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Missed IAP (Indian Academy of Paediatrics) Recommended Immunization Opportunity Among Children in Eastern Odisha,India-A Hospital Based Study.

KEYWORDS: Immunization, catch up immunization, vaccine

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ABSTRACT *"You let a doctor take a dainty, helpless baby, and put that stuff from a cow, which has been scratched and had dirt rubbed into her wound, into that child. Even, the Jennerians now admit that infant vaccination spreads disease among children. More mites die from vaccination than from the disease they are supposed to be inoculated against." (George Bernard Shaw, 1929). There is a great change in thinking long way since George Bernard Shaw fulminated against vaccination in the 1920s. Vaccines are now widely regarded as an effective and cheap tool for improving health. Children in all corners of world are routinely immunized against major diseases, and the practice has become a decisive part of global public health efforts. Immunization is one of the most cost effective public health interventions and largely responsible for reduction of under-5 mortality rate. However, vaccine preventable diseases (VPDs) are still responsible for over 5 lakh deaths annually in India [4] .This underlines the need of further improvement. Today, India is a leading producer and exporter of vaccines, still the country is home to one-third of the world's unimmunized children. There are a number of reasons why India lags behind its many less developed neighbour's in vaccination rates. They include huge population with relatively high growth rate, geographical diversity and some hard to reach populations, lack of awareness regarding vaccination, inadequate delivery of health services, inadequate supervision and monitoring, lack of micro-planning and general lack of inter-sectorial coordination, and weak VPD surveillance system. In this article, we discuss IAP recommended vaccination coverage, socio-demographic obstacles associated with low vaccination uptake in eastern part of odisha, India. Limitation of the study was it is a hospital based study.*

Methods and Objectives. To estimate infant & children's IAP (Indian academy of paediatrics) recommended vaccination coverage in east part of odisha. Children admitted to paediatrics indoor of IMS & SUM Hospital,Bhubaneswar,Odisha for various diseases condition from 0-5year were interrogated from May 2015 to April 2016.A face-to-face questionnaire was administered by trained investigators. Photocopy of Immunization card was obtained from parents for reference. The objective was to evaluate infant vaccination coverage retrospectively in 0- to 59-month-old children. These studies offered the opportunity to assess some factors influencing vaccine uptake in infants & children.

Results and Discussion. Approximately >90% of the children have received BCG, OPV, DTP & measles vaccination. Similarly More than 85 % have received hepatitis B, MMR is around 75 % & > 70 % taken Hib vaccine. Substantially poor uptake was shown by some IAP recommended vaccines i.e. Rotavirus 50%, Pneumococcal vaccine 54%, Hepatitis A 47%,, chicken pox 58%,Typhoid conjugate vaccine 51%,IPV 55% & Typhoid polysaccharide around 49%. Definite association was observed between vaccination coverage with the mother's & Fathers level of education. Indeed, additional effort is needed to increase The IAP recommended vaccine coverage rates because the incidence, mortality & morbidity of said vaccine preventable diseases are more prevalent in India. Catch up immunization Schedule awareness will definitely help in this regards. Vaccine specific missed opportunity is very high in this region of odisha.

Introduction

India and China were two countries where "some form of inoculation" was practiced even before 16th century (43). However, modern immunization developed in India in 19th century. In initial years about fifteen vaccine institutes were established beginning in the 1890s. World's first plague vaccine by Haffkine (in 1897) and Manson's development of an indigenous cholera vaccine were the most notable achievements of these institutes.By the time Indians inherited the leadership of the above institutions (from Britishers), research and technological innovation was side-lined as demands for routine vaccine production took priority [44].By early 1970s, many childhood diseases had almost disappeared from developed countries. These diseases, however, continued to take many lives in poorer countries. In fact, in 1974, fewer than 5% of children, worldwide were immunized by age 1 against diphtheria, polio, tuberculosis, pertussis, measles, and tetanus [46].That is why WHO launched the Expanded Programme on Immunization (EPI) in 1974 to bring vaccination against these six diseases to many unreached areas. Immunization coverage is definitely a major indicator for vaccination programs in India. As such, administrative coverage for the entirety of 2014 will be available during 2016(July).During May 2015, the Government of India conducted a review of state-level administrative and survey-based coverage data to derive a revised time series of official coverage estimates from 1998 through 2013.Estimate based on extrapolation from data reported by national government. The reporting cycle for the Government of India is from April 1 through March 31. During 2014, national immunization schedule included DTP as well as DTP-HepB-Hib. DTP-HepB-Hib combination vaccine introduced during 2013.Immunization is one of the most cost effective public health interventions since it provides direct and effective protection against preventable morbidity and mortality. It has been a major contributor in the decline of under-5 mortality rate from ~ 233 to ~63 (per 1000) in last five decades in India. [4] .However, vaccine preventable diseases (VPDs) are still responsible

