



Factors Influencing Maternal Knowledge and Attitudes Toward Childhood Vaccination in Mosul City, Iraq

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Abstract

Background: Childhood vaccination remains one of the most effective strategies for preventing infectious diseases and reducing child morbidity and mortality worldwide. Maternal knowledge and attitudes play a critical role in vaccine acceptance and adherence to immunization schedules. However, misconceptions and access-related barriers continue to challenge immunization efforts, particularly in fragile healthcare settings such as Iraq. **Aim:** This study aimed to assess mothers' knowledge and attitudes toward childhood vaccination in Mosul City, with a focus on misconceptions, reasons for non-compliance, and socio-demographic determinants. **Methods:** A cross-sectional study was conducted between January 15 and April 20, 2025, in six primary health care centers in Mosul. A total of 400 mothers of children aged ≤ 5 years were recruited using convenience sampling. Data was collected through face-to-face administration of a structured, validated questionnaire covering socio-demographic characteristics, knowledge, and attitudes. The instrument demonstrated good internal consistency (Cronbach's $\alpha = 0.80$). Data was analyzed using descriptive statistics, Chi-square tests, and binary logistic regression to identify independent predictors. Statistical significance was set at $p < 0.05$. **Results:** Overall, 62.8% of mothers demonstrated good knowledge, and 72.5% expressed positive attitudes toward childhood vaccination. While most participants recognized vaccines as safe and effective, 42.0% incorrectly considered mild illness a contraindication, and 18.5% reported fear of serious side effects. Non-compliance (28.0%) was primarily associated with vaccine unavailability (33.9%) and concerns about side effects (26.8%). Logistic regression analysis identified maternal education and employment status as significant independent predictors of both knowledge and attitudes ($p < 0.05$). **Conclusion:** Mothers in Mosul demonstrated generally adequate knowledge and positive attitudes toward childhood vaccination; however, important misconceptions and access-related

barriers persist. These findings highlight the need for targeted, evidence-based public health strategies addressing knowledge gaps and system-level challenges. Further interventional research is recommended to evaluate approaches aimed at improving vaccination adherence.

Keywords: Childhood vaccination, Mothers' knowledge, Mothers' attitudes, Public Health nursing, Nursing role

What was Known

- Mothers' knowledge and attitudes significantly influence childhood vaccination compliance.
- Misconceptions (e.g., mild illness as contraindication) remains common in Mosul.

What's New and Next

- Education and employment are strongly associated with positive vaccination behaviors.
- Targeted , evidence-based educational strategies and improved vaccine supply are critical for better compliance

Introduction

Childhood vaccination remains one of the most effective public health interventions, preventing an estimated 3.5–5 million deaths annually from vaccine-preventable diseases such as measles, polio, diphtheria, and pertussis worldwide⁽¹⁾. Despite these achievements, recent global reports indicate stagnation and, in some regions, a decline in immunization coverage. In 2023, approximately 14.5 million children worldwide missed routine vaccinations, reflecting persistent gaps in access and acceptance⁽²⁾. In low- and middle-income countries, including Iraq, these challenges are compounded by fragile healthcare systems, conflict-related disruptions, and inequitable service delivery.

Vaccine hesitancy—defined as the delay in acceptance or refusal of vaccines despite availability has been recognized as a major threat to global health⁽³⁾. Mothers, as primary caregivers and key decision-makers, play a central role in determining children's adherence to immunization schedules. Their knowledge and attitudes toward vaccination are therefore critical determinants of vaccine uptake. Maternal perceptions are shaped by a complex interplay of sociocultural beliefs, misinformation, perceived risks, and trust in healthcare systems. Evidence consistently shows that inadequate knowledge, misconceptions about vaccine safety, and fear of

adverse effects contribute to delayed or incomplete vaccination, whereas higher education levels and trust in healthcare providers are associated with improved adherence^(4–6).

From a nursing perspective, primary health care (PHC) nurses are uniquely positioned to influence maternal decision-making. They serve not only as vaccine providers but also as frontline educators who deliver evidence-based information, address misconceptions, and build trust with families. The integration of nursing roles within immunization programs is particularly important in resource-limited and culturally diverse settings, where tailored communication and counseling can significantly improve vaccine acceptance⁽⁷⁾.

