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Research

Assessment of knowledge, attitude, and adherence to vaccine protocols in the Riyadh region

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ABSTRACT

Background: Childhood vaccination is considered the most cost-effective measure to prevent infectious diseases. Parental knowledge and attitude about vaccination are important factors that affect adherence to vaccine protocol.

Objectives: This study aims to assess the knowledge and attitude towards vaccination and the factors affecting them. Additionally, it seeks to identify adherence to vaccine protocols among parents in the Riyadh Region, Saudi Arabia.

Methods: A cross-sectional study was conducted from June 2024 to July 2024. Data was collected using an online, self-reported questionnaire. The questionnaire was designed based on a review of relevant literature to assess the knowledge and attitude and adherence to vaccine protocols.

Results: Out of 400 Saudi Arabian parents, 56.5%(226) were females. Good knowledge of vaccination was found in 30.2%(121) of parents, while 29.3%(117) exhibited positive attitudes towards vaccination. Most parents (396;99.0%) reported their children received vaccinations, but 31.8%(127) admitted to delays in vaccination schedules. Significant predictors of good knowledge included younger age, female sex, widowed marital status, employment, and having younger children. Similarly, factors associated with a positive attitude towards vaccination were female sex, higher knowledge scores, and unemployed status.

Conclusion: Although most Saudi parents reported that their children received vaccinations, knowledge gaps and misconceptions about vaccination are present. These findings emphasize the need for targeted interventions to improve vaccination knowledge and attitudes among Saudi parents.

Keywords: Infectious diseases, Vaccine-Preventable Diseases, Immunization

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INTRODUCTION

Vaccine-preventable diseases (VPDs) pose significant global public health challenges, with vaccines recognized as highly cost-effective interventions that annually prevent millions of deaths.¹ Given the susceptibility of young children to vaccine-preventable diseases, mandatory vaccination protocols have been implemented worldwide.² Despite advancements in Saudi Arabia's healthcare system and the implementation of comprehensive immunization policies since 1984, challenges persist in achieving optimal vaccination coverage, with up to 20% of children in some areas not receiving all recommended vaccines.^{3,4} Parents play a crucial role as primary decision-makers for their children's health, influencing

vaccination compliance and program success through their knowledge and attitudes toward immunization.⁵ Continuous assessment of public perceptions and understanding of childhood immunization is essential to identify areas for improvement and tailor effective interventions.⁶ Previous studies indicate a lack of attitude among Saudi parents, contributing to negative attitudes towards childhood vaccinations.⁷ Parents would be interested in immunizing their children if educated about the essential role of children in communicating the infection in families and in public, as well as the economic burden and health effects.⁸

Therefore, this study aims to assess the knowledge, attitude, and adherence to vaccination protocols among parents in the Riyadh Region, Saudi Arabia. Additionally, it seeks to identify factors influencing attitudes and knowledge regarding vaccination protocols. By analyzing these factors, valuable insights can be gained to enhance vaccination programs and improve public health outcomes.

METHODS

A web-based cross-sectional study was conducted among the general population of Riyadh, Saudi Arabia. Parents with at least one child residing in the east, south, west, and north Riyadh provinces were included if they agreed to participate. Parents with children living in Riyadh for less than 6 months and those working in the health field were excluded. Recruitment methods employed a convenience sampling technique to engage participants. The study used an online self-reported questionnaire, which was distributed through popular social media platforms such as WhatsApp, Snapchat, Telegram, and Twitter to ensure wide coverage. The sample size calculation utilized a statistical formula.⁹

