International Journal Dental and Medical Sciences Research
Volume 6, Issue 2, Mar - Apr 2024 pp 156-164 www.ijdmsrjournal.com ISSN: 2582-6018

Assessment Of Immunisation Status In Children And The Factors Influencing Non – Immunisation Or Partial Immunisation.

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Submitted: 10-03-2024 Accepted: 20-03-2024

ABSTRACT:
Immunization has been one of the most significant and cost-effective public-health interventions to decrease childhood morbidity and mortality. Approximately 1.5 million children die each year of vaccine-preventable diseases in India.[1] Vaccination is one of the most acclaimed public health achievements in history. Most of the vaccine-preventable diseases (VPDs) that once threatened the lives of many people are at historically low levels in many high- and middle-income countries.[2] Although international agencies such as World Health Organization (WHO), the United Nations Children's Fund (UNICEF), and now the Global Alliance for Vaccines and Immunization (GAVI) provide extensive support for immunization activities, the success of an immunization program in any country depends more upon local realities and national policies. This is particularly true for a huge and diverse developing country such as India, with its population of more than 1 billion people and 25 million new births every year. [3] In 1985, the UIP was started in India with the aim of achieving at least 85% coverage of primary immunization of infants with three doses of DPT and OPV, one dose of BCG and one dose of Measles.1 Despite all efforts put by government and non-governmental institutes for 100 % coverage still there are low coverage areas, and the factors which results in low coverage needs to address successfully.[4]
Keywords: Immunization, vaccine, India.

I. INTRODUCTION

Vaccinations are an effective public health intervention against outbreaks of contagious diseases, which can be serious and fatal. Primary care practitioners, who play an important role in advocating and administrating both childhood and adult vaccination, are often faced with situations where the risks of administering a vaccine may seem to outweigh its benefits. In these situations, a good understanding of precautions and contraindications to vaccination helps in decision making. An earlier article on childhood immunisation highlighted some basic principles of vaccine scheduling, such as minimum age and minimum interval requirements.[1]

Immunization is a significant, cost effective, and important public health intervention measure to prevent disease. Roughly 3 million children die every year of vaccine preventable diseases (VPDs) and a significant number of these children live in developing countries. Recent estimates suggest that approximately 34 million children are not completely immunized, with almost 98% of them living in developing countries. Effective immunization has reduced the morbidity and mortality of children due to VPD to a great extent worldwide. Eradication of small pox is a glaring example of the success of vaccination.[1]

A study in different states of India showed that 63.3% children were fully immunized, 27.1% were partially immunized, and 9.6% were unimmunized. Another study in urban slums of Lucknow district showed that only 44.1% children were fully immunized, while 32% were partially immunized, and 23.9% were unimmunized.[2]

Department of Family Welfare, Ministry of Health & Family Welfare, Govt. of India commissioned a study to India Council of Medical Research on Coverage Evaluation Surveys (CES) for Universal ImmunizationProgramme (UIP) in all the States and Union Territories. In the past few years, such Coverage Evaluation Surveys were conducted through UNICEF. The Coverage Evaluation Surveys undertaken by The Institute for Research in Medical Statistics (IRMS), New Delhi covered 90 districts.

The number of districts covered from different States were broadly in proportion to their population. Further, while selecting the districts in each major State, due representation has been given, to major geographical region in the State. Based on data collected in the study, Singh & Yadav (2000) presented the results on immunization coverage at All India level indicating that improvement in the coverage levels has been observed in the recent years. Literacy of mother is key to the success of the Universal ImmunizationProgramme (UIP) and improvement could also be achieved by better follow-up and reducing the drop-out rate. The states of Bihar, Madhya Pradesh, Rajasthan and UP known as BIMARU states are lagging in performance level.

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Volume 6, Issue 2, Mar - Apr 2024 pp 156-164 www.ijdmsrjournal.com ISSN: 2582-6018

These states account for about 45% of the India's population and about 60% of total births. About 43 per cent population of these BIMARU states is living below poverty line as against about one third for the country. Population growth in the BIMARU states continues to be high on account of marriage at an early age, large size of population in the reproductive age group and high fertility rate. In view of this, it is important to study the immunization coverage level in these states. This paper presents an analysis of Immunization Coverage in BIMARU States vis-a vis rest of the country.

