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ORIGINAL ARTICLE

The reasons behind incomplete children vaccination in a sample from Iraqi society

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Abstract

Objective: This study was conducted to assess the prevalence of incomplete vaccination among children aged under 15 years and the factors associated with it.

Method: A cross-sectional study was conducted among 330 children who visited the main two teaching hospitals in Al-Kut City (Al Zahraa Teaching Hospital 'the 6th-floor' and Al Karama Teaching Hospital), in addition to three Primary Healthcare Centers (PHCCs) (Abdullah Ben Rawaha, Al Hakeem, and Badra) in Al-Kut City/ Wasit Province/ Iraq. Data were collected using a modified and translated questionnaire from a previous study.

Results: The number of children who got the vaccine in their lives was 85.2%, and only 50% of them mentioned completing the vaccine schedule. The main cause of non-compliance was the long-distance walking to the health center (70.3%). Children who were eligible but didn't receive the vaccination (60%) due to factors like doctor refusal. More than half (55.2%) mentioned a lack of awareness regarding the schedule. Complications were noted in only 10.9%, with the highest percentage complaining of elevated body temperature (6.1%). There is a significant association between the vaccination status of children and their ages, monthly family income, parents' education, and residency (P value < 0.001). Gender was also associated with (P-value =0.002).

Conclusion: In this study, a higher percentage of children didn't receive their routine vaccines as recommended by health facilities, and this may relate to many factors like age, gender, family income, and parents' educational level. These results are of great value in planning for increasing vaccination coverage.

Keywords: Barriers, Children vaccination, Immunization, Iraq

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INTRODUCTION

Immunization is the process of artificially inducing immunity through vaccination (active immunization) or the administration of antibodies (passive immunization). Vaccination is the administration of any vaccine or toxoid (inactivated toxin) for the prevention of disease [1].

Over the years, studies have shown the effectiveness of vaccination as the most effective public health measure to prevent vaccine-preventable diseases (VPD), especially in children [2, 3]. Vaccines save 2 to 3 million lives annually [2], and they save lives from many diseases, such as diphtheria, tetanus, whooping cough, influenza, and measles [4, 5]. Worldwide, smallpox was eliminated, with a 94% reduction in the incidence of poliomyelitis, and a 94% reduction in neonatal tetanus, in addition to eliminating disease, disability, and death from common childhood diseases [6]. About 29% of deaths among children under five years of age can be eliminated and prevented by vaccines worldwide [7, 8]. The Expanded Program on Immunization (EPI), launched in 1974, has improved the survival and health of children worldwide. The goal is to provide at least 95% of children with the basic vaccination series [9].

Since 1983, the Global Advisory Group (GAG) of the World Health Organization (WHO) Expanded Program on Immunization (EPI) has advised program managers to explore ways to reduce missed vaccination opportunities. A straightforward strategy to increase vaccination coverage is to vaccinate all eligible children in any case. To achieve and maintain high vaccination coverage over the next ten years, the WHO is actively encouraging member countries to adhere to the Missed Opportunities for Vaccination (MOV) strategy. When people eligible for vaccination visit a health facility but do not receive the necessary vaccinations, it is called MOV. According to WHO recommendations, children are considered fully vaccinated when they receive the following vaccines: BCG against tuberculosis, three doses of pentavalent vaccine (DPT HepB Hib), PCV against polio, two doses of Rotavirus, and a measles vaccine. Before the age of 12 months, children who have missed at least one dose of these vaccines are considered to have received incomplete vaccination [10].

According to the WHO, global vaccination coverage has decreased from 86% in 2019 to 81% in 2021. In addition, it is reported that in 2021, approximately 25 million children under one year did not receive basic vaccines, 19.9 million children did not receive recommended doses of vaccination, and the number of unvaccinated children has increased by 5 million since 2019. Thus, reaching high vaccination coverage remains one of the most pressing public health problems worldwide, especially in low- and middle-income countries [11, 12]. In addition, vaccination dropout rates in Asian and African countries remain stable from year to year [13]. The WHO said that Iraq was one of the 10 countries where 70% of children under one year of age have not received diphtheria, tetanus, and pertussis (DTP3) [14]. According to WHO and UNICEF reports, the highest estimated vaccine coverage in Iraq during 2023 was for DPT1 (97%) followed by BCG (93%), while it was only (51%) for both HepB and MCV2 [15]. Despite its widespread use, low vaccination rates have been recorded even in developing countries. Failures or delays in vaccinating children in high-risk

