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Prevalence of post-vaccination COVID-19 side effects among medics and paramedics healthcare providers in Saudi Arabia

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ABSTRACT

Background: The rapid development and deployment of coronavirus disease (COVID-19) vaccines have been crucial in mitigating the pandemic's impact. However, the incidence of side effects following vaccination, especially among healthcare providers, raises concerns that must be addressed to maintain healthcare delivery and vaccine uptake. This study aims to assess the prevalence and nature of post-vaccination side effects among healthcare providers in Saudi Arabia and to explore how speciality influences these reactions.

Materials and methods: A cross-sectional survey was conducted among 386 healthcare workers across Saudi Arabia from January to December 2023. Participants included medics and paramedics who had received at least one dose of a COVID-19 vaccine. Data were collected using a structured questionnaire covering demographic information, vaccine type, number of doses, and post-vaccination symptoms. Statistical analysis involved Chi-square tests to explore the associations between demographic factors and the impact of post-vaccination symptoms on work.

Results: Most healthcare providers experienced mild to moderate side effects, with the most common being injection site pain, headaches, and fever. A significant proportion of the respondents reported symptoms severe enough to affect their work capacity. No significant differences were observed in post-vaccination symptoms among different ABO blood groups. However, a notable gender difference was observed, with females more likely to report an impact on work capacity.

Conclusions: The study highlights the commonality of post-vaccination symptoms among healthcare providers and their impact on their work capacity. It underscores the importance of tailored health communications and interventions that address the specific needs of healthcare providers to manage post-vaccination symptoms effectively. Future research should focus on longitudinal studies to track symptoms' duration and evolution and explore gender-specific responses to vaccination further.

Keywords: COVID-19, vaccination, healthcare providers, side effects, Saudi Arabia, medics, paramedics, work capacity

INTRODUCTION

The emergence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the ensuing coronavirus disease (COVID-19) pandemic has triggered an unparalleled global public health emergency. This crisis has had a profound impact on healthcare systems worldwide, necessitating rapid and innovative responses to mitigate its devastating effects [1]. Central to these efforts is the accelerated development of effective vaccines, a breakthrough that marked a pivotal turning point in combating the pandemic. Despite their transformative role in reducing disease severity and mortality, the rapid development and deployment of COVID-19 vaccines have raised significant concerns about their safety, side effects, and public perception [2, 3]. These issues are particularly pertinent to healthcare providers, who served on the frontlines of the pandemic and were among the first recipients of these vaccines [1, 4, 5].

The urgency of developing COVID-19 vaccines has been underscored by the rapid escalation of the pandemic and its overwhelming burden on global healthcare infrastructure. Traditional vaccine development timelines were drastically shortened, with several vaccines authorized for emergency use within a year of virus discovery. This extraordinary achievement was facilitated by leveraging pre-existing research on coronaviruses, particularly SARS-CoV and Middle East respiratory syndrome-related coronaviruses. These studies provided critical insights into coronavirus structure and function, notably the role of the spike protein in viral entry into host cells, which became the primary target for SARS-CoV-2 vaccine development [6, 7].

The introduction of mRNA vaccine technology has revolutionized vaccine development, as exemplified by the Pfizer-BioNTech and Moderna vaccines. Decades of research enabled this technology to use the genetic sequence of a virus to elicit an immune response without using a live virus [7, 8]. Similarly, adenovirus vector vaccines, such as those from AstraZeneca and Johnson & Johnson, utilize viral vectors to deliver genetic material, a method extensively studied in vaccine development for other infectious diseases [9, 10]. Unprecedented international collaborations among researchers, pharmaceutical companies, and regulatory bodies expedited vaccine development. Substantial investments in infrastructure and resources facilitated largescale clinical trials and streamlined approval processes [11, 12].

COVID-19 vaccines have demonstrated remarkable efficacy across diverse populations and against multiple variants of concern, thereby reducing infection rates, hospitalization, and mortality [13, 14]. Furthermore, vaccines have significantly mitigated the risk of long-term complications, such as "long COVID" [15, 16]. However, their deployment was accompanied by reports of adverse effects, which, although generally mild and transient, included rare but serious events, such as anaphylaxis, myocardial infarction, and thromboembolic phenomena [17, 18]. Such side effects shaped public attitudes and influenced vaccine uptake, especially among healthcare providers, who play a crucial role in public health campaigns [19-21]. Recent large-scale studies in Saudi Arabia and globally have provided updated evidence on these side effects, reporting high rates of transient symptoms such as myalgia, fever, and fatigue, while also highlighting demographic differences in risk and work capacity impact [2, 20-22].

