Factors Associated With Appropriateness of Vaccination Age Coverage For Measles Vaccine In Kufa District, Najaf Governorate, Iraq

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ABSTRACT
Measles is one of the diseases that can be effectively managed with vaccination. Herd immunity is a concept that describes the situation where a large proportion of a population is vaccinated, resulting in high coverage rates. Measles infections persist at high levels in specific areas despite the general vaccination rates. Administering the vaccination at the recommended age is crucial for attaining protection and reducing the transmission of vaccine-preventable illnesses . Cross –sectional study was conducted from 1st of OCT .2023 until 25th of JAN. 2024 among mothers with their child aged 12-23 month. The purpose of this study was to assess age-appropriate measles vaccination coverage and associated factors. Collected data using pre-tested questionnaires also data on measles vaccination were taken from vaccination card.This study analyzed 388 mothers, revealing that the majority of father age were between 20-34y, with 41.2% having primary education. Mother age found to be 258(66.5%) between 20-34y .225(57.9%) of father occupation were free job and 334(86.1%) were house wife by occupation, the sex of child 201(51.8%) were found to be female .68.61% were vaccinated with measles vaccine on time, (29.38%) were delayed and (1.80%) were found to be unvaccinated. The education level, number of children in the family and child order are significantly associated with measles vaccination status of child. As we revealed that the proportion of individuals receiving the vaccine within the designated timeframe is below 70%. We should focus on enhancing on time of routine children immunization. This can be achieved by reinforcing existing techniques, developing new approaches, and emphasizing the media's role in promoting the significance of timely vaccine administration.

1. Introduction

Every year, vaccinations save millions of lives by averting over 20 serious diseases [1] .Nowadays, measles is a vaccine-preventable disease of interest [2]. Measles is an extremely infectious, febrile disease that causes fever, coughing, and, in extreme cases, pneumonia. It is caused by a paramyxovirus virus [3] [4]. As it is a highly contagious disease that is main causes of mortality in children [4] [5].measles continues to expose immunity gaps, with 22 million children missing their first dose in 2022 compared to 19 million in 2019 [6].Due to the highly infectivity rate of measles, achieving at least 95% immunity in the population is necessary to prevent epidemics, making it a very high barrier for community protection. When reintroducing the disease, outbreaks may occur if extremely high vaccination rates are not maintained. Measles not only causes pain, but controlling outbreaks also costs money and takes time away from essential medical services [7][8].The World Health Organization recommends that at least 95% of the population receive two doses of measles vaccine [9] . Measles remains prevalent in many developing countries, particularly in parts of Africa and Asia [10].A considerable number of supplemental immunisation programs have been disrupted by the COVID-19 pandemic, with 61 million measles-containing vaccination doses being skipped or forgotten between 2020 and 2022. This waning of immunity makes people more susceptible and raises the possibility of measles outbreaks [11]. In addition to the high coverage of vaccination required to prevent vaccine preventable diseases (VPD), children should receive regular and timely vaccinations which reduces their chances of contracting the disease [12]. Vaccination timeliness refers to the practice of delivering vaccines as soon as they are considered suitable and following the recommended time intervals between doses. The timing of vaccination plays a critical role in the development of protective antibodies and the effectiveness of disease protection in adolescents. The effectiveness of vaccination protection depends on timely administration of effective vaccines [13].In Iraq measles still a major public health problem, affecting young children below five years mainly infants [14]. The Trans placental transit of maternal antibiotics, which persist for the first 4-6 months

of life and decrease at varying rates, causes the peak age incidence of measles to occur during the second part of the first year of life [15].The measles epidemiology in Iraq has become concerning in recent years. According to the World Health Organization (WHO), a significant number of measles cases 7,601 were reported in Iraq in 2024 [16]. This suggests that the nation has to increase immunisation rates and carry out improved disease surveillance [17] .Despite the importance of the topic and its health effects, few studies worldwide have dealt with this issue, especially in Iraq.

2. Methodology

Study design and period

A primary health care center-based cross-sectional study was conducted to assess age-appropriate measles vaccination coverage and associated factors between October 1, 2023, and January 25, 2024.