groups can limit the impact of vaccination programs on disease burden [16]. It is necessary to identify the determinants associated with the lack of vaccination to inform and optimize interventions. Several studies, mostly based on the Demographic and Health Survey (DHS), have examined these determinants and found common factors associated with non-vaccination, for example: low monthly family income, low family education, young maternal age, and distance from the health facility. In all cases, they have not studied the risk factors after vaccination, and some factors may be specific to the vaccine administered at birth [17-19].

Although vaccination services are provided free of charge in Iraq, comprehensive vaccination coverage remains low. Geographical variation was noticed in different places in Iraq; some met the optimal coverage of EPI, while others were still under the threshold necessary to save children from VPD [20]. This may be related to some obstacles that vary in different places. Including maternal age, low family income, low educational level for both parents, lack of proper information, and distance from healthcare services [21,22]. The overall prevalence of incomplete vaccination coverage in Al-Kut has not yet been studied, and the reasons for non-utilization of vaccination services remain poorly understood and documented. Therefore, this study aims to determine the prevalence of incomplete vaccination among children under 15 years of age in Wasit Province and identify the key determinants of underutilization of vaccination services. Specifically, the study seeks to answer the following research questions:

1. What are the key socio-cultural, economic, and logistical barriers influencing parental decisions regarding childhood vaccination in Al-Kut, Wasit Province?

2. How do healthcare accessibility, provider communication, and parental misconceptions act as barriers to childhood vaccination completion in Al-Kut?

By addressing these questions, this study will provide essential insights into the factors contributing to incomplete vaccination and help develop effective strategies to improve vaccination coverage, reduce vaccination failure rates, and ultimately decrease the burden of infectious diseases among children.

METHODS

Study design and setting:

This cross-sectional study was conducted among children in AL-Kut City/ Wasit Province/ Iraq. The target population in this study was children who visit the main two teaching hospitals in the city (Al Zahra Teaching Hospital 'the 6th-floor' and Al Karama Teaching Hospital), in addition to three Primary Healthcare Centers (PHCCs) (Abdullah Ben Rawaha, Al Hakeem, and Badra). The data was collected from the beginning of March till the 28th of April 2024.

Sampling and sample size:

The sample size was calculated according to the cross-sectional study design equation for sample size (n = Z2 P (1-p) / d2). Z is the value of the standard normal distribution (Z =1.96). Considering (P) prevalence of MOV in Iraqi children was 31.6% [23], degree of precision =0.05, and power of the study =80%. The calculated required sample was 330. A convenient sample of parents who have children who met the inclusion criteria

was included in this study while visiting the selected places for data collection with their children. A convenient sample (non-probability sampling technique) was used to collect the required sample size by choosing suitable and available participants while they were inpatients, waiting to see to doctor, or in other places like pharmacies of the selected hospitals and PHCCs.

Inclusion criteria:

Children of both sexes who were under the age of 15 years old and visited the selected places during the study period for different reasons were included.

Exclusion criteria:

Children who were too ill or whose parents were harry to wait to complete the questionnaire and those whose parents' refused participation were excluded from the study.

Data collection tool:

A self-assessment questionnaire was given to parents who could read the questionnaire and answer the questions. Parents who could neither read nor write were interviewed by the researchers themselves. The questions included in the questionnaire were adapted from a previously published study that already tested for reliability [24], with some modifications to be clearer and more suitable to the Iraqi community. It was prepared in English and then translated into Arabic (by a language expert) to make it easier and convenient for the parents of the participants to understand. Experts in community medicine evaluated the questionnaire, and it was pretested with 5 parents before the final data collection for the validity and reliability of this tool.

The questionnaire consisted of two parts:

Part 1: was designed to collect information about socio-demographic data like age, sex, the sequence of the child between his/her Siblings, number of Siblings, the place of residence, monthly family income, and the level of education of both father and mother.

Part 2: was designed to collect information about the immunization status of the child and factors related to missed opportunities of immunization (distance from the child's house to the health center, child's health status on the day of vaccination, the availability of vaccine, the staff training, and if there are any previous complications when taking vaccine.... etc.).