Healthcare providers are uniquely positioned to evaluate vaccine safety and efficacy, owing to their high exposure risk and early access to vaccination. Their experiences offer valuable insights into the short- and long-term effects of vaccination that are vital for refining public health strategies [19, 23, 24]. Existing studies on vaccine-related side effects often overlook the distinct challenges faced by healthcare providers, including the impact of side effects on their work capacity and their role in influencing community vaccination decisions [16, 25, 26]. For example, a 2025 Swiss study found that recent booster doses were associated with increased short-term sick leave among healthcare workers, underscoring the occupational implications of post-vaccination symptoms [20]. A 2025 Saudi study found that healthcare workers with blood type O reported more work disruption post-vaccination, emphasizing ABO blood group as a relevant factor [22]. This study aims to contribute to a nuanced understanding of vaccine reactions in this critical population by addressing these gaps.

An emerging area of interest is the role of genetic and immunological factors, such as the ABO blood group, in modulating vaccine responses. Previous research suggests associations between certain blood groups and COVID-19 susceptibility, with blood type O linked to a potentially lower risk of severe outcomes [27, 28]. Recent findings also indicate that vomiting and certain systemic side effects may be significantly associated with specific blood groups, suggesting a possible immunogenetic basis for differential responses to the vaccines [22]. Investigating whether these differences extend to vaccine-induced side effects could inform personalized vaccination strategies and optimize safety and efficacy based on individual immunological profiles [29].

This study focuses on the prevalence and nature of postvaccination side effects among healthcare providers in Saudi Arabia, a population that has not been extensively examined. Saudi Arabia's unique role in pandemic control efforts and its diverse healthcare workforce provide a valuable setting for exploring these dynamics. This study seeks to identify the trends and challenges specific to this group by examining their demographic and occupational factors. The findings aim to bridge critical knowledge gaps, offering evidence-based recommendations to enhance vaccine rollout strategies and address vaccine hesitancy among healthcare providers [30, 31].

By emphasizing its innovative approach and practical significance, this research contributes to the global effort to refine vaccination protocols and strengthen healthcare systems during a pandemic. This underscores the importance of targeted public health interventions that prioritize healthcare workers' safety and wellbeing, ultimately benefiting broader community health outcomes.

MATERIALS AND METHODS

Study Design and Participants

This cross-sectional study was conducted among healthcare workers in various regions of Saudi Arabia between January and December 2023. Healthcare facilities were stratified based on size, type (governmental, private, or non-profit), and geographical distribution (Northern, Southern, Middle, Western, and Eastern regions). Hospitals within each stratum were randomly selected using a computer-generated randomization process. The proportional representation of each region ensured that the sample reflected the national distribution of healthcare providers. However, a potential sampling bias might exist, particularly if certain regions had lower response rates.

The sample size was calculated based on the estimated prevalence of vaccine-related side effects among healthcare workers. Assuming a prevalence of 50% (to maximize variability and ensure a conservative estimate), 95% confidence level, and 5% margin of error, the minimum required sample size was 384 participants.

Inclusion and Exclusion Criteria

Participants included healthcare workers aged 20 years and more who had received at least one dose of the COVID-19 vaccine. Individuals were excluded if they had been diagnosed with COVID-19 within 30 days before the survey, reported chronic illnesses or immunocompromised conditions, were pregnant, or were younger than 20 years. These exclusions were designed to minimize confounding factors influencing vaccine side effects. To avoid confounding symptoms from active infection, the study excluded healthcare workers who had not received a COVID-19 vaccine or who had been diagnosed with COVID-19 within 30 days before the survey. A total of 386 Saudi healthcare providers (both sexes, aged 20 years and older) were identified using a cluster random sampling method. Individuals with chronic illnesses, immunocompromised states, or recent adverse reactions to other vaccines were also excluded to ensure that their reported symptoms were attributable to COVID-19.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of the College of Medicine (E-22-7389). Participation was voluntary, and informed consent was obtained electronically prior to completing the survey. Participants were assured of confidentiality and anonymity, and data were used solely for research purposes. This study was conducted in accordance with the principles outlined in the Declaration of Helsinki.

Data Collection

Data were collected via a self-administered questionnaire distributed electronically through internal communication systems in hospitals and professional social media groups to reach a broad audience within the healthcare community in Saudi Arabia. Participation was encouraged but entirely voluntary, with reminders sent 2 months after the initial distribution to maximize response rates. In total, two reminder emails were sent during the data-collection period to encourage participation. The questionnaire was structured to minimize recall and social desirability biases. Responses were collected anonymously, and participants were assured of confidentiality to promote honest reporting.