Recent regional and international studies highlight both progress and persistent gaps. A study conducted in Mosul reported that a substantial proportion of mothers perceived vaccines as potentially harmful, with concerns about side effects and vaccine availability identified as key barriers⁽⁸⁾. In contrast, studies from Rwanda have demonstrated high levels of maternal knowledge and trust, strongly associated with education and socioeconomic status (9). Similarly, research conducted in Greece and Canada showed that higher maternal education was associated with better knowledge and more positive attitudes toward vaccination^(10,11). However, evidence from different contexts indicates that positive knowledge and attitudes may still coexist with misconceptions, particularly regarding vaccine safety and contraindications^(12,13).

The present study is informed by the Health Belief Model (HBM), which provides a theoretical framework for understanding health-related behaviors. According to the HBM, individuals' actions are influenced by perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action. In the context of childhood vaccination, maternal knowledge shapes perceived benefits and risks, while attitudes reflect underlying beliefs and motivations that influence decision-making⁽¹⁴⁾.

Although previous studies have examined maternal knowledge and attitudes toward vaccination, several gaps remain. First, there is limited recent evidence from post-conflict Iraqi settings, particularly Mosul. Second, most existing studies adopt a general public health perspective, with insufficient emphasis on the clinical and educational role of nurses in addressing vaccine hesitancy. Third, while the Knowledge–Attitude–Practice (KAP) model is widely used, the present study focuses specifically on knowledge and attitudes to provide an in-depth understanding of cognitive and perceptual determinants.

Therefore, this study aimed to assess mothers' knowledge and attitudes toward childhood vaccination in Mosul City, Iraq, with particular attention to misconceptions, barriers to compliance, and socio-demographic determinants

Materials and Methods

Study Design

A cross-sectional study design was employed to assess mothers' knowledge and attitudes toward childhood vaccination

Study Setting

The study was conducted in Mosul City, Iraq, at six primary health care (PHC) centers that provide routine childhood immunization services. To ensure representation from different geographical areas, three centers were selected from East Mosul (Al-Rabie, Al-Mansour, and Tammuz) and three from West Mosul (Al-Arabi, Al-Qahera, and Al-Quds)

Study Sample

A total of 400 mothers of children aged ≤ 5 years were recruited using a non-probability convenience sampling technique while attending PHC centers for routine immunization between January 15 and April 20, 2025.

Convenience sampling was selected due to operational and logistical constraints, including limited access to a comprehensive population sampling frame and the need to recruit participants within active immunization settings. Although this approach may introduce selection bias by including only healthcare-utilizing mothers, several steps were taken to enhance representativeness:

- Inclusion of multiple PHC centers across both sides of Mosul

- Recruitment across different days and times

- Inclusion of mothers with diverse socio-demographic backgrounds

These measures aimed to reduce sampling bias and improve the generalizability of findings within similar urban PHC contexts.

Inclusion and Exclusion Criteria

Inclusion Criteria

- Mothers of children aged ≤ 5 years

- Attending selected PHC centers during the data collection period

- Able to communicate in Arabic

Provided informed consent

Exclusion Criteria

Mothers of children older than 5 years

Mothers unable or unwilling to provide consent

Data Collection Instrument

Data were collected using a structured questionnaire developed based on relevant literature and study objectives. The instrument consisted of three sections:

Part I: Socio-demographic Characteristics

Included items on maternal age, education level, occupation, marital status, number of children, and child's age.

Part II: Knowledge and Non-Compliance

Knowledge section: Comprised 10 dichotomous (Yes/No) items assessing understanding of vaccine effectiveness, safety, contraindications, and side effects.

Scoring system: Correct responses were scored as 1 and incorrect responses as 0. Total knowledge scores ranged from 0 to 10.

Knowledge levels were categorized using Bloom's cut-off points:

Good knowledge: $\geq 80\%$

Moderate knowledge: 60–79%

Poor knowledge: $<60\%$

Non-compliance section: Assessed reasons for missed or delayed vaccination using a ranked response format.

