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Knowledge and attitude toward cardiopulmonary resuscitation among medical students in Saudi Arabia

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ABSTRACT

Background: Cardiopulmonary resuscitation (CPR) is used to sustain blood flow and oxygenation in patients experiencing cardiac arrest. It involves performing several cycles of chest compressions and artificial respiration. This study aimed to assess the knowledge and attitudes toward CPR among medical students in Saudi Arabia. *Methodology:* A cross-sectional study was conducted using an online questionnaire at a single time point. The target sample consisted of medical students in Saudi Arabia. Data were collected and analyzed using the Statistical Package for the Social Sciences. *Results:* 1,692 people took part in the survey; the majority of them (80.1%) were between the ages of 20 and 25, with 57.8 percent of women and 42.2 percent of males. Only 10.9 percent of individuals reported having a poor knowledge score, whereas the majority of participants (54 percent) reported having a moderate knowledge-score. Most participants (95.3%) had positive-attitudes toward-CPR and only 4.7% had negative attitudes. In total, 67.1% participants had poor practice scores and 32.9% had good practice scores. There was a significant-association between knowledge-scores of participants and age (p=0.001) and academic year (p=0.001). There was also a significant association between attitude scores and marital status (P=0.046) and academic year (p=0.001). *Conclusion:* The results of our paper showed that medical students had good knowledge and positive attitudes toward CPR but poor practice. In general, our results are better than those of previous studies conducted in Saudi-Arabia. Additionally, they are better than other reported figures worldwide.

Keywords: Cardiopulmonary, Saudi Arabia, medical students.

1. INTRODUCTION

Cardiopulmonary resuscitation (CPR) is characterized by effective and timely chest compressions with minimal interruptions to preserve adequate organ perfusion and prevent irreversible damage to the organs (Varney et al., 2022; Almulhim et al., 2022). As CPR is the second link in the survival-chain, it is imperative that this lifesaving first aid method be-taught and practiced worldwide because it improves a victim's survival rate when properly administered by a trained individual before medical assistance arrives (Nomura et al., 2021). Guideline quality, efficient education of healthcare personnel and local implementation are the three multiplicands. Thus, healthcare personnels' knowledge and experience in CPR protocols and regular CPR training play crucial roles in patient survival (Spinelli et al., 2021). Unfortunately, skills are not retained, leading to weak responses to emergencies beyond critical areas (Kuhnigk et al., 1994). However, strong evidence suggests that CPR skills and knowledge deteriorate over time (Harvey et al., 2022). The global mean incidence of cardiac arrest outside a hospital is roughly 55/100,000 people (Jiang et al., 2020). A study conducted in the KSA, showed that the primary cause of death in 223 of 1,273 deaths was sudden cardiac arrest (Mohamed et al., 2021).

Previous studies published on this topic assessed the-knowledge & attitude toward CPR among students and other individuals in the healthcare professions. A cross-sectional study conducted among medical studies in Jeddah, Saudi Arabia in 2019 indicated that the mean (standard deviation) and median (P75) scores of the total knowledge were 37.86 (13.92) and 37.04 (44.44) out of 100, respectively, demonstrating that none of the parameters that were studied had a statistically significant link with knowledge level (Alghamdi et al., 2021). Additionally, a study among Jordanian health university students found that participants' mean CPR knowledge score was 3.9 (1.7) out of 10 possible points and trained participants' mean score was greater than that of the untrained participants (4.6 (±1.6) vs 3.8 (±1.6), $p<0.001$) (Oteir et al., 2019).

Furthermore, research on junior-doctors and medical-students was conducted in Egypt. The study showed that only 6.2% of the 145 medical students who participated had sufficient understanding of CPR and 91% had favorable attitudes toward CPR training (Mohammed et al., 2020). However, there is a general lack of CPR research in Saudi Arabia. Therefore, we conducted this cross-sectional study to evaluate Saudi medical students' CPR knowledge. The main-objective of this paper was to assess whether medical students in Saudi Arabia have sufficient knowledge of and attitudes toward CPR.

2. MATERIALS AND METHODS

Study design

This descriptive-cross-sectional study was conducted among medical-students in Saudi-Arabia by sending a modified English questionnaire to all Saudi Arabian regions. The questionnaires were designed in Google Forms and sent online (WhatsApp, Twitter and Telegram).

