Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 4
Open Access

Distribution Of The Factors Influencing Discontinuation Of Routine Immunisation Among Children Under Seven Years In Chennai - An Observational Study.

Running Title: Factors Influencing Discontinuation Of Immunisation.

Dr. Harish N[1],Dr.A.P.Krithika[2],Dr. Ramya Ramanathan[3],Dr. Sundari Subramanian[4]
1) Junior Resident, Department of Paediatrics, Sree Balaji Medical College and Hospital,Chennai, Tamil Nadu, India.
2) Professor, Department of Paediatrics, Sree Balaji Medical College and Hospital,Chennai, Tamil Nadu, India.
3)Associate Professor, Department of Paediatrics, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India.
4) Professor and HOD, Department of Paediatrics, Sree Balaji Medical College and Hospital, Chennai, Tamil Nadu, India.
CORRESPONDING AUTHOR:
DR RAMYA RAMANATHAN, MD (Paediatrics), CORRESPONDING AUTHOR Associate Professor , Department of Pediatrics , Sree Balaji Medical College and Hospital,
No 7, CLC works road, Chrompet , Chennai, Tamilnadu , India- 600044
Email id: ramyacaduceus@gmail.com

Cite this paper as: Dr. Harish N,Dr.A.P.Krithika,Dr. Ramya Ramanathan,Dr. Sundari Subramanian (2024) Distribution Of The Factors Influencing Discontinuation Of Routine Immunisation Among Children Under Seven Years In Chennai - An Observational Study.*Frontiers in Health Informatics, 13* (4), 939-950

ABSTRACT
Immunization is vital in protecting children from infectious diseases like tuberculosis, diphtheria, and measles. Despite its importance, gaps in vaccine coverage persist. This study aims to examine the factors influencing the discontinuation of routine childhood immunization and assess the association between vaccine discontinuation and various demographic and socio-economic factors among children in Chennai.

This observational study included 224 children under seven years from primary health centers in Chennai, conducted over 18 months. Among the participants, 54.5% were female and 45.5% male, with most living in urban areas (63.4%). Factors influencing immunization included proximity to health centres and birth order, but socioeconomic status and literacy showed no correlation. Significant barriers included lack of family support (26.3%), long travel distance (20.5%) and vaccine hesitancy (13.4%). This study highlights modifiable and non-modifiable factors influencing immunization rates, including maternal knowledge and family support. Interventions addressing these barriers are crucial for improving immunization coverage in children.

Keywords: coverage; children; hesitancy; Vaccine.

INTRODUCTION

Each year, it is estimated that over 5.2 million children under the age of five die globally (1), with 1.5 million of these deaths resulting from diseases that could have been prevented by vaccines (2). A significant portion of these deaths occur in low- and middle-income countries (LMICs) (3). Vaccination is recognized as one of the most effective public health strategies for controlling and eradicating life-threatening infectious diseases. Immunization programs have been credited with eradicating smallpox worldwide and significantly reducing the incidence of diseases such as diphtheria, measles, polio, rubella, and tetanus (4-6). In addition to

preventing disease, vaccination also helps to reduce drug resistance and supports economic and societal well-being. Thus, it is considered one of the greatest public health successes of the 20th century (7-10).

For vaccination programs to succeed, high vaccination coverage is essential. When a sufficient proportion of the population is vaccinated, even those who are not vaccinated benefit through herd immunity (5,11). The World Health Organization (WHO) recommends that children receive at least 10 vaccines as part of routine immunization (12). Each year, more than 100 million children are vaccinated against diseases such as diphtheria, tetanus, pertussis, tuberculosis, polio, measles, and hepatitis B (13). However, over 19 million children annually do not receive all the recommended vaccines, leading to outbreaks of preventable diseases and child deaths. The majority of under-vaccinated or non-vaccinated children reside in LMICs, where factors such as limited access to vaccination services, missed opportunities during healthcare visits, and vaccine hesitancy contribute to low coverage (14). Vaccine hesitancy, defined as uncertainty or opposition to vaccination, is a significant factor behind reduced vaccination rates. It is influenced by complacency (lack of perceived need for vaccines), confidence (trust in vaccines), and convenience (accessibility of vaccines).