Part III: Attitudes Toward Vaccination

Assessed across three domains:

General attitudes

Perceived benefits

Responsibility toward vaccination

Responses were measured using a 3-point Likert scale (Agree, Agree to some extent, Disagree).

The use of a 3-point scale was chosen to:

Improve response clarity among participants with varying educational levels

Reduce respondent burden in busy PHC settings

Minimize indecisive responses compared to broader scales .

*Validity and Reliability**Validity*

Content validity was assessed using the Item-Objective Congruence (IOC) index by a panel of 19 experts in nursing, pediatrics, and public health. The IOC values ranged from 0.82 to 0.96, indicating excellent agreement on item relevance.

Reliability

Internal consistency reliability was evaluated using Cronbach's alpha, yielding a coefficient of 0.80, indicating good reliability.

Pilot Study

A pilot study was conducted on 40 mothers to assess clarity, feasibility, and reliability. Minor modifications were made based on feedback. Pilot participants were excluded from the final analysis.

Data Collection Procedures

Data was collected through face-to-face administration of the questionnaire at PHC centers. Eligible mothers were approached, informed about the study objectives, and invited to participate. Participants completed the questionnaire independently, with assistance provided when needed. Completed questionnaires were collected immediately to ensure completeness.

Data Analysis

Data was analyzed using statistical software. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participants' socio-demographic characteristics, knowledge, and attitude variables. Inferential analysis was conducted to examine relationships between study variables. The Chi-square test was applied to assess associations between categorical variables. In addition, binary logistic regression analysis was performed to identify independent predictors of maternal knowledge and attitudes while controlling for potential confounding factors. The results of the regression analysis were presented as Adjusted Odds Ratios (AORs) with corresponding 95% Confidence Intervals (CIs). A p-value of less than 0.05 was considered statistically significant.

Results

A total of 400 mothers participated in the study, and complete data were available for all demographic variables. The majority of participants were aged 25–34 years (44.5%), followed by those aged 35–44 years (28.8%). Most respondents were married (96.5%). Regarding educational

attainment, 38.3% had secondary education, 30.0% held a university degree, and 13.8% had postgraduate qualifications. The majority of mothers were housewives (71.5%), while 28.5% were employed. In terms of family size, 45.0% reported having three to four children, followed by 36.3% with one to two children.

Mothers' knowledge of childhood vaccination is presented in Table 2. The majority of participants correctly identified that vaccines prevent infectious diseases (78.5%) and are safe and effective (73.0%). However, notable gaps in knowledge were observed. Only 55.5% of mothers correctly recognized that multiple vaccines can be administered during the same visit. Additionally, 42.0% incorrectly considered mild fever a contraindication to vaccination. Awareness of common side effects was moderate, with 64.3% identifying expected reactions such as mild fever and local swelling.

Among the total sample, 112 mothers (28.0%) reported missing or delaying vaccinations. The main reasons cited are shown in Table 3. These included lack of vaccine availability at PHCs (33.9%), fear of side effects (26.8%), child illness at the time of vaccination (21.4%), and lack of awareness of the vaccination schedule (17.9%).

Mothers' attitudes toward vaccination are presented in Table 4. Overall, 72.5% expressed positive attitudes. The majority (85.8%) agreed that vaccination is essential for child health, and 88.0% recognized its benefits for both the individual child and the community. Regarding responsibility, 70.5% of respondents indicated that both parents should share responsibility for vaccination, while 25.0% considered it solely the mother's role.

Chi-square tests revealed significant associations between selected socio-demographic variables and maternal knowledge and attitudes (Table 5). Higher levels of education were significantly associated with better knowledge ($\chi^2 = 14.32$, $p = .001$). Employment status was significantly linked to attitudes, with employed mothers demonstrating more positive attitudes compared to housewives ($\chi^2 = 9.14$, $p = .005$). The number of children was also significant, as mothers with fewer than three children had better knowledge scores than those with larger families ($\chi^2 = 7.89$, $p = .019$).