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for over 5 lakh deaths annually in India. This underlines the need for further improvement. India, including many other developing countries, is far behind in adequate coverage of Routine Immunization (RI). According to World Health Organization (WHO)/UNICEF estimates, DTP3 coverage in the South-East Asia and Africa regions of WHO for 2010 remained relatively low at 77% [5] In India, the coverage was even lower at 61% [1,6] .Thus, the SEA Regional Director declared 2012 as the Year for Intensifying RI in the Region [2,3,5]. Similar level of coverage was documented in other studies by Khokhar et al in urban slums of Delhi[47], This was endorsed by Government of India (GoI) and 2012 was declared as the Year of Intensification of RI in India also [6] .There is about 23 new improved vaccines that are now available or would be available soon. Although inclusion of a new vaccine in national schedule adds the cost of vaccine and logistics to the health budget of a country, it also results in savings by reduction of the disease burden. Thus, the decision to include a new vaccine in national schedule needs careful scientific analysis regarding all the issues involved, ranging from policy issues (whether introduction of the new vaccine is in sync with immunization policy of the country) to technical and programmatic issues (whether implementation of the decision is technically feasible) [48].New vaccines should not be introduced at the expense of sustaining existing immunization activities. Instead, the introduction of a new vaccine should be viewed as an opportunity to strengthen immunization systems, increase vaccine coverage and reduce inequities of access to immunization services [39].Making available of the vaccine in few areas, for certain sections and for limited duration will not have any impact at national level. The 'equity' needs to be ensured so that the vaccine reaches to the every corner of the society who needs it the most [49].

Material and Methods. To estimate infant & children's vaccination coverage in east part of odisha. Children admitted to IMS & SUM Hospital paediatrics indoor for various diseases condition from 0-5year were interrogated for a period of 1 year from May 2015 to April 2016. A face-to-face questionnaire was administered by trained investigators. Photocopy of Immunization card was obtained from parents to record vaccination uptake status. The objective was to evaluate vaccination coverage retrospectively in 0- to 59-month-old children. These studies offered the opportunity to assess some factors influencing vaccine uptake in infants & children.

Results

One thousand children were evaluated regarding immunization status.300 (30%) children are <12 month.668 (66.8%) cases are between 13 to 59 month.32 (3.2%) children are more than 59 month. Missed opportunity for total vaccine was found to be 57 %(n=570) which is constitute of 78% in <12 month, 47.60% in 13 to59 month and 56.25 % in >59 month (Table-3). Missed opportunity rate decreased with increase in mother & fathers education. Primary mother's education shows 78.40% opportunity followed by 52.75% (secondary), 20.63% in tertiary education (Table1).Fathers education level also reveals similar trend i.e. no formal education 81.25%(13),Primary 71.25%(119),Secondary 57.37%(288) and tertiary 50.16%(150) respectively(Table-2). IAP (Indian academy of paediatrics) recommended immunization coverage status shows promising result for UIP used vaccines only. Vaccine coverage percentage for UIP recommended vaccine as follows BCG 94%,OPV0 94.2%,OPV1 95.6%,OPV2 96%,OPV3 94%,DPT1 94%,DPT2 93.2%,DPT3 92.6%,DPTb 89%,measles 90.8% & DTP at 5yr 74% coverage. Other vaccine which is also a part of UIP schedule revels less coverage are Hepatitis B 1 88.6%, Hepatitis B 2 87.2%, Hepatitis B 3 86.6%, Hib1 76%, Hib2 75.4% and Hib3 75% including both in private/government supply (Table-5). Status of IPV intake is around 53%.But the real concern lies on other IAP recommended vaccines i.e. Rotavirus ,pneumococcal, Typhoid, Hepatitis A & MMR vaccine which covers important vaccine preventable diseases commonly prevailing in India. Coverage for Rotavirus is for rotavirus1 52.2%, rotavirus2 51.2%, rotavirus3 50.2% & for Pneumococcal i.e. PCV 1 56.6%, PCV 2 56%, PCV 3 54% and PCV b 50% accordingly(Table-5).Despite knowing hepatitis A is the most common cause of jaundice in children in India vaccine uptake is very low i.e. 62.8 % for 1st & 62 % for 2nd dose. Similarly typhoid vaccine coverage is around 50%.As described later chicken pox is a self-limiting disease but in few cases it can be fatal. Varicella coverage in our study is 59.8 for 1st dose & 58.2 for 2nd dose (Table 5).

