

# Knowledge and Attitude of Mothers Towards Childhood Vaccination in Taif, Saudi Arabia

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**Abstract—Background:** Misconceptions and inadequate knowledge about vaccination represent an important barrier against adherence to vaccination schedules.

**Objectives:** To assess the knowledge and attitude of mothers of children under five years of age with regard to standard childhood vaccination.

**Subjects and methods:** A cross-sectional study was conducted at Taif Children's Hospital (a subsidiary of the Ministry of Health), Saudi Arabia, among a sample of mothers of children aged below five years attending the hospital's outpatient clinics during the study period of May-July 2021. A valid questionnaire was utilised for data collection, comprising demographic questions as well as an assessment of respondents' knowledge and attitude towards childhood vaccination.

**Results:** The study included 397 mothers, more than half of whom (53.9%) were aged between 20 and 30 years. Overall, the total knowledge score ranged between 5 and 10, with an arithmetic mean of 9.03 and standard deviation of ( $\pm 1.25$ ). Higher-educated mothers (university or above) were more knowledgeable about childhood vaccination than lesser-educated mothers (mean ranks were 200.44 and 123.35, respectively),  $p=0.020$ . Overall, the total score for attitude towards childhood vaccination ranged between 5 and 10, with an arithmetic mean of 9.15 and standard deviation of ( $\pm 0.48$ ). Married mothers expressed a more positive attitude towards childhood vaccination than divorced mothers (mean ranks were 200.83 and 144.81, respectively),  $p=0.014$ .

**Conclusion:** The knowledge about, and attitude towards, childhood vaccination among mothers in Taif, Saudi Arabia are excellent. However, some misconceptions require correction.

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**Index Terms—**Childhood immunization, Vaccination

## I. INTRODUCTION

According to the World Health Organization (WHO), the administration of vaccines stimulates the human immune system to protect the individual against infectious diseases through a process called immunisation [1]. Immunisation is the most cost-effective intervention; it prevents nearly 3 million deaths per year and can save the lives of about

1.5 million children per year, globally [1,2]. Furthermore, it has been documented that successful immunisation reduces hospitalisation, cost of treatment, and mortality [3].

Misconceptions and inadequate knowledge about vaccination represent an important barrier against adherence to vaccination schedules. These misconceptions and inadequate knowledge cover aspects including the definition of a vaccine, its adverse effects, vaccine-preventable diseases, and development of diseases after the administration of vaccines [4].

Low rates of complete childhood vaccination still exist in many developing countries. This represents a public health problem; the United Nations Children's Fund (UNICEF) has reported that nearly one third of mortality in children under five years can be prevented by vaccination [5]. The success of childhood immunisation programmes depends on many factors, some emphasis, you could say on the improvement of parents' knowledge regarding vaccines [6]. Since parents are the primary health decision-makers for their children, their knowledge and attitude towards immunisation significantly impact the immunisation status of their children [7]. Mothers' understanding of the reasons for childhood vaccination, as well as barriers against vaccination, is crucial when it comes to designing campaigns to

improve vaccination uptake in Saudi Arabia; the present study therefore aims to investigate the knowledge and attitude of mothers of children under five years towards standard childhood vaccination.

## II. METHODS

This cross-sectional study was conducted at Taif Children's Hospital (a subsidiary of the Ministry of Health) located in the centre of Makkah Region, in the western part of Saudi Arabia. It is the fourth-largest city in the region, with an area of approximately 13,840 km<sup>2</sup>. The population of Taif Governorate was estimated at 993 800 people in the year 1435H corresponding to the Gregorian year 2013, representing 12.8% of the region's total population [8].

Participants eligible for inclusion in this study were mothers of children aged below five years who attended the outpatient clinics of Taif Children's Hospital (MOH) during the study period of May-July 2021. Mothers who did not have children below the age of five, and severely ill mothers who could not cooperate properly with the researcher, were excluded from the study.