Statistical analysis:

Data were analyzed by the Statistical Package for Social Sciences software program (SPSS), version 26. Categorial variables were presented by frequency and percentage. The association between different variables was assessed by either the Chi-square test or Fisher's Exact test. The significant P-value was less than 0.05.

The dependent variable in this study is the vaccination status. The independent variables were Sex, age, residence, monthly family income, level of education of both parents, child sequence among his siblings, and children number.

RESULTS

The results of this study were based on the analysis of 330 samples of children whose parents completed filling out the questionnaires. Those children were divided into two groups: those who completed their

vaccinations and those who did not complete their vaccinations.

The sociodemographic characteristics of the study participants (Table 1) show that most of the parents who filled out the questionnaire were mothers (70%). More than half of the participating children were males (54.5%). The majority of the participants' ages range between 0-7 years (81.2%). Nearly two-thirds of the participants lived in urban areas (65.5%). Moreover, the family's monthly income was more than 750 $ in nearly half of the samples (49.1%).

Table 1. Frequency of socio-demographic structures of the 330 participants

Variables		n	%
Parent who fills out the questionnaire	Father	99	30
	Mother	231	70
Sex	Male	180	54.5
	Female	150	45.5
Age (years)	≤ 3	141	42.7
	4-7	127	38.5
	8-11	52	15.8
	≥ 12	10	3.0
Place of residence	Urban	216	65.5
	Rural	114	34.5
Family monthly income (USA $)	< 250	47	14.2
	250-499	52	15.8
	500-749	69	20.9
	750-1000	86	26.1
	>1000	76	23.0

The educational level of the participants is shown in Table 2. Nearly half of the mothers (47.6%) were Illiterate or (read and write) or had graduated from primary school. Nearly one-third (28.2%) had having college and above education. Of the fathers, more than half (52.4%) had having college and above education.

Table 2. Educational level of the study participants

Educational level	Mothers		Fathers	
	n	%	n	%
Illiterate or read and write	93	28.2	51	15.5
Primary school	64	19.4	33	10.0
Intermediate school	39	11.8	36	10.9
Secondary school	41	12.4	37	11.2
College and above	93	28.2	173	52.4

Figure 1 illustrates the overall number of siblings in the families. More than half of the families had 1-3 siblings (54.5%), and few had more than 7 siblings (6.1%).

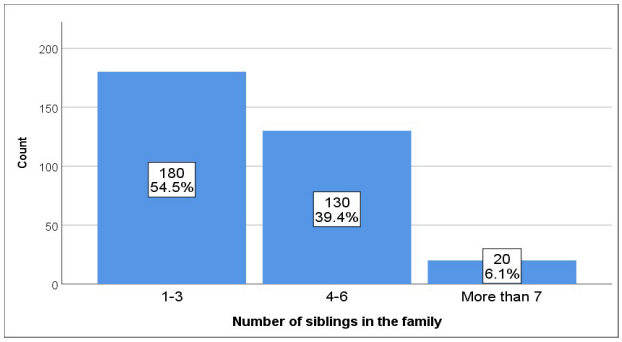

Figure 1. Number of siblings in the families of the participants

Figure 2 illustrates the sequence of the child among his siblings. It shows that around three-quarters of the children ranged from the 1st to the 3rd (70%). Only 2.7% had the 7th sequence and above.

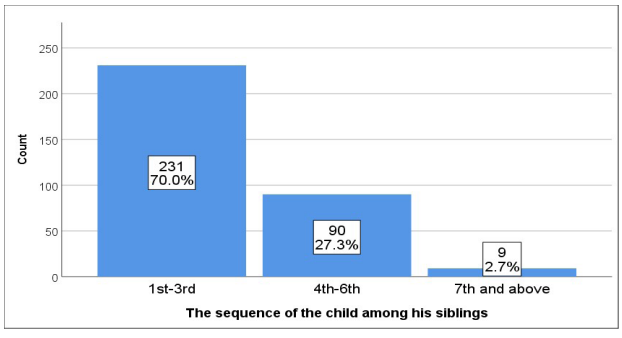

Figure 2. The sequence of the child among his siblings.