TABLE-1 Missed opportunity in infants aged 60 month & below in relation to mothers education

Education	Number of mother	Frequency	% of Total
Primary	352	276	78.40
Secondary	508	268	52.75
Tertiary	126	26	20.63
Total	986	570	57.80

Table 2).Missed opportunity in infants aged 60 month & below in relation to Fathers education

Education	Number of Father	Frequency	% of Total
No Formal	16	13	81.25
Primary	167	119	71.25
Secondary	502	268	53.38
Tertiary	299	170	56.85
Total	984	570	57.92

(Table 3).
Missed Opportunities for IAP Recommended immunization in various age Groups

Age groups(months)	Frequency	% of Total
0-12(300)	234	78
13-59(668)	318	47.60
>59(32)	18	56.25
TOTAL(1000)	570	57

(Table 4).
(Table 4).Vaccine specific missed opportunities (Total missed cases-570)

Vaccine	Number of missed children	% of Total
BCG	60	10.52
OPV0	58	10.17
OPV1	44	07.71
OPV2	40	7.01
OPV3	60	10.52
DPT1	59	10.35
DPT2	68	11.92
DPT3	74	12.98

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DPT4	110	19.29
DPT5	260	45.61
HEPATITIS B1	114	20
HEPATITIS B2	128	22.45
HEPATITIS B3	234	41.05
Hib1	240	42.10
Hib2	246	43.15
Hib3	250	43.85
Hibb	300	52.63
IPV1	444	77.89
IPV2	454	79.64
IPV3	455	79.82
IPVb	500	87.71
PCV1	434	76.14
PCV2	460	80.70
PCV3	440	77.19
PCVb	500	87.71
ROTAVIRUS1	378	66.31
ROTAVIRUS2	388	68.07
ROTAVIRUS3	398	69.82
MEASLES	92	16.14
MMR1	206	36.14
MMR2	236	41.40
TYPHOID CONJUGATE VACCINE1	478	83.85
TYPHOID CONJUGATE VACCINE2	488	85.61
HEPATITIS A1	372	65.26
HEPATITIS A2	390	68.42
CHICKEN POX1	402	70.52
CHICKEN POX2	418	73.33
TYPHOID POLYSACCHA-RIDE VACCINE	506	88.77

Vaccine specific missed opportunities for immunization are interesting & very promising in the present study. Missed opportunity ranges from 7%(OPV) to 70 %(chicken pox),Rotavirus 68%, Inactivated polio 78%,TCV(Typhoid conjugate vaccine) 84% & pneumococcal vaccine around 78%(Table 4).. If awareness regarding catch up immunization made during each health care visit then disease burden including mortality & morbidity definitely come down in few more vaccine preventable diseases that is prevailing in the community which is sometimes devastating.

(Table 5).

