

ORIGINAL ARTICLE

Knowledge, attitude, and acceptance of adult vaccination programs among healthcare workers in Saudi Arabia: a cross-sectional study

Nada Kamaleldin Seedahmed Gargab^{1*}, Mohammad Maksoud¹

Full list of author information is available at the end of the article.

ABSTRACT

Background: Healthcare workers (HCWs) are more susceptible to infection as they are in contact with patients with different diseases and conditions. Therefore, vaccination of HCWs can reduce the infection of preventable diseases and consequences related to such infections. The knowledge, attitude, and acceptance of HCWs regarding adult vaccination programs determine HCWs' uptake of vaccines, as well as their recommendation of the vaccine to patients.

Aim: To assess the knowledge, attitude, and acceptance of HCWs regarding adult vaccination programs in Saudi Arabia.

Methods: This was a cross-sectional study that was conducted on HCWs at the National Medical Care between the period from July to June. The study was conducted via a questionnaire distributed to the participants, which investigated knowledge, attitude, and acceptance of HCWs regarding adult vaccination programs.

Results: A total of 210 HCWs met the criteria and were enrolled. There were 161 (76.7%) who received the influenza vaccine and the COVID-19 booster dose, but only 56 (26.7%) recommended adult vaccines to their patients. The mean $\pm$ SD score of knowledge and attitude was 4.6 ± 1.5 and 23.4 ± 2.85 , respectively. The mean score of knowledge and attitude was significantly influenced by gender, nationality, profession, and years of experience ($p < 0.05$). There was a linear correlation between knowledge and attitude ($R = 0.758$, $p < 0.001$).

Conclusion: The HCWs had low knowledge, a positive attitude, and moderate acceptance of adult immunization. There was a positive correlation between knowledge and attitude. Furthermore, higher acceptance of vaccinations was linked with higher knowledge and attitude.

Keywords: Knowledge, attitude, acceptance, HCWs, vaccination programs.

Introduction

Immunization is a global health success story, as it results in saving millions of lives annually [1]. Vaccination is a fundamental element of preventive healthcare; it has a significant role in reducing the burden of infectious illness and improving health outcomes [2]. Adult vaccination has gained potential attention recently as it provides protection against a wide range of diseases that can cause severe consequences [2]. The immune system weakens as age increases, making adults more prone to infections such as influenza, shingles, pneumonia, and other infections that can be

prevented through timely vaccinations [1]. Furthermore, in the case of healthcare workers (HCWs), as they are in contact with patients, the probability of infection transmission is high [3].

Correspondence to: Nada Kamaleldin Seedahmed Gargab

*Care Medical Hospital, Saudi Arabia.

Email: nada.km33@gmail.com

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Vaccination and immunization of HCWs have been associated with improvements in safety and reduction in morbidity and mortality in hospitals [4–9]. Additionally, vaccination of HCWs resulted in reduction of workplace absence, provides cost savings for healthcare organizations, and delivers economic benefits for the healthcare system [4,10,11]. Nonetheless, adult vaccination programs are not as effective as those of childhood [12,13]. This may return to a lack of knowledge regarding the vaccination and its importance, concerns regarding the efficacy and its side effects, the absence of national policy addressing immunization, economic cost, and lack of health insurance coverage for adult vaccination. However, such factors may differ in the case of adult vaccination among HCWs [1].

HCWs have an important role in the success of vaccination programs, and their knowledge and attitude in relation to vaccines determine their intention for vaccine acceptance and uptake as well as their recommendation of the vaccine [14,15]. Therefore, understanding the knowledge, attitude, and acceptance of HCWs regarding adult vaccination is crucial for designing effective interventions and improving vaccination rates in the community and among the HCWs [2]. The uptake and success of vaccination programs for adults can be influenced by the knowledge and attitude of HCWs regarding adult vaccination [16]. HCWs who have negative attitudes or are hesitant about vaccines can share such unfavorable attitudes and tend to recommend vaccination to their patients infrequently [17]. Therefore, a proactive and positive attitude with a belief in the importance of adult vaccination is associated with the acceptance and uptake of the vaccination [16].