While most vaccine preventable deaths in India are due to pneumonia and diarrhea, complete immunization with existing routine vaccines against tuberculosis, diphtheria, pertussis and tetanus, polio, measles, hepatitis B and H. influenzae type b are essential to avert the associated mortality, morbidity and to prevent future outbreaks of these vaccine preventable diseases.[4]

However, despite almost three decades of the UIP, the proportion of children aged 12–23 months receiving the full schedule of vaccinations in India is around 61% and for third dose DPT (DPT3) coverage is 72%, still below the global average of 86% . The persisting low routine immunization coverage implies that one in three children born every year still do not receive complete protection against the diseases currently covered by the UIP, placing them at the highest risk of mortality and morbidity[5]

India's slow progress to achieving universal immunization for all children has generally been attributed to its sheer population size, high growth rate, geographic and cultural diversity and limited healthcare spending. However, large inter-state and inter-district disparities in immunization coverage have helped uncover important supply and demand-side factors associated with uptake of routine vaccinations. Supply-side factors generally include a lack of trained personnel to manage and deliver immunization services, poor relationship between health care workers and mothers, inconvenient timing, or location of immunization services and even vaccine stock outs.[6]

Demand side factors associated with routine vaccination uptake however are complex and often multi-faceted. Previous research from India tends to highlight socio-demographic characteristics associated with uptake such as child's gender, order of birth, place of delivery, maternal age at childbirth, parental education, caste and religious preference, household wealth and location (urban or rural)[7]

Of late, non-socio-demographic demand-side issues such as awareness regarding the need for and timing of routine childhood vaccinations, fears regarding some or all routine vaccines and parental beliefs regarding false contraindications to routine vaccinations have been reported as reasons linked to partial vaccination and non-vaccination of Indian children[8]

The current Indian UIP schedule recommends one dose of BCG vaccine at birth (or as soon as possible), three doses of DPT, OPV and Hepatitis B (added in 2007) or pentavalent vaccine (available in some Indian states since 2011) provided at 6, 10 and 14 weeks of age and one dose of measles vaccine at 9 months of age.

EPI RECOMMENDATIONS WHICH WERE IN USE DURING THE SURVEYS AS FOLLOWS

(1) Fully vaccinated – Children who received one dose of BCG, three doses of DPT, three doses of OPV (excluding the zero dose) and one dose of measles vaccine by 12 months of age.
(2) Partially vaccinated – Children who received at least one but not all the recommended vaccines by 12 months of age.
(3) Unvaccinated – Children who did not receive any of the recommended vaccines by 12 months of age.[9]

THE PRECAUTIONS, CONTRAINDICATIONS AND FALSE CONTRAINDICATIONS TO VACCINE ADMINISTRATION IN CHILDREN:

PRECAUTIONS, CONTRAINDICATIONS AND FALSE CONTRAINDICATIONS The consensus among most experts is that there are very few conditions where vaccines arecontraindicated. These include known hypersensitivity to one or more vaccine components, hypersensitivity to a prior dose of vaccine, encephalopathy occurring within one week of pertussis vaccination with no other identifiable cause, intussusception following rotavirus vaccination and severe combined immunodeficiency.[10]Precautions are medical conditions that may interfere with vaccination. Although the vaccine may be given, the risks associated with vaccine administration need to be weighed against the benefits. Examples of precautions include worsening of thrombocytopenia after a dose of measles, mumps and rubella (MMR) vaccine in recipients with pre-existing idiopathic thrombocytopenic purpura, and

the risk of abscess formation and lymphadenitis after the Bacillus Calmette–Guérin (BCG) vaccine. In these situations, the patient should be counselled appropriately and a joint decision arrived at.[11] Finally, there are false contraindications where the risks of administering the vaccine seem to outweigh the benefits, but in fact do not. As such, golden opportunities for vaccination can be missed or unnecessarily delayed.