Out of 330 samples that were selected, the majority of the participants were vaccinating their children in general (85.2%). As for the children included in the questionnaire, half

of those registered were taking their vaccines regularly according to the schedule of the health center, and the other half were not taking them as required, as shown in Table 3.

Table 4 shows whether children received their routine vaccinations as recommended by the health center in association with their demographic features.

Table 3. Vaccination history of the children.

Vaccination history		n	%
Did you vaccinate your children at all?	Yes	281	85.2
	No	49	14.8
Did this child receive his routine vaccines as recommended in the primary health care center?	Yes	165	50
	No	116	35.2

Table 4. The association between childhood vaccination and socio-demographic data

		Yes		No		
		n	%	n	%	
Sex	Male	76	42.2	104	57.8	**0.002**
	Female	89	59.3	61	40.7	
Age (Years)	0-3	49	34.8	92	65.2	**<0.001**
	4-7	74	58.3	53	41.7	
	8-11	36	69.2	16	30.8	
	12-15	6	60.0	4	40.0	
Residence	Urban	143	66.2	73	33.8	**<0.001**
	Rural	22	19.3	92	80.7	
Monthly family income (USA $)	<250	1	2.1	46	97.9	**<0.001**
	250-499	11	21.2	41	78.8	
	500-749	33	47.8	36	52.2	
	750-1000	60	69.8	26	30.2	
	>1000	60	78.9	16	21.1	
Level of education of the mother	Illiterate/ read and write	15	16.1	78	83.9	**<0.001**
	Primary school	27	42.2	37	57.8	
	Intermediate school	24	61.5	15	38.5	
	Secondary school	28	68.3	13	31.7	
	College and above	71	76.3	22	23.7	
Level of education of the father	Illiterate/ read and write	5	9.8	46	90.2	**<0.001**
	Primary school	4	12.1	29	87.9	
	Intermediate school	15	41.7	21	58.3	
	Secondary school	20	54.1	17	45.9	
	College and above	121	69.9	52	30.1	
Child sequence among siblings	1st-3rd	117	50.6	114	49.4	**0.481**
	4th-6th	42	46.7	48	53.3	
	7th and above	6	66.7	3	33.3	
Children number in the family	1-3	90	50.0	90	50.0	**0.158**
	4-6	61	46.9	69	53.1	
	More than 7	14	70.0	6	30.0	

The highest percentage of female children received their vaccines as recommended by primary health centers (59.3%) and those between the ages of 4-7 years (58.3%), as well as those who lived in urban areas (66.2%). Those with a good monthly family income of 750_1000$ and above 1000$ were (69.8%) and (78.9%) respectively. The table also shows the extent of the influence of the educational level of the parents, as the rate of consistency in vaccinating children increases with the increase in the educational level, whether for the mother or the father as it shows that a greater proportion of vaccinated children had parents with a college education and above, for the mothers (76.3%) and the fathers (69.9%). A significant association was found between the vaccination status of the children and their sex, age, residency, family income, and parent education.

For those children who didn't complete their vaccination (165), Table 5 illustrates the possible causes leading to non-adherence to the recommended vaccination schedule. The most frequently mentioned causes were long-distance walking to the health center (70.3%), followed by children going to the health center at the time of appointment but returning home without vaccination (60%) then the lack of information about the days for vaccination (55.2%). Respondents who were concerned about the vaccine's safety were (40.6%). Only 7 (4.2%) parents mentioned being ill on the day of immunization as a cause of non-compliance with the routine vaccination schedule.

Table 5. Logistical factors affecting compliance with childhood vaccination schedule.

Possible causes of incomplete vaccination	**Yes**		**No**	
	n	**%**	**n**	**%**
The presence of health centers in the city or village	127	77	38	23
Vaccination campaigns reach the area	141	85.5	24	14.5
Have a concern about vaccine safety	67	40.6	98	59.4
Engaged in work or have no time to accompany the child to receive the vaccine	57	34.5	108	65.5
Long waiting time at the health facility	50	30.3	115	69.7
The vaccine was not found on the appointment day, so I received the vaccine the next day.	23	13.9	142	86.1
The child's ill health at the time of immunization	76	46.1	89	53.9
Lack of information about the days for vaccination	91	55.2	74	44.8
Forget the days of immunization	56	33.9	109	66.1
Long-distance walking to the vaccination center	116	70.3	49	29.7
Parents' illness on the day of vaccination	7	4.2	158	95.8
Lack of money	19	11.5	146	88.5
The child came to a health facility or outreach site and did not receive the vaccination for which he was eligible	99	60	66	40
Among the 99 who mentioned not receiving vaccines although going to health centers, the reasons were:	**n**		**%**	
There was no vaccine in that center	9		9.1	
There was no specialized staff	21		21.2	
The doctor didn't accept child vaccination	65		65.7	
The vaccine was expired	4		4	