Study setting

Participants, recruitment and sampling procedure: The target population was 2nd- to 6th-year undergraduate medical students from all medical schools in Saudi Arabia, who were invited to participate in this survey during July 2022 – March 2023.

Inclusion and Exclusion criteria

In this study, we included male and female medical-students in Saudi Arabia who volunteered to participate. The medical-students who did not agree to participate in our research were excluded.

Sample size

Formula was used to calculate the adequate sample size in the prevalence study:

$$n = (z)^2\, p\, (1 - p) / d.$$

n = Sample size
z = Confidence level, which was 1.96
p = Expected prevalence, which was 50%
d = Absolute error, which was 5%
Thus, the minimum sample size was 384.

Method for data collection and instrument (Data collection Technique and tools)

Scoring System

A questionnaire was created to conduct this research and collect medical students' knowledge, attitudes and practices regarding CPR. The questionnaire consisted of four main sections containing 18 questions in total. The sections were divided into demographic factor, student knowledge levels, student attitudes and student practices. The practice, attitude and knowledge scoring system were used to score each response to the questions with the aim of comparing and correlating three components: Students' knowledge, attitude and practice.

Knowledge score

The knowledge section consisted of 12 multiple-choice items. The first question asked if they had heard of the term CPR and the choices contained two possible answers: Yes or no. The second question asked whether they had ever encountered a situation where CPR was required and this question also contained two possible answers, either yes or no. The remaining 10 questions were designed to ask about pure facts, containing one correct answer.

Correct answers and choices of yes received 1 point and incorrect answers and choices of no received 0 points. The score range for this section was 0–12 and the score were classified as poor, average, strong for a score between 0–4, 5–8 and 9–12, respectively.

Attitude score

This section included three questions regarding medical students' attitudes toward CPR. The variable 'No' received 0 and the variable 'Yes' received 1 point. The scores varied from 0 to 3 and were classified into two levels: Positive and negative attitudes for scores of 2–3 and 0–1, respectively.

Practice score

Three questions were included in this section. The variables were assigned a value of 0 for "No" and 1 for "Yes." The scores varied from 0 to 3 and were classified as good practice for a score between 2–3 and poor practice for a score between 0–1.

Analyses and entry method

After data collection, the questionnaires were checked for completeness, correctness and internal consistency to exclude missing or inconsistent data. Corrected data were entered into a computer using Microsoft Office Excel for Microsoft-365 MSO (Version 2206). Data were then transferred to the Statistical Package of Social Science Software (SPSS) program version 20 (IBM SPSS Statistics for Windows, version 20.0, Armonk, NY, IBM Corp) for statistical analysis.

Questionnaire Design

The questionnaire was designed to capture important aspects of KAP among the population in the sample area.

3. RESULTS

Table 1 shows the socio-demographic-characteristics of participants. The study included 1,692 participants, most of whom (80.1%) were aged 20–25 years, 57.8% were women and 42.2% were men. In this study, 95.1% of the participants were Saudi and only 4.9% participants were non-Saudi. As regards marital status, 90.9% participants were single and only 6.5% were married. In total, 22% of the participants were in the 4th, 17.6% in 5th and 15.8% in 6th academic years.

Table 1 Socio-demographic characteristics of participants (n=1692)

Parameter		No.	%
Age	Less than 20	263	15.5
	20 – 25	1355	80.1
	26 – 30	69	4.1
	31- 45	5	.3
Gender	Male	714	42.2
	Female	978	57.8
Nationality	Saudi	1609	95.1

	Non-Saudi	83	4.9
Marital status	Single	1538	90.9
	Engaged	35	2.1
	Married	110	6.5
	Widow	4	.2
	Divorced	5	.3
Academic year	First year	136	8.0
	Second year	205	12.1
	Third year	207	12.2
	Fourth year	372	22.0
	Fifth year	297	17.6
	Sixth year	268	15.8
	Intern	207	12.2

As in Figure 1, regarding the knowledge score about CPR among participants, nearly half of the participants (54%) reported moderate knowledge score, followed 35.1% strong score and only 10.9% reported poor knowledge score. As in Table 2, 95.3% of the participants had a positive attitude toward CPR and only 4.7% had a negative attitude.