Questionnaire Content and Design

The survey instrument was a structured questionnaire developed to capture comprehensive data regarding participants' experiences post-COVID-19 vaccination. The first section collected demographic information, including age, sex, marital status, professional designation (medical or paramedic), years of experience, educational level, and monthly income. The second section inquired about the specific COVID-19 vaccine received, number of doses administered, and date of the last vaccination to account for any temporal side effects. Participants were asked to report their ABO blood group, which was later cross-referenced with medical records for accuracy. The postvaccination symptom section was designed to identify adverse reactions following vaccination. Participants were asked about the onset, duration, and type of symptoms. Additionally, several questions assessed whether the symptoms affected the participants' ability to work, including specific duties, such as surgery performance. Participants reported any measures they took to manage their symptoms, including over-the-counter medications, such as paracetamol or NSAIDs, rest, and medical consultations. To gauge expectations of the vaccine's effectiveness, questions solicited participants' pre-vaccination expectations and whether the actual immune response matched these expectations. The questionnaire design employed multiple-choice questions and yes/no options to facilitate ease of completion and clarity of data for analysis.

The questionnaire was validated by experts in immunology, epidemiology, and survey design to ensure content relevance and clarity. A pilot test was conducted with a small group of healthcare workers to refine the questions based on feedback, estimate the completion time, and assess the survey's overall user-friendliness.

The reliability, consistency, and stability of the questionnaire were assessed using the Cronbach's alpha coefficient to evaluate internal consistency. The total number of participants included in the study was 386. Cronbach's alpha was calculated for the overall questionnaire and for specific constructs identified through principal component analysis (PCA) to ensure the reliability of grouped items. The overall Cronbach's alpha for the questionnaire was $\alpha = 0.640$, indicating a moderate level of internal consistency across all items. To further refine reliability, PCA was conducted to group items into distinct constructs based on their underlying relationships. These constructs were tested individually for reliability: socio-economic construct (PC1): Cronbach's alpha was $\alpha = 0.86$, reflecting high internal consistency and reliability within this grouping. Biological/health construct (PC2): Cronbach's alpha was $\alpha = 0.68$, demonstrating moderate reliability and nearing the acceptable threshold. Vaccination construct (PC3): Cronbach's alpha was $\alpha = 0.39$, indicating lower reliability, likely due to the limited number of items and participant responses within this construct. Theseis suggest that the questionnaire demonstrates reliable measurement within key constructs, particularly for the socio-economic and biological/health-related domains.

Statistical Analysis

Descriptive statistics were used to summarize the demographic data and responses to the questionnaire, which are presented as frequencies and percentages. Chi-square tests were used to examine the association between vaccination status and postvaccination symptoms, the impact of symptoms on work, and the efficacy of symptom relief measures. Statistical significance was set at $p < 0.05$. Data analysis was conducted using SPSS software (version 29.0; IBM Corp., Armonk, NY, USA).

RESULTS

Demographic and Professional Characteristics

The study population comprised 386 medical professionals, including 76 (19.7%) medics and 310 (80.3%) paramedics (**Table 1**). The age distribution showed that most participants were between 20 and 35 years (69.9%), followed by those aged 36 to 50 years (23.8%), whereas a smaller proportion were older than 51 years (6.2%). There were no significant differences in age distribution between medics and paramedics ($p = 0.073$).

The gender distribution was slightly skewed toward women, representing 56.5% of the total participants, compared to men at 43.5%. Sex distribution between medics and paramedics also showed no significant differences ($p = 0.620$). Regarding marital status, 61.7% of the participants were single, 35.8% were married, and 2.6% were divorced. There was no significant association between marital status and participants' roles ($p = 0.184$).

A significant association was observed with educational level. Those with a BCs certification constituted 8.0% of the medics compared to 54.1% of the paramedics ($p < 0.001$). The distribution of participants with a diploma, MSc, and PhD/medical board favored paramedics. Monthly income also

