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Assessment of the Knowledge, Attitude, and Perception of Healthcare Providers Regarding Halal Pharmaceuticals

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Abstract:

Background: The intersection of religious beliefs and medical practices significantly impacts medication usage and patient adherence to treatment regimens. Emerging within this discourse is the concept of halal pharmaceuticals, emphasizing the alignment of therapeutic drugs with religious beliefs. Despite its importance, there is limited awareness among healthcare providers (HCPs) regarding their ingredients, standards, and manufacturing processes, particularly in the Middle East region. Thus, this study aimed to investigate the knowledge, attitudes, and perceptions (KAP) of HCPs concerning Halal pharmaceuticals, which are crucial for addressing the growing concerns among patients and consumers.

Methods: A cross-sectional survey involved diverse HCPs (physicians, pharmacists, and nurses) in Jordan. The survey encompassed demographic data, knowledge about Halal pharmaceuticals, attitudes, and perceptions. Descriptive statistics and inferential analyses were performed to examine the associations between demographic variables and KAP scores.

Results: A total of 381 HCPs participated in the study. While HCPs generally had a high level of knowledge, gaps existed, particularly concerning pharmaceutical composition and Halal alternatives. Attitudes and perceptions were mostly positive or neutral, though variations occurred among professions. Pharmacists exhibited significantly higher knowledge scores compared to physicians and nurses. Information sources included academic institutions, peers, religious and educational books, and online resources. Factors, such as age, marital status, religion, education type, insurance type, working place, and years of experience significantly influenced the KAP scores of participants.

Conclusion: Tailored educational interventions are critical for addressing knowledge gaps, fostering positive attitudes, and ensuring culturally sensitive healthcare related to Halal pharmaceuticals. Leveraging diverse information sources and tailoring education based on demographics can enhance understanding. Improved knowledge, attitudes, and perceptions enable HCPs to meet the needs of diverse patient populations and provide safe, Halal-compliant medications. Additionally, further research into the perspectives and willingness of patients to pay for Halal pharmaceuticals is essential to ensuring equitable access to pharmaceutical care services.

Keywords: Halal pharmaceutical, Healthcare provider, Patient care, Cultural competence, Healthcare education, Information source.

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1. INTRODUCTION

The intersection of religious beliefs and medical practices profoundly influences medication usage and patient adherence to treatment regimens in healthcare [1]. Across various religions, including Islam, distinct guidelines and considerations shape this interplay, with the Islamic faith holding particular significance in the realm of medication use [2, 2]. Emerging within Islamic healthcare discourse is the concept of "Halalopathy," which denotes the harmonious alignment between therapeutic drugs and deeply held religious beliefs and lifestyles of individuals [3]. Such alignment not only fosters trust in treatment but also has the potential to enhance the placebo effect [4].

In delivering patient-centered care, pharmacists and healthcare providers (HCPs) play a pivotal role, necessitating a thorough understanding of the intersection between medicine and religious beliefs to effectively serve diverse communities with varying cultural and spiritual backgrounds [1]. Central to this understanding is the Arabic term "Halal," denoting what is permitted or lawful under Islamic law, while "Haram" signifies what is forbidden or prohibited [5]. Items of uncertain status are referred to as "Mashbooh," reflecting the mandate of Islam to avoid anything of doubtful origin [6].

The principles of Halal and Haram extend to all aspects of life in Islam, including pharmaceutical products [7]. However, existing studies predominantly focus on pharmaceuticals permissible for consumption by Muslims [7-9]. Halal description encompasses not only the ingredients of a product but also the entire preparation process, ensuring maximum hygiene and minimal contamination with potentially toxic, ritually unclean (Najis), and impure (Khabith) substances [10]. Halal pharmaceutical standards mandate strict adherence to these requirements at every step, from production containers to consumer packaging [11].

The core definition of Halal is based on general Islamic principles, where everything is deemed permissible by nature, and non-Halal items are considered exceptions [10]. Medicines are composed of active ingredients and excipients obtained from various sources, including animals, plants, or synthetic origins [8]. Haram animal sources include dead animals, flowing or congealed blood, pig derivatives, such as pork, lard, and porcine gelatin, animals killed or not slaughtered according to Islamic shariah law [12], carnivorous animals with fangs, predator birds, frogs, and snakes [13]. Haram pharmaceuticals from plant or synthetic origins include intoxicants of all types, such as alcohol and illegal drugs [14], as well as pharmaceuticals containing non-Halal or potentially toxic ingredients that may pose risks to human health [10].