The sample size was computed using the statistical formula for a cross-sectional survey:

$$n = Z^2XPXQ/D^2$$

based on the following values:

n: Calculated sample size

Z: The z-value for the selected level of confidence

$$= 1.96$$

P: Estimated prevalence of lowest level of good knowledge about childhood vaccination = 37.1% (0.37), based on a previous Saudi study carried out in Riyadh [8]

$$Q: (1 - P) = 62.9\% (0.63)$$

D: Maximum acceptable error = 0.05

Thus, a total of 394 mothers were invited to participate in the study, giving a sample of 358 mothers with 10% was added to the total sample size for the non-respondents. We used non-probability convenience sampling to collect data from all mothers who fulfilled the inclusion criteria, until the sample size was attained.

An interview questionnaire was used in this study, which was used previously in another Saudi study carried out in Arar [9]. It includes three main parts:

- Demographic data of participants (age, current marital status, number of children, education, job status and residence, and parent's age, education and job status).

- Knowledge assessment questions, with "yes" and "no" responses, covering various aspects of awareness and knowledge of childhood vaccination (10 questions).

- Questions regarding attitude towards vaccination (9 questions).

Before giving the questionnaires to the mothers, informed consent was requested from each of them; everyone had the right not to participate in the study or to withdraw from the study prior to completion. The researcher explained the purpose of the study to all of the respondents, and the respondents' confidentiality and privacy were guaranteed.

The data were collected and verified by hand, and then coded prior to computerised data entry. The Statistical Package for Social Sciences (SPSS) software, version 26.0, was used for data entry and analysis. We applied descriptive statistics (e.g. number and percentage) and analytic statistics using non-parametric statistical tests for non-normally distributed data, as evidenced by significant Shapiro-Wilk test. The Mann-Whitney test was applied to compare two groups, while the Kruskal-Wallis test was applied to compare more than two groups; a p-value  $\leq 0.05$  was considered statistically significant.

## III. RESULTS

### *Demographic characteristics*

The study included 397 mothers. Their demographic characteristics are summarised in Table 1. More than half of them (53.9%) were aged between 20 and 30 years, and their husbands were in the same age group (57.4%). The majority (96.7%) were currently married and 47.3% had two children, including the index one. The majority of the mothers (97.5%) and their husbands (93.7%) were university graduates or above, and living in Taif City (95.7%). Approximately half of them (50.9%) were housewives.

### *Knowledge about childhood vaccination*

All of the surveyed mothers could recognise that vaccinations play a role in child health. The vast majority were sure that vaccinations are important for their children (99.7%), were aware that even healthy children require vaccination (99.7%),

**Table I**  
Demographic characteristics of mothers (n=397)

Factors	Percent (n)
<i>Mother's age (years)</i>	
<20	9.1 (36)
20-30	53.9 (214)
31-40	33.5 (133)
≥41	3.5 (14)
<i>Father's age</i>	
20-30	57.4 (228)
31-40	38.8 (154)
≥41	3.8 (15)
<i>Mother's current marital status</i>	
Married	96.7 (384)
Divorced	3.3 (13)
<i>Number of children, including the index one</i>	
One	13.9 (55)
Two	47.3 (188)
Three	30.7 (122)
≥Four	8.1 (32)
<i>Mother's education level</i>	
Secondary school/below	2.5 (10)
University/above	97.5 (387)
<i>Father's education level</i>	
Secondary school/below	6.3 (25)
University/above	93.7 (372)
<i>Residence</i>	
Inside Taif City	95.7 (380)
Outside Taif City	4.3 (17)
<i>Mother's job status</i>	
Housewife	50.9 (202)
Working	49.1 (195)
<i>Father's job status</i>	
Government employee	80.1 (318)
Private sector employee	12.3 (49)
Military	5.5 (22)
Business/trade	2.1 (8)

believed that vaccination reduces the probability of death or illness in a child (99.5%) and reduces the transmission of infectious diseases (99.5%), were aware that some vaccinations are accompanied by side effects such as fever (97.2%), and believed that vaccinations should be given after certain age (95%). Only 59.9%, on the other hand, were aware that some vaccinations can cause convulsions and skin rash, as illustrated in Table 2.