Among the 99 who mentioned not receiving vaccines although going to the health center, for most of them, the reasons were the doctor didn't accept child vaccination (65.7%) followed by a lack of specialized staff in the health center (21.2%).

Even though 147 incompletely vaccinated children showed no previous complications, the other children (n=18, 10.9%) complained of one or more of those complications. The main complication was elevated body temperature, which was a complaint among 15 children, while rash and fever were complaints among 2 children, and only one child had abdominal pain as shown in table 6.

Table 6. Previous complications among the participants.

Presence of previous vaccine complications		n	%
Previous complications in the same child or other children	Yes	18	10.9
	No	147	89.1
	Total	165	100.0
From the total (165) who didn't complete their child vaccination, the complications that appeared are:	Abdominal pain and allergy	1	0.6
	Elevated body temperature	15	6.1
	Elevated body temperature and rash	2	0.6

Table 7 illustrates the perception of the respondents for the reasons behind incomplete vaccination. The highest percentage of the participants agreed that the lack of accessibility to a health facility was the most important contributing factor among them (38.5%), followed by receiving warnings from neighbors and relatives about the danger of vaccines (35.8%). Only one-quarter of them mentioned migration from the place of original residence to another place (25.7%).

Table 7. Perception-based factors for reasons behind incomplete vaccination

Perception of reasons behind incomplete vaccination	Responses (Yes)		Percentage of Cases (165)
	n	%	
Migration from the place of original residence to another place	46	25.7	27.9
The accessibility to a health facility with immunization facilities was poor	69	38.5	41.8
Receiving warnings from neighbors or relatives about the danger of vaccines	64	35.8	38.8
Total	179	100.0	108.5

DISCUSSION

Vaccination is one of the most effective and cost-effective health interventions. The factors that determine incomplete vaccination are complex. This study aims to evaluate the most common reasons for not completing the vaccination schedule among children in a sample of Iraqi society.

The results of this evaluation can help open a new perspective for future research that will go beyond recognizing these reasons and evaluate to reduce and overcome the difficulties faced by such a challenge.

In the present study, most of the parents who completed the questionnaire were mothers. This can be explained by the fact that the mother is the one who is closest to the children, whether in hospitals or health centers. Most of the participants live in urban areas since

the questionnaires were distributed to a greater extent in the city center and to a lesser extent in rural areas. Most of the parents had a good monthly family income based on their educational level, which was well above high school. Most of the children's sequence among their siblings run between the 1st-3rd sequence (70.0%); this was consistent with the study conducted in Ethiopia[7].

In this study, about half of the children studied stated that they were fully vaccinated; this result is lower than that reported by UNICEF Iraq statistics in 2015 (72%) [25] and by the Department of Primary Health (PHCD) / MOH in 2014 (73%) [26]. In comparison to other countries in the region, the UNICEF statistical report in 2015 shows the following results: Saudi Arabia (96%) [27], Jordan (98%) [28], Turkey (97.6%), and Syria (58%) [25].

Vaccination coverage: In general, according to the results of the questionnaires distributed to selected families, the percentage of vaccinated children in each family reached (85.2%). This can be related to the cultural and scientific levels of these families. In addition to the distribution of educational and guidance campaigns by the Iraqi Ministry of Health on the importance of vaccination in overcoming diseases and protecting their most important risk factors, as well as the fact that vaccination is free in Iraq. Other researchers in Iraq reported percentages of children who were not vaccinated at all, (0.5%) [29] and (6%) [30], which is lower than what was reported in this study (14.8%). Another study in Baghdad [30] found that 22.3% of children were not vaccinated. Much higher rates were reported by other researchers outside Iraq: Prakash in India in 2006 (35%) [31] and Nisar in Pakistan in 2007 (30%) [32]. This diversity may be due to differences in study contexts, sampling techniques, and the fact that these studies were conducted in poor urban areas where most children come from families with low socio-economic status.