While Islam permits the use of non-Halal medicines in life-saving situations, guidelines for such circumstances require collaboration between Muslim HCPs and Islamic scholars [6, 15]. With approximately 1.8 billion Muslims worldwide, the growing Muslim population is driving increased global recognition of Halal products as a new benchmark for safety and quality assurance [16]. Halal-certified products are widely accepted by consumers, particularly Muslims and those of other religions [11, 14]. Despite the availability of Halal pharmaceuticals, there remains limited global awareness among HCPs regarding their ingredients, standards, and manufacturing processes [17, 18].

Moreover, while some Islamic schools of thought provide guidelines on the use of intoxicating substances for medicinal purposes (necessities make the forbidden permissible) [19-22], a comprehensive understanding of the knowledge, attitudes, and perceptions (KAP) of healthcare providers regarding Halal pharmaceuticals, particularly in the Middle East region, remains lacking.

Therefore, this study aimed to address this gap by evaluating and comparing the KAP regarding Halal pharmaceuticals among various HCPs in Jordan. Given the predominantly Muslim population of Jordan and its active involvement in ensuring the provision of Halal foods and pharmaceuticals, understanding the KAP of healthcare providers is crucial for delivering patient-centered care that respects religious beliefs and meets the needs of the diverse population.

2. MATERIALS AND METHODS

2.1. Study Design and Participants

This study utilized a cross-sectional design using an electronic questionnaire to compare the levels of KAP regarding Halal pharmaceuticals among different HCPs. The participants included healthcare professionals working in various government and private hospitals in Jordan. The Raosoft calculator was used to determine the minimum required sample size, with a 95% confidence level and a 5% margin of error. It was found to be 377 HCPs. The sample consisted of doctors, pharmacists, and nurses, who were selected through convenience sampling.

2.2. Inclusion-exclusion Criteria and Quality Control

The inclusion criteria for participants were as follows: (1) holding a valid license as a doctor, pharmacist, or nurse; (2) actively practicing in a hospital setting during the study period, and (3) being willing to participate voluntarily and providing informed consent to participate in the study. There were no restrictions based on age, gender, years of experience, or clinical specialty. Participants who did not meet these criteria, did not provide consent, or had many incomplete data points were excluded from the study.

2.3. Data Collection Methods, Instruments Used, and Measurements Assessed

Data collection was conducted using a structured, self-administered questionnaire developed specifically for this study. The questionnaire was divided into several sections, including demographic information (age, gender, professional role, years of experience, *etc*.) and items related to the knowledge, attitude, and perception of HCPs regarding Halal pharmaceuticals. The questionnaire was designed based on a comprehensive review of existing

literature and expert consultation to ensure content validity. It consisted of multiple-choice and Likert-scale questions, allowing participants to provide their responses easily and efficiently. The questionnaire was distributed to eligible participants through an online survey platform, and visits were made to a number of healthcare settings in Jordan, mainly Jordan University Hospital (JUH) and King Abdullah University Hospital (KAUH). Participants were instructed to complete the questionnaire during their non-work hours to ensure privacy and minimize response bias. The anonymity of the participants was ensured, and no identifying information was collected (supplementary material).

2.4. Ethical Considerations

Ethical approval was sought under the reference number (1/1/2019-2020) from the Research Ethics Committee and the Clinical Pharmacy Department at Zarqa University. Participants gave their electronic informed consent and took part voluntarily. Prior to their participation, participants received a thorough explanation of the goals of the study. To ensure complete participant anonymity, the study purposefully avoided gathering any individually identifiable data. Along with that, participants had the freedom to stop taking the survey at any time.

2.5. Statistical Analysis

Descriptive statistics, such as frequencies and percentages, were used to summarize the demographic characteristics of the participants. The levels of KAP were analyzed using mean scores and standard deviations. To compare the KAP levels among different HCPs, an analysis of variance (ANOVA), or independent sample *t*-test, was performed. A *p*-value of less than 0.05 was considered statistically significant. The data were analyzed using SPSS v27 (Statistical Package for Social Sciences) software. Data screening procedures were conducted to check for missing data and outliers. Missing data were filtered before the analysis was performed. Assumptions of statistical tests, including normality and independence, were examined and addressed as necessary.

3. RESULTS

3.1. Demographic Characteristics

A total of 381 healthcare providers participated in the study, representing a diverse sample of HCPs, including 138 physicians (36.3%), 179 pharmacists (47.1%), and 63 nurses (16.6%). The medical profession distribution showed that the highest number of participants were pharmacists, followed by physicians in various capacities, including resident physicians (12.6%), intern physicians (12.1%), consultant physicians (4.5%), and fellow physicians (4.2%). Dentists accounted for 2.9% of the sample, and nurses represented 16.5%. Table **1** presents the socio-demographic characteristics of the HCPs who participated in the study. The majority of participants were 337 Jordanians (88.9%), 201 single (52.8%), 257 female (67.5%), 369 Muslim (96.1%), 297 non-smokers (78%), and 195 with 1–4 years of professional experience (51.2%). In terms of age distribution, the highest proportion fell within the 26–30 age group (36.2%), followed by the 18–25 age group (29.4%). In terms of education level, many participants held a bachelor's degree (81.9%), followed by master's degrees (11.9%), PhDs (4.9%), and diplomas (1.4%). Most participants (81.9%) reported having insurance. Among those with insurance, the most common types were JUH insurance (52.8%) and MOH insurance (15.9%). Regarding the working environment, the largest percentage of participants worked at JUH (38.9%), followed by community pharmacies (26.8%), and the smallest percentage worked in private clinics (3.4%).