Review of Literature

A previous Saudi study from Makkah was conducted on health practitioners to assess their knowledge, attitude, and practice (KAP) regarding adult vaccination. The study enrolled 193 participants and found that the majority of participants displayed good knowledge and positive attitudes toward adult vaccination. Additionally, nurses were more prone to provide information, address concerns, and actively recommend adult vaccination [2].

A study from Abha enrolled 103 primary healthcare (PHC) physicians to assess their KAP regarding adult vaccination. It was found that only 6% of the physicians had good knowledge, and 41% had a positive attitude. Consequently, most of the physicians (70%) displayed poor practice. The knowledge was considerably higher among older and non-Saudi subjects, whereas positive attitude was associated with female gender, non-Saudi physicians, and having experience for more than 10 years. Good practice was linked with older age and experience of more than 10 years [18].

One study in Saudi Arabia was conducted on HCWs, but focused on influenza vaccination only and included 1,273 HCWs and found that most HCWs had appropriate knowledge regarding vaccination, where 37.1% had a high level, and 26.6% had a moderate level. However, less than one-half (41.2%) had a positive attitude to the vaccine, and 80.2% displayed good vaccine practices. The acceptance and uptake of the vaccine were found to be influenced by some factors, including awareness of guidelines, previous vaccination, workplace availability, engagement in training programs, type of workplace settings, and having positive attitudes toward the vaccine [19].

Another Saudi study focused on hepatitis B vaccination among healthcare professionals (HCPs). A total of 476 surveys were retrieved from the professionals, and it was found that almost 16.5% had not received the hepatitis B vaccine; however, the majority of participants believed that vaccination is an effective strategy to reduce disease incidence (75%). The availability of the vaccine was a major barrier to vaccination (48.7%), and safety concerns surrounding the vaccine (37%) [20].

Another study from Saudi Arabia was conducted on 200 HCWs in PHC centers in Riyadh to assess the acceptance of seasonal influenza vaccine. It was found that only 41% of the HCWs received the vaccination, which reveals a low acceptance level. Based on multivariate analysis, HCWs who perceived influenza vaccine as beneficial (odds ratio [OR] 1.25), those doing clinical work (OR 2.83), and non-Saudi HCWs (OR 3.81) were more prone to vaccinate against influenza [21]. However, the study focused on acceptance of only one vaccination, not vaccination in general. Another Saudi study focused on acceptance of HCWs but regarding the COVID-19 vaccine. The study included 673 HCWs, and it was discovered that almost one-half (50.52%) were willing to have the vaccine [22].

A study from India conducted on 500 HCPs reported a low level of knowledge regarding immunization, where only 7.8% of the professionals had excellent knowledge, whereas 15.2% had good knowledge. The most recognized vaccines were hepatitis B (71.2%) and tetanus (46.4%). However, the large majority of the participants (95.6%) had a positive attitude toward recommending vaccines, and 85.4% actively motivated others to vaccinate. Surprisingly, only 48.8% expressed willingness to vaccinate. The major barriers to vaccination included financial factors and family members [1]. In Italy, only 14.1% of HCWs knew all the recommended vaccinations for HCWs. Physicians and those who had received information about vaccinations from scientific journals, educational activities, or professional associations were more likely to have knowledge, whereas those aged 36–45 years were less likely to have knowledge [23].



Rationale of the Study

Vaccination has a significant role in reducing the burden of infectious illness and improving health outcomes. HCWs are more prone to infection as they are in contact with patients with different diseases and conditions. Therefore, vaccination of HCWs can reduce the infection of preventable diseases and consequences related to infection. The success of adult vaccination programs is influenced by HCWs, as the knowledge, attitude, and acceptance of HCWs regarding vaccinations determine HCWs' intention for vaccine acceptance and uptake, as well as their recommendation of the vaccine to patients. Consequently, the knowledge, attitude, and acceptance of HCWs affect the uptake of vaccination among HCWs and the patients from the general population. Therefore, understanding the knowledge, attitude, and acceptance of HCWs regarding adult vaccination is crucial for designing effective interventions and improving vaccination rates in the community and among the HCWs.