The calculated sample size for this cross-sectional survey is approximately 384. We increased it to 400 to compensate for the non-response rate. Data collection employed a self-reported questionnaire that was distributed in Arabic. The questionnaire was structured based on a review of relevant literature^{5,10-14} and covers demographic details, parents' knowledge of childhood vaccination, attitudes toward vaccination, and adherence to vaccination practices. The parents' knowledge was assessed by nine questions with responses ranging from "I do not know", "No", and "Yes". A score of one was given for every correct answer, while incorrect answers and I do not know were coded with a "0" score. The total score of knowledge ranged from 1 to 9. All scores greater \geq than 80% were graded as good, scores between 60% and 79% as fair, and below 60% as poor knowledge. Attitudes were gauged through a three-point Likert scale ("Agree", "Neutral" and "Disagree") and contained six questions about vaccination. For analysis, "Agree" was coded with a score of "2", "Disagree" was coded with a score of "0", and "Neutral" answers were coded with a score of "1". The total score of attitude ranged from 1 to 12. The attitude, then, was categorized into positive ($>80\%$), neutral (60-80%), and negative attitude ($<60\%$). Data analysis was conducted using IBM SPSS Statistics version 27. Each question in the survey was mandatory to ensure the completeness of data for subsequent analysis. Categorical data were summarized using frequencies and percentages, while quantitative data were assessed for normality using Kolmogorov's test. Descriptive statistics, including means, standard deviations, medians, and interquartile ranges (25th-75th percentile), were employed to summarize quantitative variables. Logistic regression analysis was performed to identify predictors of good awareness and positive attitudes toward vaccination among the participants. All statistical tests were two-tailed, with significance set at $p < 0.05$. Ethical approval was obtained from the research unit at the College of Medicine, Dawadmi, Shaqra University (Reference number: ERC_SU_S_202400018). Participant information was treated with strict confidentiality. The study followed established international ethical standards, including the Helsinki Guidelines and their revisions. Before commencement, participants were thoroughly briefed on the research objectives. They

were informed that participation was voluntary, and consent was obtained via an initial survey question, where they indicated their willingness to take part in the study.

RESULTS

Table 1 presents the general characteristics of parents and their children. Regarding the demographic profile of the parents, more than one-third (138; 34.5%) of them fall within the 31-40 age range, 56.5% (226) are females, 52.3% (209) have attained university education, the majority (345; 86.3%) are married, and 61.5% (246) of the parents were employed. In terms of family composition, families with more than three children accounted for 55.2% (221) of the sample. The median age of the oldest child was 15.0 years, and for the youngest child was 5.0 years.

Table 1: Demographic and family characteristics of the study participants

Parameters		n=400	%
Parent age (Years)	20-30	99	24.8
	31-40	138	34.5
	40-50	93	23.3
	>50	70	17.5
Parent sex	Male	174	43.5
	Female	226	56.5
Parent Education	Primary	3	0.8
	Intermediate	28	7.0
	Secondary	160	40.0
	University	209	52.3
Marital status	Married	345	86.3
	Widow	11	2.8
	Divorced	44	11.0
Parent Employment	Working	246	61.5
	Not working	154	38.5
Number of children	1	80	20.0
	2	67	16.8
	3	32	8.0
	>3	221	55.2
Old Child age (Years): Median (25-75 IQ)	15.0 (6.0-22.7)		
Young child age (Years): Median (25-75 IQ)	5.0 (2.0-8.0)		
Number of children below 7 years	0	159	39.8
	1	120	30.0
	2	93	23.3
	3	24	6.0
	4	4	1.0

Table 2 shows the knowledge of parents regarding the vaccination. More than two-thirds of parents (265;66.3%) reported knowing about vaccines, and how they work, only 12.8% (51) disagreed that Vaccines protect against diseases for which they are given, and 46.5% (186) of parents agreed that vaccines protect against diseases for which they are given. Furthermore, most parents (356; 89.0%) recognized that regular child vaccination provides lifelong protection from infectious diseases. 74.0% (296) of parents acknowledged that continuous and meticulous investigations ensure vaccine safety. In

addition, the majority of parents (334; 83.5%) claimed to know the vaccines that were given to their children, 85.5% (342) had information about the importance of childhood vaccination, and 72.5% (290) of parents reported knowing the consequences if they delayed their children's vaccination. Overall, the knowledge scores indicate that 30.2% (121) of parents had good knowledge, 49.8% (199) had fair knowledge, and 20.0% (80) had poor knowledge regarding vaccination. The mean knowledge score was 5.5 out of 8, with a range of 1 to 7.