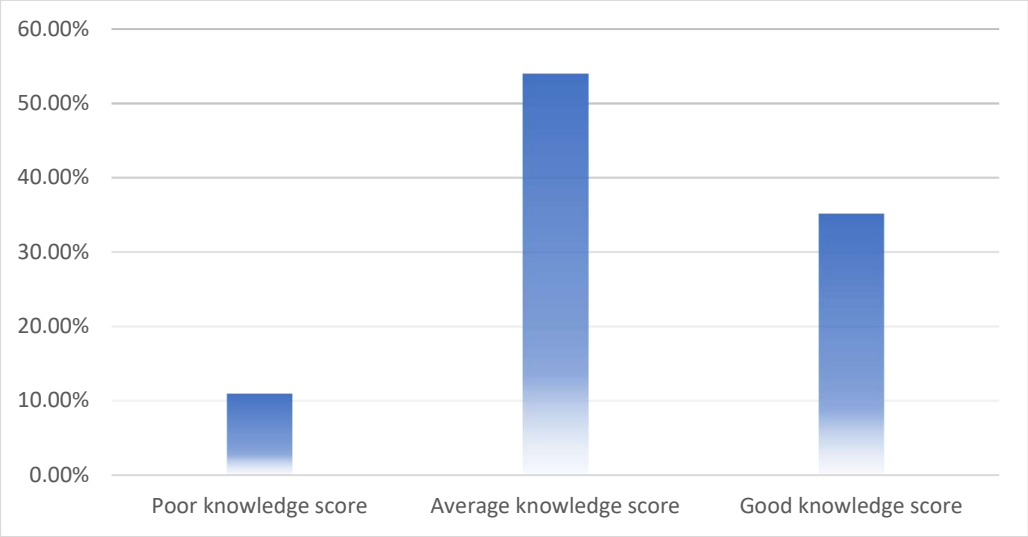

Figure 1 Participants' knowledge towards cardiopulmonary resuscitation (n= 1,692)

Table 2 Participants' attitude towards CPR (n= 1692)

Attitude score	No.	%
Positive Attitude	1612	95.3
Negative attitude	80	4.7

Table 3 shows the practice score among participants; nearly two-third of the participants (67.1%) had a poor practice score, whereas, 32.9% had a good practice score.

Table 3 Participants' practice towards CPR (n= 1692)

Practice score	No.	%
Positive Practice	1135	67.1
Negative Practice	557	32.9

Table 4 shows the relation between the knowledge-score of the participants and socio-demographic characters; the results showed that there were a significant-association between knowledge score of the participants and age (p=0.001) and academic year

(p=0.001). However, there were no-significant-association between (knowledge score) and sex, nationality and marital status (P >0.05).

Table 4 Association between participants' knowledge scores with socio-demographic characters

	Knowledge score				Total (N=1692)	P value
		Poor	Average	Good		
Age	Less than 20	63	167	33	263	0.001
		34.1%	18.3%	5.6%	15.5%	
	20 – 25	115	712	528	1355	
		62.2%	78.0%	88.9%	80.1%	
	26 – 30	7	33	29	69	
		3.8%	3.6%	4.9%	4.1%	
	31 – 45	0	1	4	5	
		0.0%	0.1%	0.7%	0.3%	
Nationality	Saudi	179	871	559	1609	0.284
		96.8%	95.4%	94.1%	95.1%	
	Non-Saudi	6	42	35	83	
		3.2%	4.6%	5.9%	4.9%	
Gender	Male	79	391	244	714	0.790
		42.7%	42.8%	41.1%	42.2%	
	Female	106	522	350	978	
		57.3%	57.2%	58.9%	57.8%	
Marital status	Single	160	822	556	1538	0.071
		86.5%	90.0%	93.6%	90.9%	
	Engaged	3	21	11	35	
		1.6%	2.3%	1.9%	2.1%	
	Married	20	64	26	110	
		10.8%	7.0%	4.4%	6.5%	
	Widow	1	3	0	4	
		0.5%	0.3%	0.0%	0.2%	
	Divorced	1	3	1	5	
		0.5%	0.3%	0.2%	0.3%	
Academic year	First year	33	87	16	136	0.001
		17.8%	9.5%	2.7%	8.0%	
	Second year	47	143	15	205	
		25.4%	15.7%	2.5%	12.1%	
	Third year	29	124	54	207	
		15.7%	13.6%	9.1%	12.2%	
	Fourth year	42	170	160	372	
		22.7%	18.6%	26.9%	22.0%	
	Fifth year	14	153	130	297	
		7.6%	16.8%	21.9%	17.6%	
	Sixth year	13	128	127	268	
		7.0%	14.0%	21.4%	15.8%	
	Intern	7	108	92	207	
		3.8%	11.8%	15.5%	12.2%	