In 2019, the WHO identified vaccine hesitancy as one of the top 10 global health threats.The state government, along with various non-governmental organizations (NGOs), has undertaken numerous initiatives to strengthen routine immunization programs. These include community engagement, mobile vaccination units, and health education campaigns, aiming to address the gaps in immunization coverage. Despite these efforts, factors such as socio-economic disparities, misinformation, accessibility issues, and vaccine hesitancy continue to contribute to missed vaccinations, leading to incomplete immunization among children. Additionally, logistical challenges in vaccine distribution and the need for more trained healthcare personnel are crucial factors that impact the consistency and coverage of routine immunization.

Although increasing attention has been given to vaccine demand, there is limited understanding of the factors that shape caregiver's attitudes and behaviors toward routine childhood immunization. Qualitative research is valuable for exploring people's beliefs, behaviors, and decision-making processes, helping to inform policies and practices that encourage vaccine acceptance and uptake. Hence the present study is aimed to evaluate the factors influencing discontinuation of routine immunisation among children under seven years in Chennai. The study seeks to identify the socio-economic, cultural, and geographic factors contributing to the discontinuation or delay in routine immunizationand provide evidence-based recommendations to improve immunization coverageand the strategies that can be used to promote awareness amongst the general population.

MATERIALS AND METHODS

This observational study was conducted in Primary Health Centres in Chennai for a duration of 15months from August 2022 to October 2023.The sampling method that was followed was Purposive sampling. A total of 224 of them who filled the inclusion criteria have been taken for the study. Informed consent was obtained from each study subject parents after the nature of the study was fully explained. The Institutional ethical clearance was obtained to conduct the study with the ethical approval number 002/SBMC/IHEC/2022/1732.

The sample size was calculated using the following formula: -

Dobson's formula n=Z2 (1-α/2)PQ/ d2

=1.96 ×1.96×30×70 6 2 ≈224

Z 2 (1-α/2) – Level of confidence 95% which is 1.96

P- Approximate proportion of outcome.

P = 30

Q = 100-P = 100-30 = 70

d 2 - Expected error margin

d = 6

sample size 224

ELIGIBILITY CRITERIA

INCLUSION CRITERIA:

Parents of children under 7 years of age.

EXCLUSION CRITERIA:

Children with co-morbidities and chronic diseases

Children on long term immunosuppression drugs

STUDY METHODOLOGY:

A semi-structured questionnaire was prepared and validated by experts to ensure its accuracy. Content validity was established through expert review. Vaccine defaulters were selected from primary health centres(PHC) in Chennai, excluding children on immunosuppressive drugs and those with chronic disorders. Written informed consent in both English and native language explaining the details of the study were obtained, for all participating children. The questionnaire collected information on vaccination and related factors. Data were entered into Microsoft Excel and analysed using SPSS software version 27.0. Demographic data were presented as frequencies and percentages for categorical variables, and means with standard deviations for continuous variables, with results visualized using bar and pie charts. The significance level was set at 0.05.

The questionnaire had three sections. Section 1 included information regarding the socio demographic variables like participants age, gender,religion, residence and distance from nearest primary health centre(PHC), order of siblings, father and mother's occupation ,income, educational status.Socio economic status of the family was classified using Modified BG Prasad scale 2022, which included five classes namely class I with per capita income Rs. 8397 and above, class II with per capita income Rs. 4156-8396, class III with per capita income Rs. 2460-4155, class IV with per capita income Rs. 1272-2456, class V with per capita income Rs. 1272 and below. The Indian Academy of Pediatrics (IAP) defines a child as fully vaccinated if they have received all the vaccines recommended by the National Immunization Schedule (NIS) for their age, including all the required doses at the appropriate intervals. A child is considered partially vaccinated if they have received some, but not all, of the required vaccines or doses, or if any vaccines are missed or delayed. Section 2 included vaccine defaulter details in three subcategories. The first category included questions on awareness. The questions were "Does vaccine protect against infectious diseases?', "Should parents vaccinate their children against all recommended vaccines?". The second category comprised of questions on access to immunization, "Has distance, timing of clinic, travelling , time needed to get to clinic or wait at clinic and/or costs in getting to clinic prevented you from getting your child immunized?" , "Distance / Time/Travel /Lack of Information about the place and time / Nothing prevented" ,"What pressures in life that prevent you from getting your child immunized? Lack of time / Lack of support from family members / No pressures" "Previous unavailability of vaccine or health worker? yes/no".The third category of questions were on acceptance,"Any reasons that your child should not be vaccinated? - No need if child is healthy/ Child may develop complications like fever/ No reasons", "What negative information did you hear about vaccines? - Child may die/ Child may develop complications like fever/ Don't know what is given to child /No negative information heard", "Did you take your child for vaccination even after hearing negative information? -Yes/no", "Have you ever been reluctant or hesitant to vaccinate your child? -Yes/no", "Have you ever refused any vaccine? -Yes/no","What difficulties are there for some ethnic groups to vaccinate their children? - They choose not to vaccinate /They do not feel welcome at the health service /The health services don't reach them /No difficulties", Section 3 included COVID pandemic details. "Defaulter during Covid-19 pandemic: yes/no" ," COVID-19 tested : yes/no", "If yes , COVID-19 : positive/negative" , "Contact history with COVID-19 : YES/NO", "If yes ,COVID-19 positive: parents/siblings/relatives/neighbours/friends", "Did travel restrictions affect- Vaccination / other medical needs / none of the above" , "Place of stay during pandemic: Rural/ urban / semi- urban / migratory" , "Nearest PHC during pandemic stay" , "Was waiting for pandemic restrictions to get over to get vaccinated : yes/no"