Table 2: Knowledge of the parents regarding the vaccination of their children

Parameters	n=400	%
Know vaccines and how they work		
Yes	265	66.3
No	135	33.8
Vaccines protect against diseases for which they are given		
No	51	12.8
I Do not know	163	40.8
Yes	186	46.5
Regular child vaccination causes lifelong protection from several infectious diseases		
Yes	356	89.0
I Do not know	37	9.3
No	7	1.8
Continuous and meticulous investigations ensure vaccine safety		
Yes	296	74.0
I do not know	92	23.0
No	12	3.0
Know the vaccines that were given to their children		
Yes	334	83.5
No	66	16.5
Having information about the importance of childhood vaccination		
Yes	342	85.5
No	58	14.5
Know the Consequences if they delay their children's vaccination		
Yes	290	72.5
No	110	27.5
Total knowledge score:		
Mean±SD	5.5±1.5	
Range (Minimum-Maximum)	7(1-8)	

Table 3 presents the attitudes and beliefs of parents regarding vaccination. The findings reveal that the majority of parents (335; 83.8%) agreed that Vaccines strengthen the immune response against specific diseases for which they are prepared. 76.3% (305) agreed that vaccinations are given in successive doses to maintain a long-lasting effect, and 67.0% (268) agreed that vaccinations are the best way for personal protection. Regarding the belief that vaccines cause some side effects, 48.0% (192) of parents agreed, 26.5% (106) were neutral, and 25.5%(102) disagreed. When it comes to the perception of enough evidence supporting the preventive effect of vaccinations, 37.3%(149) of parents agreed, 34.3%(137) were neutral, and 28.5% (114) disagreed. In terms of the belief that one's immune system alone can protect against diseases, 26.3% (105) of parents agreed, 23.3% (93) were neutral, and half (202; 50.5%) disagreed. Overall, among the 400 parents surveyed, the attitude scores showed that 29.8% (119) had a positive attitude, 49.2% (197) had a neutral attitude, and 21.0% (84) had a negative attitude toward vaccination.

Table 3: Attitudes and beliefs of the parents regarding the vaccination

Parameters	n=400	%
Vaccines strengthen the immune response against specific diseases they are prepared for		
Agree	335	83.8
Neutral	46	11.5
Disagree	19	4.8
Vaccines cause some side effects		
Agree	192	48.0
Neutral	106	26.5
Disagree	102	25.5
Vaccinations are given in successive doses to maintain a long-lasting effect		
Agree	305	76.3
Neutral	91	22.8
Disagree	4	1.0
There is enough evidence that vaccinations prevent the occurrence of infectious diseases		
Agree	149	37.3
Neutral	137	34.3
Disagree	114	28.5
Vaccinations are the best way for personal protection		
Agree	268	67.0
Neutral	82	20.5
Disagree	50	12.5
One's immune system can alone protect from diseases		
Agree	105	26.3
Neutral	93	23.3
Disagree	202	50.5
Total attitude score:		
Mean±SD	8.6±1.6	
Range (Minimum-Maximum)	7(5-12)	

Table 4 illustrates the worries and adherence of parents toward vaccination. The results indicate that most of the parents had a history of past vaccination (392;98.0%) and reported having received the COVID-19 vaccination (330; 82.5%). When asked about worries regarding vaccine side effects, 56.8% (227) of parents expressed concerns, and 60.3% (241) of parents indicated that the severity of the disease would influence their decision to vaccinate their child.

The vast majority of parents (396; 99.0%) reported a history of their children's vaccination. However, when asked about adherence to their children's vaccination schedule in the past, 31.8% (127) of parents admitted to experiencing delays. Among the reasons for delay in children's vaccination, common factors included being busy at work (35; 19.6%), vaccine unavailability (39; 21.8%), and forgetting appointments (47; 26.3%). Regarding the occurrence of side effects after their children's vaccination, only 11.5% (46) of parents reported experiencing such effects.