As in Table 5, regarding the relation between the attitude scores of the participants and socio-demographic characteristics, the results-showed that there was a significant-association between attitude scores and marital status (P=0.046) and academic year (p=0.001). However, no-significant-association-was found with age, sex or nationality (p>0.05).

Table 5 Association between participants' attitude scores with socio-demographic characters

		Attitude		Total (N=1692)	P value
		Positive	Negative		
Age	Less than 20	244	19	263	0.058
		15.1%	23.8%	15.5%	
	20 - 25	1294	61	1355	
		80.3%	76.3%	80.1%	
	26 - 30	69	0	69	
		4.3%	0.0%	4.1%	
	31- 45	5	0	5	
		0.3%	0.0%	0.3%	
Nationality	Saudi	1532	77	1609	0.624
		95.0%	96.3%	95.1%	
	Non-Saudi	80	3	83	
		5.0%	3.8%	4.9%	
Gender	Male	683	31	714	0.522
		42.4%	38.8%	42.2%	
	Female	929	49	978	
		57.6%	61.3%	57.8%	
Marital status	Single	1471	67	1538	0.046
		91.3%	83.8%	90.9%	
	Engaged	33	2	35	
		2.0%	2.5%	2.1%	
	Married	101	9	110	
		6.3%	11.3%	6.5%	
	Widow	3	1	4	
		0.2%	1.3%	0.2%	
	Divorced	4	1	5	
		0.2%	1.3%	0.3%	
Academic year	First year	124	12	136	0.001
		7.7%	15.0%	8.0%	
	Second year	185	20	205	
		11.5%	25.0%	12.1%	
	Third year	194	13	207	
		12.0%	16.3%	12.2%	
	Fourth year	361	11	372	
		22.4%	13.8%	22.0%	
	Fifth year	285	12	297	
		17.7%	15.0%	17.6%	
	Sixth year	262	6	268	
		16.3%	7.5%	15.8%	
	Intern	201	6	207	
		12.5%	7.5%	12.2%	

Regarding the relation between practice scores of the participants and socio-demographic characteristics, the results showed a significant-association-between practice scores, age and academic year (p=0.001). However, there was no significant association with sex, marital status or nationality (p>0.05) (Table 6).

Table 6 Association between participants' practice scores with socio-demographic characters

		Practice		Total (N=1692)	P value
		Bad	Good		
Age	Less than 20	235	28	263	0.001
		20.7%	5.0%	15.5%	
	20 – 25	857	498	1355	
		75.5%	89.4%	80.1%	
	26 – 30	40	29	69	
		3.5%	5.2%	4.1%	
	31- 45	3	2	5	
		0.3%	0.4%	0.3%	
Nationality	Saudi	1080	529	1609	0.871
		95.2%	95.0%	95.1%	
	Non-Saudi	55	28	83	
		4.8%	5.0%	4.9%	
Gender	Male	487	227	714	0.399
		42.9%	40.8%	42.2%	
	Female	648	330	978	
		57.1%	59.2%	57.8%	
Marital status	Single	1025	513	1538	0.380
		90.3%	92.1%	90.9%	
	Engaged	21	14	35	
		1.9%	2.5%	2.1%	
	Married	82	28	110	
		7.2%	5.0%	6.5%	
	Widow	3	1	4	
		0.3%	0.2%	0.2%	
	Divorced	4	1	5	
		0.4%	0.2%	0.3%	
Academic year	First year	126	10	136	0.001
		11.1%	1.8%	8.0%	
	Second ear	180	25	205	
		15.9%	4.5%	12.1%	
	Third year	160	47	207	
		14.1%	8.4%	12.2%	
	Fourth year	238	134	372	
		21.0%	24.1%	22.0%	
	Fifth year	173	124	297	
		15.2%	22.3%	17.6%	
	Sixth year	142	126	268	
		12.5%	22.6%	15.8%	
	Intern	116	91	207	
		10.2%	16.3%	12.2%	