FALSE CONTRAINDICATION: children with a personal history of febrile seizures or family history of adverse events Febrile seizures are common in childhood and can sometimes be induced by fever that develops following vaccine administration. Having a first-degree relative who has had a febrile seizure is a risk factor. However, a family history of seizures, sudden infant death syndrome or adverse reactions unrelated to immunosuppression following a dose of vaccine is not a contraindication to immunization. Certain vaccines are associated with a small increase in the risk of febrile seizures, particularly when co-administered with some others.[13] For instance, the risk of febrile seizures is increased when the inactivated influenza vaccine is administered with the pneumococcal 13-valent conjugate vaccine (PCV13) or diphtheria, tetanus and acellular pertussis (DTaP) vaccine. However, when given on a different day from the other two vaccines, the influenza vaccine was not associated with an increased risk of febrile seizures. Experts have recommended that patients with a personal or family history of febrile fits should be warned about the risk of febrile seizures following the MMR varicella (MMRV) vaccine.

Higher rates of fever and febrile fit events have been reported with the first dose of MMRV vaccine (1:1,250) given to children ≤ 4 years of age, as compared to MMR and chickenpox vaccines (1:2,500) co-administered at different sites during the same visit. On the other hand, some febrile seizures may be prevented by protecting children against vaccine-preventable diseases that can cause fever, such as measles, chickenpox, influenza and pneumococcal infections. As such, it is important to ensure that childhood vaccines are not unnecessarily omitted or delayed.[14]

FALSE CONTRAINDICATION: BREASTFEEDING MOTHERS No vaccines are contraindicated in breastfeeding, except for the yellow fever vaccine. However, breastfeeding mothers cannot avoid or postpone yellow fever vaccination if they are travelling to high-risk yellow fever-endemic areas. The rubella vaccine virus may be present in the breast milk of a vaccinated woman, but transmission of infection to the infant is rare. Even if transmission does occur, the resultant disease is well-tolerated, as the viruses are attenuated.[15]

FALSE CONTRAINDICATION: PATIENTS WITH RECENT VACCINATION A history of recent immunization is generally not a contraindication to receiving another vaccine. Table I shows vaccines commonly given in the primary care setting. However, there are certain noteworthy exceptions. If two live-attenuated vaccines are not administered simultaneously, they need to be spaced apart by at least four weeks. This is to reduce or eliminate the first vaccine's interference with the patient's antibody response to the second live-attenuated vaccine. If the second live-attenuated vaccine is administered earlier than the recommended minimum interval, it should be repeated in 28 days from the date of the invalid dose, except for the yellow fever vaccine. For inactivated vaccines, no interval is necessary to administer the second live-attenuated or inactivated vaccine. One exception to this is PCV13 and the pneumococcal polysaccharide vaccine (PPSV23), which should be given apart. The required interval between these two vaccines depends on the patient's age and underlying medical condition(s), as well as the sequence of administration. In children with risk factors (e.g. functional or anatomical asplenia, cerebrospinal fluid leak, cochlear implants, or immunocompromised states) aged 24 months to 18 years, a minimum interval of eight weeks is recommended between PCV13 and PPSV23, regardless of the sequence of administration. For adults aged ≥ 65 years, PPSV23 is given 12 months after PCV13. (20) Adults aged ≥ 19 years with risk factors (e.g. functional or anatomic asplenia, cerebrospinal fluid leaks, cochlear implants, or immunocompromised states) should be given PPSV23 no earlier than eight weeks after PCV13. For individuals aged ≥ 19 years, if PPSV23 is given earlier than PCV13 for any reason, it is recommended that PCV13 be delayed for least 12 months.[16]

VACCINATION COVERAGE:

Universal immunization of children against the six vaccine-preventable diseases (namely, tuberculosis, diphtheria, whooping cough, tetanus, polio, and measles) is crucial to reducing infant and child mortality. Differences in vaccination coverage among subgroups of the population are useful for programme planning and targeting resources to areas most in need.