Table 5 presents a logistic regression to identify predictors of good knowledge of vaccination among parents. The results indicated that young age categories were associated with good knowledge of parents toward vaccination. Female sex was also found to be a significant predictor, with female parents being 2.86 times more likely to have good knowledge compared to male parents (95% CI:1.609-5.11). Marital status was shown to influence parental knowledge. Specifically, being widowed was associated with higher knowledge levels. Employment status was a predictor of good knowledge, with employed parents being 2.08 times more likely to have good knowledge than unemployed parents (95% CI:1.170-

3.69). Additionally, having a child below 7 years was associated with good knowledge, indicating that parents with younger children were 2.84 times more likely to have good knowledge compared to parents with older children (95% CI:1.59-5.04).

Table 4: Worries and adherence of the parents toward vaccination

Parameters	n=400	%
History of parental past vaccination		
Yes	392	98.0
No	8	2.0
History of parental COVID-19 vaccination		
Yes	330	82.5
No	70	17.5
Worry about side effects of children's vaccines		
No	173	43.3
Yes	227	56.8
The severity of the disease would affect the decision to take a vaccine		
No	111	27.8
Not sure	48	12.0
Yes	241	60.3
History of children's vaccination		
Yes	396	99.0
No	4	1.0
Adherence to their children's vaccination schedule in the past		
Yes	273	68.3
Delayed	127	31.8
Causes of delay in children's vaccination schedule in the past		
Busy at work	35	19.6
Vaccine unavailability	39	21.8
Forget appointment	47	26.3
Others	58	32.4
Experiencing side effects after their children's vaccination		
No	354	88.5
Yes	46	11.5

Table 5: Logistic regression of the predictors of good knowledge of vaccination among the parents

Parameters	B	S.E.	Wald	Sig.	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
Young age categories	0.44	0.146	9.21	0.002*	1.55	1.170	2.07
Female sex	1.05	0.295	12.76	0.000*	2.86	1.609	5.11
Marital status: Married (Ref.)			7.08	0.029*			
Marital status (Widow)	1.48	0.559	7.08	0.008*	4.43	1.481	13.26
Marital status (Divorced)	-18.12	102.45	0.00	0.999	0.000	.000	
Employed	0.73	0.29	6.22	0.013*	2.08	1.170	3.69
Having a child below 7 years	1.04	0.29	12.66	<0.001*	2.84	1.59	5.04
Constant	-3.82	0.73	27.05	0.000*	0.022		

*Statistically significant (p<0.05)

Table 6 shows the logistic regression to identify predictors of a positive attitude toward vaccination among parents. Female parents were 3.58 times more likely to have a positive attitude compared to male parents (95% CI:1.91-6.72). Furthermore, a high knowledge score was a significant predictor of a positive

attitude toward vaccination. However, employment status showed a significant positive association with a positive attitude toward vaccination. Employed parents were 0.46 times as likely to have a positive attitude compared to unemployed parents (95% CI: 0.24–0.86).

Table 6: Logistic regression of the predictors of the positive attitude toward vaccination among the parents

Parameters	B	S.E.	Wald	Sig.	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
Female sex	1.27	0.32	15.83	0.000*	3.58	1.91	6.72
Employed	-0.77	0.32	5.89	0.015*	0.46	0.24	0.861
Total knowledge score	0.67	0.11	32.43	0.000*	1.95	1.553	2.46
Constant	-3.76	0.67	30.95	0.000*	0.02	-	-

*Statistically significant ($p < 0.05$)

DISCUSSION

Parental knowledge and attitude toward childhood vaccination are crucial factors that should be considered to increase vaccination coverage rates and parents' adherence to vaccine protocols.¹⁵ In this study, we assessed the level of knowledge and attitude of parents in Riyadh province regarding childhood vaccination, as well as the factors influencing them and the level of adherence to scheduled vaccines.

In terms of parental knowledge of vaccination for their children, the overall results showed that 30.2% had good knowledge, 49.8% had fair knowledge, and 20% had poor knowledge of vaccination. However, various studies conducted in SA have reported a relatively high level of awareness and knowledge among Saudi parents regarding childhood vaccination.^{5,13,14,16,17} These findings indicate that the parental knowledge about childhood vaccination should be given priority, and measures are to be taken to improve the knowledge in Riyadh province.