Overall, the total knowledge score ranged between 5 and 10, with an arithmetic mean of 9.03, standard deviation of ( $\pm 1.25$ ), a median of 10 and IQR of 8-10; Shapiro-Wilk test,  $p < 0.001$ .

Higher-educated mothers (university or above) were more knowledgeable about childhood vaccination than lesser-educated mothers (mean ranks were 200.44 and 123.35, respectively),  $p = 0.020$ , as shown in Table 3.

#### *Attitude towards childhood vaccination*

All of the mothers gave their children the mandatory vaccines, considered childhood vaccination important or very important, and believed that the government's support for the vaccination programme is sufficient. The majority of them followed their child's compulsory immunisation schedule/programme (99.7%), advised their relatives and friends to vaccinate their children (99.7%), were keen to complete all vaccination doses when there was more than one dose (99.7%), believed that the vaccination programme started from the first week of life (99.5%), and felt secure after vaccinating their child (96.5%), as illustrated in Table 4.

Overall, the total score for attitude towards childhood vaccination ranged between 5 and 10, with an arithmetic mean of 9.15, standard deviation of ( $\pm 0.48$ ), a median of 9 and IQR of 9-9; Shapiro-Wilk test,  $p < 0.001$ .

Married mothers expressed a more positive attitude towards childhood vaccination than divorced mothers (mean ranks were 200.83 and 144.81, respectively),  $p = 0.014$ ; as illustrated in Table 5.

#### IV. DISCUSSION

Vaccination is a method proven to control and eliminate life-threatening infectious diseases, particularly among vulnerable groups such as children,

and is estimated by WHO to prevent almost three million deaths every year [10]. The attitude/cooperation of parents, particularly mothers, regarding vaccination is essential to improve the vaccination rate and adherence to the childhood vaccination schedule. Studies have shown that, among other factors, parental knowledge and beliefs had a major impact on starting and continuing children's vaccination [11, 12].

In the present survey, among the participating mothers, the total knowledge score regarding childhood vaccination was excellent; its median value was 10 out of a maximum possible score of 10. Nearly all the participants, with very few exceptions, could recognise that vaccinations play a role in child health, were sure that vaccinations are important for their child, were aware that even healthy children need vaccination, believed that vaccination reduces the probability of death or illness in a child and reduces the transmission of infectious diseases, were aware that some vaccinations are accompanied by side effects such as fever, and believed that vaccinations should be given after certain age. However, only a smaller proportion of them (59.9%) were aware that some vaccinations may cause convulsions and skin rash. The same good level of knowledge was observed in another, similar, study carried out in Riyadh, particularly regarding the general role of vaccination in the prevention of certain infectious diseases, and the timing of the first dose in the vaccination schedule [13]. However, a poor level of knowledge was observed in that study regarding the importance to children's immunity of administration of multiple doses of the same vaccine, the understanding that simultaneous administration of multiple vaccines has no negative impact on a child's immunity, vaccination of children against seasonal influenza, and contraindications to vaccination. In Arar (KSA), the majority of parents were aware that vaccinations are important for their children, thought that vaccinations reduce the incidence of infectious diseases, and believed that vaccinations have a role in child health. Almost two-thirds believed that vaccination reduces the probability of death or illness in a child. Only a minority of them (6.8%) were aware that some vaccinations are accompanied by side effects such as fever, while 83.1% were aware

**Table II**

Mothers' responses to questions regarding awareness/knowledge about childhood vaccination