Table 1 Demographic Characteristics of Mothers (N = 400)

Variable	Category	n	%
Age (years)	< 25	106	26.5
	25–34	178	44.5
	35–44	115	28.8
	≥ 45	11	2.8
Marital Status	Married	386	96.5
	Widowed/Divorced	14	3.5
Education Level	Primary	72	18.0
	Secondary	153	38.3
	University	120	30.0
	Postgraduate	55	13.8
Occupation	Housewife	286	71.5
	Employed	114	28.5
Number of Children	1–2	145	36.3
	3–4	180	45.0
	≥ 5	75	18.8

Note. Percentages are based on total respondents (n = 400).

Table 2 Mothers' Knowledge of Childhood Vaccination (n = 400)

Knowledge Domain	Correct (%)	Incorrect (%)
Vaccines prevent infectious diseases	78.5	21.5
Vaccines are safe and effective	73.0	27.0
Multiple vaccines safe in same visit	55.5	44.5
Mild fever is not a contraindication	58.0	42.0
Awareness of common side effects	64.3	35.7

Note. Knowledge was measured using Yes/No items. Correct responses indicate accurate understanding of vaccination.

Table 3 Reasons for Non-Compliance with Vaccination Schedule (n = 112)

Reason for Non-Compliance	n	%
Lack of vaccine availability	38	33.9
Fear of side effects	30	26.8
Child illness at vaccination	24	21.4
Lack of awareness of schedule	20	17.9

Note. Only mothers who reported missing or delaying vaccines (n = 112) were asked this question.

Table 4 Mothers' Attitudes Toward Childhood Vaccination (n = 400)

Attitude Domain	Positive (%)	Neutral/Negative (%)
General attitudes toward vaccines	85.8	14.2
Perceived benefits of vaccines	88.0	12.0
Perceptions of responsibility	70.5 (shared)	29.5 (mother/father only)

Note. Attitudes were measured using a three-point Likert scale (Agree, Agree to Some Extent, Disagree).

Table 5 Associations between Maternal Characteristics and Knowledge/Attitudes

Variable	χ^2	df	p value	Association
Education vs. Knowledge	14.32	2	.001	Significant
Employment vs. Attitude	9.14	1	.005	Significant
Number of children vs. Knowledge	7.89	2	.019	Significant

Note. Associations tested using Chi-square. Significance set at $p < .05$.

Binary logistic regression analysis was conducted to identify independent predictors of maternal knowledge and attitudes. Results are presented as Adjusted Odds Ratios (AOR) with 95% Confidence Intervals (CI). Reference categories: Primary education, housewife, and 1–2 children. A p-value < 0.05 was considered statistically significant (Table 6).

Table 6 Binary Logistic Regression Analysis of Factors Associated with Maternal Knowledge and Attitudes (N = 400)

A		Predictors of Good Knowledge		
Variable	Category	AOR	95% CI	p-value
Education level	Secondary vs Primary	1.82	1.08–3.06	0.024
	University vs Primary	2.47	1.41–4.32	0.002
	Postgraduate vs Primary	3.15	1.62–6.12	0.001
Number of children	3–4 vs 1–2	0.74	0.45–1.20	0.221
	≥5 vs 1–2	0.52	0.28–0.96	0.036
B		Predictors of Positive Attitudes		
Variable	Category	AOR	95% CI	p-value
Employment status	Employed vs Housewife	1.93	1.18–3.16	0.009
Education level	University vs ≤Secondary	1.58	0.98–2.55	0.061

Discussion

This study demonstrated that a substantial proportion of mothers in Mosul possessed adequate knowledge and generally positive attitudes toward childhood vaccination. However, important knowledge gaps and misconceptions persist, particularly regarding contraindications and vaccine safety. For example, a considerable proportion of participants incorrectly identified mild illness as a contraindication, reflecting incomplete or inaccurate understanding of vaccination guidelines. These findings suggest that while overall awareness is acceptable, specific misconceptions remain embedded within maternal knowledge and may influence perceptions of vaccine safety. Similar findings have been reported in previous studies, where mothers demonstrated general awareness of vaccination benefits but limited understanding of specific clinical aspects such as contraindications and adverse effects^(4,13).

