

# Influence of Health Providers on Pediatrics' Immunization Rate

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## Summary

**To identify the immunization providers' characteristics associated with immunization rate in children younger than 2 years. A cohort and a cluster sampling design were implemented; 528 children between 18 and 70 months of age were sampled in five public health clinics in Mosul-Iraq. Providers' characterizations were obtained. Immunization rate for the children was assessed. Risk factors for partial immunization were explored using both bivariate analyses and multi-level logistic regression models. Less than half of the children had one or more than one missed dose, considered as partial immunization cases. The study found significant association of immunization rate with provider's type. Two factors were found that strongly impacted on immunization rate in the presence of other factors: birthplace and immunization providers' type.**

**Key words: immunization rate, Iraqi child, partial immunization, provider's characteristics.**

## Introduction

The immunization system is a successful systematic programme, especially during the last century. However, the immunization system is still imperfect because many countries still have unvaccinated children [1–5].

Mosul is the second largest governorate in Iraq after the capital city of Baghdad. According to the report of the Iraqi Health Directory in this governorate, an estimated 116 076 children in the year 2008 still needed to be vaccinated with all of the vaccines listed in the immunization schedule. The same report also showed that the first dose of the hepatitis B virus vaccine (HBV) had the highest percentage (99.71%)

of vaccines received by children, while the third dose of the same vaccine (HBV) had the lowest percentage (74.8%) of vaccines received by children [6].

Health-care providers play an important role in child immunization [7–9]. Familial knowledge and practices regarding vaccination mostly depend on vaccination providers for guidance on immunization timing and administration. In addition, immunization providers have positive effects on parental decisions related to vaccinations. Parents' decisions regarding immunization can impact immunization rates, including access to vaccinations, the communication of risks and benefits, the maintenance of accurate vaccination records and strategies for vaccination reminders [8, 10–12].

The continuity of immunization or health care by a single immunization provider is very important for decreasing parental disturbance by many immunization providers. Children who complete their immunization schedule with a single provider are more likely to have full immunization compliance than those with more than one immunization provider. Mennito and Darden [11] found that children who were immunized by multiple vaccine providers had lower rates of up-to-date immunizations than those with only one vaccine provider.

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There are many types of immunization provider that differ from country to country. The immunization facilities also differ according to immunization provider types. One study in the USA showed that the paediatricians are more likely than family physicians or general practitioners to administer vaccines as recommended by national guidelines. Also, paediatricians are more likely to refer patients to a common source for vaccine information, whereas family physicians and general practitioners cited a wide range of resources [10]. Mennito and Darden [11] also found that children who were immunized in a public or hospital-based facility were less likely to have full immunization compliance than those in a private facility and those who received vaccines in a mixed facility type were twice as likely to have up-to-date immunizations. Another study in Turkey showed that children who were immunized in peripheral health centres were more likely to have full vaccination coverage than children who were immunized in central health centres [12].

### Material and Methods

A cohort study design was chosen to determine the association of immunization rate with immunization providers' characteristics. Each child had an immunization card for recording details of the immunizations received. The data from the immunization cards and from the parents were, retrospectively, extracted to obtain the immunization history of each individual child. Five health clinics in different areas were selected in Mosul city, Iraq. Approximately, 25 children attend these health clinics per day.

In this study, the data collection form consisted of two parts: (i) immunization schedule of the children; (ii) immunization providers' characteristics. A child must receive the following vaccines by 2 years of age: one BCG dose, four or five polio vaccine doses (OPV), four DTP vaccine doses, three HBV vaccine doses and one MMR vaccine dose (Table 1).

The immunization status of the children was classified into 2 groups depending on immunization completeness: complete immunization and partial immunization. When a child received all immunization

doses without any missed dose, this child was considered to have had complete immunization, whereas if a child missed at least one immunization dose, this child was considered to have had partial immunization.

Approval from the Ministry of Health—Iraq was obtained before data collection was started. A cover letter including an information sheet describing the study objectives and the time required to fill out the questionnaire was given to all parents with an attached consent form. The collection of immunization schedule information from the children's immunization cards was the first step, whereas the parent interviews were the second step. The data collection was carried out during public health clinic days.