4. DISCUSSION

CPR is an emergency, lifesaving procedure performed when the heart stops beating. CPR is defined according to the American-Heart-Association as a part of the "chain of survival". It is the standard treatment for cardiac-arrest and combines chest compressions with ventilation (Sreevastava et al., 2004). It has been established that the chances of survival in patients with cardiac arrest can be doubled or tripled by timely and correct CPR (Okonta, 2015). Sufficient-knowledge and skills of health-care providers regarding the maneuvers and techniques for CPR prevent irreversible organ damage and improve the chances of survival in cardiac arrest victims (Brooks et al., 2015). Poor recovery of spontaneous-circulation and worse survival-rates is connected with insufficiency 2 in any phase of CPR brought about by ignorance or lack of ability (Iqbal et al., 2021). This descriptive, cross-sectional study included 1692 medical-students in Saudi-Arabia, to assess whether medical-students in Saudi-Arabia have sufficient knowledge and attitudes toward CPR.

According to the knowledge score on CPR among participants, the results of our-paper showed that nearly half of the participants (54%) reported a moderate knowledge score, 35.1% reported a strong score and only 10.9% reported a poor knowledge score. Similar to our results, another study carried out among dental students in Sakaka, Saudi Arabia, reported that overall, the participants had average knowledge towards CPR (Srinivasan et al., 2021). In Riyadh, Kingdom of Saudi-Arabia, a cross-sectional-survey among was conducted among 2,250 King Saud University students; in contrast to our results, the study found that 85% of the students feel that their knowledge is not sufficient and only 10% of those surveyed-feel that their-knowledge of CPR is adequate (Al-Turki et al., 2008). In addition, another cross-sectional, prospective study conducted among students of four northern region universities in Saudi Arabia reported that 67% of the participants had very poor knowledge, 51% correctly answered the number of emergency medical services (Red Crescent) and 59% did not know what they should first do when they encountered a situation that required CPR, whereas only 41% wrote the steps of CPR in the correct sequence (Owaid-Alsharari et al., 2018).

A cross-sectional study conducted at the Qassim University found that, in general, the knowledge of students toward CPR is insufficient; only (35.6%) of them knew the abbreviation "BLS", 43.0% of students mentioned that the survival rate in out-of-hospital cardiac arrest if CPR is performed correctly is 70%, 44.1% revealed that the mid chest is the location of chest compression application, only 24.2% of the students mentioned that the chest compression rate for adults and children was 100/min and 36.3% of them revealed that the chest compression rate in CPR if you are the only one doing it is 5:1 (Mansour et al., 2019). Moreover, results from another study conducted among 724 doctors showed that 83% respondents had poor knowledge and only 17% doctors had good knowledge (Iqbal et al., 2021).

In Egypt, another study conducted among 205 participants (60) junior-doctors and (145) medical-students revealed less-than 50 percent of the young doctors who participated in the study or 68.1 percent of them, had appropriate understanding of CPR, whereas most medical-students (93.8%) also showed inadequate-knowledge (Mohammed et al., 2020). In Northwest Ethiopia, another study conducted among 406 health professionals reported that only 25.1% participants had good knowledge of adult CPR (Mersha et al., 2020). In Nepal and India, 243 dental students found that more than half (59.3%) of the participants had inadequate knowledge, about one-third (35%) had satisfactory knowledge and only a few (5.8%) had adequate knowledge (Pun et al., 2020).

Attitude is also an important factor in the provision of CPR (Majid et al., 2019). Regarding the attitude score, our study reported that most participants (95.3%) had a positive attitude toward CPR and only 4.7% had a negative attitude. However, the date of practice score among participants showed that nearly two-thirds of the participants (67.1%) had poor practice scores and 32.9% had good practice scores. In accordance with our results, another study carried out among dental students in Sakaka found that the participants' attitudes were positive and they were willing to receive training (Srinivasan et al., 2021). Another study conducted in Riyadh reported a positive overall attitude toward CPR was positive (Al-Turki et al., 2008). In addition, data from another study revealed that the overall attitude of doctors toward CPR was a positive: 93.8 percent of those surveyed-expressed a readiness to administer CPR and the same-number of doctors allowed it for their families (Iqbal et al., 2021).