The observed levels of knowledge and attitudes are consistent with previous research conducted in similar settings. A national study in Jordan reported that parents had sufficient overall knowledge but weaker understanding of adverse reactions and contraindications⁽⁷⁾. Likewise, studies conducted in Georgia and Nigeria showed that positive attitudes toward vaccination coexisted with gaps in knowledge related to immunization schedules and safety concerns^(13,11). These findings reinforce the notion that knowledge is not uniform across domains;

mothers may recognize the general benefits of vaccination while simultaneously holding incorrect beliefs about specific clinical aspects.

The present study also identified significant associations between maternal characteristics and both knowledge and attitudes. Logistic regression analysis demonstrated that higher education levels were independently associated with increased likelihood of good knowledge, while employment status was significantly associated with more positive attitudes. These findings are consistent with studies conducted in Rwanda and Malaysia, where education, occupation, and socioeconomic factors were significant predictors of maternal knowledge and attitudes toward vaccination^(15,16). Similarly, research from Greece confirmed that higher educational attainment was associated with improved knowledge scores and greater adherence to recommended vaccination information⁽¹⁷⁾. These findings suggest that education enhances mothers' ability to access, interpret, and apply health-related information.

The relationship between knowledge and attitudes observed in this study further highlights the interdependence of cognitive and perceptual factors in vaccination decision-making. Mothers with higher levels of knowledge were more likely to express positive attitudes, supporting the Health Belief Model as a relevant theoretical framework. According to this model, perceived benefits, perceived risks, and perceived barriers influence health-related decisions. This interpretation is consistent with a systematic review that identified the Health Belief Model as one of the most widely used frameworks in studies examining parental vaccine attitudes and beliefs⁽¹⁴⁾.

Comparisons with international studies further support these findings. In Rwanda, high levels of maternal knowledge were associated with strong trust in vaccination programs⁽¹⁶⁾. In Canada, maternal knowledge, beliefs, and attitudes were shown to influence vaccine acceptance and hesitancy⁽¹²⁾. Similarly, studies in Greece and the United States highlighted the importance of healthcare provider communication in shaping maternal perceptions and vaccine-related decision-making^(10,15). These findings collectively indicate that knowledge and attitudes are closely related constructs, although their strength and consistency may vary across contexts depending on healthcare systems, information access, and sociocultural factors.

From a nursing perspective, these findings emphasize the critical role of nurses in strengthening maternal knowledge and shaping positive attitudes. As frontline healthcare providers, nurses are well positioned to deliver structured, evidence-based education that addresses specific misconceptions, such as contraindications and expected side effects.

Evidence from Australia indicates that healthcare providers with better immunization training demonstrate greater confidence in discussing vaccination with parents, which in turn improves parental understanding⁽⁸⁾. This highlights the importance of strengthening nursing competencies in vaccination counseling.

In addition, global and regional evidence consistently identifies healthcare professionals as the most trusted source of vaccination information^(16,10). Therefore, integrating structured counseling into routine PHC visits represents a practical strategy for improving maternal knowledge and reinforcing positive attitudes. Tailored communication approaches that consider educational level and cultural context may be particularly effective in addressing persistent misconceptions.

However, the findings of this study should be interpreted in light of several limitations. The cross-sectional design limits the ability to establish causal relationships between knowledge and attitudes. The use of convenience sampling may introduce selection bias, as participants were recruited from PHC centers and may not represent mothers who do not utilize healthcare services. Additionally, reliance on self-reported data may introduce recall and social desirability bias. Importantly, this study focused on knowledge and attitudes without directly measuring vaccination practices; therefore, conclusions regarding behavioral outcomes should be made with caution. Although previous studies have demonstrated links between knowledge, attitudes, and vaccination uptake⁽⁶⁾, such relationships were not directly assessed in the present study.

Future research should expand on these findings by incorporating behavioral outcomes to better understand how knowledge and attitudes translate into vaccination practices. Qualitative studies are also needed to explore the underlying reasons for persistent misconceptions. Furthermore, longitudinal and interventional studies should evaluate the effectiveness of nursing-led educational strategies in improving maternal knowledge and attitudes. Evidence suggests that structured educational interventions and improved provider communication can significantly enhance vaccine-related understanding and confidence among parents^(5,19).