Questions	Correct answer	
	N	%
Are you sure that vaccinations are important for your child?	396	99.7
Do you think vaccination reduces the probability of death or illness in a child?	395	99.5
Do you think vaccinations reduce the transmission of infectious diseases?	395	99.5
Do you think vaccinations have a role in child health?	397	100
Do you believe that vaccinations correspond to certain age?	377	95.0
Are you aware that there are many types of vaccines?	278	70.0
Are you aware that some vaccinations are accompanied by side effects such as fever?	386	97.2
Are you aware that some vaccinations may cause convulsions and skin rash?	238	59.9
Are you aware of the serious diseases that are preventable by vaccination, such as polio, measles and meningitis?	327	82.4
Are you aware that even healthy children need vaccination?	396	99.7

**Table III**

Factors associated with mothers' knowledge about childhood vaccination

	Total knowledge score (0-10)			p-value
	Median	IQR	Mean rank	
<i>Mother's age (years)</i>				
<20 (n=36)	10	8-10	194.36	
20-30 (n=214)	10	8-10	204.41	
31-40 (n=133)	10	8-10	192.78	
≥41 (n=14)	9.5	7.75-10	187.32	0.728**
<i>Father's age</i>				
20-30 (n=228)	10	8-10	202.64	
31-40 (n=154)	10	8-10	195.35	
≥41 (n=15)	9	8-10	181.10	0.633**
<i>Mother's current marital status</i>				
Married (n=284)	10	8-10	200.06	
Divorced (n=13)	9	7-10	167.77	0.271*
<i>Number of children, including the index one</i>				
One (n=55)	10	8-10	206.26	

Two (n=188)	10	8-10	190.76	
Three (n=122)	10	8-10	211.39	
≥Four (n=32)	9.5	8-10	187.67	0.313**
<i>Mother's education level</i>				
Secondary school/below (n=10)	7.5	6.75-10	123.35	
University/above (n=387)	10	8-10	200.95	0.020*
<i>Father's educational level</i>				
Secondary school/below (n=25)	9	8-10	177.60	
University/above (n=372)	10	8-10	200.44	0.288*
<i>Residence</i>				
Inside Taif City (n=380)	10	8-10	197.48	
Outside Taif City (n=17)	10	9-10	233.06	0.168*
<i>Mother's job status</i>				
Housewife (n=202)	10	8-10	194.32	
Working (n=195)	10	8-10	203.85	0.361*
<i>Father's job status</i>				
Government employee (n=318)	10	8-10	201.11	
Private sector employee (n=49)	10	8-10	200.67	
Military (n=22)	9.5	7-10	171.80	
Business/trade (n=8)	9	8-10	179.56	0.588**

\*Mann-Whitney test

\*\*Kruskal-Wallis test

**Table IV**

Mothers' responses to questions regarding attitude towards childhood vaccination

Questions	Percent (n)
Have you given your child all the mandatory vaccines? (Yes)	100 (397)
Do you follow your child's compulsory immunisation schedule/programme? (Yes)	99.7 (396)
Do you seek additional immunisations for your child, such as the annual influenza vaccine? (Yes)	99.5 (395)
Do you think the government's support for the vaccination programme is sufficient? (Yes)	100 (397)
Do you advise your relatives and friends to vaccinate their children? (Yes)	99.7 (396)
Do you believe that the vaccination programme begins from the first week of life? (Yes)	99.5 (395)
Are you keen to complete all vaccine doses when there is more than one dose? (Yes)	99.7 (396)

How do you feel after vaccinating your child?	96.5 (383)
What is your assessment of the child vaccinations?	
Important	79.8 (317)
Very important	20.2 (80)