RESULTS

Amongst 224 participants 54.5% were female and 45.5% were male.Majority of the participants 64.4% were from urban side ,34.4% from rural areas and only 2.2% were from semi urban side. There were no participants seen in class four and five and most of the participants 62.1% were seen in class three socio economic status classified according to BJ prasad scale. Two third of the participants 59.8 % were having their

residence within 5 km distance from the nearest PHC. The educational status of the parents was literate in almost the entire participants with 96.9% in father and 97.7 % in mother. Greater part of the children 91.9% were either the first or second order.When looking into the occupation ,62% of fatherswere unemployed/wage earner, 51.3% of mothers were homemaker. Very few 14.3%constituted the migratory worker category and the rest 85.7% were non migratory workers.
The majority (84.8%) of participants acknowledged that vaccines protect against diseases, whereas 15.2% disagreed. Regarding familiarity with the recommended immunization schedule, 56% reported being aware, while 44% were not. Accessibility to vaccination revealed that 56% relied on public or private transport to vaccination centers, while 44% traveled on foot. Financial constraints were a challenge for 26.3%, and the unavailability of health workers was reported by 5.4% of respondents.

Acceptability issues were significant, with 20.1% fearing complications, 4.5% believing vaccination is unnecessary for healthy children, and 2.3% citing family opposition. Additionally, 4% felt the health worker's information was unreliable, and 22% self-reported hesitancy towards vaccination.
The components with an odds ratio (OR) greater than 1 include child's age (12–17 months: adjusted OR = 1.4), child's gender (male: adjusted OR = 1.69) and child's birth order (≥3: adjusted OR = 1.4).These ORs suggest higher odds of full vaccination for younger children, males and children with higher birth order. Children whose caregivers agreed with the statement, "I am familiar with the immunization schedule (individual vaccines and timing of doses)," had increased odds of full vaccination (adjusted OR = 2.45). Similarly, those who received information about recommended vaccines during antenatal care (ANC) visits had higher odds of vaccination (adjusted OR = 2.45). Additionally, caregivers who agreed with the importance of immunization in keeping their child healthy also showed increased odds of vaccination (unadjusted OR = 3.1). These findings highlight that familiarity with the immunization schedule, effective communication during ANC visits, and positive caregiver beliefs about immunization play crucial roles in improving vaccination coverage.

Table 1: Socio-Demographic Details of the Study Participants

S. No	Socio-Demographic Details	Frequency (N=224)	Percentage (%)
1.	Gender		
	Male	102	45.5
	Female	122	54.5
2.	Place Of Residence		
	Rural	77	34.4
	Urban	142	63.4
	Semi Urban	3	2.2
3.	Socio Economic Scale (B.G Prasad classification)		
	Class-I	12	5.4
	Class-II	73	32.6
	Class-III	139	62.1
4.	Distance From Heath Care Centre		
	<5 Km	134	59.8
	>5 Km	90	40.2
5.	Fathers Education		
	Illiterate	7	3.1
	Literate	217	96.9
6.	Mothers Education		
	Illiterate	5	2.3
	Literate	219	97.7
7.	Birth Order		
	1-2	206	91.9
	>3	18	8.1
8.	Fathers Occupation		
	Unemployed/Wage Earner	139	62
	Salaried/Small Business Owner	85	38
9.	Mother's Occupation		
	Semi-Skilled	19	8.5
	Unskilled	36	16.1
	Self-Employed	54	24.1
	Homemaker	115	51.3
10.	Migratory Workers		
	Yes	32	14.3
	No	192	85.7

Table 2: Distribution Of the Study Population by The Knowledge Of Vaccination, Accessibility To Vaccination, Acceptability To Vaccination.