IAP Recommended Immunization coverage for various vaccines in 1000 children

Vaccine	Number of children immunized	% Coverage
BCG	940	94
OPV0	942	94.2
OPV1	956	95.6
OPV2	960	96
OPV3	940	94
DPT1	941	94.1
DPT2	932	93.2
DPT3	926	92.6
DPT4	890	89
DPT5	740	74
HEPATITIS B1	886	88.6
HEPATITIS B2	872	87.2
HEPATITIS B3	866	86.6
Hib1	760	76
Hib2	754	75.4
Hib3	750	75
Hibb	700	70
IPV1	556	55.6
IPV2	546	54.6
IPV3	745	74.5
IPVb	500	50
PCV1	566	56.6
PCV2	560	56
PCV3	540	54
PCVb	500	50
ROTAVIRUS1	622	62.2
ROTAVIRUS2	612	61.2
ROTAVIRUS3	602	60.2
MEASLES	908	90.8
MMR1	794	79.4
MMR2	764	76.4
TYPHOID CONJUGATE VACCINE1	522	52.2
TYPHOID CONJUGATE VACCINE2	512	51.2
HEPATITIS A1	628	62.8
HEPATITIS A2	610	61
CHICKEN POX1	598	59.8
CHICKEN POX2	582	58.2
TYPHOID POLY-SACCHARIDE VACCINE	494	49.4

Discussion

India, on its part, launched its first vaccine exactly 54 years back: BCG in 1962 [27] as a part of National Tuberculosis Program. EPI was launched in India in 1978. Initially, it included BCG, DPT (3 doses) and typhoid vaccine; OPV was added the next year. In addition to 3 primary doses of DPT and OPV, 2 boosters at 1.5 years and 5 years were also given to cover children up to 5 years of age. In 1985, the program was changed into Universal Immunization Program (UIP) which provides free vaccines for measles, poliomyelitis, tuberculosis (BCG), hepatitis B, and diphtheria, pertussis, tetanus (DPT) with a target to cover both children and immunization of 'all' pregnant women with TT.In this Program second booster at 5 years was reduced to DT (pertussis component was omitted). In the same year,

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measles vaccine was added at 9 months of age and typhoid vaccine was omitted from the program [61]. In next 2 decades, there were lots of administrative changes in UIP: It was given status of National Technology Mission in 1986 to give a sense of urgency and commitment in achieving the goals; then it was submerged in Child Survival and State Motherhood (CSSM) programme in 1992 and Reproductive and Child Health (RCH) programme in 1997 [28].Hepatitis B vaccine was initially introduced in 10 states and then extended to whole country [30].However, the focus remained on 4 vaccines (BCG, DPT, OPV and Measles) and 6 diseases only. It was only after 2006 that new vaccines like hepatitis B, second dose of measles and Japanese Encephalitis vaccines were introduced [29] .The Japanese encephalitis vaccine has been introduced in 111 districts in 15 States having a high disease burden [30] In December 2011, pentavalent vaccine (containing vaccine against diphtheria, pertussis, tetanus (DPT), Hepatitis B and Haemophilus influenzae type B (HiB)) was introduced in two states with high coverage of RI. Tamil Nadu and Kerala [31]. .later it was introduced in 6 more states (Gujarat, Karnataka, Haryana, Goa, J&K and Pondicherry) & was targeted to cover whole country: [32]. A 1970 outbreak of measles in Texarkana, Texas and Arkansas provided a dramatic example of the impact of measles vaccination campaigns and school immunization requirements (62)..India has the largest number of under-five deaths in the world [4,10]. Vaccine-preventable diseases are a major contributor to the burden, causing approximately 20% of under-five deaths in Southeast Asia [5,10].Despite these efforts, each year more than 50,000 children under the age of five die from measles in India (44% of global under-five measles deaths) [6] .India accounts for 56% (2525) of global diphtheria cases, 18% (44,154) of pertussis cases, and 23% (2404) of tetanus cases [7]..The UIP has yet to incorporate existing vaccines against mumps, pneumococcal disease, Typhoid & human papilloma virus vaccine. The World Health Organization estimates that 1 million deaths among children annually are due to pneumococcal infection, and most of these deaths occur in developing countries[8]. Streptococcus pneumoniae is a leading cause of invasive pneumococcal disease among children worldwide[9] . Pneumococcal infections cause meningitis, septicemia, and other focal infections that result from blood stream infection, as well as pneumonia, which is a major acute respiratory tract infection and a leading cause of death among children in developing countries [10] .The surveillance of over 9000 children from Bangalore has found 40 confirmed cases of invasive pneumococcal disease and shows the presence of non- vaccine serotypes. According to Nisarga and colleagues[12], serotype 6A is the most commonly encountered serotype, which is in contrast with the findings of a systematic review of surveillance studies [11]. Where it was found that the most prevalent vaccine serotypes were 14, 5, 1, 19F and 6B. This finding also highlights the changing trends of the serotypes over the years. Nisarga, et al. demonstrated the highest serotype coverage by the 13-valent pneumococcal vaccine which is consistent with the findings of the systematic review [11] and an earlier study from CMC, Vellore [13].. Vaccination to prevent invasive pneumococcal infections has not yet been introduced in the universal immunization programme (UIP), even as paediatricians advocate its use. Studies on serotype prevalence are still relevant in the Indian context. Some multicentric and single centre studies on serotypes involved in invasive pneumococcal disease (IPD) have been published [14],[15] .