Table 1. Demographic and occupational characteristics of medics and paramedics

		Specialty						Chi-square (χ^2)	p-value
		Medics		Paramedics		Total			
		n	%	n	%	n	%		
Age (year)	20-35	45	11.7	225	58.3	270	69.9	5.247	0.073
	36-50	25	6.5	67	17.4	92	23.8		
	> 51	6	1.6	18	4.7	24	6.2		
Gender	Male	35	9.1	133	34.5	168	43.5	0.246	0.620
	Female	41	10.6	177	45.9	218	56.5		
Marital status	Single	40	10.4	198	51.3	238	61.7	3.388	0.184
	Married	34	8.8	104	26.9	138	35.8		
	Divorced	2	0.5	8	2.1	10	2.6		
Education level	Diploma	3	0.8	38	9	41	10.6	89.649	< 0.001
	BSc	31	8.0	209	54.1	240	62.2		
	MSc	19	4.9	60	15.5	79	20.5		
	PhD/medical board	23	6.0	3	0.8	26	6.7		
Monthly income (Riyal)	0-8699	25	6.5	146	37.8	171	44.3	30.107	< 0.001
	8,700-11,999	7	1.8	44	11.4	51	13.2		
	12,000-15,299	8	2.1	42	10.9	50	13.0		
	15,300-20,160	9	2.3	46	11.9	55	14.2		
	> 20,160	27	7.0	32	8.3	59	15.3		
Residence area	Northern Region	8	2.1	18	4.7	26	6.7	8.446	0.077
	Southern Region	2	0.5	13	3.4	15	3.9		
	Middle Region	30	7.8	91	23.6	121	31.3		
	Western Region	26	6.7	157	40.7	183	47.4		
	Eastern Region	10	2.6	31	8.0	41	10.6		
Administrative position	Yes	14	3.6	13	3.4	27	7.0	18.992	< 0.001
	No	62	16.1	297	76.9	359	93.0		
Hospital type	Governmental	65	16.8	234	60.6	299	77.5	5.508	0.062
	Private	11	2.8	60	15.5	71	18.4		
	Non-profit	0	0.0	16	4.1	16	4.1		
ABO blood type	Type A	23	6.0	97	25.1	120	31.1	2.892	0.409
	Type B	15	3.9	41	10.6	56	14.5		
	Type O	34	8.8	161	41.7	195	50.5		
	Type AB	4	1.0	11	2.8	15	3.9		
Rh blood type	Positive	63	16.3	272	70.5	335	86.8	1.251	0.63
	Negative	13	3.4	38	9.8	51	13.2		
Work experience (year)	< 3	41	10.6	166	43.0	207	53.6	2.072	0.558
	3-5	8	2.1	36	9.3	44	11.4		
	5-10	14	3.6	40	10.4	54	14.0		
	> 10	13	3.4	68	17.6	81	21.0		
Administrative position	Yes	14	3.6	13	3.4	27	7.0	18.992	< 0.001
	No	62	16.1	297	76.9	359	93.0		

showed a significant difference ($p < 0.001$), with the highest income bracket (> 20,160 Saudi Riyals) being more represented among medics (7.0%) than among paramedics (8.3%).

Participants were distributed across various regions of Saudi Arabia, with the Western Region being the most represented (47.4%). The geographical distribution of medics and paramedics approached significance, with a higher proportion of medics in the Northern Region (30.8%) than in other regions ($p = 0.077$).

Most participants were employed in government hospitals (77.5%), with the remainder employed in private (18.4%) and nonprofit (4.1%) sectors. Medics and paramedics showed no significant differences in hospital type ($p = 0.062$).

The analysis revealed that type O was the most prevalent blood group among the participants, comprising 50.5% of the total sample. This was followed by type A at 31.1%, type B at 14.5%, and type AB at 3.9%. Among medics, type O accounted for 8.8%, while paramedics showed a much higher prevalence at 41.7%. Similarly, type A was observed in 6.0% of medics and 25.1% of paramedics. Their was no statistically significant association between ABO blood group distribution and speciality ($p = 0.409$).

The majority of participants were Rh-positive (86.8%), while Rh-negative individuals constituted 13.2% of the sample. Among medics, 16.3% were Rh-positive, and 3.4% were Rh-negative. In contrast, paramedics showed higher proportions, with 70.5% Rh-positive and 9.8% Rh-negative individuals. The chi-square test for Rh blood type also demonstrated no significant association with specialty ($p = 0.63$)

Work experience varied, with 53.6% of the participants having less than 3 years of experience. The proportion of participants with more than 10 years of experience was 21.0%. Medics and paramedics had no significant difference in work experience ($p = 0.558$).

Out of the total sample, 7.0% of participants held an administrative position, while 93.0% did not. Among medics, 3.6% ($n = 14$) reported having an administrative role, compared to 3.4% ($n = 13$) of paramedics. Most participants without administrative roles were paramedics, accounting for 76.9% ($n = 297$), while medics comprised 16.1% ($n = 62$) of this group. A chi-square analysis revealed a statistically significant

Table 2. Impact of COVID-19 symptoms on work performance among healthcare workers

Characteristics		COVID-19 symptoms affect your work						Chi-square (χ²)	p-value
		Yes		No		Total			
		n	%	n	%	n	%		
Age (year)	20-35	97	42.5	77	33.8	174	76.3	0.001	1.000
	36-50	25	11.0	20	8.8	45	19.7		
	> 51	5	2.2	4	1.8	9	3.9		
Gender	Male	43	18.9	56	24.6	99	43.4	10.672	0.001
	Female	84	36.8	45	19.7	129	56.6		
ABO blood type	Type A	40	17.5	27	11.8	67	29.4	0.987	0.804
	Type B	16	7.0	16	7.0	32	14.0		
	Type O	65	28.5	54	23.7	119	52.2		
	Type AB	6	2.6	4	1.8	10	4.4		
Rh blood type	Positive	109	47.8	87	38.2	196	86.0	0.005	1.000
	Negative	18	7.9	14	6.1	32	14.0		
History of COVID-19	Positive	109	47.8	87	38.2	196	86.0	0.005	1.00
	Negative	18	7.9	14	6.1	32	14.0		
Number of doses	One dose	3	1.3	1	0.4	4	1.8	3.206	0.361
	Two dose	13	5.7	7	3.1	20	8.8		
	Three dose	101	44.3	89	39.0	190	83.3		
	Four dose	10	4.4	4	1.8	14	6.1		
Vaccine type	Pfizer	58	25.4	56	24.6	114	50.0	16.005	0.042
	Pfizer, AstraZeneca	35	15.4	24	10.5	59	25.9		
	Pfizer, AstraZeneca, Moderna	7	3.1	0	0.0	7	3.1		
	Pfizer, Moderna	13	5.7	8	3.5	21	9.2		
	AstraZeneca	6	2.6	8	3.5	14	6.1		
	AstraZeneca, Moderna	2	0.9	3	1.3	5	2.2		
	Moderna	4	1.8	0	0.0	4	1.8		
	Moderna, Oxford	2	0.9	0	0.0	2	0.9		
	Pfizer, Astrazeneca, Astrazeneca	0	0.0	2	0.9	2	0.9		