**Table V**

Factors associated with mothers' attitude towards childhood vaccination

	Total knowledge score (0-10)			p-value
	Median	IQR	Mean rank	
<i>Mother's age (years)</i>				
<20 (n=36)	9	9-9.75	211.40	
20-30 (n=214)	9	9-9	200.36	
31-40 (n=133)	9	9-9	196.29	
≥41 (n=14)	9	9-9	172.14	0.460**
<i>Father's age</i>				
20-30 (n=228)	9	9-9	199.33	
31-40 (n=154)	9	9-9	202.20	
≥41 (n=15)	9	9-9	161.10	0.172**
<i>Mother's current marital status</i>				
Married (n=284)	9	9-9	200.83	
Divorced (n=13)	9	8.5-9	144.81	0.014*
<i>Number of children, including the index one</i>				
One (n=55)	9	9-9	199.16	
Two (n=188)	9	9-9	190.13	
Three (n=122)	9	9-9.25	211.08	
≥Four (n=32)	9	9-9	204.80	0.163**
<i>Mother's education level</i>				
Secondary school/below (n=10)	9	8.75-9	192.80	
University/above (n=387)	9	9-9	199.16	0.806*
<i>Father's educational level</i>				
Secondary school/below (n=25)	9	9-9.5	200.84	
University/above (n=372)	9	9-9	198.88	0.9078
<i>Residence</i>				
Inside Taif City (n=380)	9	9-9	199.83	
Outside Taif City (n=17)	9	9-9	180.47	0.335*
<i>Mother's job status</i>				
Housewife (n=202)	9	9-9	198.43	

Working (n=195)	9	9-9	199.59	0.887*
<i>Father's job status</i>				
Government employee (n=318)	9	9-9	200.87	
Private sector employee (n=49)	9	9-9	196.47	
Military (n=22)	9	9-9.25	196.64	
Business/trade (n=8)	9	9-9	146.69	0.312**
		*Mann-Whitney test	**Kruskal-Wallis test	

that even healthy children require vaccination [9]. In a previous study carried out in Taif (KSA), the majority of parents (91.9%) could recognise the role of routine vaccination in protecting children from certain infectious diseases and their complications, and knew the timing of the first dose in the vaccination schedule (86.9%), while only 41.6% could recognise that administration of multiple doses of the same vaccine is important for children's immunity [14]. Outside the Kingdom, some similar and some different findings have been observed. In Nigeria, all mothers were aware of vaccination and most had a good knowledge about vaccination of children under five years [15]. In Sudan, the majority of mothers (90%) had heard about vaccination and slightly more than half of them (52%) had poor knowledge about the number of routine doses given to children under two years [16]. In Jerusalem-Palestine, inadequate knowledge about vaccines and vaccination schedules was observed [17]. In Georgia, almost one third of respondents (32%) did not have sufficient information about the routine vaccination schedule and, as a result, vaccination was incomplete in 36% of children. Reported reasons for incomplete vaccination were lack of knowledge about a routine vaccination schedule (25.5%), low awareness of the necessity of the second or third vaccine dose (18.6%), fear of post-vaccination side effects (16%), and fear of illness among children (9.6%) [18]. The use of different knowledge assessment tools, as well as a difference in age categories of the participants' children, could explain some of the differences in findings between the abovementioned studies and the present one.

The present survey revealed that more educated mothers (university or above) were more knowledgeable about childhood vaccination than the lesser-educated groups. In a similar study carried out in Riyadh, factors associated with parents'

knowledge of childhood immunisation were gender, residence and educational level [13].

In Nigeria, the mothers' age, education level, job status and family structure were significantly associated with their level of knowledge [10]. In Malaysia, the mothers' age, education level and job status were significantly associated with the vaccination knowledge score [19]. The present survey also revealed a very positive attitude of mothers towards childhood vaccination, with a median score of 9 out of a maximum score of 10. Nearly all of the mothers gave their children the mandatory vaccinations, considered childhood vaccination important or very important, believed that the government's support for the vaccination programme is sufficient, followed their child's compulsory immunisation schedule/programme, advised their relatives and friends to vaccinate their children, were keen to complete all vaccination doses when there was more than one dose, believed that the vaccination programme started from the first week of life, and felt secure after vaccinating their child. In Riyadh-Saudi Arabia, the attitude of parents towards childhood immunisation was positive, except in a few aspects relating to vaccination side effects and the probability of occurrence of diseases against which the child was vaccinated [13]. In Arar-Saudi Arabia, most parents gave their children all the mandatory vaccines, followed their children's compulsory immunisation schedule/programme, and felt secure after vaccinating their children [9]. In Nigeria, all the mothers expressed a positive attitude towards vaccination and 86.4% had fully vaccinated their children [20]. In Uganda, the majority of mothers (93.5%) believed that childhood immunisation protects children from diseases, and this belief was significantly associated with vaccination uptake. The two main reasons for non-vaccination were "fearful of side effects" (44%) and "ignorance/disinterest/laziness" (44%) [21].