Additionally, information on immunization coverage is important for monitoring and evaluation of the Expanded Programmes on Immunization (EPI). NFHS-3 collected information on vaccination coverage for all living children born in the five years preceding the survey. According to the guidelines developed by the World Health Organization, children are considered fully vaccinated when they have received a vaccination against tuberculosis (BCG), three doses of the diphtheria, whooping cough (pertussis), and tetanus (DPT) vaccine; three doses of the poliomyelitis (polio) vaccine; and one dose of the measles vaccine by the age of 12 months. BCG should be given at birth or at first clinical contact, DPT and polio require three vaccinations at approximately 4, 8, and 12 weeks of age, and measles should be given at or soon after reaching 9 months of age. NFHS-3 asked mothers in India whether they had a vaccination card for each child born since January 2000 (in states which began fieldwork in 2005) or since January 2001 (in states which began fieldwork in 2006).

If a card was available, the interviewer was required to carefully copy the day, month, and year that each vaccination was received. For vaccinations not recorded on the card, the mother's report that the vaccination was or was not given was accepted. If the mother could not show a vaccination card, she was asked whether the child had received any vaccinations. If any vaccinations had been received, the mother was asked whether the child had received a vaccination against tuberculosis (BCG); against DPT; against polio; and against measles. For DPT and polio, information was obtained on the number of doses of the vaccine given to the child. In such cases, mothers were not asked the dates of vaccinations. To distinguish Polio 0 (polio vaccine given at the time of birth) from Polio 1 (polio vaccine given about six weeks after birth), mothers were also asked whether the first polio vaccine was given just after birth or later.

Children who received BCG, measles, and three doses each of DPT and polio (excluding Polio) are considered to be fully vaccinated. Based on information obtained from a card or reported by the mother ('either source'), 44 percent of children age 12-23 months are fully vaccinated and 5 percent have not received any vaccinations. Coverage for BCG, DPT, and polio (except Polio 0) vaccinations is much higher than for 'all vaccinations. BCG, the first dose of DPT, and all three doses of polio vaccine have each been received by at least 76 percent of children. Fifty-five percent of children have received three doses of DPT. Although DPT and polio vaccinations are given at the same time as part of the routine immunization programme, the coverage rates are higher for polio than for DPT (for all three doses), undoubtedly because of the Pulse Polio campaigns. Not all children who begin the DPT and polio vaccination series go on to complete them. The difference between the percentages of children receiving the first and third doses is 21 percentage points for DPT and 15 percentage points for polio. Fifty-nine percent of children age 12-23 months have been vaccinated against measles. The relatively low percentages of children vaccinated with the third dose of DPT and measles are mainly responsible for the low proportion of children fully vaccinated. As expected, vaccination coverage for each type of vaccine and for full vaccination is much higher for children for whom a vaccination card was shown than for the children whose vaccination information is all based on mother's recall because no vaccination card was shown. According to the immunization schedule outlined by Government of India and the World Health Organization (WHO), all primary vaccinations, including measles, should be administered by the time a child is 12 months old.[17]

II. MATERIALS AND METHODS:

This 6-month study was conducted between November 2018- May 2019 at ESIC hospital, Chennai.The demographic and socioeconomic data was recorded.The immunization status of the enrolled patients was assessed as per the national immunization programme checklist.

Mother was considered the primary respondent; if the mother was not available, father was interviewed. Mothers were asked about the immunizations received by their children at one year of age, and where possible, this information was verified by cross-checking against the vaccination cards of the children. Children who had received BCG and three doses of DPT/oral polio vaccine (OPV) andmeasles vaccine as scheduled in the first year of life were classified as fully immunized. Those who had missed any dose of six primary vaccines were labelled as partially immunized, and those who had not received any vaccine, except OPV in pulse polio immunization, up to 12 months of age, were defined as non-immunized. If the child was partially immunized or non-immunized, the reasons for the same were recorded using questionnaires. Children of age 12-60 months of both the gender were included and children whose immunization cards were unavailable were excluded.

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STATISTICAL ANALYSIS: Statistical analysis will be carried out using the SPSS software (version 13). The p value of <0.05 will be considered significant. Chi-square test and logistic regression analysis will be done to determine the statistical significance.

