

Knowledge and attitudes toward vaccination among Saudi medical students

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ABSTRACT

Background: Studies have identified healthcare providers as an important determinant of vaccination acceptance. However, knowledge and attitudes toward vaccination have not been sufficiently studied in Saudi Arabia, especially among medical students. Therefore, we conducted this study to explore vaccination knowledge and attitudes among medical students at a large Saudi university. **Methods:** A cross-sectional survey was conducted on 182 Saudi medical students between February 2019 and May 2019. Participants were invited to fill out a self-administered questionnaire assessing knowledge and attitudes toward vaccination. The statistical analysis included descriptive analysis, Chi-square test, independent samples *t*-test, and analysis of variance (ANOVA). The relationship between knowledge and attitudes was assessed using Pearson's correlation test. **Results:** A total of 182 respondents completed the questionnaires, giving a response rate of 91%. The study included male (52.7%) and female (47.3%) students from study years 2, 3, 4, 5, and 6. The overall mean knowledge score was under average [3.05/9, standard deviation (SD) = 1.86] and the respondents showed generally moderate attitudes toward vaccination (mean = 30.60/45, SD = 6.07). While there was no sex difference in both the scores on knowledge and attitudes domains, the year of study was significantly associated with the mean knowledge score ($F = 6.48, P < 0.01$) and attitudes score ($F = 7.12, P < 0.01$). As predicted, there was a significant linear relationship between vaccination knowledge and attitudes ($r = 0.71, P < 0.01$). **Conclusion:** The study revealed generally moderate attitudes of Saudi medical students toward vaccination. However, several knowledge gaps were detected. The implications of the current findings are discussed.

Keywords: Attitudes, knowledge, medical students, public health, Saudi Arabia vaccination, vaccines

Introduction

Vaccination is recognized as one of the most powerful public health strategies for reducing the burden, morbidity, and mortality related to infectious diseases.^[1-3] Despite the efficacy, widespread availability, and safety of vaccination, a growing number of parents are concerned about their safety and reluctant

to vaccinate their children.^[4] Anti-vaccination campaigns based on scientifically flawed data have been conquering the industrialized world and spreading doubtful attitudes toward vaccination since the swine flu epidemics (2009–2010).^[5] These vaccination-unfriendly attitudes represent a serious risk for public health.^[6] This phenomenon, known as “hesitancy,” has impacted the public views of vaccination as a safe and efficient method of disease prevention, resulting in reduced rates of vaccine coverage and increased rates of preventable epidemics and outbreaks.^[7-11] Measles outbreaks are an example of the impact of vaccine

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hesitancy. Although eliminating measles by 2015 was one of the main goals of the World Health Organization European Region (WHO-Euro), measles outbreaks were observed in many European countries between July 2014 and June 2015.^[12]

Healthcare workers represent a trustful source of health-related information. Previous studies have shown that physicians' attitudes toward vaccines directly affect patients' decisions about the acceptance of vaccines.^[13,14] Furthermore, studies have shown that parents perceive healthcare providers as the most reliable and important factor affecting their decisions to uptake vaccines for their children or themselves.^[15,16] Considering these findings, healthcare professionals must be well-prepared to communicate evidence-based information with patients and their relatives and improve knowledge and attitudes toward vaccination. In Saudi Arabia, pediatricians and general practitioners are the doctors who usually recommend vaccination, and thus they have a key role in immunization promotion. Therefore, educating future doctors early in their career is an essential component of delivering knowledgeable medical graduates, who improve vaccine acceptance among the public.^[17] Medical students discuss vaccines as part of their clerkship in pediatrics and internal medicine, usually starting in their fourth year. Previous research conducted on medical students recognized the importance of evaluating students' knowledge and attitudes toward vaccines to plan targeted interventions to help equip students for future patient interaction regarding vaccination.^[18,19]

Based on the Ajzens' theory of planned behavior (TPB),^[20] which states that subjective norms, attitude, and perceived control shape the individual's behavior, we hypothesized that students' attitude toward vaccines would influence their engagement in vaccination promotion. In addition, we presumed that knowledge of vaccination would be correlated with attitudes toward vaccination. Therefore, we carried out this study to explore the knowledge and attitudes of medical students regarding vaccination in Saudi Arabia and to assess the effect of students' characteristics on knowledge and attitudes toward vaccination.