Another study conducted in the North Region of Saudi Arabia focused on the attitude of the participants towards CPR and found that only 18% of the students had been taking a CPR training course; however, attitude toward CRP training was positive; among all participants, 60% were unable to write the correct sequence of CPR steps and only 43% knew the first step of CPR (Owaid-Alsharari et al., 2018). Another study conducted among the Qassim University students reported that their attitudes and practices toward CPR were insufficient; about 55.5% of the students-thought that a CPR training course was mandatory for all students as a graduation requirement, but most students in this study wanted to learn CPR (82.5%) and this was a positive attitude among them (Mansour et al., 2019).

Concerning the practice of students toward CPR, only 46.4% and 35.5% looked for safety and open airways in comatose persons, respectively, which is an insufficient practice for saving lives (Mansour et al., 2019). In Egypt, another study conducted among

(junior-doctors) and (medical-students) held overwhelmingly positive attitudes toward CPR training and most junior-doctors and medical-students agreed that CPR training was necessary (95% and 61.1%, respectively) and should be included in the curriculum (83.3 percent and 779 percent) (Mohammed et al., 2020). In addition, another study conducted among health professionals reported that 60.8% of them had a good attitude, based on profession; one (90.1%) physician and one (94.1%) anesthetist had better attitudes toward adult CPR compared with other professions (Mersha et al., 2020). In India, another study conducted among dental students found that all students had positive-attitudes toward-CPR training (Pun et al., 2020).

Regarding the relation between knowledge scores of participants and socio-demographic characteristics, the results of our-paper showed a significant-association between knowledge scores of the participants and age (p=0.001) and academic year (p=0.001). However, there was no-significant-association between the knowledge-score and sex, nationality or marital status (P >0.05). In addition, the results showed a significant-association between practice scores, age and academic year (p=0.001). However, there was no significant-association with sex, marital status or nationality (p>0.05). Regarding the relation between attitude scores of participants and socio-demographic characteristics, the results showed a significant-association between attitude scores and marital status (P=0.046) and academic year (p=0.001). However, no-significant-association-was found with age, sex or nationality (p>0.05).

In accordance with our results, another study reported no-significant-differences between male & female-students and students-from-medicine-related-colleges had significantly (p<0.001) more-knowledge and scored-better than those from non-medicine-related colleges (Al-Turki et al., 2008). Another study found that there was a significant-increase in knowledge and attitudes regarding CPR among women rather than among men in most items and no-significant difference-existed between men and women (p>0.05) regarding most CPR-practices; however, Most Cardio-pulmonary-resuscitation practice, attitudes and knowledge items showed a significant-increase among medical-students when compared to nonmedical students (p<0.05) (Mansour et al., 2019). Another study reported no-significant-association between (knowledge-level) and sex or age; however, there was a significant-effect of academic level on knowledge score (p = 0.001) and the knowledge score increased with an increase in academic level (Pun et al., 2020).

5. CONCLUSION

The results of our study concluded that medical students had good knowledge and positive attitudes toward CPR, but they had poor practice. In general, our results are better than those of previous studies conducted in Saudi-Arabia. In addition, they are better than other reported figures worldwide.

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We thank the participants who were all contributed samples to the study.

Author Contributions

The authors confirm contribution to the paper as follows: Study conception and design: Ahmed Nawi Alshammari, Shoug Saleh Alnasyan, Khame Alzahran; data collection: Ammar Saud Alharbi, Hajar Saleh Algarni, Masooma Abduljalil Abuidrees, Reema Saleh Alzahrani, Shajn Suliman Alsaadi, Shujaa Masoud Almutairi; draft manuscript preparation: Ahmed Nawi Alshammari, Shoug Saleh Alnasyan, Ammar Saud Alharbi, Hajar Saleh Algarni, Masooma Abduljalil Abuidrees, Reema Saleh Alzahrani, Shajn Suliman Alsaadi, Shujaa Masoud Almutairi, Khames Alzahrani. All authors reviewed the results and approved the final version of the manuscript.

Ethics statement

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Medicine, Hail University, Hail City, Saudi Arabia (ethical approval number: H-2023-046). Participants were informed that their participation was voluntary and that completing the questionnaire indicated their consent to participate.

Informed consent

Written informed consent was obtained from all individual participants included in the study.

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This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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