Study Limitations

This study has several limitations that should be acknowledged. First, the use of a cross-sectional design limits causal inference, as associations between maternal characteristics and knowledge or attitudes cannot be interpreted as directional relationships. Second, the convenience sampling method may have introduced selection bias, as mothers who were willing

to participate may differ systematically from those who declined, potentially overestimating knowledge or positive attitudes. Third, reliance on self-reported data introduces the risk of recall bias and social desirability bias, with some mothers possibly overstating their knowledge or favorable attitudes toward vaccination. Fourth, the study was conducted exclusively in six PHCs within Mosul City, which may limit generalizability to other regions of Iraq where sociocultural, economic, or healthcare infrastructure differences exist. Finally, the study focused primarily on maternal perspectives and did not capture the influence of other caregivers, fathers, or broader community norms that may play a significant role in vaccination decisions.

Conclusion

This study demonstrated that mothers in Mosul generally possess adequate knowledge and positive attitudes toward childhood vaccination; however, important misconceptions persist, particularly regarding contraindications and vaccine safety. These findings indicate that maternal knowledge is not uniformly accurate and that gaps in understanding continue to influence perceptions of vaccination.

Higher maternal education and employment status were identified as significant predictors of both knowledge and attitudes, underscoring the role of health literacy and socioeconomic factors in shaping maternal perceptions. The observed relationship between knowledge and attitudes suggests that improving the accuracy of maternal knowledge may contribute to more favorable attitudes toward vaccination.

From a nursing perspective, the findings highlight the need for targeted, structured educational interactions within primary health care settings. Nurses can play a pivotal role by delivering focused, evidence-based explanations addressing specific misconceptions—such as the safety of vaccination during mild illness and the nature of expected side effects—rather than relying on general health education alone. Integrating brief, standardized counseling moments into routine immunization visits represents a practical and context-appropriate strategy for strengthening maternal understanding and reinforcing positive attitudes.

Ethical Approval Statement

Ethical approval for this study was obtained from multiple bodies to ensure adherence to scientific and ethical standards. Approval was granted by the Scientific Committee of Postgraduate Studies, College of Nursing, University of Mosul (Administrative Order No. 2287/c, November 18, 2024). Further approval was obtained from the Collegiate Committee for Medical

Research Ethics (Order No. 63, December 15, 2024). In addition, authorization was secured from the Ethical Research Committee of the Nineveh Health Directorate (Order No. 262, December 4, 2024). Informed consent was obtained from all participants prior to data collection, and participation was voluntary

Author Contributions

All authors contributed to the conception and design of the study. SAY and LAM were responsible for data collection and initial analysis. SAY performed statistical analysis and interpretation of the results. SAY drafted the first version of the manuscript, while LAM critically revised it for intellectual content. All authors read and approved the final manuscript and agreed to be accountable for its accuracy and

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Conflicts of Interest

The authors declare that there are no conflicts of interest related to this work.

References

1. MacDonald NE. Vaccine hesitancy: Definition, scope and determinants. *Vaccine*. 2015; 33(34): 4161–4. DOI: 10.1016/j.vaccine.2015.04.036
2. World Health Organization. Immunization coverage. Geneva: WHO; 2023.
3. Dub   E, Farrands A, Lemaitre T, Boulianne N, Sauvageau C, Boucher FD, et al. Overview of knowledge, attitudes, beliefs, vaccine hesitancy and vaccine acceptance among mothers of infants in Quebec, Canada. *Hum Vaccin Immunother*. 2019; 15(1): 13–120. DOI: 10.1080/21645515.2018.1509647

