coverage.

CONCLUSION

Table-1 Association of sociodemographic profile with immunization status of the children

Characteristics	Total (n = 608) Number (%)	Immunization status (n = 608)			p value
		Completely immunized (n = 467) Number (%)	Partially immunized (n = 134) Number (%)	Unimmunized (n = 7) Number (%)	
Gender					
Male	311 (51.2 %)	242 (77.8 %)	67 (21.6 %)	2 (0.6 %)	0.453
Female	297 (48.8 %)	225 (75.7 %)	67 (22.6 %)	5 (1.7 %)	
Age					
1 ≥ 2 years	152 (25 %)	127 (83.5 %)	24 (15.8 %)	1 (0.7 %)	0.047
2 ≥ 5 years	339 (55.8 %)	261 (77 %)	74 (21.8 %)	4 (1.2 %)	
5 ≥ 6 years	117 (19.2 %)	79 (67.5 %)	36 (30.8 %)	2 (1.7 %)	
Socioeconomic status					
Upper class	2 (0.3 %)	2 (100 %)	0	0	0.022
Upper middle	39 (6.4 %)	36 (92.3 %)	3 (7.7 %)	0	
Lower middle	32 (5.3 %)	30 (93.7 %)	2 (6.3 %)	0	
Upper lower	58 (9.5 %)	50 (86.2 %)	8 (13.8 %)	0	
Lower	477 (78.4 %)	349 (73.1 %)	121 (25.4 %)	7 (1.5 %)	

Table-2 Association of maternal and birth characteristics with immunization status

Characteristics	Total (n = 608) Number (%)	Immunization status (n = 608)			p value
		Completely immunized (n = 467) Number (%)	Partially immunized (n = 134) Number (%)	Unimmunized (n = 7) Number (%)	
Maternal education					
Illiterate	22 (3.6 %)	8 (36.4 %)	12 (54.5 %)	2 (9.1 %)	<0.0001
Primary school	129 (21.2 %)	87 (67.4 %)	40 (31 %)	2 (1.6 %)	
Middle school	253 (41.6 %)	193 (76.3 %)	57 (22.5 %)	3 (1.2 %)	
High secondary	103 (17 %)	85 (82.5 %)	18 (17.5 %)	0	
Graduate/PG	101 (16.6 %)	94 (93.1 %)	7 (6.9 %)	0	
Maternal occupation					
Housewife	417 (68.6 %)	327 (78.4 %)	88 (21.1 %)	2 (0.5 %)	0.0005
Unskilled	121 (19.9 %)	78 (64.5 %)	38 (31.4 %)	5 (4.1 %)	
Skilled	48 (7.9 %)	42 (87.5 %)	6 (12.5 %)	0	
Professional	22 (3.6 %)	20 (90.9 %)	2 (9.1 %)	0	
Place of delivery					
Hospital	596 (98 %)	465 (78 %)	127 (21.3 %)	4 (0.7 %)	<0.0001
Home	12 (2 %)	2 (16.7 %)	7 (58.3 %)	3 (25 %)	
Birth order					
One	323 (53.1 %)	289 (89.5 %)	34 (10.5 %)	0	<0.0001
Two	214 (35.2 %)	155 (72.4 %)	57 (26.6 %)	2 (0.9 %)	
Three and above	71 (11.7 %)	23 (32.4 %)	43 (60.6 %)	5 (7 %)	

Table-3 Coverage of individual vaccines

Vaccine	Number of eligible children	Number of children immunized	Percentage immunized
BCG + OPV 0 dose	608	590	97.0 %
Pentavalent 1 + OPV 1	608	589	96.9 %
Pentavalent 2 + OPV 2	608	585	96.2 %
Pentavalent 3 + OPV 3	608	571	93.9 %
Measles containing vaccine 1	608	537	88.3 %
Measles containing vaccine 2	491	363	73.9 %
Booster 1 - DPT + OPV	491	384	78.2 %
Booster 2 - DPT + OPV	117	81	69.2 %

Table-4 Reasons for incomplete immunization

Reasons	Number (%)
Lack of knowledge of the subsequent doses of vaccines	47 (35.1 %)
Child unwell when vaccination was due	24 (18 %)
Fear of side effects	18 (13.4 %)
Busy in work/profession	14 (10.4 %)
Parents' forgetfulness of the schedule	12 (9 %)

The present study highlights that the immunization status of children attending a tertiary care hospital is not satisfactory. There is a significant association of socioeconomic status, place of delivery, birth order, education and occupation of mother with the immunization status of the child. Special attention needs to be given to the groups who are at a high risk of incomplete / no immunization and on vaccines having low coverage (second dose measles containing vaccine and booster doses of DPT). Efforts should be made to create awareness in the community regarding the importance of vaccines and the immunization services available.

Lack of faith in the effectiveness of immunization	11 (8.2 %)
Family problems/illness of mother	9 (6.7 %)
Migration to native place	6 (4.5 %)
Reaction to previous dose of vaccine	4 (3 %)
Immunization center too far from home	3 (2.2 %)

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