III. RESULTS

Of the 235 patients who visited the pediatric outpatient and chosen for the study, 45% of the patients were male and 54.5% were female. The mean age of the mother's age and child's age 22.9 and 2.55 respectively. Most of the patients were Hindus (67.1%), Christians (23%) and (9.7%) were Muslims. Education of the responders(mother/father) were studied as ≤primary-55.2% and >primary-44.77% (Table 1)

Table 1: DISTRIBUTION OF DEMOGRAPHIC DETAILS

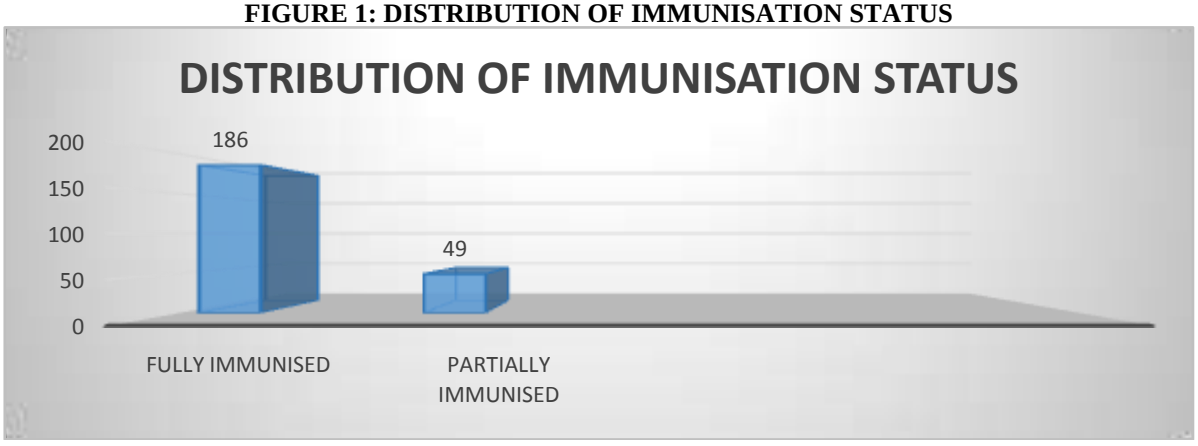
PATIENTS	GENDER	RELIGION	EDUCATION	FAMILY
TOTAL NUMBER OF PATIENTS (n=235)	Male-45%	Hindu-67.1%	≤primary-55.2%	Joint-34%
	Female-54.5%	Muslim-9.7%	>primary-44.77%	Nuclear-66%
		Christian-23%		

Out of the 235 patients 186 (79.1%) were fully immunised and 49(20.8%) were partially immunised. (Table 2)

TABLE 2: PERCENTAGE OF FULLY AND PARTIALLY IMMUNISED PATIENTS

PATIENTS (n=235)	NUMBER	PERCENTAGE%
FULLY IMMUNIZED	186	79.1%
	49	20.8%

FIGURE 1: DISTRIBUTION OF IMMUNISATION STATUS



When most of the frequent reasons responsible for partial immunisation was studied using questionnaire, most of the responses were as, having family problems (32%), child ill-not brought (19%), unaware of the need for 2 and 3 dose (15%) and (12%) responded that they were unaware of need for immunisation and (9%) responded the places for vaccination was place too far. (Table 3)