Study setting and population

The study was conducted in the Kufa region of Najaf, Iraq. There are 15 health centers in the district, including 10 primary health centers and 5 branch hospitals. These facilities provide basic health services to the population, including childhood vaccination programs. The projected population of Kufa District in 2023 is 334,918. The source population included all mothers with children aged 12 to 23 months living in the Kufa region.

Sample size and sampling technique

The sample size was calculated using a method for a single population percentage, taking into account the following assumptions: a margin of error of 5%, a confidence level of 95%, and a vaccine coverage rate of 50% for the appropriate age group. By incorporating a 10% non-response rate, we acquired a conclusive sample size of 388 children accompanied by their moms. Eight Primary Health Care (PHC) centers were chosen at random. A systematic sample technique was utilized to choose the necessary number of children from each Primary Health Care (PHC) center, utilizing the listed children as a sampling frame.

Inclusion and exclusion criteria

All children within second year of age with their mothers living in Kufa district will be the source population. Mothers who have a vaccination card with written records of vaccination dates will be included in the study and critically ill mothers who are unable to respond will be excluded from the study.

Data collection

Data was gathered with a well-designed questionnaire that was administered through in-person interviews. The questionnaire includes inquiries regarding socio-demographic and economic variables, utilization of maternal health services, and the vaccination status of a child, specifically focusing on non-vaccination or delayed vaccination. Data regarding the immunisation status of children was obtained from their vaccination card.

Data analysis

The process of inputting and examining data was carried out via SPSS Statistics version 26. We performed descriptive statistics to get the frequencies and percentages. A chi-square test was used to determine the association between the vaccinations status of the measles vaccine and socio-demographic factors. A statistical significance was determined when the p-value was less than 0.05.

Ethical consideration

Verbal consent was obtained from the participants in the questionnaire.

Funding

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3. Results and discussion

Sociodemographic characteristics of mothers and their children

All 388 of mother are included in the study information about sociodemographic variables were obtained for analysis, found that the father age 12 (3.1%) were below 20 years, 259 (66.8%) are between 20-34 y. Mother age found to be 73(18.8%) were below 20 y, 258(66.5%) between 20-34, majority of father (41.2%) had Primary education and(7.7%) were illiterate ,majority of mother education were (37.1%) primary education , while 4.6% were found to be illiterate as indicated in(table 1) , 360 (92.8)% of mothers was married and 225(57.9%) of father occupation were free job and 334(86.1%) were house wife by occupation, regarding the sex of child 201(51.8%) were found to be female and regarding to child order 107(27.5%) were first child for mother, 213(54.8%) of families were found to be between 5-10 person in the family and 273(70.3%) of families had 3 and less children Majority of mothers were had planned pregnancy 251 (64.6%), with 159(40.9%) regular ANC attendance and 255(65.7%) of mother were had complete tetanus toxoid vaccine, 327(84.3%) were found to take less than 30 min to reach primary health centers. [Table 1] [Table2].

Table 1. Sociodemographic characteristics of the study sample by state of time appropriateness of Measles vaccine

		Measles vaccine appropriateness					
		None n=7	Delayed n=114	Appropriate n=267	**Total N=388**	**%**	**P -value**
age group of father (years)	< 20	1 8.3%	5 41.7%	6 50.0%	12 100.0%	3.1	0.076
	20-34	6 2.3%	69 26.6%	184 71.0%	259 100.0%	66.8	
	35 and more	0 0.0%	40 34.2%	77 65.8%	117 100.0%	30.1	
age group of mother (years)	<20	3 4.1%	16 21.9%	54 74.0%	73 100.0%	18.8	0.134
	20-34	4 1.6%	76 29.5%	178 69.0%	258 100.0%	66.5	
	35 and more	0 0.0%	22 38.6%	35 61.4%	57 100.0%	14.6	
Marital status	Married	7 1.9%	105 29.2%	248 68.9%	360 100.0%	92.7	0.975
	Divorced	0 0.0%	3 30.0%	7 70.0%	10 100%	2.5	