Methods

A descriptive cross-sectional study was conducted between February 2019 and May 2019 in a large leading university that is located in Jazan region, Southwestern Saudi Arabia. The study included medical students from years 2 to 6. The faculty of medicine of this university has a total of around 400 students. We excluded students of the first year as they are in the preparatory year and not expected to have formal exposure to the study topic. A random sample was calculated and stratified by sex and year of study. The sample consisted of a total of 200 students, who were invited to fill out an anonymous questionnaire assessing their knowledge and attitudes toward vaccination. Participation was entirely voluntary, and students were asked to provide informed written consent prior to participation. Students were approached in their classes after lectures. The study authors, who collected data, explained the purpose of the study to each class, and then participants were asked

to fill out the questionnaire separately to preserve their privacy. The questionnaire took 5–10 min to complete. The study was approved by the research committee of the university.

The questionnaire was self-administered, which was developed and validated by the authors of a previous study on Serbian students.^[21] The questionnaire incorporated questions on the participants' baseline characteristics (sex, age, and year of study), knowledge, and attitudes toward vaccination. To assess knowledge on vaccination, participants answered eight correct/incorrect questions with a "don't know" option to avoid forced-choice. Each correct answer was given a score of 1, with a total knowledge score of 8. Statements including misconceptions about vaccination were reverse-coded, that is, those who chose "incorrect" were given a score of 1. The Cronbach's alpha for the knowledge scale was 0.89, indicating good internal consistency. We used a 5-point Likert scale to assess attitudes toward vaccination in nine questions. The possible responses were as follows: strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, and strongly disagree = 1. Negative attitudes were reverse-coded. The total score of attitudes ranged from 9 to 45. The categorization of attitudes was based on the scales' quartiles. Scores from 9 to 27 (25th percentile) indicated negative attitudes, 28 to 30 (50th percentile) indicated moderate attitudes, and scores more than 30 indicated positive attitudes. The Cronbach's alpha for the attitudes scale was 0.86, indicating good internal consistency.

The mean and standard deviation (SD) were calculated for continuous variables. The categorical variables were presented as frequencies and percentages. Chi-square test was used for comparison between different categorical variables. Independent samples *t*-test and analysis of variance (ANOVA) were applied to calculate the difference between continuous and categorical variables. The correlation between knowledge and attitudes was calculated using Pearson's correlation test. Differences were considered significant if $P < 0.05$ or < 0.01 . Data were analyzed using the Statistical Package of Social Sciences (SPSS) Version 20 (SPSS, IBM Corp., Armonk, NY, USA).

Results

Baseline characteristics of the study population

Of the 200 students included in the study, a total of 182 participants completed the questionnaires (response rate: 91%). Table 1 shows the baseline characteristics of the study population. The ages ranged from 20 to 27 years, with a mean age of 23.1 years [(SD) 1.5 years]. The distribution of male and female participants was nearly even (52.7% vs 47.3%, respectively). Most of the respondents were in their fifth year (23.1%), followed by students of the sixth year (20.9%) [Table 1].

Knowledge on vaccination

As shown in Table 2, the respondents had under average scores on the knowledge questionnaire (mean = 3.05, SD = 1.86). There

was no statistically significant difference between the scores of male (mean = 2.91, SD = 1.82) and female (mean = 3.22, SD = 1.89) respondents ($t = 1.14, P = 0.25$). Regarding the year of study, ANOVA revealed that students of the sixth (mean = 3.40, SD = 1.28) and fifth (mean = 3.40, SD = 1.95) years had significantly higher mean knowledge scores than did their peers in earlier years ($F = 6.48, P < 0.01$). Regarding the year of study, the analysis of variance revealed that students of the 6th (Mean = 34.16, SD = 4.46) and 5th (Mean = 31.45, SD = 5.76)

years had significantly higher mean knowledge scores than did their colleagues in earlier years ($F = 7.12, P < 0.01$) [Table 2].

The question on the legal obligation for vaccination of children in the Saudi Arabia showed the highest proportion of correct answers (64.8%). Less than half of the respondents correctly answered questions on the connection between vaccines chronic illnesses such as autism, diabetes and multiple sclerosis (35.7%), efficiency of vaccines (30.8%), the fact that giving multiple vaccines at the same time cannot overload the immune system (37.4%), and that mumps virus infection can have serious complications such as hearing loss and meningitis (38.5%). Only a small fraction of students correctly thought that vaccinations are not contraindicated in a child with an ear infection [Table 3].