association between administrative position and speciality (p < 0.001). This indicates a noteworthy difference in the proportion of administrative roles held by medics versus paramedics.

Table 1 presents the demographic and occupational characteristics of a sample of 379 healthcare workers, consisting of 68 medics (17.9%) and 311 paramedics (82.1%). Variables analyzed include age, gender, marital status, educational level, monthly income, and residence area in Saudi Arabia.

Factors Affecting Work Due to Adverse Reactions Following COVID-19 Vaccination

This study investigated the impact of COVID-19 vaccination-related adverse reactions among healthcare professionals who received the vaccine. Of these, 127 (55.7%) reported that adverse reactions affected their work capacity, whereas 101 (44.7%) did not report an impact on work.

Participants were predominantly aged 20-35 (76.6%), with 97 (42.5%) reporting an impact on work and 77 (33.8%) reporting no impact. This was followed by those aged 36-50 (19.7%), with 25 (11.0%) affected and 20 (8.8%) unaffected. The smallest age group was over 51 years (3.9%), with five (2.2%) reporting an impact and four (1.8%) reporting no impact. There were no significant differences in the effect of age on work capacity (p = 1.00).

Significant sex-related differences were observed. Among the 99 male participants (43.4%), 43 (18.9%) reported that the vaccine affected their work, compared with 56 (24.6%) who did not. Conversely, among the 129 female participants (56.6%), a higher proportion 84 (36.8%) reported an impact on work compared to 45 (19.7%) who did not (p = 0.001).

No significant association was found between participants' blood groups and the impact on work due to adverse reactions to the vaccine. This was true for all blood types: A (29.4%), B (14.0%), O (52.2%), and AB (4.4%; p = 0.804). Rh factor was also not significantly correlated with the extent of work impact, with Rh-positive individuals constituting 86.0% of the sample. Of these, 09 (47.8%) were affected and 87 (38.2%) were unaffected. Among Rh-negative individuals (14.0%), 18 (7.9%) reported an impact and 14 (6.1%) did not (p = 1.00).

A no significant correlation was observed between the history of COVID-19 and the impact on work. Of those with a history of COVID-19 (64.5%), 84 (36.8%) reported that their work was affected by adverse vaccine reactions, whereas 63 (27.6%) did not report an impact (p = 0.555).

Regarding the number of COVID-19 vaccine doses received, the majority received three doses (83.3%), with 101 (44.3%) affected and 89 (39.0%) unaffected. However, the difference in work impact based on the number of doses was not statistically significant (p = 0.361).

The type of vaccine used was a significant factor. Those who received the Pfizer vaccine (50.0%) had a nearly equal distribution of work impacts, with 58 (25.4%) affecte and 56 (24.6%) unaffected. However, a significant correlation was observed among those who received mixed vaccines, notably Pfizer and Moderna (9.2%), with 13 (5.7%) affected, and Pfizer, AstraZeneca, and Moderna (3.1%), where all seven reported an impact on work (p = 0.042).

Table 2 summarises the impact of COVID-19 symptoms on work performance among 228 healthcare workers, detailing the distribution by age, gender, blood group, Rh blood type, past history of COVID-19, number of COVID-19 vaccine doses taken, and vaccine type. Charactirstics with a p-value less than 0.05 are considered statistically significant.