Methodology

This research was a cross-sectional study that was conducted in Saudi Arabia via an online questionnaire on all HCWs at the National medical care. The questionnaire was distributed online, and the HCWs were invited through social media and emails. The study was conducted between the period from----- to-----.

Population

All HCWs at the National medical care.

Inclusion criteria

- HCWs working in Saudi Arabian healthcare facilities.
- HCWs working in governmental and private hospitals.
- HCWs of both genders.
- Having experience of ≥ 1 years.

Exclusion criteria

- HCWs from outside Saudi Arabia.
- Having less than 1 year of experience.

Data collection

The researcher designed a questionnaire to collect the data from the participants after reviewing related literature. The questionnaire included four sections with permission for participation in the study before the questions of the survey. The first section included questions investigating the demographics of HCWs and immunization status. The second section included questions investigating the knowledge of HCWs regarding vaccination, whereas the third section involved questions investigating the acceptance of HCWs regarding vaccination through the investigation of factors present and that increase the likelihood of receiving the adult vaccine. The fourth section investigated the attitude of the HCWs.

Pilot study

A pilot study was conducted on 25 participants meeting the inclusion criteria and using the same survey adopted in the original research. The validity and reliability of the survey were investigated; Cronbach's alpha (α) was 0.81

Statistical analysis

SPSS version 26 was implemented for data analysis; mean ($\pm$ SD) and frequency (%) described numerical and

Table 1. Demographic characteristics.

Variables		Mean	n	%
Age		38.9 $\pm$ 8.5		
I voluntarily agree to participate	Yes		210	100.0
Gender	Female		104	49.5
	Male		106	50.5
Nationality	Non-Saudi		145	69.0
	Saudi		65	31.0
Profession	Allied Health Professional		48	22.9
	Dentist		41	19.5
	Nurse		56	26.7
	Pharmacist		48	22.9
	Physician		17	8.1
Years of experience	<5		56	26.7
	5-10		106	50.5
	>15		48	22.9



qualitative data, respectively. The possible correlations were investigated through the Student *t*-test or ANNOVA to test the correlation between variables based on the type and number of variables. *p* value significance was deemed at ≤ 0.05 .

Ethical consideration

----- provided us with the ethical approval before the initiation of the study on-----, with an approval number of-----. The survey was available online; therefore, participation in the study is voluntary. However, the survey included permission to be provided from each participant before filling out the questionnaire.

Results

A total of 210 eligible subjects agreed to participate in this study; the mean $\pm$ SD of age of the participants was 38.9 ± 8.5 years. Males were slightly more dominant compared to females, 106 (50.5%) versus 104 (49.5%), respectively. Non-Saudi healthcare providers represented more than one-half of the subjects, 145 (69%), and the largest proportion was the nurse profession, 56 (26.7%). Almost one-half of the subjects reported an experience of 5-10 years 106 (50.5%), as shown in [Table 1](#).

The acceptance of vaccination among our participants revealed that only 47 (22.4%) received formal training

Table 2. Vaccine acceptance among the study group.

Questions	No		Yes	
	<i>n</i>	%	<i>n</i>	%
Have you received formal training on immunization?	163	77.6	47	22.4
Have you received the seasonal influenza vaccine during the last year?	49	23.3	161	76.7
Have you received a COVID-19 booster dose?	49	23.3	161	76.7
Have you received any adult vaccines in the last 5 years?	49	23.3	161	76.7
Do you routinely recommend adult vaccines to your patients?				
Always	56	26.7		
Rarely	49	23.3		
Sometimes	105	50.0		

Table 3. Assessment of knowledge toward vaccination.