Knowledge About Vaccination		Frequency (%)
Vaccine Protects	Yes	190(84.8)
	No	34(15.2)
Familiar With The Recommended Immunisation Schedule	Yes	125(56)
	No	99(44)
Accessibility To Vaccination		
Mode Of Travel	Walk	99(44)
	Public/Private Transport	125(56)
No financial Support From Family		59(26.3)
Health Worker Not Available		12(5.4)
Acceptability To Vaccination		
Fear Of Complications		45(20.1)
No Need If Child Is Healthy		10(4.5)
Opposition From Family		5(2.3)
Health Worker Information Was Not Reliable		9(4)
Self Reported Hesitancy		49(22)

Table 3: Association With Socio-Demographic Variables And Vaccination Status

Characteristic	Categories	Proportions,N(%)		Prevalence Odds Ratio(95%Ci)	
		Fully Vaccinated	Partially Vaccinated	Unadjusted	Adjusted
Socio-Demographic					
Child's Age(Months)	12- 17	84(44)	19(54.3)	1.6(0.8-2.9)	1.4(0.78-2.4)
	18- 23	105(56)	16(45.7)		
Child's Gender	Male	96(51)	22(64)	1.6(0.7-2.1)	1.69(0.92-2.2)
	Female	93(49)	13(36)		
Child's Birth Order	1	79(41.8)	18(51.4)	1.1(1-2.1)	1.4(1.1-1.78)
	2	90(47.6)	14(40)		
	≥3	20(8.6)	3(8.6)		
Place Of Vaccination	Public Facility	179(94.7)	31(88.6)	0.5(0.2–1.1)	0.87(0.81–2.1)
	Private Facility	20(5.3)	4(11.4)		
Mother's Age At Birth Of Child (Years)	<20	22(12.2)	4(11.4)	0.89(0.24-1.54)	-
	20- 30	155(82)	27(77.1)		
	>30	12(6.8)	4(11.4)		
Mother's Education	Illiterate	6(3.2)	11(31.4)	3.1(1.34-8.34)	-
	Upto12thstandard	161(85)	18(51.4)		
	Diploma/Degree	22(11.8)	6(19.5)		
	Illiterate	23(12.2)	7(20)		
Father's Education	Upto12thstandard	155(82)	23(65.7)	0.91(0.6-3.21)	-
	Diploma/Degree	11(5.8)	5(14.3)	0.65(0.51-7.16)	
Mother's Occupation	Homemaker	166(88.0)	80(82.5)	0.69(0.12-2.31)	-
	Wage Earner	72(38.1)	15(42.8)		
	Salary Earner/Business	27(14.3)	5(14.1)	0.76(0.57-3.1)	-
	Unemployed	10(5.2)	5(14.3)		
Father's Occupation	Wage Earner	155(82)	16(45.7)	2.6(1.31-7.2)	2.5(1.1-8.1)
	Salary Earner/Business	34(17.8)	14(40)	1.2(1-5.2)	1.1(0.9-5.1)