Age and gender:

The results of this study show a significant relationship between vaccination status with children's gender and age. The percentage of incomplete vaccinations decreased with age, reaching a maximum in the age group of 0 to 3 years (65.2%), then decreasing after the age of 3 years, The fact that the parents might perceive that certain vaccines are less critical for older children, especially if the child is healthy or if they have already received some vaccinations also younger children often have more frequent healthcare visits due to routine check-ups, while older children may see healthcare providers less frequently, leading to missed vaccination opportunities. The percentage of incomplete vaccinations is significantly higher among males (57.8%) than among females (40.7%). On a broader scope, boys are more likely to get vaccinated due to social and cultural aspects [4]. However, in certain areas, girls could potentially have better coverage. In some households, it is believed that males are "stronger," so they are less likely to be afflicted by sickness, which creates an excuse for not vaccinating them to the same degree as girls. A study conducted in Baghdad, Al-Karkh region, reported that the percentage of incomplete vaccinations reaches its maximum in the age group from 12 to 24 months (43.7%) and that the percentage of incomplete vaccinations is significantly higher in males (55.7%) than in females (44.3%) [33]. Some studies found no direct effect of gender on a child's vaccination

status, like that conducted in 165 countries by Fuertes [34].

Parents' education:

Regarding maternal education, the study found a statistically significant relationship between vaccination status and maternal education ($P < 0.001$). The percentage of incompletely vaccinated children was high among children of mothers with little education (83.9%) and mothers who are illiterate or only able to read and write. This percentage decreased among children whose mothers had secondary or higher education. In contrast, other studies have shown that the percentage of unvaccinated children was high among children of highly educated mothers (47%), and the percentage of unvaccinated children was higher among children of working mothers (governmental employees) (51.4%) [33]. Many other studies confirmed the results of this study and found that the majority of incompletely vaccinated children came from parents with a low level of education [23_30, 33]. Public health education is a well-defined way to encourage the population to healthy behaviors and involvement in preventive measures. Internet, as it is widely used by people, can serve as an excellent tool in focusing on vaccine-related awareness gaps, distributing children's vaccination schedules for parents, and answering any questions that may arise about the vaccination efficacy and side effects [35, 36].

Number of children in the family:

In the present study, there was no statistical association between the number of family members and vaccination status. Although extended families with more than 7 children seem to have a higher rate of complete vaccination of their children, this contradicts many other studies that have found a significant association with the number of family members and children [7, 8, 10, 11, 17, 33].

Reasons for incomplete vaccination:

Half of the collected samples were from children who did not complete the vaccination schedule for several reasons, the most frequent was the long distance between the vaccination center and the child's place of residence. In this study, it was found that there was an inverse relationship between the distance of the health center, the beneficiary's home, and the vaccination status (70.3%) of children who did not complete the vaccination schedule. This may be because, according to them, the family does not have private transport to go to the vaccination center or a long distance to walk. The study also found that the lack of family information about the schedule and days of vaccination is an important factor in the failure to vaccinate children (55.2%), possibly due to the loss of the vaccination card. In addition, professional engagement contributed to 34.5% of the reasons. Migration from the original place of residence to another place contributed to (25.7%) of cases and attributed several reasons to warnings received from neighbors or relatives about the risk of vaccines (35.8%). Among the children who are not vaccinated despite visiting the health center, most are not vaccinated by the specialist doctor, this is because of their illness (65.7%). A smaller percentage did not receive vaccines due to the lack of specialized personnel for vaccination (21.2%) and the unavailability of the vaccine at the vaccination appointment, which only accounts for approximately (9.1%) of all reasons. In comparison, another researcher