A detailed examination of knowledge revealed that a significant proportion of parents understood how vaccines work, recognized the lifelong protection offered by regular vaccination, knew the type of vaccines, trusted the safety of vaccines, were aware of the vaccines given to their children, understood the importance of childhood vaccination, and knew the risks of delaying vaccination. This aligns with views reported in previous studies from SA that explored the knowledge gap among parents regarding vaccines.^{5,15}

Regarding attitude, 29.8% of parents exhibited positive attitudes. On the other hand, previous studies have found that most Saudi Arabian parents have a positive attitude toward childhood vaccination and recognize its benefits.^{13,14} The majority of parents agreed that vaccines strengthen the immune response to the specific disease for which they are used. This is consistent with previous studies.^{13,14} These findings emphasize the importance of targeted communication and educational efforts to foster positive vaccination attitudes among parents.

Despite vaccines being widely known as a major means to prevent diseases, conflicting attitudes and inaccurate information or misconceptions still exist regarding vaccines.¹⁸ The present study revealed diverse attitudes among parents toward vaccination. The majority of parents demonstrated positive attitudes, agreeing that vaccines strengthen the immune system, considering vaccinations as the best way for personal protection, and thinking that successive vaccine doses ensure long-lasting effects. However, opinions varied on other aspects such as acknowledgment of vaccine side effects, evidence supporting vaccine effectiveness, and the effectiveness of immune response against specific diseases for which they are used for.

In another study conducted in Jeddah, Saudi Arabia, a majority of parents agreed that childhood vaccines protect against diseases for which they are given.¹⁴ This finding aligns with the results of a

systematic review by Smith et al¹⁹, which indicated that most parents recognize the importance of vaccines for their child's health. A similar belief, observed in 26.3% of participants in this study, was also reported in a previous study¹⁴, where parents believed that the immune system alone could provide sufficient protection against diseases. Likewise, Reich et al²⁰ demonstrated that a significant number of parents hold the belief that enhancing their child's immune system through natural methods is a safer alternative to vaccination. However, contrasting these views, another study found that only 11.7% of parents believed that children should rely on natural infection to develop immunity.¹⁴ These findings are also consistent with previous studies that highlighted vaccine misconception and adherence as a growing concern among parents.^{19,21} Addressing misconceptions and concerns is crucial in promoting vaccine uptake and ensuring the health of children and the wider community. Notably, some parents continue to hold misconceptions and hesitations toward vaccination, despite the overwhelming evidence that vaccines are safe and effective. These beliefs can impact vaccination uptake and lead to outbreaks of vaccine-preventable diseases. Therefore, healthcare providers must be aware of these beliefs and work to educate and address any concerns, emphasizing the importance of vaccination.¹⁷

Examining worries and adherence of parents toward vaccination, while the majority demonstrated a positive vaccination history and adherence to their children's vaccination schedule, concerns about vaccine side effects and the influence of disease severity on decision-making were evident. Parents usually worry about the potential side effects of vaccines.^{14,17} Religious, ideological, or cultural reasons may affect the opinions of parents regarding vaccines.²² However, it is noteworthy to note that these concerns may not be the primary causes of vaccine adherence among Saudi parents.¹⁴ These findings highlight the importance of addressing parental concerns, providing accurate information, and promoting vaccine confidence through targeted interventions and communication strategies.

Regarding adherence to the vaccine protocol, the majority of parents (99%) vaccinated their children, which is consistent with previous research in Saudi Arabia.^{8,14} However, some parents still delay vaccinating their children, indicating that healthcare providers may need to address these concerns among vaccine-hesitant parents. These results are consistent with previous studies that recorded low vaccine delay levels among parents and that most parent vaccinate their children on time according to the national immunization schedule.^{8,12,14,17,23} Similarly, in Al-Madinah Al-Munawara, Saudi Arabia, the majority of parents adhered to the recommended vaccination schedule for their children. A large proportion of parents demonstrated good practice toward vaccination, with vaccination according to the Ministry of Health (MOH) schedule being reported as the norm.²⁴ We explored that the most common causes of delayed vaccination were forgotten vaccine dates, unavailability of vaccines, and parents' employment commitments. Alotaibi et al¹² reported similar causes of vaccine delay. They also consider this delay an important predictor associated with reluctance to give the vaccine in the future. These findings contribute to the understanding of factors associated with vaccine adherence and highlight the importance of education in promoting vaccine acceptance.