Table 4 : Association With Immunization And Vaccination Status

Characteristic	Categories	Proportions, N (%)		Prevalence Odds Ratio(95%Ci)	
		Fully Vaccinated	Partially Vaccinated	Unadjusted	Adjusted
Travel To Immunization Facility	Walking	128(67.7)	22(62)	0.92(0.69-2.32)	-
	Private/Public Transport	172(32.3)	13(38)		
I Think Immunization Is Important To Keep My Child Healthy	Don't Agree(N)	8(4)	2(5.7)	3.1(1.78–10.13)	-
	Agree(Sa,A)	181(96)	33(94.3)		
I Am Familiar With The Immunization Schedule (Individual Vaccines &Timing Of Doses)	Don't Agree(N,Da,Sda)	47(25.0)	14(40)	2.56(1.3-7.33)**	2.45(1.28-6.38)**
	Agree(Sa,A)	142(75.0)	21(60)		
The Timing Of Immunization Sessions Was Convenient For Me	Don't Agree(N,Da)	98(52)	21(60)	1.56(0.63-5.33)	-
	Agree(Sa,A)	91(48)	14(40)		
Self-Reported Hesitancy With One Or More Childhood Vaccines	Hesitant(Sh,Vh,N)	128(67.7)	2(5.7)	0.91(0.69-2.18)	-
	Not Hesitant(Nth,Nh)	172(32.3)	33(94.3)		
Health-Worker Home Visits	No/Not Sure	38(20)	8(24)	1.29(0.78-2.24)	-
	Yes	151(80)	27(76)		
Information About Recommended Vaccines Provided During Anc Visits	No/Not Sure	8(4)	5(14.3)	2.31(1.52-6.2)**	2.45(1.03-3.9)**
	Yes	181(96)	30(85.7)		

DISCUSSION:

India, with a population of 1.35 billion, faces significant healthcare challenges, particularly with 41% of the population under 18 and a high birth rate (15). According to NFHS-4 data, infant and under-5 mortality rates are 41 and 50 per 1,000 live births, respectively, primarily due to preventable conditions like low birth weight, infections, and pneumonia. Many of these deaths can be reduced through timely immunization.

High immunization coverage is essential to reduce vaccine-preventable diseases. This requires expanding vaccine coverage, maintaining a reliable cold chain, and minimizing missed vaccinations. WHO guidelines consider a child fully vaccinated by 12 months if they have received the required doses of BCG, DPT, polio, HBV, measles, and Vitamin A (16) .

Globally, vaccine-preventable diseases account for 20% of deaths in children under five. Immunization is one of the most cost-effective health interventions, directly reducing morbidity and mortality. Despite progress, challenges like logistical issues, vaccine shortages, and unequal access remain. Efforts must focus on improving vaccine availability and coverage, especially for underserved populations.

Measuring vaccination coverage is crucial for assessing immunization program success and understanding the social factors behind non-immunization. After steady coverage from 2010 to 2019, global vaccine coverage dropped in 2020, largely due to the COVID-19 pandemic, which disrupted supply chains and reduced access to healthcare. The largest declines were seen in South-East Asia and the Eastern Mediterranean regions (17).

The main purpose for conducting this study was to identify and assess the factors that influence childhood immunization and its outcomes. In the present study amongst the 224 study participants the female children immunized were 54.5% and male children immunized were 45.5%. This result is consistent with a study conducted by Vinod et al (18), which revealed better immunization rates among female children. 63.4% of the study participants were based from urban area as compared with 34.4% of the study participants who were from rural areas. 2.2% of the study participants were from semi-urban areas. This finding is consistent with the study findings of Malini et al (19) which established that children belonging to urban areas had the best immunization coverage as compared with children living in rural areas. According to our present study children residing <5 km had better access to immunization which constitutes 56.3% followed by 26.3% of the study participants residing more than km from the immunization centers. These results are consistent which a study conducted by Maralihalli et al (20) which showed similar results.

Of the 224 study participants 32.1% of the children were first born, the majority of the children immunized were second born. These results are similar to the findings established by a study conducted by Yadav et al (21). In this study, socioeconomic status and literacy were found to have no correlation with children receiving full or partial immunization coverage.

The number of siblings was identified as a factor affecting childhood immunization uptake in a cross-sectional study conducted in Angola, which included 1209 children under the age of 5. Families with 2 to 3 siblings were more likely to vaccinate their children compared to families with fewer than 2 siblings. This increased likelihood may be due to the parents' accumulated experience over time regarding the importance of immunization and the medical complications that can arise from a lack of immunization.

The study also found no correlation between literacy rates and immunization levels. Mothers were more likely to default on completing their child's immunization due to insufficient health awareness, echoing findings from studies such as that by Hailay Gebretnsae Aregawi et al (22)

Amongst these children 62.1% of the study participants who were immunized belonged to upper to lower economic scale followed by 32.6% belonging to middle socio-economic scale and 5.4% participants belonging to lower socio-economic scale. The anthropometric measurements of the study participants did not show any significant correlation with the immunization status of the study participant which is consistent with the study findings of Vishwanath et al (23)

The factors associated with the hurdles of immunization were no support from family members which constituted 26.3%, long distance travel and lack of time constituted 20.5%, hesitancy for immunization constituted 13.4% and finally healthcare worker not being available constituted 5.4%. these findings are

indicative of the immunization programmes being successful but the accessibility and other factors still pose a problem and can be marked as areas for improvision.