In Sudan, more than half of the respondents (55%) had negative attitudes towards vaccination of children in vaccination campaigns [16]. In Jerusalem- Palestine, the majority of mothers (94%) considered vaccination to be the main activity in maternal and children's clinics [17]. In Georgia, the majority of mothers (97%) had a positive attitude toward immunisation and believed that vaccination plays an important role in preventing infectious diseases [18]. Again, comparison of these studies, including the present one, is not always practical, mainly due to demographic differences and the use of different tools to assess attitudes towards childhood vaccination. The current study showed that married mothers expressed a more positive attitude towards childhood vaccination than their divorced counterparts. In a study conducted in Riyadh [13], factors associated with parents' attitudes towards immunisation were gender, residence and education level. In Malaysia, mothers' education, age and job status were significantly associated with their attitude towards childhood vaccination [19] while in Georgia, mothers' education was significantly associated with their attitude regarding immunisation [18].

The present study has some limitations that bear mentioning. First, it is a single-centre study, which could affect the generalisability of the results. Being a cross-sectional study is also considered a limitation, as this can prove only association, and not causality, between exposure factors and outcomes. Finally, the use of an interview questionnaire in this study renders it subject to bias. Despite these limitations, the study addresses a topic of public health importance and its assessment could assist decision-makers in Taif City, Saudi Arabia.

## V. CONCLUSION

The knowledge of, and attitude towards, childhood vaccination among mothers in Taif, Saudi Arabia, are excellent. However, there are some misconceptions that need correction. More educated mothers (university or above) were more knowledgeable about childhood vaccination than the lesser-educated groups, and married mothers expressed a more positive attitude towards childhood vaccination than their divorced counterparts. Based on the findings of the present study, our recommendations are as follows:

-More health education is needed at outpatient clinics and primary care centres, particularly for less educated mothers, to improve awareness and correct certain misconceptions regarding childhood vaccination.

-Further study is warranted to include mothers from different settings in Taif, in order to provide a clearer view of the situation.

-Parents should be included both in health education activities and in further research, as they could have a positive role in increasing coverage and adherence to childhood vaccination schedules.

## VI. REFERENCES

1. World Health Organization. Health Topics (Immunization). Available from: <http://www.who.int/topics/immunization/en/>. [Last accessed on 2018 Apr 05].
2. World Health Organization. Media Centre (Immunisation Coverage). Available from: <http://www.who.int/mediacentre/factsheets/fs378/en/>. [Last accessed on 2018 Apr 08].
3. Caingles SE, Lobo JJ. Survey on the knowledge, attitudes and practices of parents in Barangay 8a, District 1, Davao City regarding their children's immunization. *PIDSP J.* 2011; 12(1):46-53.
4. Malande OO, Munube D, Afaayo RN, Annet K, Bodo B, Bakainaga A, et al. Barriers to effective uptake and provision of immunization in a rural district in Uganda. *PLoS ONE* 2019;14(2): e0212270. <https://doi.org/10.1371/journal.pone.0212270>
5. UNICEF. Immunization programme. The challenge of immunizing the children who need it most, 2015. Available from: [http://www.unicef.org/immunization/index\\_2819.html](http://www.unicef.org/immunization/index_2819.html)
6. Jheeta M, Newell J. Childhood vaccination in Africa and Asia: the effects of parents' knowledge and attitudes. *Bull World Health Organ.* 2008 Jun; 86(6): 419. doi: 10.2471/BLT.07.047159
7. Damnjanovic K, Graeber J, Ilic S, Lam WY, Lep Ž, Morales S, et al. Parental Decision-Making on Childhood Vaccination. *Front. Psychol.* 2018;9:735. doi: 10.3389/fpsyg.2018.00735
8. Taif municipality <http://www.taifcity.gov.sa/pages/57>
9. Alruwaili AAS, Abo El-fetoh NM, Alruwaili TAS, Alanazi WAS, Alhazmi HHR, Alanazi NAB,