Table 3. Percentage of reported side effects among COVID-19 vaccine recipients according to specialties

		Specialty			Chi-square (χ²)	p-value
		Medics	Paramedics	Total		
		n (%)	n (%)	n (%)		
Fever	No	18 (7.9)	54 (23.7)	72 (31.6)	0.987	0.382
	Yes	54 (23.7)	126 (55.3)	156 (68.4)		
Tiredness	No	12 (5.3)	80 (35.1)	92 (40.4)	5.953	0.020
	Yes	36 (15.8)	100 (43.9)	136 (59.6)		
Headache	No	17 (7.5)	92 (40.4)	109 (47.8)	3.741	0.073
	Yes	31 (13.6)	88 (38.6)	119 (52.2)		
Severe local pain at the injection site	No	22 (9.6)	92 (41.2)	116 (50.9)	0.619	0.516
	Yes	26 (11.4)	86 (37.7)	112 (49.1		
Body ache (myalgia)	No	29 (12.7)	126 (55.3)	155 (68)	1.599	0.225
	Yes	19 (8.3)	54 (23.7)	73 (32.0)		
Joint pain (arthralgia)	No	30 (13.2)	123 (53.9)	153 (67.1)	0.584	0.490
	Yes	18 (7.9)	57 (25.0)	75 (32.9)		
Nausea	No	44 (19.3)	159 (69.7)	203 (89.0)	0.431	0.612
	Yes	4 (1.8)	21 (9.2)	25 (11.0)		
Vomiting	No	45 (19.7)	172 (75.4)	217 (95.2)	0.269	0.704
	Yes	3 (1.3)	8 (3.5)	11 (4.8)		
Diarrhea	No	46 (20.2)	174 (76.3)	220 (96.5)	0.078	0.676
	Yes	2 (0.9)	6 (2.6)	8 (3.5)		
Syncope	No	47 (20.6)	180 (78.9)	227 (99.6)	3.767	0.211
	Yes	1 (0.4)	0 (0.0)	1 (0.4)		
Allergic rash	No	45 (19.7)	170 (74.6)	215 (94.3)	0.034	0.739
	Yes	3 (1.3)	10 (4.4)	13 (5.7)		

Prevalence of Adverse Reactions to COVID-19 Vaccination

The distribution of post-vaccination symptoms among medics and paramedics was assessed to identify potential differences between the two groups (**Table 3**). Fever was the most commonly reported symptom, affecting 68.4% of participants, with 23.7% of medics and 55.3% of paramedics reporting this condition. However, the chi-square test indicated no statistically significant association between fever and speciality (p = 0.382). Tiredness, reported by 59.6% of participants (15.8% medics and 43.9% paramedics), showed a significant association with speciality (p = 0.020), highlighting that paramedics were more likely to experience tiredness. Headache, reported by 52.2% of participants, approached statistical significance (p = 0.073), with 13.6% of medics and 38.6% of paramedics affected.

Severe local pain at the injection site (49.1%), body aches (32.0%), and joint pain (32.9%) were frequently reported but showed no significant association with speciality (p = 0.516, p = 0.225, p = 0.490, respectively).

Symptoms such as nausea (11.0%), vomiting (4.8%), diarrhoea (3.5%), and syncope (0.4%) were less common and showed no significant association with speciality (p > 0.05). Allergic rash was reported by 5.7% of participants, with 1.3% of medics and 4.4% of paramedics affected, but no significant association was observed (p = 0.739). Overall, tiredness was the only symptom significantly associated with specialty, suggesting that paramedics may experience a greater burden of post-vaccination symptoms compared to medics.

Table 3 presents the percentage of reported side effects among medics and paramedics (n = 229) following COVID-19 vaccination. The p-values indicate the statistical significance of the differences between the two groups for each symptom. Symptoms with a p-value less than 0.05 are considered statistically significant.

Strategies for Relief from Postvaccination Symptoms

In the aftermath of the COVID-19 vaccination program, individuals employed various measures to alleviate their symptoms. The study quantified the percentage of participants who adopted the three strategies for symptom relief among specialists who participated in the study and those who confirmed using different relief measures. Among the medications used, 4.4% (n = 10) of medics reported not using paracetamol, whereas 7% (n = 16) reported using it. By contrast, 23.7% (n = 54) of paramedics did not use paracetamol, whereas 20.6% (n = 47) did. The difference in paracetamol use between medics and paramedics was not statistically significant (p = 0.172).

Regarding taking 2 to 3 days of rest, 4.8% (n = 11) of medics reported not taking rest, whereas 6.6% (n = 15) did. Among paramedics, 25.9% (n = 59) did not rest, whereas 18.4% (n = 42) took 2 to 3 days of rest. The difference in this measure between medics and paramedics was not statistically significant (p = 0.141).

Regarding visiting a doctor, 9.6% (n = 22) of medics reported not visiting a doctor compared to 1.8% (n = 4) who did. Among paramedics, 39.9% (n = 91) did not visit a doctor, whereas 4.4% (n = 10) did. The difference in doctor visits between medics and paramedics was also not statistically significant (p = 0.426).

Table 4 compares post-vaccination care and health-seeking behaviour between medics and paramedics, specifically examining the use of paracetamol, taking two to three days of rest, and visiting a doctor (n = 127).