The COVID related disruption in immunization constitutes 31% and those who avoided immunization due to the fear of contracting COVID infection constituted 20% and other restrictions due to COVID constituted 19% . All these factors as a whole contribute to defaulters for immunization and decrease in the rates of immunization as exhibited by the 95% confidence interval established as Odds ratio for each and every parameter associated with immunization. These factors act as a temporary barrier hindering the success rates of immunization and in the outreach of our National Immunization Programme. Measures taken to overcome the hurdles caused by these parameters can pave way for better immunization outreach programmes and higher success rates of immunization.

Immediate action is essential to address gaps in immunity caused by disruptions in immunization services during the pandemic, aiming to prevent outbreaks of vaccine-preventable diseases. This is particularly crucial in countries where health systems are already strained by COVID-19. To reverse concerning trends and sustain or surpass vaccination coverage levels achieved before the pandemic, targeted and tailored approaches are necessary.

Specific strategies must be defined at the country level to locate children who missed vaccinations, reduce missed opportunities for immunization, and implement catch-up vaccination programs. These measures are vital to mitigate the impact of COVID-19 on global immunization goals and ensure progress continues towards achieving universal immunization coverage. Strenghts - This study is one of a kind that has been done in South India which implies immunization is crucially important and it is equally important to increase mother's awareness about immunization through local health awareness programs or follow by Accredited Social Health Assistant (ASHA) workers. Limitations -The study being a hospital-based study, it does not reflect the total population in a given community and also the sample size was small. Further research is required to elaborate and confirm the findings from this study.

CONCLUSION:

This study identified key factors influencing childhood immunization uptake in South India, categorized into modifiable and non-modifiable factors. Modifiable factors, including maternal knowledge, attitude, self-efficacy, and obstetric history, were found to directly affect vaccination rates.

These insights can guide the development of targeted interventions, particularly through immunization education for pregnant women. Addressing these factors can significantly improve immunization coverage in regions with low rates, ultimately enhancing public health outcomes.

REFERENCES:-

1.Singh, S.; Sahu, D.; Agrawal, A.; Vashi, M.D. Ensuring childhood vaccination among slums dwellers under the National Immunization Program in India-Challenges and opportunities. Prev. Med. 2018, 112, 54–60. [CrossRef] [PubMed]

2. Forshaw, J.; Gerver, S.M.; Gill, M.; Cooper, E.; Manikam, L.; Ward, H. The global effect of maternal education on complete childhood vaccination: A systematic review and meta-analysis. BMC Infect. Dis. 2017, 17, 801. [CrossRef] [PubMed]

3.Gera, T.; Shah, D.; Garner, P.; Richardson, M.; Sachdev, H.S. Integrated management of childhood illness (IMCI) strategy for children under five. Cochrane Database Syst. Rev. 2016, 6, CD010123. [CrossRef]

4. Callaghan, T.; Motta, M.; Sylvester, S.; Trujillo, K.L.; Blackburn, C.C. Parent psychology and the decision to delay childhood vaccination. Soc. Sci. Med. 2019, 238, 112407. [CrossRef]

5. Cooper, S.; Schmidt, B.-M.; Sambala, E.Z.; Swartz, A.; Colvin, C.J.; Leon, N.; Wiysonge, C.S. Factors that influence par ents' and informal caregivers' views and practices regarding routine childhood vaccination: A qualitative evidence synthesis. Cochrane Database Syst. Rev. 2021, 10, CD013265. [CrossRef]