	Widowed	0 0.0%	0 0.0%	1 100.0%	1 100%	0.2	
	Separated	0 0.0%	6 35.3%	11 64.7%	17 100.0%	4.3	
Education of father	Illiterate	2 6.7%	15 50.0%	13 43.3%	30 100.0%	7.7	
	Read &write	1 2.3%	12 27.9%	30 69.8%	43 100.0%	11.0	**0.010**
	Primary school	3 1.9%	38 23.8%	119 74.4%	160 100.0%	41.2	
	Secondary school	1 1.4%	28 38.4%	44 60.3%	73 100.0%	18.8	
	University & above	0 0.0%	21 25.6%	61 74.4%	82 100.0%	21.1	
Education of mother	illiterate	1 5.6%	6 33.3%	11 61.1%	18 100.0%	4.6	
	read and write	0 0.0%	12 27.9%	31 72.1%	43 100.0%	11.0	
	primary school	1 0.7%	45 31.3%	98 68.1%	144 100.0%	37.1	0.521
	secondary school	3 3.5%	28 32.6%	55 64.0%	86 100.0%	22.1	
	institute and above	2 2.1%	23 23.7%	72 74.2%	97 100.0%	25	
Occupation of father	government employee	2 1.5%	33 25.4%	95 73.1%	130 100.0%	33.5	
	self-employed	0 0.0%	4 26.7%	11 73.3%	15 100.0%	3.8	
	free job	4 1.8%	70 31.1%	151 67.1%	225 100.0%	57.9	0.391
	private employee	1 6.3%	5 31.3%	10 62.5%	16 100.0%	4.1	
	other	0 0.0%	2 100.0%	0 0.0%	2 100.0%	0.5	
Occupation of mother	House wife	7 2.1%	102 30.5%	225 67.4%	334 100.0%	86.1	
	government employee	0 0.0%	9 20.0%	36 80.0%	45 100.0%	11.5	0.683

	private employee	0 0.0%	2 28.6%	5 71.4%	7 100.0%	1.8	
	other	0 0.0%	1 50.0%	1 50.0%	2 100.0%	0.5	
Family income	sufficient	4 1.5%	76 28.7%	185 69.8%	265 100.0%	68.2	0.718
	insufficient	3 2.4%	38 30.9%	82 66.7%	123 100.0%	31.7	
Family type	single	2 0.9%	63 29.7%	147 69.3%	212 100.0%	54.6	0.376
	joint	5 2.8%	51 29.0%	120 68.2%	176 100.0%	45.3	
Family size	<5	1 1.0%	23 23.5%	74 75.5%	98 100.0%	25.2	0.437
	5-10	5 2.3%	69 32.4%	139 65.3%	213 100.0%	54.8	
	>10	1 1.3%	22 28.6%	54 70.1%	77 100.0%	19.8	
Number of children	3 and less	7 2.5%	72 25.9%	199 71.6%	278 100.0%	71.6	0.019
	More than 3	0 0.0%	42 38.2%	68 61.8%	110 100.0%	28.3	
Time to PHCC	<30min	6 1.8%	93 28.4%	228 69.7%	327 100.0%	84.2	0.641
	=> 30min	1 1.6%	21 34.4%	39 63.9%	61 100.0%	15.7	

Factors influencing vaccination status

(Figure 1) show that from all 388 children (68.61%) were vaccinated with measles vaccine on time, (29.38%) were delayed and (1.80%) were found to be unvaccinated.

As shown in (Table 2) Parental age was not significantly associated with adequacy of measles vaccination. Father's education was found to be significantly associated with measles vaccination status, p value = 0.01,the majority of fathers education were primary school most of their children had on time vaccination 119(74.4%) and 38(23.8%) were had delayed vaccination status, and in term of educational level for mothers were144(37.1%)had primary school background and most of their children had on time vaccination ,45(31.3%) were delayed and 1(0.7%) were unvaccinated .

occupational status for parent not significantly associated and also family income and family size . Number of children was significantly associated with measles vaccination status p-value (0.019).) , majority of number of children to family found to be 3 and less were 199 (71.6%) on time vaccination and 72 (25.9%) were delayed , families who had more than 3 children were 110(28.3) from them delayed were 42(38.2%)and 68 (61.8%)on time measles vaccination . in this study most mother had regular visits for antenatal care with completed TT vaccination status but both factors were not Child sex was also significantly associated, but child order was significantly associated with measles vaccination status: p-value (0.047)and first child order 107(27.5) from them were on time vaccination 75 (70.1%) while 29(27.1%) delayed and 3(2.8%) unvaccinated [Table 1][Table 2]