Items	No or do not know		Yes	
	<i>n</i>	%	<i>n</i>	%
Influenza vaccination is recommended annually for healthcare workers	49	23.3	161	76.7
Adult vaccination can reduce hospitalization rates	105	50.0	105	50.0
The pneumococcal vaccine is recommended for some high-risk adults	154	73.3	56	26.7
Vaccines can provide herd immunity	90	42.9	120	57.1
Mild fever after vaccination is usually a normal reaction	120	57.1	90	42.9
Vaccines can cause the diseases they are designed to prevent	49	23.3	161	76.7
Immunocompromised adults may require special vaccination recommendations	98	46.7	112	53.3
Adult vaccination contributes to disease prevention	56	26.7	154	73.3
Range, mean (SD)	2-8, 4.6 (1.5)			



on immunization, whereas most of the participants, 161 (76.7%), reported receiving a seasonal influenza vaccine during the last year, a COVID-19 booster dose, and an adult vaccine in the previous 5 years. However, a small proportion 56 (26.7%) reported always recommending adult vaccination to their patients, as shown in Table 2.

Regarding the knowledge toward vaccination, the largest proportion, 161 (76.7%), stated that the influenza vaccine is recommended annually for HCWs, and vaccines can cause the disease they are designed to prevent. The lowest proportion, 56 (26.7%), agreed that the pneumococcal vaccine is recommended for some high-risk adults. The range of knowledge was 2–8 scores, whereas the mean $\pm$ SD score of knowledge was 4.6 ± 1.5 scores, as shown in Table 3.

Table 4. Knowledge score according to sociodemographics.

Variables		Knowledge score		p Value
		Mean	SD	
Gender	Female	3.97	1.56	<0.001
	Male	5.15	1.13	
Nationality	Non-Saudi	4.27	1.68	<0.001
	Saudi	5.23	0.42	
Profession	Allied Health Professional	2.08	0.58	<0.001
	Dentist	5.90	0.62	
	Nurse	4.95	0.40	
	Pharmacist	5.00	0.00	
	Physician	5.88	0.33	
Years of Experience	<5	4.95	0.40	<0.001
	>15	5.00	0.00	
	5–10	4.17	1.99	

The investigation of the correlations between knowledge mean score and sociodemographics revealed a significant association ($p < 0.001$), where males, Saudi subjects, dentists, physicians, and those having experience of more than 15 years reported the highest mean score of knowledge, as shown in Table 4.

The correlations between knowledge mean score and acceptance of vaccination revealed significant correlations between the mean score of knowledge and seasonal influenza, COVID-19 booster dose, and adult vaccine ($p < 0.001$). The highest mean score of knowledge was reported by those who received the influenza vaccine, the COVID-19 booster dose, and the adult vaccine. However, no considerable relation was found between knowledge and training on immunization ($p = 0.94$), as shown in Table 5.

The attitude of HCPs toward vaccination was investigated via ten questions. The questions and answers of the participants are shown in Table 6. The range of attitude score is 20–28 with a mean $\pm$ SD score of 23.4 ± 2.85 .

There were significant correlations between the mean score of attitude and demographics of the participants (Table 7). The highest mean score of attitude was reported by males ($p < 0.001$), Saudi healthcare providers ($p = 0.008$), dentists ($p < 0.001$), and those with more than 15 years of experience ($p < 0.001$).

The attitude of the healthcare providers revealed significant associations with acceptance of the vaccine (Table 8). The highest mean score of attitude was significantly reported by those who did not receive training on immunization, received influenza vaccine, COVID-19 booster dose, and adult vaccine ($p < 0.001$).

There was a positive significant correlation between the scores of knowledge and attitude ($R = 0.758$, $p < 0.001$), Table 9.

Table 5. Knowledge score according to vaccine acceptance.

Items	Knowledge score				p Value
	No		Yes		
	Mean	SD	Mean	SD	
Have you received formal training on immunization?	4.57	1.58	4.55	1.08	0.94
Have you received the seasonal influenza vaccine during the last year?	2.82	1.63	5.10	0.92	<0.001
Have you received a COVID-19 booster dose?	2.00	0.00	5.35	0.48	<0.001
Have you received any adult vaccines in the last 5 years?	2.00	0.00	5.35	0.48	<0.001



Table 6. Attitudes toward vaccination.