Table 1. Socio-demographic characteristics of healthcare providers.

Parameter (N*)	N (%)
Gender (N=381) • Male • Female	124 (32.5) 257 (67.5)
Age Distribution (N=381) • 18-25 • 26-30 • 31-40 • More than 40	112 (29.4) 138 (36.2) 80 (21.0) 51 (13.4)
Nationality (N=379) • Jordan • Others	337 (88.9) 42 (11.1)
Marital Status (N=381) • Single • Married	201 (52.8) 180 (47.2)
Smoking Status (N=381) • Smoker • Non-smoker	84 (22.0) 297 (78.0)
Religion (N=381) • Muslim • Non-Muslim	369 (96.9) 12 (3.1)

(Table 1) contd.....

Parameter (N*)	N (%)
Type of Medical Profession (N=380) • Pharmacist • Total Physicians • Intern Physician • Resident Physician • Fellow Physician • Consultant Physician • Dentist • Nurse	 179 (47.1) 138 (36.3) 46 (12.1) 48 (12.6) 16 (4.2) 17 (4.5) 11 (2.9) 63 (16.6)
Education Level (N=370) • Diploma • BSc • MSc • PhD	 5 (1.4) 303 (81.9) 44 (11.9) 18 (4.9)
Having Insurance (N=381) • Yes • No	 312 (81.9) 69 (18.1)
Insurance Type (N=309) • Ministry of Health • Jordan University Hospital • Royal Medical Services • Private • Others	 49 (15.9) 163 (52.8) 44 (14.2) 44 (14.2) 9 (2.9)
Working Place (N=380) • Jordan University Hospital • King Abdullah University Hospital • Private Hospital • Private Clinic • Community Pharmacy • Others	 148 (38.9) 27 (7.1) 34 (8.9) 13 (3.4) 102 (26.8) 56 (14.7)
Years of Experience (N=378) • 1-4 • 5-9 • More than 10	 195 (51.6) 90 (23.8) 93 (24.6)

Note: *: the number of participants per each parameter is different because of the presence of some missing data.

3.2. Knowledge Regarding Halal Pharmaceuticals

The knowledge of the participants regarding Halal pharmaceuticals was assessed through a series of questions. The mean score for knowledge was 80 ± 20.2, indicating a high level of knowledge among HCPs. The knowledge score was calculated from different knowledge questions presented in Table **2**, where the answer yes scored 1 and the answer no scored 0. The analysis revealed a significant difference in knowledge scores among physicians, pharmacists, and nurses ($p < 0.05$). Further tests indicated that pharmacists were significantly more aware of the concept of Halal pharmaceuticals compared to physicians ($p < 0.05$), while nurses seemed to be less aware of the Halal pharmaceuticals than physicians and pharmacists ($p < 0.05$). The results also revealed various sources of information that individuals rely on to obtain knowledge about halal and non-halal pharmaceuticals. Fig. (**1**) presents the distribution of participants and the corresponding percentages for each information source. Among the participants, the majority (45.7%) indicated that they rely on Fiqh Fatwas, which are religious legal opinions, as a source of information on this topic. On the other hand, television, radio, or daily newspapers were indicated by only 6 (1.6%) of participants as a source of information, suggesting a relatively limited impact of traditional media channels.

Table 2. The knowledge of healthcare providers regarding Halal pharmaceuticals.

Parameter (N*)	N (%)	
	Yes	No
Are you aware of the term/word “Halal”? **(N=381)**	374 (98.2)	7 (1.8)
Are you aware of the term/word “Haram”? **(N=381)**	368 (96.6)	13 (3.4)
Are you aware of the term/word “Halal Pharmaceuticals”? **(N=380)**	253 (66.6)	127 (33.4)
Did you know that dead animals, blood, pork and alcohol are forbidden for Muslims to use in any form except when necessary? **(N=380)**	352 (92.6)	28 (7.4)
Did you know that resources are available to offer halal alternatives to pharmaceuticals that contain non-halal ingredients? **(N=376)**	244 (64.9)	132 (35.1)
Did you know that capsules are made of gelatin that can be obtained from non-Halal animal sources? **(N=380)**	272 (71.6)	108 (28.4)
Did you know that syrups and elixirs can contain alcohol? **(N=380)**	313 (82.4)	67 (17.6)
Did you know that the alcohol content in medicines, if it exceeds a certain percentage, is considered forbidden? **(N=379)**	262 (69.1)	117 (30.9)

Note: *: the number of participants per each parameter is different because of the presence of some missing data.