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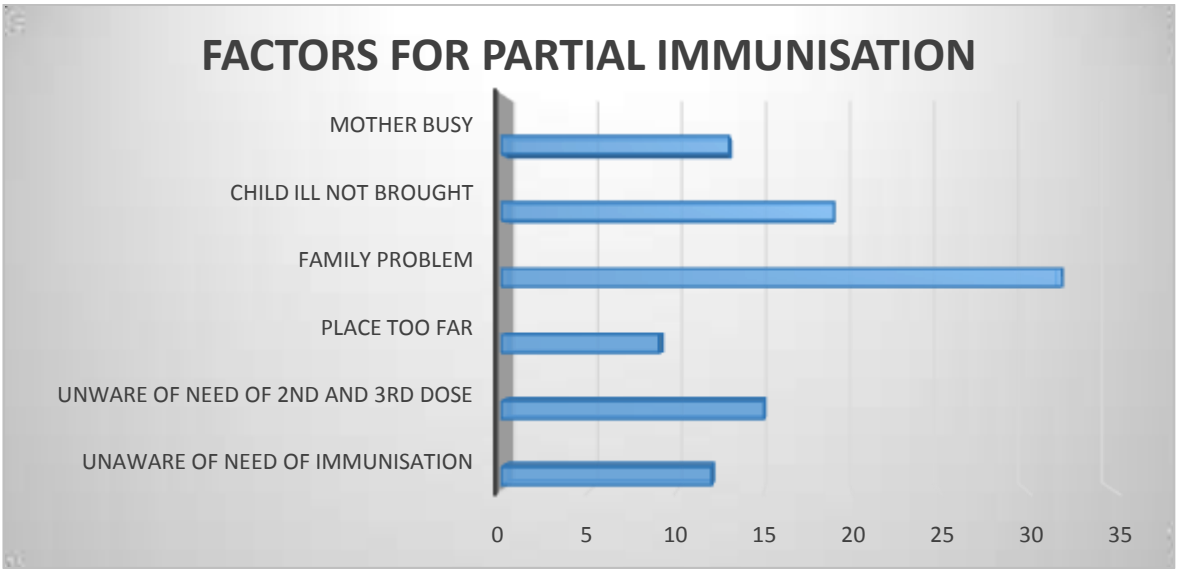
TABLE 3: FACTORS INFLUENCING PARTIAL IMMUNISATION

REASONS FOR PARTIAL IMMUNISATION	PERCENTAGE
Unaware of need for immunization	12%
Unaware of the need for 2nd and 3rd dose	15%
Place too far	9%
Mother too busy	13%
Family problem, mother ill	32%
Child ill- not brought	19%

FIGURE 2: FACTORS FOR PARTIAL IMMUNISATION



When the correlation between immunization with education, mother's age and religion were calculated using chi-square, there was a significant correlation p value (p>0.05) with education (0,0020*) as this may affect the awareness and importance of vaccination among the responders (where shown in Table 4)

TABLE 4: CORRELATION OF IMMUNISATION WITH EDUCATION, RELIGION AND MOTHER'S AGE

COLERRATION WITH IMMUNISATION	P VALUE
RELIGION	0.8488
EDUCATION	0.0020*

Using chi-square (p value (p>0.05) considered significant)

The vaccinations that were partially immunized among the patients were mostly dose of Penta-2 (43%), IPV (22%), OPV-3(18%), measles (9%), and Penta-3 (8%). Out of all the vaccinations most of the patients missed 2nd and 3rd doses of vaccination. Among the fully immunized population, 44% of the patients visited the hospital late for getting vaccinated. (Figure 3)

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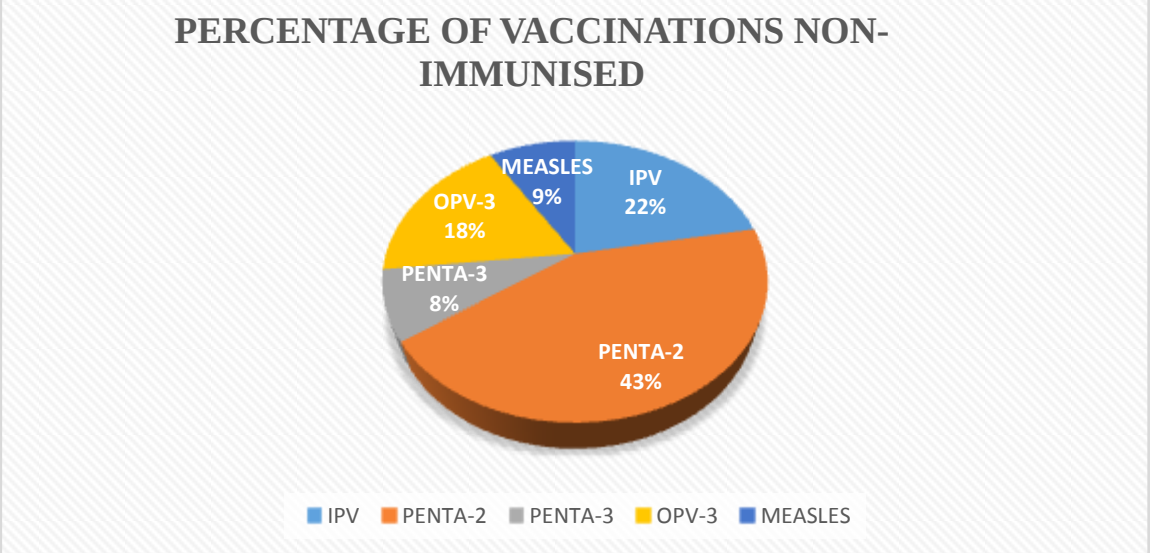
FIGURE 3: PERCENTAGE OF VACCINATIONS NON-IMMUNISED.