Most cases meningococcal diseases around the world are caused by Serogroups A, B, and C. Serogroups A and C are common in Asia and Africa (25) .During the 1980's meningococcal disease caused several outbreaks throughout India, Nepal, and Africa (26).In India routine immunization with meningococcal vaccine is not recommended. It is routinely recommended for high risk children e.g., anatomic or functional asplenia, immunodeficiency states, sickle cell disease etc. There are a number of reasons why India lags behind its per capita GDP counterparts in vaccination rates (compare to Bangladesh, where 82% of children are fully vaccinated by age two). Huge population with relatively high growth rate is a barrier in itself. Approximately 27 million children are born in India each year – the largest birth cohort in the world – but less than 44% receive a full schedule of vaccinations [33]..To reach each and every one of such a huge cohort every year is obviously a tidious task. Geographical diversity (snow bound/ hilly areas, deserts, tropical forest areas, remote island territories), cultural diversity (with various religions, languages, traditions, beliefs and customs) and Political instability ("coalition" governments, "politically sensitive areas" like Naxal/ terrorist-affected areas), Reaching out to mobile/migrant population (that is a significant proportion of population in some states) is another challenge and make the task more complex. Special efforts are needed to identify and reach some pockets of low immunization that are still there in many states. Coverage Evaluation Survey of UNICEF [34]. found that reason for partially immunization/ non-immunization was "did not feel the need", "not knowing about the need" and "not knowing where to go for vaccination" in 28.2%, 26.3% and 10.8% cases. This means that lack of awareness is one great barrier to achieve cent per cent immunization coverage. A more recent study in 225 villages of Uttar Pradesh corroborated the fact that lack of awareness is the one of the main reason for partial immunization/ non-immunization [35].Hence, the demand for vaccines also suffers. Low levels of education negatively impact health-seeking behaviour. In addition, adverse events following immunization (AEFI) even when these are shown to be unrelated to a vaccine, have been widely reported in the media and have contributed to a culture hostile to vaccination in certain communities [33]. A public-private partnership between GoI, NTAGI, Indian Academy of Paediatrics' (IAP), Indian Medical Association (IMA), development partners, ICDS, Ministries of Railways, Education and Defence, and key NGOs involved with immunization and State representation should be strengthened [21]. All hard-to-reach interiors and urban slum areas should be attended at least four times per year with RI or catch ups (36) .WHO is working with countries and partners relentlessly to improve global vaccination coverage, including through these initiatives adopted by the World Health Assembly in May 2012.

The Global Vaccine Action Plan

The Global Vaccine Action Plan (GVAP) is a roadmap to prevent millions of deaths through more equitable access to vaccines. Countries are aiming to achieve vaccination coverage of ≥90% nationally and ≥80% in every district by 2020. While the GVAP should accelerate control of all vaccine-preventable diseases, polio eradication is set as the first milestone. It also aims to spur research and development for the next generation of vaccines.In April 2015, WHO warned that 5 out of the 6 GVAP targets were off-track, with only 1 target on the introduction of underutilized vaccines showing sufficient progress[37,42,45]. This finding was based on the independent assessment report by the Strategic Group of Experts (SAGE) on immunization.