Several factors were associated with parents' knowledge and attitudes toward vaccination. Younger age categories, female sex, being widowed, employment status, and having a child below 7 years were predictors of good knowledge among parents. Similarly, female sex, employment status, and higher knowledge scores were predictors of a positive attitude toward vaccination. These findings highlight the importance of considering demographic factors and knowledge levels when developing interventions to improve parental knowledge and attitudes toward vaccination. Previous research has indicated that sociodemographic factors, such as gender, can influence parents' beliefs and knowledge about vaccination.¹⁴ A study conducted by Almutairi et al¹⁶ found that good knowledge, attitude, and practice toward immunization were associated with female gender and higher education. Similarly, Alshammari

et al⁵ and Habib et al¹³ revealed that good knowledge, attitude, and practice were more likely among females. This association between female gender and positive attitude toward child immunization can be explained by the fact that mothers often accompany their children during vaccination visits and may actively seek information from the internet or social media. Additionally, as primary caregivers, mothers typically spend more time educating their children about health, which may contribute to their higher levels of knowledge and positive attitudes.⁵ Regarding family composition, Ramadan et al²⁵ found that parents with more children tended to have higher knowledge and a positive attitude toward vaccines. Alshammari et al⁵ also demonstrated a significant association between parents' age, the number of children, and good knowledge.²⁶ Alotaibi et al¹² also found that understanding the importance of immunization is linked to a better attitude toward vaccines. The positive attitude toward vaccination may be influenced by the awareness that vaccination is mandatory and necessary for school registration.²⁵ These findings highlight the importance of considering these factors when developing interventions to improve parental knowledge and attitudes toward vaccination.

CONCLUSION

This study explored the knowledge, attitude, and adherence to vaccination protocols among parents in the Riyadh Region, Saudi Arabia. While nearly all parents reported that their children received vaccinations, there were notable knowledge gaps and misconceptions regarding vaccination. Factors such as younger age, female sex, marital status, employment, and having younger children were identified as predictors of good knowledge. Although the majority of parents reported adherence to vaccination schedules, a considerable proportion admitted to delays in vaccination. Overall, the study emphasizes the significance of targeted health education interventions to improve parental knowledge and attitudes toward vaccination. By addressing knowledge gaps, addressing misconceptions, and promoting positive attitudes, healthcare professionals and policymakers can contribute to increasing vaccination rates and improving overall public health outcomes.

LIMITATIONS AND STRENGTHS

This study has the following limitations that should be taken into account when interpreting the findings. First, the reliance on self-reported questionnaires might have introduced some level of bias, as participants may have responded in ways they perceived to be socially acceptable rather than completely accurate. Second, the cross-sectional study design limits the ability to establish causal relationships between the identified predictors and parental knowledge, attitudes, or adherence to vaccination protocols. Third, while the convenience sampling method allowed for broad regional representation, it may not fully reflect the diverse demographic characteristics of the Saudi parental population, which could affect the generalizability of the findings. Furthermore, relying solely on online social media platforms for participant recruitment may have excluded individuals with limited internet access or lower technological proficiency, potentially underrepresenting certain groups.

Despite these limitations, this research offers significant strengths. The sample size was sufficient to ensure statistical reliability, and the survey instrument was both well-structured and grounded in relevant literature. Moreover, the study identified critical predictors influencing parental knowledge and attitudes, providing valuable insights that can inform healthcare policies and targeted educational initiatives to enhance vaccination adherence and address parental concerns effectively.

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Conflict of Interest

The authors declare no conflicts of interest relevant to this article.

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