	Agree		Disagree		Neutral		Strongly agree		Strongly disagree	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Vaccines are important to my health	0	0.0	0	0.0	98	46.	112	53.3	0	0.0
My child(ren) receive all recommended vaccines	112	53.3	0	0.0	49	23.3%	49	23.3	0	0.0
I trust the advice of my main health care provider regarding vaccines	97	46.2	0	0.0	64	30.5	49	23.3	0	0.0
Health care providers have my best health interests at heart	56	26.7	0	0.0	105	50.0	49	23.3	0	0.0
It is important for everyone in my community to get recommended vaccines	146	69.5	0	0.0	49	23.3	0	0.0	15	7.1
I am concerned about the serious adverse effects of vaccines	56	26.7	0	0.0	105	50.0	49	23.3	0	0.0
I worry that vaccines might not be safe	15	7.1	41	19.5	49	23.3	105	50.0	0	0.0
New vaccines are not as safe as older vaccines	56	26.7	0	0.0	49	23.3	105	50.0	0	0.0
It is possible to have too many vaccines	0	0.0	0	0.0	105	50.0	105	50.0	0	0.0
My child(ren) do not need vaccines for diseases that are not common anymore	0	0.0	0	0.0	105	50.0	105	50.0	0	0.0
Range, mean (SD)	20-28, 23.4 ± 2.85									

Table 7. Attitude score in relation to demographics.

Variables		Attitude score		<i>p</i> value
		Mean	SD	
Gender	Female	21.86	2.25	<0.001
	Male	24.92	2.55	
Nationality	Non-Saudi	23.04	3.25	0.008
	Saudi	24.22	1.33	
Profession	Allied Health Professional	20.17	1.15	<0.001
	Dentist	27.80	1.25	
	Nurse	22.02	0.49	
	Pharmacist	24.94	0.43	
	Physician	22.18	0.73	
Years of experience	<5	22.02	0.49	<0.001
	5-10	23.44	3.72	
	>15	24.94	0.43	

Discussion

Vaccination and immunization of HCWs are linked with improvements in safety and a reduction in morbidity and

mortality in hospitals [4-9]. Additionally, the knowledge and attitude of HCWs regarding vaccination in relation to vaccines determine their intention for vaccine acceptance and uptake as well as recommending the vaccine to the patients [14, 15]. Therefore, understanding the knowledge, attitude, and acceptance of HCWs regarding adult vaccination is necessary [2]. This study was conducted to assess the knowledge, attitude, and acceptance of HCWs regarding adult vaccination programs in Saudi Arabia.

In the current study, we found that the knowledge of HCWs was low, and there was a generally positive attitude with moderate acceptance of adult vaccination. In contrast to our findings regarding knowledge, a study from Makkah enrolled 193 participants, including PHC physicians, nurses, and health educators, revealed that the majority of the participants exhibited good knowledge [2], but in agreement with our findings, there was a positive attitude towards adult vaccination [2]. However, the study did not investigate the acceptance level, nor did it investigate the factors influencing knowledge and attitude.

Nonetheless, our findings were superior to those from Abha, Saudi Arabia. The study focused on PHC physicians and included 103 physicians, revealing that only 6% of the physicians had good knowledge, whereas 41% had a



Table 8. Attitude score in relation to vaccine acceptance.

		Attitude score		p value
		Mean	SD	
Have you received formal training on immunization?	No	23.90	3.04	<0.001
	Yes	21.70	0.72	
Have you received the seasonal influenza vaccine during the last year?	No	21.63	3.26	<0.001
	Yes	23.94	2.49	
Have you received a COVID-19 booster dose?	No	20.00	0.00	<0.001
	Yes	24.44	2.45	
Have you received any adult vaccines in the last 5 years?	No	20.00	0.00	<0.001
	Yes	24.44	2.45	

Table 9. Correlation between knowledge and attitude score.

		Attitude score
Knowledge score	R	0.758**
	p value	<0.001

**strong positive correlation.

positive attitude toward adult vaccination, and 70% had poor practice. Such findings indicate a very low level of knowledge and practice and a low attitude toward adult vaccination [18]. Similar to our findings, one study enrolled Saudi medical students found that the overall mean knowledge score was below average (3.05 out of 9), and the respondents exhibited generally moderate attitudes toward vaccination (mean = 30.60/45) [24].