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World Immunization Week

The last week of April each year is marked by WHO and partners as World Immunization Week. It aims to raise public awareness of how immunization saves lives, encouraging people everywhere to vaccinate themselves and their children against deadly diseases. IN 2015, under the global slogan "Close the immunization gap", more than 180 countries, territories and areas marked the week with activities including vaccination campaigns, training workshops, round-table discussions and public information campaigns. Global immunization coverage 2014 BCG (85%),DTP1 (90%) DTP 2(80%) ,Polio (80%),Measles (80%),Hepatitis B 75%,PCV 31% & Rotavirus 19%. [37] .According to recent unpublished data, more than 80 candidate vaccines are in the late stages of clinical testing. About 30 of these candidate vaccines aim to protect against major diseases for which no licensed vaccines exist, such as malaria and dengue. The benefits of development of better vaccines for existing VPDs like tuberculosis, typhoid and influenza, increasing the ambit of VPDs by development of vaccines against mass killers like HIV, malaria, dengue fever, RSV, enteric pathogens like E.coli, Klebsiella, etc, development of more thermo stable vaccines (so that need of maintenance of cold chain is obviated) and development of alternative delivery of vaccines, like mucosal vaccines/ edible vaccines [36,38] cannot be overemphasized [38]. Integrated Disease Surveillance Project (IDSP)- a state based decentralized surveillance program in the country launched by Ministry of Health and Family Welfare, GoI in November 2004, and IDsurv–a web-based infectious disease surveillance program developed by IAP–are laudable efforts in this regard [39,40,63]...However, more comprehensive, coordinated efforts in the line of Active Bacterial Core surveillance-a population-based surveillance system run by Centers for Disease Control and Prevention (CDC), Atlanta in US would actually serve the purpose in the long run [41] .The immunization schedule is complex," said Larry Pickering, executive secretary of the Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) and a collaborator on the project. "By using the online immunization scheduler, parents can ensure that their children stay current on all recommended vaccines, and they can also obtain useful information about vaccines and vaccine-preventable diseases. "The online catch-up immunization scheduling tool, which was developed by the Georgia Institute of Technology and the Centers for Disease Control and Prevention (CDC), is available at https://www.vacscheduler.org/. Since the new tool launched in January 2012, the site has recorded nearly 63,000 visits, 22 percent of them repeat visitors. Nearly half of the visitors identified themselves as health care providers.

Catch-up Immunization Schedule ,United States, 2016,For additional guidance for use of the vaccines described in this publication, see the *ACIP Recommendations*.

Children age 4 months through 6 years

Vaccine	Minimum Age for Dose 1	Dose 1 to dose 2	Minimum Interval Between Doses		
			Dose 2 to dose 3	Dose 3 to dose 4	Dose 4 to dose 5
Hepatitis B1	Birth	4 weeks	8 weeks *and* at least 16 weeks after first dose. Minimum age for the final dose is 24 weeks.		
Rotavirus2	6 weeks	4 weeks	4 weeks2		
Diphtheria, tetanus, & acellular pertussis3	6 weeks	4 weeks	4 weeks	6 months	6 months3
Haemophilus influenzae type b4	6 weeks	4 weeks if first dose administered before the 1st birthday. 8 weeks (as final dose) if first dose was administered at age 12 through 14 months No further doses needed if first dose was administered at age 15 months or older	4 weeks4 if current age is younger than 12 months *and* first dose was administered at younger than age 7 months, *and* at least 1 previous dose was PRP-T (ActHib, Pentacel) or unknown. 8 weeks *and* age 12 through 59 months (as final dose)4 if current age is younger than 12 months *and*- first dose was administered at age 7 through 11 months; *OR* if current age is 12 through 59 months *and*first dose was administered before the 1st birthday, *and*second dose administered at younger than 15 months; *OR* if both doses were PRP-OMP (PedvaxHIB; Comvax) *and* were administered before the 1st birthday. No further doses needed if previous dose was administered at age 15 months or older.	8 weeks (as final dose)This dose only necessary for children age 12 through 59 months who received 3 doses before the 1stbirthday.	
Pneumococcal5	6 weeks	4 weeks if first dose administered before the 1st birthday. 8 weeks (as final dose for healthy children) if first dose was administered at the 1st birthday or after. No further doses needed for healthy children if first dose administered at age 24 months or older.	4 weeks if current age is younger than 12 months and previous dose given at < 7 months old. 8 weeks (as final dose for healthy children) if previous dose given between 7-11 months (wait until at least 12 months old); OR if current age is 12 months or older and at least 1 dose was given before age 12 months. No further doses needed for healthy children if previous dose administered at age 24 months or older.	8 weeks (as final dose)This dose only necessary for children aged 12 through 59 months who received 3 doses before age 12 months or for children at high risk who received 3 doses at any age.	
Inactivated Poliovirus6	6 weeks	4 weeks6	4 weeks6	6 months6 (minimum age 4 years for final dose).	