DISCUSSION

This comprehensive investigation of the experiences of 386 medical professionals post-COVID-19 vaccination reveals a complex interplay between demographic characteristics, professional roles, and symptom management strategies. It

Table 4. Post-vaccination management strategies among medics and paramedics

		Specialty						Chi-square (χ²)	p-value
		Medics		Paramedics		Total			
		n	%	n	%	n	%		
Used paracetamol	No	10	4.4	54	23.7	64	28.1	1.862	0.172
	Yes	16	7.0	47	20.6	63	27.6		
Took two to three days of rest	No	11	4.8	59	25.9	70	30.7	2.169	0.141
	Yes	15	6.6	42	18.4	57	25.0		
Visit a doctor	No	22	9.6	91	39.9	113	49.6	0.634	0.426
	Yes	4	1.8	10	4.4	14	6.1		

provides a nuanced understanding of how healthcare professionals confront and cope with vaccine-related adverse effects.

The absence of significant differences in age and sex distributions between medics and paramedics suggests that such demographic factors do not distinctly influence the roles assumed within the medical profession. This observation corroborates findings from a broader workforce analysis, indicating a trend toward balanced representation across the healthcare sector [27]. Additionally, these factors may not substantially influence vaccine reactogenicity either in the general population or among healthcare workers [16, 19]. The lack of an association between age and side effects may reflect the broad safety profile of COVID-19 vaccines across all age groups included in this study. However, the relatively small sample size of older participants (> 50 years) may have limited the statistical power to detect significant differences. Age-related differences in side effects may be more pronounced for severe adverse events, which were rare in this cohort, than for common but mild side effects [2]. Recent reports from large-scale Saudi cohorts confirm this general safety profile, showing only transient systemic symptoms such as fatigue, fever, and myalgia as predominant adverse events [2, 22].

The hypothesis that blood type may influence susceptibility to COVID-19 or immune responses to vaccination stems from studies that reported correlations between certain blood groups (such as type O) and reduced disease severity [23, 25]. Healthcare workers, especially those with type O blood, reported greater disruption to work following COVID-19 vaccination [22]. However, our findings suggest that blood type has a limited role in determining the incidence of vaccine-related side effects. This may be due to the complex interaction of immunological factors, such as genetic predisposition and environmental influences, which extend beyond blood group classification. Additionally, the homogeneous population and sample size of our study may have reduced the variability in this parameter. This aligns with the findings of [22], which observed that while vomiting and certain systemic side effects were associated with blood group, overall incidence rates of adverse reactions did not differ significantly between ABO types. Another study concluded that SARS-CoV-2 booster vaccination does not contribute to protecting the healthcare workforce but rather increases the likelihood of symptomatic infection and workday loss [20, 21].

Notably, educational level was significantly correlated with professional role, highlighting an educational stratification within the medical workforce that aligns with the professional hierarchy. Higher income among medics further underscores the economic disparities within the healthcare system [29]. The observed geographical trends, with a higher concentration of medics in the Northern Region, may reflect regional healthcare investment disparities, as documented in recent healthcare service reports [30]. The finding that 7% of participants held administrative positions emphasizes the pyramidal structure of medical employment, where few ascend to leadership roles. This supports ongoing discussions regarding the need for more inclusive leadership opportunities in healthcare [31].

The present study highlights the significant differences in the prevalence of postvaccination symptoms between medics and paramedics. The results indicated that paramedics reported higher incidences of tiredness, headache, body ache, dizziness, syncope, memory problems, and lymphadenopathy compared with those of medics. These findings suggest that paramedics experience more pronounced reactogenicity profiles after vaccination. The high prevalence of symptoms among paramedics may be attributable to several factors. One potential explanation is the difference in job-related physical and psychological stress levels. Paramedics often work in physically demanding and stressful environments compared with those of medics, which may exacerbate the manifestation of postvaccination symptoms. This aligns with studies showing that high-stress levels can affect immune responses and potentially increase the severity of vaccine-related side effects [32]. Additionally, variations in exposure to infectious agents or dose may play a role [3]. Because of their frequent and close contact with patients in uncontrolled environments, paramedics may exhibit different immune system activation patterns compared to medics working in more controlled clinical settings [33]. Differences in baseline health status and lifestyle factors, such as sleep patterns and physical activity, known to influence immune function, could also have contributed to the observed differences [34].

Despite not reaching conventional levels of statistical significance, the trend toward significance observed for fever and severe local pain at the injection site warrants further investigation. These symptoms, along with others approaching significance, such as joint pain and nausea, indicate that there may be underlying differences that a larger sample size could potentially elucidate. The significant findings of dizziness, syncope, memory problems, and lymphadenopathy, albeit with very low incidence rates, are noteworthy and warrant closer examination in future studies. Although rare, these symptoms have important implications for postvaccination monitoring and care, particularly in occupational health settings. Rare but serious side effects of vaccines can affect workforce health and readiness, underscoring the need for effective monitoring systems [21, 35]. New evidence from a 2025 Swiss study further supports this concern, showing that recent booster doses were linked to increased short-term sick leave, highlighting occupational health implications [20].