IV. DISCUSSION

Immunization is the most cost-effective intervention in child health. There is an impending risk of outbreak of vaccine-preventable diseases due to increasing urbanization, migration, increasing slums, high density of population, continuous influx of a new pool of infective agents, and poor coverage of primary immunization. Attempts to improve the coverage have been going on for years. India has the largest number of unvaccinated children globally reported by Kumar A et al, Socio-economic differentials in childhood immunization in India. Accurate measurement of vaccination coverage is an essential step in determining expected reduction in morbidity and mortality from vaccine preventable diseases.

Most of the patients were fully immunised 79.1% and only 20.9% were partially immunised and none of the patients were non-immunised in this present study. In contrast to the previous observation reported by Mathew et al where 25% of children were fully immunized and Saxena et al. found that 30% were completely immunized. This shows a drastic improvement in the vaccination coverage in a urban population. The increase in partially vaccinated children, while suboptimal, possibly implies that greater numbers of children are receiving at least some of the recommended UIP vaccines compared with earlier years.

Determinants of receipt of vaccination completion are complex and interwoven. This study identified several reasons affecting childhood immunization. In this study most common reasons were Unaware of need for immunisation, family problems, child illness and unable to visit hospital and place too far for vaccination similar to study Nath B et al among urban slums of Lucknow district. When the relation between partial immunisation with education and religion were studies, there was a significant relation with education and partial immunisation.

More than half of the responders received less than primary education which could possibly account to the awareness and attitude through wards immunisationsimilar to the study where, more than two-thirds (70.4%) of mothers with missed opportunities for vaccination had either primary school education or no formal education. This finding is in support of a report from Turkey study (Altinkaynak et al., 2004) that education of mothers increases the vaccination chance of a child and reduces missed opportunity.

The concerns and experiences of previously anticipated vaccine side effects experienced by the child, importance of second and third doses in few vaccinations, immunisation at right time and other factors should be addressed and managed appropriately to improve the coverage of immunization. The limitation of this study includes, inclusion of babies less than 1year and pregnant women, to provide early guidance and education about importance of vaccination.

V. CONCLUSION

This study examined the sociodemographic details and factors influencing partial immunisation among Indian children. Parents education have a great impact on immunization coverage. In order to improve the vaccination coverage, investments in basic services, such as primary education, particularly for girls, is essential as increased education can

influence a mother's understanding of the importance of immunization in her child's health. Efforts to increase vaccine uptake should address parental fears related to vaccination to improve trust in government health services as part of ongoing social mobilization. The importance of primary immunization is overshadowed by repeated Pulse Polio Immunization (PPI) rounds and thus awareness should be generated among people that there are five other vaccines to be given to their children other than polio vaccine.

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[2]. Michiko Ueda et al, (2014) conducted a study on "Maternal work conditions, socioeconomic and educational status, and vaccination of children: A community-based household survey in Japan" and concluded that because vaccination is free and widely available in Japan, our findings indicate that provision of free vaccinations is not sufficient to achieve high vaccination rates.

[3]. Duraimurugan Murugesan et al, (2017) conducted a study on "immunization coverage of 12-23 months children in urban areas of Kanchipuram district, Tamil Nadu" concluded that opportunity should be used to vaccinate eligible children by overcoming the hurdles, to achieve the goal of 100% immunization coverage.

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