- et al. Knowledge, Attitude and Practice of the Parents Regarding Child Vaccinations in Arar, Northern Saudi Arabia. *The Egyptian Journal of Hospital Medicine* 2018; 72 (9): 5178-5182
10. World Health Organization. Global Immunization Vision and Strategy, WHO/UNICEF, Geneva, 2015.
11. Lee Ventola C. Immunization in the United States: Recommendations, barriers, and measures to improve compliance. Part 1: Childhood Vaccinations. *P T*. 2016 Jul; 41(7): 426–436.
12. Callaghan T, Motta M, Sylvester S, Lunz Trujillo K, Blackburn CC. Parent psychology and the decision to delay childhood vaccination. *Soc Sci Med*. 2019 Oct;238:112407. doi: 10.1016/j.socscimed.2019.112407. Epub 2019 Jul 29. PMID: 31366444.
13. ALAmri ES, Horaib YF, Alanazi WR. Knowledge and attitudes of parents on childhood immunization in Riyadh, Saudi Arabia. *The Egyptian Journal of Hospital Medicine* 2018; 70 (2): 251-256 DOI: 10.12816/0043085 Accepted: 20/10/2017
14. Yousif MA, Albarraq AA, Abdallah MAA, Elbur AI. Parents' knowledge and attitudes on childhood immunization, Taif, Saudi Arabia. *J Vaccines* 2013; 5: 215.
15. Adefolalu OA, Kanma-Okafor OJ, Balogun MR. Maternal knowledge, attitude and compliance regarding immunization of under five children in Primary Health Care centres in Ikorodu Local Government Area, Lagos State. *J ClinSci* 2019;16:7-14.
16. Fad KH, Ibrahim AA, BaharDldoom MM, Ahmed ZOH. Knowledge, attitude and practice of mothers with children less than five years toward vaccination in khartoum state-ummbada locality-allbugaa-2017. *Nurs Palliat Care* 2019;4:1-4 doi: 10.15761/NPC.1000207
17. Zamir CS, Israeli A. Knowledge, attitudes and perceptions about routine childhood vaccinations among Jewish Ultra-Orthodox mothers residing in communities with low vaccination coverage in the Jerusalem district. *Matern Child Health J*. 2017 May;21(5):1010-1017. doi: 10.1007/s10995-017-2272-5.
18. Verulava T, Mariam Jaiani M, Lordkipanidze A, Jorbenadze R, Dangadze B. Mothers' knowledge and attitudes towards child immunization in Georgia. *The Open Public Health Journal* 2019; 12: 232-237. DOI: 10.2174/1874944501912010232, 2019, 12, 232-237
19. Balbir Singh HK, Badgujar VB, Yahaya RS, Abd Rahman S, Sami FM, Badgujar S, et al. Assessment of knowledge and attitude among postnatal mothers towards childhood vaccination in Malaysia. *Hum Vaccin Immunother*. 2019;15(11):2544-2551. doi: 10.1080/21645515.2019.1612666.
20. Vonasek BJ, Bajunirwe F, Jacobson LE, Twesigye L, Dahm J, Grant MJ, et al. Do maternal knowledge and attitudes towards childhood immunizations in rural Uganda correlate with complete childhood vaccination? *PLoS ONE* 2016;11(2): e0150131. doi:10.1371/journal.pone.0150131.