Regarding symptom management following vaccination, the majority opting for rest (25.0%) aligns with the body's innate recuperative processes and is considered adequate [36]. The 27.6% use of paracetamol was consistent with its known efficacy in alleviating mild-to-moderate vaccine-related symptoms [37]. The low frequency of doctor visits (6.1%) may indicate either a high threshold for seeking medical advice among healthcare professionals or an overestimation of self-management capacity [38]. The higher impact on work capacity reported by women (p = 0.001) could suggest sex-specific differences in immunological responses or symptom-reporting behaviour, especially with chronic diseases, a topic that warrants further investigation [39, 40], particularly to evaluate other medical conditions and lifestyles that may be associated with improving COVID-19 outcomes [41]. Our findings indicate that women reported a higher frequency and severity of vaccine-related side effects than men, consistent with studies linking stronger immune responses in women to vaccines, such as those for influenza and COVID-19 [19, 23]. Biological mechanisms, such as hormonal influences where estrogen enhances immune activation and testosterone suppresses it, and genetic factors, including immune-related genes that escape inactivation on the second X chromosome, may underlie this disparity [30-32]. Additionally, women tend to exhibit higher levels of proinflammatory cytokines (including IL-6 and TNF-α) postvaccination, which could explain more pronounced systemic side effects [42, 43]. Behavioural differences, including higher health-seeking tendencies, may also contribute to the observed sex differences, warranting further exploration. This observation is reinforced by recent global reviews documenting consistent sex-specific differences in vaccine responses and adverse event profiles across diverse populations [21].

While the findings of this study revealed a tendency toward self-reliance in managing postvaccination symptoms, it is imperative to understand the implications of such practices on professional healthcare delivery and patient safety [44]. The analysis revealed no statistically significant differences between medics and paramedics regarding the use of paracetamol, taking 2-3 days of rest, or visiting a doctor after vaccination. The p-values for all comparisons were above the threshold for significance ($p > 0.05$), indicating no substantial difference in health-seeking behaviors or symptom management strategies between the two groups. Further studies with larger sample sizes are necessary to explore these trends. In particular, recent Saudi reports emphasize the need to integrate occupational health monitoring systems with vaccine surveillance to better support healthcare workers experiencing post-vaccination symptoms [2, 22]. Future research should examine the longitudinal effects of COVID-19 vaccination on healthcare professionals' work capacity and wellbeing. Studies should also explore educational and policy interventions necessary to facilitate effective symptom management and ensure optimal patient care.

This study had several limitations. First, its cross-sectional design precluded the establishment of causal relations between demographic factors and adverse reactions. Longitudinal studies are required to assess the duration and evolution of postvaccination symptoms over time. Reliance on self-reported data may also introduce recall bias, particularly in reporting symptoms and the effectiveness of relief measures. Moreover, as the study population consisted solely of medical professionals, the findings may not be generalizable to the broader population, given that healthcare workers may have greater health literacy and access to medical knowledge. Another limitation was the lack of data on symptom severity, which may influence individuals' decisions to seek rest, medication, or medical advice. Furthermore, this study did not capture the potential psychological impacts of vaccination, such as vaccine hesitancy or stress associated with working during a pandemic, which could influence the perception and reporting of symptoms. Finally, the study was conducted within the context of Saudi Arabia's healthcare system and may reflect cultural and regional healthcare practices that are not applicable to other settings. Although this study provides valuable insights, the small number of participants in certain subgroups (including older adults and Rh-negative individuals) may have limited the ability to detect significant associations. Additionally, the self-reported data could have introduced reporting biases, which may have obscured subtle differences between the groups. These limitations are consistent with those noted in other recent studies [2, 20-22], reinforcing the need for robust longitudinal and multi-country investigations to confirm these patterns.

CONCLUSIONS

This study provides valuable insights into the adverse reactions experienced by medical professionals in Saudi Arabia following COVID-19 vaccination and their methods of symptom relief. While most adverse reactions were mild-to-moderate in nature and were effectively managed with rest and over-the-counter medication, a noteworthy proportion of healthcare workers experienced symptoms that were severe enough to affect their work capacity. The significant sex difference in the reported impact on work capacity suggests a potential area for further research on sex-specific responses to vaccination. Additionally, substantial reliance on self-management strategies indicates confidence in personal health management among medical professionals. However, it also underscores the importance of clear guidelines and communication regarding postvaccination care. Despite these limitations, this study contributes the evidence necessary to develop effective public health strategies and workplace policies to support healthcare workers following vaccination. It emphasizes the need for continued surveillance of vaccine side effects. This study reinforces the importance of providing accessible, evidence-based information on symptom management to ensure the wellbeing of those on the frontline of healthcare.

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