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Measles, mumps, rubella8	12 months	4 weeks			
Varicella9	12 months	3 months			
Hepatitis A10	12 months	6 months			
Meningo-coccal11 (Hib-MenCY ≥ 6 weeks; MenACWY-D ≥9 mos; MenACWY-CRM ≥ 2 mos)	6 weeks	8 weeks11	See footnote 11	See footnote 11	

Children and adolescents age 7 through 18 years

Vaccine	Minimum Age for Dose 1	Minimum Interval Between Doses		
		Dose 1 to dose 2	Dose 2 to dose 3	Dose 3 to dose 4
Meningococcal11 (Hib-MenCY ≥ 6 weeks; Men-ACWY-D ≥9 mos; MenACWY-CRM ≥ 2 mos)	N/A	8 weeks11		
Tetanus, diphtheria; tetanus, diph-theria, and acellular pertussis12	7 years 12	4 weeks	4 weeks if first dose of DTaP/DT was administered before the 1st birthday. 6 months (as final dose) if first dose of DTaP/DT or Tdap/Td was administered at or after the 1st birthday.	6 months if first dose of DTaP/DT was adminis-tered before the 1st birthday.
Human papillomavirus13	9 years	Routine dosing intervals are recommended.13		
Hepatitis A10	N/A	6 months		
Hepatitis B1	N/A	4 weeks	8 weeks *and* at least 16 weeks after first dose	
Inactivated Poliovirus6	N/A	4 weeks	4 weeks6	6 months6
Measles, mumps, rubella9	N/A	4 weeks		
Varicella10	N/A	3 months if younger than age 13 years. 4 weeks if age 13 years or older		

This schedule includes recommendations in effect as of January 1, 2016. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement for *detailed recommendations*. Clinically significant adverse events that follow vaccination should be reported to *Vaccine Adverse Event Reporting System (VAERS)* online or by telephone (800-822-7967). Suspected cases of vaccine-preventable diseases should be reported to the state or local health department. Additional information, including *precautions and contraindications* for vaccination, is available from *CDC's Vaccines and Immunization* online site or by telephone (800-CDC-INFO [800-232-4636]).

This schedule is approved by the Advisory Committee on Immunization Practices (*ACIP*), the American Academy of Pediatrics (*AAP*), the American Academy of Family Physicians (*AAFP*), and the American College of Obstetricians and Gynaecologists (*ACOG*).

Conclusion

Immunization has delivered excellent results in reducing morbidity and mortality from childhood vaccine preventable infections in the last 50 years. Although the success has not been as spectacular as in developed world, the fact is we have eradicated small pox and polio. There has been substantial reduction in the incidence of many VPDs & promising achievement in UIP recommended vaccine but there is urgent need of promoting other IAP recommended vaccine. It is widely believed that the progress in last two decades or so has not been as swift on this front as in other fields. Nevertheless, there has been some improvement in last few years: Introduction of newer antigens in UIP (Hepatitis B, 2nd dose of Measles, Japanese encephalitis and Hib in few states), framing of National Vaccine Policy, and acknowledging the need to intensify RI are steps in right direction. We now need to step up our efforts to strengthen all components of UIP (vaccination schedule, delivery and monitoring, and VPD/AEFI surveillance), Promoting other important IAP recommended vaccine i.e. Pneumococcal conjugate vaccine, Varicella, Human papilloma virus vaccine, Typhoid conjugate/polysaccharides vaccine & others. Promoting catch –up immunization schedule at all level i.e. government, private & public sectors. Overcome all barriers (geographical, politico-social and technical) and invest heavily in R&D to achieve immunization's full potential and a healthier Nation. There must be clear cut transparent guidelines on the policy of introduction of newer vaccines. And in the last, efforts should be made to devise guidelines to regulate hitherto 'unregulated' private vaccine market. There must be a 'code of conduct' for marketing vaccines in private sector particular vaccine based on the disease burden data of that VPD rather than on the availability of the product in the international market.

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