The acceptance of vaccination among our subjects was generally moderate, as more than three-quarters of the subjects reported receiving different vaccines. Such findings are better than those from a previous Saudi study that focused on acceptance of seasonal influenza vaccine among HCWs, which revealed that only 41% of the participants had received the influenza vaccine [21]. Also, regarding seasonal influenza vaccination, a higher proportion of our participants (76.7%) reported uptake of the vaccine, and this rate was higher compared to that reported in the previous study [21]. Additionally, it was found that vaccination uptake was influenced by gender, nationality, occupation, and work experience, whereas on multivariate analysis, vaccine uptake was linked with non-Saudi HCWs [21]. In our study, acceptance displayed significant correlations with knowledge and attitude, where those who reported higher acceptance also reported higher attitude and knowledge. Such findings indicate that having adequate knowledge and attitude would increase the acceptance of adult vaccination. However, we found that even those who did not receive immunization training reported more positive attitudes toward vaccination compared to

those who received training; this may be related to the profession of the participants or their long experience that made them understanding the importance of vaccination and have positive attitude toward it.

A study from Pakistan enrolled HCWs, including vaccinators, reported that more than one-half (57.5%) received no training related to expanded programs on immunization [25]. Also, a study from Spain conducted on nursing students discovered that only 44.1% reported sufficient training on vaccines [26]. Such findings were better compared to ours, where less than one-quarter (22.4%) of our subjects reported receiving training on immunization.

One study from India included 500 HCPs who reported that 85.4% actively motivated others to vaccinate [1]. In our study, the recommendation of adult vaccines to patients was not optimal, which was in contrast to the findings of the previous Indian study. Additionally, regarding the practice, only 35.8% in the Indian study had received at least one vaccine (excluding COVID-19) [1]. On the other hand, our study revealed a higher proportion of participants who received the booster dose of COVID-19.

Regarding the factors affecting knowledge, we found that higher knowledge and positive attitude were linked with male gender, Saudi HCWs, dentists, and those with experience exceeding 15 years. In contrast to our findings, the previous study revealed that better knowledge was significantly detected among non-Saudi physicians ($p = 0.001$), whereas positive attitude was significantly higher among female participants ($p = 0.013$), non-Saudi physicians ($p = 0.004$) [21], but in agreement with our findings, those with high experience in PHC ($p = 0.044$) had a positive attitude [21].

Another study enrolled Saudi medical students demonstrated findings in contrast to ours, where gender revealed no impact on the mean score of knowledge and attitude [24]. However, in agreement with our findings, there was a significant linear relationship



between vaccination knowledge and attitudes ($r = 0.71$, $p < 0.01$) [24]. Such a positive correlation indicates the importance of adequate knowledge in driving the attitude toward vaccination and, in turn, may improve vaccination acceptance.

Conclusion

The HCWs in this study had low knowledge, a positive attitude, and moderate acceptance of adult immunization. Also, we found a positive correlation between knowledge and attitude, which indicates the importance of adequate knowledge to drive a positive attitude toward vaccination. Furthermore, higher acceptance of vaccinations was linked with higher knowledge and attitude. Such findings indicate that both knowledge and attitude may relate to acceptance and uptake of the vaccines among HCWs. Therefore, increasing knowledge through educational campaigns is necessary.

Limitations, Strengths, and Recommendations

The limitation of this study was the small sample size; however, the strength of this study was the assessment of knowledge, attitude, and acceptance, and their correlation with each other and other variables. The establishment of educational programs and training is necessary to increase the knowledge of HCWs regarding adult vaccination. Also, performing similar studies after the establishment of the educational programs to assess the impact of such programs on the level of knowledge is recommended.

List of Abbreviations

Healthcare workers (HCWs)

healthcare professionals (HCPs)

primary healthcare (PHC)

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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Consent to participate

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Ethical approval

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Author details

Nada Kamaleldin Seedahmed Gargab¹, Mohammad Maksoud¹

¹Care Medical Hospital, Riyadh, Saudi Arabia

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