### Statistical analysis of the data

The data were analysed using the Statistical Package for Social Science (SPSS) for windows version 15.0 and the level of significance was set at  $<0.05$  for all analyses. The chi-square test was used to measure the association between nominal variables. Multivariate binary logistic regression analysis was used to find the factors that predicted complete compliance. Adjusted odds ratios were used.

### Result

In all, 282 children were immunized with all vaccination doses. These children were considered as having had complete immunization, but less than half of the children had one or more than one doses missed and were considered as having had partial immunization.

This study did not find any significant association between immunization completeness and the number of immunization providers and birthplace, as shown in Table 2. However, there was a significant association between immunization completeness and provider type ( $p < 0.05$ ). This study also showed that the majority of the children were immunized in public institutions.

By using logistic regression, two factors were found to be strongly associated with immunization completeness in the presence of other factors. The birthplace was significantly associated with immunization completeness, where children who

TABLE 1  
*Immunization schedule in Iraq*

Vaccine type	Age (months)						
	At birth	2	4	6	9	15	18
BCG	First						
HBV	First	Second		Third			
DTP		First	Second	Third			Fourth
OPV	First	Second	Third	Fourth			Fifth
MMR						First	
Measles					First		

TABLE 2  
Associations between immunization completeness and immunization provider's characteristics

Provider's characteristics	Immunization completeness (%)		Total (%)	<i>p</i>
	Partial immunization	Complete immunization		
Number of provider				0.184
1	193 (79.8)	213 (74.5)	406 (76.9)	
>1	49 (20.2)	73 (25.5)	122 (23.1)	
Providers types				<0.001 <sup>a</sup>
Private clinic	8 (3.3)	2 (0.7)	10 (1.9)	
Public clinic	191 (78.9)	177 (61.9)	368 (69.7)	
Government hospital	6 (2.5)	40 (14.0)	46 (8.7)	
Private clinic and public clinic	15 (6.2)	31 (10.8)	46 (8.7)	
Private clinic and government hospital	8 (3.3)	21 (7.3)	29 (5.5)	
Public clinic and government hospital	14 (5.8)	15 (5.3)	29 (5.5)	
Birthplace				0.052
General hospital	78 (32.2)	106 (37.1)	184 (34.8)	
Maternity hospital	144 (59.5)	166 (58)	310 (58.7)	
Maternity home	10 (4.2)	12 (4.2)	22 (4.2)	
Home	10 (4.1)	2 (0.7)	12 (2.3)	
Total, <i>n</i> (%)	242 (100)	286 (100)	528 (100)	

$\chi^2$  test.

<sup>a</sup>*p* < 0.05

TABLE 3  
Predictors of immunization completeness in children

Factors	<i>p</i>	OR (95% CI)
Provider number		
(>1 vs. 1)	0.266	0.518 (0.16–1.65)
Providers types	<0.001 <sup>a</sup>	
Public health vs. private health	0.061	5.179 (0.92–29.02)
Hospital vs. private health	<0.001	89.903 (11.46–704.8)
Private health–public health vs. private health	0.017	13.651 (1.6–116.47)
Private health–hospital vs. private health	0.002	36.236 (3.69–355.82)
Public health–hospital vs. private health	0.014	17.196 (1.79–164.33)
Birthplace	0.01 <sup>a</sup>	
Home vs. maternity home	0.068	6.564 (0.87–49.4)
Maternity hospital vs. maternity home	0.026	6.802 (1.26–36.71)
General hospital vs. maternity home	0.004	12.992 (2.30–73.12)

Logistic regression test.

<sup>a</sup>*p* < 0.05.

were delivered in the general hospital had a greater chance of immunization completeness [odds ratio (OR)=12.9, 95% confidence interval (CI)=2.30–73.12, *p*=0.004]. In other words, children who were born in general hospitals were 12.9 times more likely to receive complete immunizations than children born in maternity homes, and children who were born in maternity hospitals were 6.8 times more likely to receive complete immunization than children born in maternity homes (OR=6.8, 95% CI=1.26–36.71, *p*=0.026), whereas there was no significant difference between home and maternity home births. The logistic regression also revealed

a significant association between immunization completeness and clinic type. Children immunized in hospitals were 89.9 times more likely to receive complete immunization than children immunized in private clinics (OR=89.9, 95% CI=11.46–704.8, *p*<0.001), whereas there was no significant difference between children immunized in public health and private health clinics, as shown in Table 3.