Table 1: Baseline characteristics of the study population

Variables	n	%
Age (years)		
Range	20-27	
Mean (SD)	23.1 (1.5)	
Sex		
Male	96	52.7
Female	86	47.3
Total	182	100.0
Second year	33	18.1
Third year	32	17.6
Fourth year	37	20.3
Fifth year	42	23.1
Sixth year	38	20.9
Total	182	100.0

SD: standard deviation

Table 2: Summary descriptives for the participants' responses on the knowledge and attitudes questionnaires

Variables	Knowledge mean (SD)	Attitudes mean (SD)
Sex		
Male	2.91 (1.82)	30.74 (5.79)
Female	3.22 (1.89)	30.45 (6.40)
	$t=1.14, P=0.25$	$t=0.32, P=0.75$
Second year	2.55 (1.80)	30.55 (5.76)
Third year	2.53 (1.78)	27.94 (4.62)
Fourth year	2.46 (1.86)	28.35 (7.21)
Fifth year	3.40 (1.95)	31.45 (5.76)
Sixth year	4.13 (1.28)	34.16 (4.46)
	$F=6.48, P<0.01$	$F=7.12, P<0.01$
Total	3.05 (1.86)	30.60 (6.07)

SD: standard deviation

Attitudes toward vaccination

As shown in Table 2, the respondents had moderate attitude scores toward vaccination as (Mean = 30.60, SD = 6.07). There was no statistically significant difference between the scores of male (mean = 30.74, SD = 5.79) and female (mean = 30.45, SD = 6.40) respondents ($t = 0.32, P = 0.75$). Regarding the year of study, ANOVA revealed that students of the sixth (mean = 34.16, SD = 4.46) and fifth (mean = 31.45, SD = 5.76) years had significantly higher mean knowledge scores than did their colleagues in earlier years ($F = 7.12, P < 0.01$).

A considerable proportion of the respondents strongly agreed (40.1%) and agreed (26.4%) that “The doctor has an important role in educating parents about the importance of childhood vaccination.” Students’ responses to the statements assessing their attitudes toward vaccination are listed in Table 4.

Knowledge and attitudes

In Table 5, Pearson’s correlation analysis showed a high positive linear relationship between the respondents’ knowledge and attitudes toward vaccination ($r = 0.71, P < 0.01$). This means the higher the students’ knowledge, the more the positive attitudes toward vaccination [Table 5].

Table 3: Distribution of the participants' responses to the knowledge questionnaire

Statement	Correct		Incorrect		Don't know	
	n	%	n	%	n	%
The modern scientific evidence confirms the connection of vaccines with chronic illnesses such as autism, diabetes, and multiple sclerosis.	58	31.9	65	35.7	59	32.4
Vaccines are 100% efficient.	60	33.0	56	30.8	66	36.3
In Saudi Arabia there is a legal obligation for vaccination of children.	118	64.8	26	14.3	38	20.9
Giving multiple vaccines at the same time can overload the immune system.	61	33.5	68	37.4	53	29.1
Mumps virus infection can have serious complications such as hearing loss and meningitis	70	38.5	49	26.9	63	34.6
Thanks to systematic implementation of vaccination, poliomyelitis (polio) and diphtheria are virtually cut-off from the European continent.	88	48.4	41	22.5	53	29.1
Reduced rates of vaccination in certain regions of Europe and the United States caused the significant increase in the incidence of measles and whooping cough in these regions. *	64	35.2	47	25.8	71	39.0
A child with an ear infection under antibiotic therapy should not be administered the vaccine	39	21.4	27	14.8	116	63.7

*Correct statement

Table 4: Distribution of the participants' responses to the attitudes questionnaire

Statement	Strongly disagree		Disagree		Neither agree nor disagree		Agree		Strongly agree	
	n	%	n	%	n	%	n	%	n	%
	Media allegations about the connection between vaccines with chronic diseases, such as autism, and multiple sclerosis, have led me to doubt about vaccination as safe method.*	27	14.8	32	17.6	52	28.6	51	28.0	20
It is important to keep vaccination coverage of the population in order to avoid the emergence of new epidemics.	18	9.9	26	14.3	28	15.4	62	34.1	48	26.4
Educating parents about vaccines is an important way to connect a vaccination coverage of the population.	19	10.4	25	13.7	23	12.6	65	35.7	50	27.5
The doctor has an important role in educating parents about the importance of childhood vaccination.	14	7.7	24	13.2	23	12.6	48	26.4	73	40.1
It is no longer necessary to vaccinate children because all of these diseases are very rare today.*	27	14.8	34	18.7	51	28.0	61	33.5	9	4.9
Vaccines contain substances that have been proven harmful to children's health.*	38	20.9	55	30.2	32	17.6	44	24.2	13	7.1
There is not enough evidence that immunization prevents the occurrence of infectious diseases.*	35	19.2	42	23.1	38	20.9	50	27.5	17	9.3
I would advise the patient to vaccinate their child in a prescribed program of immunization	19	10.4	18	9.9	31	17.0	69	37.9	45	24.7
If vaccines against HIV and hepatitis C were available, I would definitely be vaccinated	23	12.6	9	4.9	26	14.3	73	40.1	51	28.0