Figure 1. Appropriateness of measles vaccine

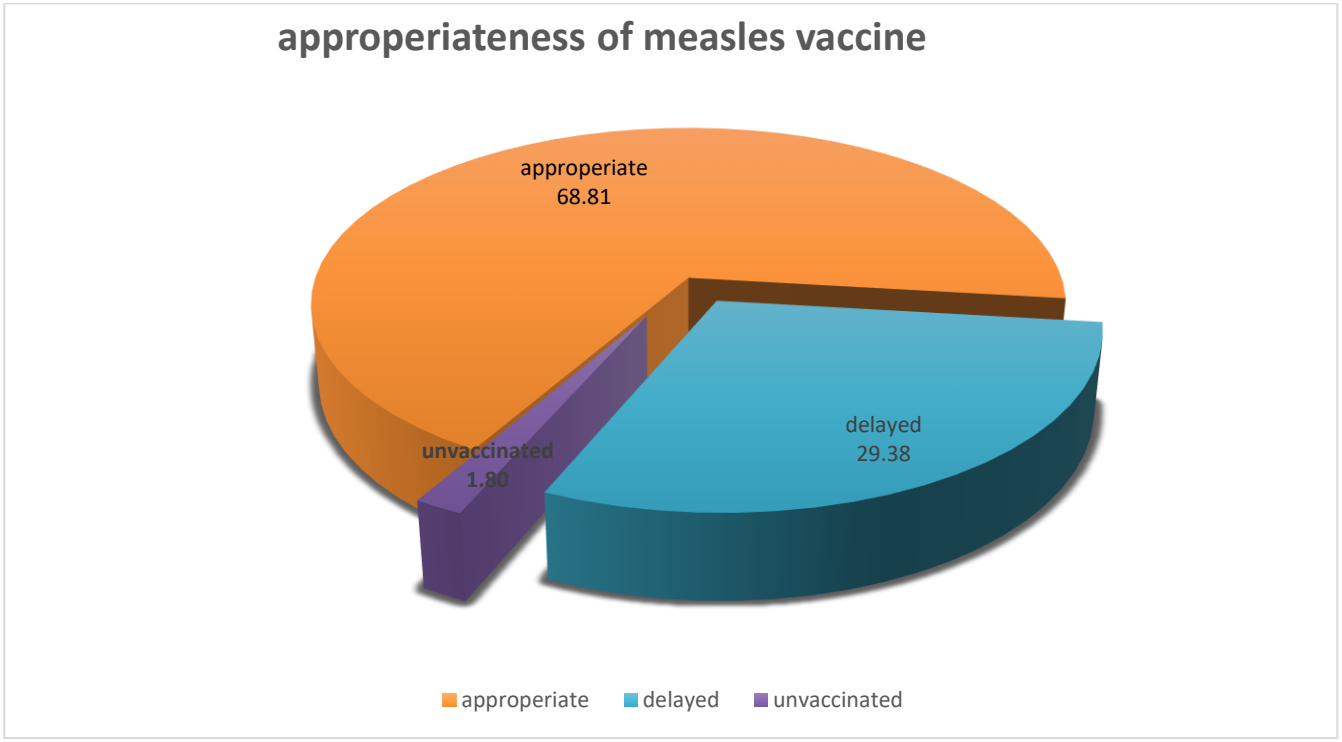

Table 2. Pregnancy related characteristics by Measles vaccine time appropriateness

		Measles vaccine appropriateness			Total N=388	%	P value
		None	Delayed	Appropriate			
		n=7	n=114	n=267			
Pregnancy status	Planned	6 2.4%	66 26.3%	179 71.3%	251 100.0%	64.7	0.116
	unplanned	1 0.7%	48 35.0%	88 64.2%	137 100.0%	35.3	
ANC attendance	regular	1 0.6%	40 25.2%	118 74.2%	159 100.0%	40.9	0.353
	irregular	1 1.2%	26 31.0%	57 67.9%	84 100.0%	21.6	
	in need	3 3.3%	30 32.6%	59 64.1%	92 100.0%	23.7	
	Treatment	2 3.8%	18 34.0%	33 62.3%	53 100.0%	13.6	