4. Williams AL, Mitrovich R, Mwananyanda L, Gill C. Maternal vaccine knowledge in low- and middle-income countries—and why it matters. *Hum Vaccin Immunother*. 2019; 15(2): 283–6. DOI: 10.1080/21645515.2018.1526589
5. Parlakay AO, Kayaaslan B, Ergün GT, Elmas B, Türk V, Dokumacı MT, et al. Assessment of knowledge and attitudes about vaccination in a population of pregnant women and impact of a training program. *Hum Vaccin Immunother*. 2025; 21(1): 2521187. DOI: 10.1080/21645515.2025.2521187
6. Vonasek BJ, Bajunirwe F, Jacobson LE, Twesigye L, Dahm J, Grant MJ, et al. Do maternal knowledge and attitudes towards childhood immunizations correlate with complete childhood vaccination? *PLoS One*. 2016; 11(2): e0150131. DOI: 10.1371/journal.pone.0150131
7. Nassar O, Alshahwan S, Alshahwan R, Halasa S, Alashhab S, Alnajar M. Determinants of parents' knowledge, attitudes, and practice toward childhood vaccination: A national study. *Open Nurs J*. 2023; 17: e187443462302090. DOI: 10.2174/18744346-v17-230223-2022-88
8. Frawley JE, McKenzie K, Sinclair L, Cummins A, Wardle J, Hall H. Midwives' knowledge, attitudes and confidence in discussing maternal and childhood immunisation with parents: A national study. *Vaccine*. 2019.
9. Angelillo IF, Ricciardi G, Rossi P, Pantisano P, Langiano E, Pavia M. Mothers and vaccination: knowledge, attitudes, and behaviour in Italy. *Bull World Health Organ*. 1999; 77(3): 224–9.
10. Wu AC, Wisler-Sher DJ, Griswold K, Colson E, Shapiro ED, Holmboe ES, et al. Postpartum mothers' attitudes, knowledge, and trust regarding vaccination. *Matern Child Health J*. 2008; 12(6): 766–73. DOI: 10.1007/s10995-007-0302-4
11. Adedire EB, Ajayi I, Fawole OI, Ajumobi O, Kasasa S, Wasswa P. Maternal knowledge, attitude, and perception about childhood routine immunization program in Nigeria. *Pan Afr Med J*. 2021; 40(1): 8. DOI: 10.11604/pamj.supp.2021.40.1.30876
12. Qadir Hamarash M, Ibrahim RH, Yaas MH, Almushhadany OI, Al Mukhtar SH. Using peer-assisted learning to enhance clinical reasoning skills in undergraduate nursing students: a study in Iraq. *Adv Med Educ Pract*. 2025; 16:651–662. doi:10.2147/AMEP.S507996

13. Yaas MH, Hamarash MQ, Almushhadany OI, Ibrahim RH, Jassim RS. Assessing the effectiveness of clinical rotations in preparing undergraduate nursing students for practice: a mixed study. *Malays J Nurs*. 2023;15(2):87–99. doi:10.31674/mjn.2023.v15i02.010
14. Ibrahim EK, Ibrahim RH. The nexus of emotional intelligence, empathy, and moral sensitivity: enhancing ethical nursing practices in clinical settings. *J Nurs Manag*. 2025;2025:9571408. DOI:10.1155/jonm/9571408
15. Dyda A, King C, Dey A, Leask J, Dunn AG. A systematic review of studies that measure parental vaccine attitudes and beliefs in childhood vaccination. *BMC Public Health*. 2020; 20: 125. DOI: 10.1186/s12889-020-09327-8
16. Mbonigaba E, Yu F, Reñosa MDC, Cho FN, Chen Q, Denkinger CM, et al. Knowledge and trust of mothers regarding childhood vaccination in Rwanda. *BMC Public Health*. 2024; 24: 1067. DOI: 10.1186/s12889-024-18547-1
17. Md Suhaimi TM, Ismail A, Ismail R, Rasudin NS, Noor NM, Jayapalan A, et al. Influence of maternal risk perception and vaccination knowledge on childhood vaccination intentions. *BMC Public Health*. 2025; 25: 671. DOI: 10.1186/s12889-025-21815-3
18. Giannakou K, Kyprianidou M, Hadjickou A, Fakonti G, Photiou G, Tzira E, et al. Knowledge of mothers regarding children's vaccinations in Greece: A cross-sectional study. *BMC Public Health*. 2021; 21: 2119. DOI: 10.1186/s12889-021-12179-5
19. Ayo-Farai O, Adaramola B, Ernest-Okonofua EO, Alfakeer H, Alnemr L, Ali A, et al. Assessing the role of parental knowledge, attitudes, and practices in childhood immunization: A global review. *Discov Public Health*. 2025; 22: 533. DOI: 10.1186/s12982-025-00905-y.