6.Saeterdal, I.; Lewin, S.; Austvoll-Dahlgren, A.; Glenton, C.; Munabi-Babigumira, S. Interventions aimed at communities to inform and/or educate about early childhood vaccination. Cochrane Database Syst. Rev. 2014, 11, CD010232. [CrossRef]
7.Ames, H.M.; Glenton, C.; Lewin, S. Parents' and informal caregivers' views and experiences of communication about routine childhood vaccination: A synthesis of qualitative evidence. Cochrane Database Syst. Rev. 2017, 2, CD011787. [CrossRef]
8.Rus, M.; Groselj, U. Ethics of vaccination in childhood—A framework based on the four principles of biomedical ethics. Vaccines 2021, 9, 113. [CrossRef] [PubMed]
9.Gidengil, C.; Chen, C.; Parker, A.M.; Nowak, S.; Matthews, L. Beliefs around childhood vaccines in the United States: A systematic review. Vaccine 2019, 37, 6793–6802. [CrossRef]
10. Bärnighausen, T.; Bloom, D.E.; Cafiero-Fonseca, E.T.; O'Brien, J.C. Valuing vaccination. Proc. Natl. Acad. Sci. USA 2014, 111, 12313–12319. [CrossRef]
11. Forster, A.S.; Rockliffe, L.; Chorley, A.J.; Marlow, L.A.; Bedford, H.; Smith, S.G.; Waller, J. A qualitative systematic review of factors influencing parents' vaccination decision-making in the United Kingdom. SSM-Popul. Health 2016, 2, 603–612. [CrossRef] 12. WHO.Table 2: Summary of WHO Position Papers—Recommended Routine Immunizations for Children. Available online: https://cdn.who.int/media/docs/default-source/immunization/immunization_schedules/immunization-routine-table2 .pdf?sfvrsn=3e27ab48_9&download=true (accessed on 19 January 2023).
13. WHO. Immunization Agenda 2030: A Global Strategy to Leave No One Behind. Available online: https://www.who.int/ publications/m/item/immunization-agenda-2030-a-global-strategy-to-leave-no-one-behind (accessed on 19 January 2023).
14. WHO.ProgressandChallenges with Achieving Universal IMMUNIZATION Coverage. WHO/UNICEF Estimates of National Immunization Coverage (WUENIC). Available online: https://cdn.who.int/media/docs/default-source/immunization/wuenic progress-and-challenges-15-july-2022.pdf?sfvrsn=b5eb9141_7&download=true (accessed on 19 January 2023).
15. Nguyen, K.H.; Srivastav, A.; Lindley, M.C.; Fisher, A.; Kim, D.; Greby, S.M.; Lee, J.; Singleton, J.A. Parental Vaccine Hesitancy and Association with Childhood Diphtheria, Tetanus Toxoid, and Acellular Pertussis; Measles, Mumps, and Rubella; Rotavirus; and Combined 7-Series Vaccination. Am. J. Prev. Med. 2022, 62, 367–376. [CrossRef]
16. World Health Organization. Understanding the behavioural and social drivers of vaccine uptake WHO position paper–May 2022–Note de synthèse de l'OMS–mai 2022. Wkly. Epidemiol. Rec. Relev. ÉpidémiologiqueHebd. 2022, 97, 209–224.
17. Bechini, A.; Boccalini, S.; Ninci, A.; Zanobini, P.; Sartor, G.; Bonaccorsi, G.; Grazzini, M.; Bonanni, P. Childhood vaccination coverage in Europe: Impact of different public health policies. Expert Rev. Vaccines 2019, 18, 693–701. [CrossRef] [PubMed] 18. Al-Regaiey, K.A.; Alshamry, W.S.; Alqarn
18.Bhaskar, Emmanuel; Thobias, S.1; Anthony, Syluvai1; Kumar, Vinod2; Navaneethan, 2. Vaccination rates for pandemic influenza among pregnant women: An early observation from Chennai, South India. Lung India 29(3):p 232-235, Jul–Sep 2012. | DOI: 10.4103/0970-2113.99105
19.Statistics Sierra Leone. Sierra Leone 2015 Population and Housing Census. https://www.statistics.sl/index.php/census/census-2015.html. Accessed 18 May 2022.

20.National Library of Medicine (U.S.). MULTIple Doses of IPTi Proposal: a Lifesaving High Yield Intervention (MULTIPLY). ClinicalTrials.gov Identifier: NCT05085340. 2021.

21.World Health Organization. WHO Guidelines for Malaria. Geneva; 2022.

22.Suresh K, Chandrashekara S. Sample size estimation and power analysis for clinical research studies. J Hum Reprod Sci. 2012;5:7–13.

23.Lahuerta M, Sutton R, Mansaray A, Eleeza O, Gleason B, Akinjeji A, et al. Evaluation of health system readiness and coverage of intermittent preventive treatment of Malaria in infants (IPTi) in Kambia district to inform national scale-up in Sierra Leone. Malar J. 2021;20:74.