### Discussion

Partial immunization might be due to a lack of vaccination information among parents or providers.

Inadequate information on vaccination status may lead to inappropriately timed or missed immunizations, resulting in decreased protection against diseases, increased side effects and increased costs [13, 14]. In addition, partial immunization may have been due to the immunization card or clinical records not providing a clear and complete immunization record. The immunization card is very important for the immunization provider to be able to determine which vaccination is due on a child's visit. In addition, the immunization card is important for parents to be able to determine or check their child's immunization status [2, 14].

Immunization providers were changed due to various reasons, such as the family moving from one area to another or the family not being satisfied with the first provider and preferring the second or third immunization provider. Study finding is consistent with the results of previous studies in the USA [11] and China [15], in which 68.3% of American children and 52.8% of Chinese children were vaccinated by one vaccination provider, whereas another study in the USA showed that the majority of children were vaccinated by two or more vaccination providers.

This study shows that the Iraqi families preferred government institutions (public clinics, government hospitals) to other immunization provider types due to the fact that immunization is provided free of charge in government institutions and the fact that families trust vaccines that have been imported by the government. This result is in agreement with the results of a study in Turkey [16], where 95% of the children were vaccinated in primary health-care centres supported by the government. However, the results of the present study are not consistent with those of studies in the USA [11, 17], in which the majority of the children were vaccinated in private clinics. In the USA, the parents have to pay for vaccinations in centres where the children are vaccinated.

Most of the parents in this study preferred to deliver their babies in a hospital than at homes, probably because they believed that hospitals could provide better care of the child and the mother. The distribution of birthplace is consistent with another study conducted in Turkey [16], in which 94.6% of the children were delivered in hospitals and 5.4% of the children were delivered at homes. Different results were found for a study in China regarding the birthplace, where 42% of the children were born in hospitals and 58% of the children were born at homes [15].

The findings of the studies suggested that the children who received all of their vaccinations from one immunization provider were more likely to have received complete immunization than children who were immunized by different providers; this would be because single provider would have full records

of the immunization and the medical history of children from birth until the time of immunization, and this would decrease immunization errors in the vaccination schedule [11, 15, 17–20]. It is noteworthy that the association between number of providers and immunization completeness was insignificant in bivariate and multivariate analyses in the current study. This unsatisfactory result might have been due to homogeneity of the data, since >75% of the children had been immunized by a single immunization provider as most of the Iraqi families had had their children immunized in the nearest clinic and did not transfer them to another clinic.

In this study, the association between immunization facility type and vaccination status was significant. In addition, the children who were immunized in government hospitals were 89 times more likely to have full vaccinations than children who received their vaccinations in private clinics. This shows that children who were born in hospitals and who received their first immunization dose in the hospital tended to continue their immunizations in the same hospital. In addition, government institutes provide free vaccinations, but the families needed to pay the cost of immunization in private clinics. The results of this study are consistent with those of other studies [16, 21, 22] in which the families preferred to have their children immunized in public hospitals rather than in private clinics; thus, the children were fully vaccinated in the hospitals. Other studies [11, 23, 24] showed that most of the children were immunized in private clinics due to a higher socio-economic class, more highly educated families and a greater interest in the well-being of their children.

After controlling for the other variables in the final multivariate analysis, birthplace was found to be associated with immunization completeness, whether it was in a maternity home or maternity hospital or a general hospital. This study found that children who were delivered in a maternity hospital were more than six times more likely to have received complete immunization than children delivered in a maternity home. In addition, children who were delivered in a general hospital were more than 12 times more likely to have received complete immunization than children delivered in a maternity home. The findings of this study is similar to the findings in China, Lebanon and Turkey [15, 16, 25], which showed that the children born at homes were more than twice as likely to have delayed immunization than children who were delivered in hospitals. The reason given was that the mothers who gave birth in a hospital usually had a greater level of education and a higher monthly income. In addition, they may have had more sources of information, such as general or private health service clinics.

## Conclusion

Improving communication between parents and immunization provider will engage the parents in decision-making; clarify the importance of immunization and highlight the value of immunization compliance. A planned educational programme is needed; the educational level of the parents needs to be taken into consideration when the programme is planned, especially as regards those with a lower educational level.

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