in Iraq found that the main reasons for delaying vaccination are social commitments and busy family responsibilities (63.4%). When a mother/family experiences a social event such as death or illness, participation in a vaccination exercise becomes a matter of lower priority. The second reason was the change of residence, which represents approximately (35.5%) of the causes; people move within the country (internal movements, 24%) and between countries neighbors (external movements, 11.4%). This migration is associated with low vaccination coverage, which may be due to the poor social integration of migrant populations. The third reason for incomplete vaccination is childhood illness (24.6%); of them (71.4%) are due to the decision of the family, and the rest (28.6%) due to the medical opinion in the health center on the day of the vaccination, which is considered as a reason for the lack of vaccination opportunity. The second reason for not having the opportunity to be vaccinated was the unavailability of the vaccine at the vaccination appointment, which only accounts for approximately (5%) of all reasons. In some cases, several reasons have been mentioned, and considerable overlap has been observed [33]. In Nigeria, a study of rural Nigerian children in 2021 found that the reasons were: concern about the safety of the vaccine (38.8%), long journey (17.5%), long waiting time (15, 2%), lack of money (10.6%), lack of personnel (5.4%), childhood diseases (3.6%), lack of vaccine (3.5%) and about (5%) others [1]. An Indian study was conducted in the urban slums of Agra district in 2022 to demonstrate the biosocial factors associated with routine immunization coverage shows that (98.6%) of incompletely vaccinated children live in neighborhoods that are not covered by the Integrated Child Development Services (ICDS) program, (81%) came from large families, (60.5%) were born in state hospitals, (71.4%) had illiterate mothers, and (30%) of them lived more than one kilometer from the nearest health institution [19]. The diversity mentioned between the current study and comparable studies may be due to the difference in the sampling frame and to the differences in the socioeconomic and security levels where these studies were carried out. Health sector policymakers can use these data for improvement in vaccination coverage by increasing awareness campaigns. It helps track vaccination rates, identifying trends and gaps in coverage. This is crucial for controlling vaccine-preventable diseases. By identifying specific populations or areas with low coverage, health authorities can design targeted outreach and education programs to improve vaccination rates. Understanding coverage disparities can help ensure that vulnerable populations receive the necessary vaccinations and promote health equity. Effective research can guide healthcare centers in optimizing their resources and staffing for vaccination efforts. Identifying obstacles can help direct resources and action.

Limitations:

The limitations of this study can be summarized as follows: First, there may be other possible factors that can influence vaccination that were not considered in this study. In addition, this study did not include a qualitative method to answer the questions "Why?". Second, when the vaccination cards were not available, the vaccination records were based on the self-reports of the caregivers, which led to a risk of recall bias that is not unique to this study. Bias can also be stated because the survey was

administered to illiterate people by others. Finally, this study included a relatively small sample and focused on visitors to hospitals and primary health centers and mainly those who lived in urban places. This may be caused by a non-probability sampling technique, which may limit the generalizability of the study results and their implications for all children and all health parameters of the reference population of the provinces of Iraq. Despite the limitations mentioned above, the results are important for understanding the obstacles to full immunization coverage in children.

CONCLUSION

Although a large percentage of the participating children received vaccinations, the majority did not follow the proper schedule due to various related factors. There is a need to promote and sensitize people about the importance and positive effects of vaccination as well as the negative effects of not fully vaccinating.

Future studies need to understand the role of culture, how vaccines are perceived, and how willing people are to receive them. Also, it will be useful for understanding the contributions of community leaders and organizations toward promoting vaccine uptake. An assessment of the impact of health communication strategies and campaigns on improving vaccine coverage, analyzing the impact of social networks and other means of mass communication and disinformation on the vaccination attitude and decision-making process vis-à-vis vaccination needs to be done. In addition, there is also a need to properly address the underlying factors that contribute to vaccine hesitancy and the ways through which acceptance of vaccines can be increased. To enhance the generalizability of the results, we recommend a future studies employ probability sampling methods to ensure a more representative sample of the population. Participants from all Iraqi provinces, including equal representation from both urban and rural areas, are essential to understanding the factors influencing incomplete vaccination across different demographic and geographic contexts.

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Ethical Declaration: Official approval and permission to conduct this study were obtained from the ethics committee of the Faculty of Medicine of Wasit University. Verbal consent was obtained from each respondent (parent) before data collection, and then the objective of the study was explained. The names of the participants are not recorded, and all forms of questionnaire data are kept secure and used only for research purposes.

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Author Contribution: Concept: TMJT, SID, SBAA, Design: TMJT, SID, SBAA, Writing: TMJT, SID, SBAA, Data collection: TMJT, SID, SBAA, Data analysis: TMJT, SID, SBAA, Revising the manuscript critically: TMJT, SID, SBAA, Final approval: TMJT, SID, SBAA.

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