TT status	complete	2 0.8%	77 30.2%	176 69.0%	255 100.0%	65.7	0.196
	uncomplete	3 3.4%	27 30.7%	58 65.9%	88 100.0%	22.6	
	Don't know	2 4.5%	9 20.5%	33 75.0%	44 100.0%	11.3	
	None	0 0.0%	1 100.0%	0 0.0%	1 100.0%	0.3	
Sex of child	Female	5 2.5%	60 29.9%	136 67.7%	201 100.0%	51.8	0.551
	Male	2 1.1%	54 28.9%	131 70.1%	187 100.0%	48.2	
Child order	1st	3 2.8%	29 27.1%	75 70.1%	107 100.0%	27.6	**0.047**
	2nd	1 1.0%	19 19.2%	79 79.8%	99 100.0%	25.5	
	3rd	3 3.7%	25 30.9%	53 65.4%	81 100.0%	20.8	
	4th	0 0.0%	20 40.0%	30 60.0%	50 100.0%	12.8	
	5&above	0 0.0%	21 41.2%	30 58.8%	51 100.0%	13.1	

According to WHO Measles minimum age to be taken is at 9 months and considered to be delayed if taken at > 10 months [18].This study aimed to assess the appropriateness of measles vaccination in children aged 12 to 23 months. This is probably the only study to identify factors associated with delays in measles vaccination in Kufa region, Najaf government .We found that measles vaccination status were (68.81%) age appropriate and its lower than that conducted in Ethiopia were (77%) ,while delayed measles vaccination in our study found to be (29.38 %) which was more than delayed (21.1%) in Ethiopia study [19]. Parent education considered one of most factors with significant effect on vaccination status as determine by other studies [20] [21]. in our study we found that only father education had significant association while mother were not and it's the same result found in other study [22][23] ,while many study conducted that father education had no association this difference may resulting from the cultural and social behaviors [24][25][26]. In Iraq Typically, the mother is responsible for physically taking the child to receive the vaccine. However, fathers normally have the authority to decide whether or not their children should be vaccinated, and in many situations, the mother may be unable to administer the vaccine to her child. Hence, the father's educational attainment significantly influences the child's likelihood of receiving the vaccine. Parent occupations were releaved not significantly affect their child vaccination and it's opposite to results of other study were indicated that significant relationship between maternal occupation and infant immunization status [27]. Other sociodemographic factors found to be significantly associated were Number of children p-value (0.019) and most of mother with 3 and less children found to give their child age appropriate Measles vaccination which higher than those had more than three children, a study conducted in 31 low and middle-income countries found that higher number of children was associated with delayed vaccinations [28]. Study conducted in Jordan from (Jan.2019–Jun. 2019) found that births order one of the factors that significantly associated with vaccination status among children within 2 years, this results similar to our finding that birth order had significant association with age appropriate measles vaccine, as orders increase delayed vaccination among children increase [29]. Sex of child not significantly associated, while study conducted in Senegal found that female more likely to have timely vaccination with measles vaccine [30]. Family income has no

effect on the extent of coverage of the appropriate age for the vaccine, while a number of studies had a different opinion. Like study conducted by Geweniger& Abbas (2020) they found that income has an effect on the vaccination status [31].In the research maternal heath utilization (pregnancy status, ANC attendance and TT status) not associated with vaccination status but it's opposite to study found that maternal health utilization and complete tetanus toxoid vaccination significantly effecting the vaccination status [32][33].

4. Conclusion and future scope

Our research revealed that a significant number of children experienced a delay in receiving their measles vaccination. Out of the 388 children included in the study, only 68.61% received the measles vaccination at the appropriate age. However, we found the father's education level, the number of children in the family, and the birth order of the children were significantly related to timely vaccination against measles. To achieve the required timely vaccination coverage, programs implemented by health facilities must be improved. Additionally, it is crucial to consistently remind parents of the significance of this issue and the potential repercussions of delayed vaccination on their child's immunity.

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