*Negative attitudes were reverse-coded

Table 5: Correlation between knowledge and attitudes

Variables	Knowledge score	Attitudes score
Knowledge score		0.710*
Attitudes score	0.710*	

*Correlation is significant at the 0.01 level (two-tailed)

Discussion

The research on knowledge and attitudes toward vaccination among Saudi medical students is limited. The existing published studies demonstrated a lack of knowledge on the current topic among Saudi medical students. Al Shammari conducted a study to assess knowledge and attitude toward influenza vaccination among Saudi healthcare professionals and found a remarkable lack of knowledge, as almost 75% were not aware of the influenza vaccination guidelines published by the Centre for Disease Control. The reported vaccination rate was as low as 38%.^[22] Similar results were found by another study of Saudi medical students, which revealed unsatisfactory knowledge of influenza vaccination.^[23] This study presented preliminary data on the knowledge and attitudes toward vaccination among medical students in the Southwestern part of Saudi Arabia. Our findings are in agreement with those of previous studies conducted in Saudi Arabia^[22,23] and United States of Emirates, Kuwait, and Oman.^[24] In a study of 2010 pediatricians and 1712 general practitioners, the authors reported a significant relationship between vaccination coverage rate and physicians' attitudes toward vaccination.^[13] Similarly, the WHO Strategic Advisory Group of Experts (SAGE) on Immunization has reported that physicians' beliefs and attitudes were among the significant determinants of vaccine hesitancy.^[25] Bearing in mind the presumptions of the TPB,^[20] the unsatisfactory attitudes found in this study may negatively impact the medical students' engagement in the promotion of vaccination.

The analysis of individual items showed serious gaps in the knowledge of vaccination among the surveyed students. For example, only 35.7% of students knew that there was no association between MMR vaccines and chronic diseases such as autism, diabetes, and multiple sclerosis. Higher percentages were reported by Leask *et al.* (59%),^[26] Betsch *et al.* (55.8%),^[18] and Cvjetkovic *et al.* (53.4%).^[21] However, these studies collectively confirmed the susceptibility of medical students to the lack of proper education or media allegations.^[21] Additionally, we found gaps in students' knowledge regarding the efficiency of vaccines, giving multiple vaccines and the immune system overload, complications of mumps virus infection, and conditions in which vaccinations are not contraindicated, such as in a child with an ear infection. These findings could be used in planning targeted interventions aiming at bridging such gaps in their knowledge.

As predicted, the knowledge score among the surveyed students was strongly correlated with their scores on the attitudes domain, showing a significant linear relationship between both domains ($r = 0.71, P < 0.01$). These findings are in line with a study of Serbian medical students that found knowledge to be the strongest independent predictor of attitudes toward vaccination.^[21] Studies by Betsch *et al.*^[18] and Pelly *et al.*^[19] have also shown similar findings. Therefore, we agree with Cvjetkovic *et al.*^[21] who proposed including vaccinology in the mandatory curricula of the Faculty of Medicine with an emphasis on gaining communication skills regarding vaccination. However, it is noteworthy that further research on the topic is warranted to confirm our preliminary findings. The analysis of the difference in knowledge and attitudes with respect to the year of study revealed a significant relationship. Students of the second, third, and fourth years had significantly lower scores on both domains than did students of the fifth and sixth years. This could be due to lower exposure to the topic of vaccination among students of earlier years. In fact, the students of this

university do not have any formal education on vaccination until their first pediatric clerkship in the fifth year, and we included students of earlier years to assess the effect of year of study on the study outcomes. These findings are consistent with what has been found by previous studies.^[21,23] Again, early involvement of medical students in a well-organized and targeted curricular education on vaccination would deliver medical graduates who are equipped with evidence-based information and competent to improve the acceptance and coverage of vaccination among the public. Medical students are the future doctors who will be in a position to deliver medical advice to the public. Studies have shown that most parents follow the advice of their primary health care providers and adhere to the school vaccination requirements by having their children fully vaccinated before school entrance.^[27,28]

The results of this study should be interpreted with caution as the study has some limitations, including the relatively small sample size, the enrollment of students of a single institution in Saudi Arabia, and the use of self-administered instrument. Despite these limitations, the results of this study have a marked potential in encouraging future studies to explore and improve knowledge and attitudes toward vaccination among medical students from around the country.

Conclusion

This study revealed generally moderate attitudes of Saudi medical students toward vaccination. The knowledge gaps detected in this study and the significant correlation between knowledge and attitudes toward vaccination imply introducing a comprehensive vaccinology curriculum at the undergraduate level. However, further studies are required to validate the findings of this study.

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Conflicts of interest

There are no conflicts of interest.

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