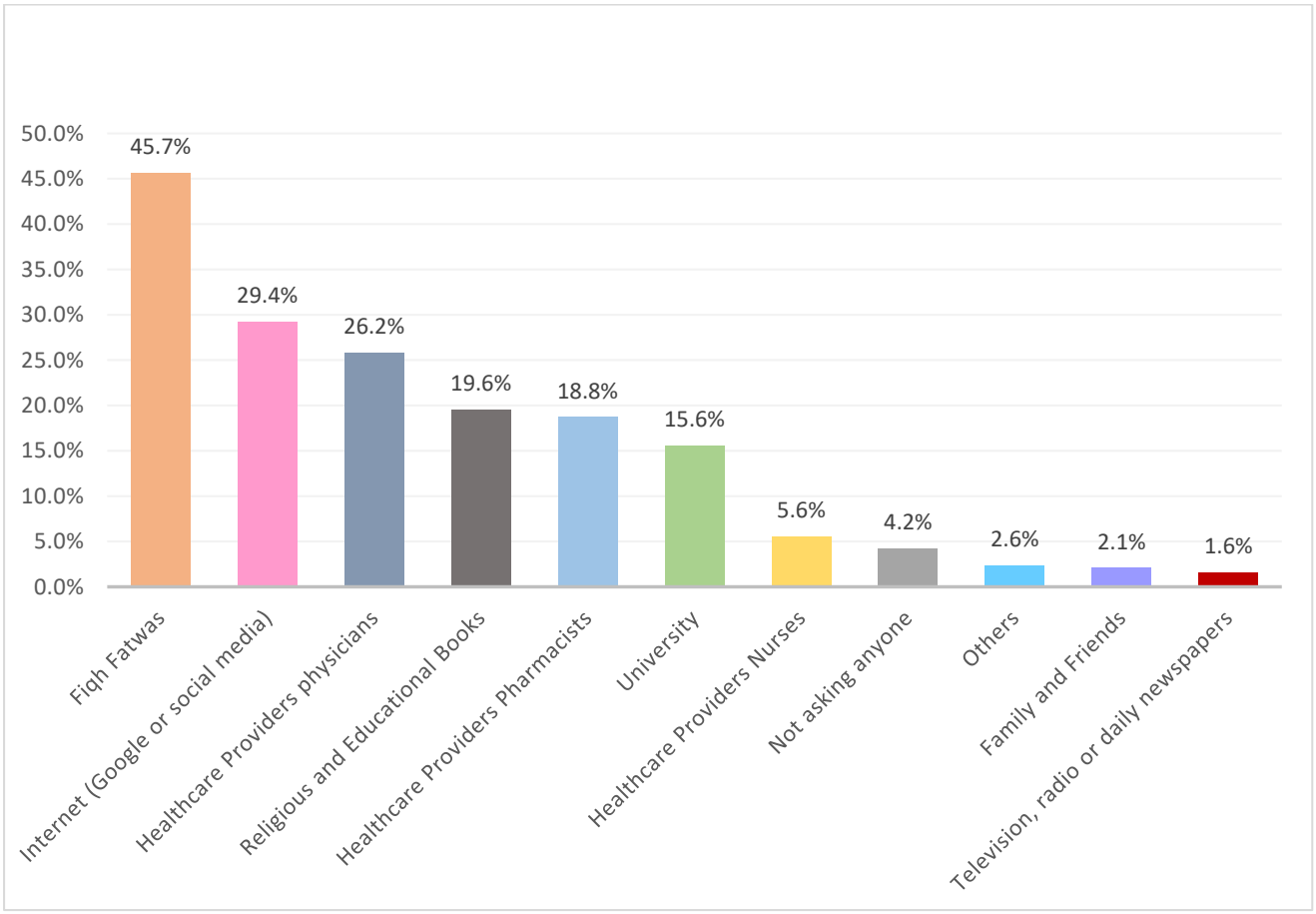

Fig. (1). Sources of information about halal and non-halal pharmaceuticals. (N=379).

Table **2** presents the knowledge of HCPs regarding Halal pharmaceuticals. The majority demonstrated awareness of the terms “Halal” (98.2%) and “Haram” (96.6%). However, a smaller percentage of participants were aware of the term “Halal Pharmaceuticals” (66.6%).

3.3. Attitude Towards Halal Pharmaceuticals

The attitudes of the participants towards Halal pharmaceuticals were assessed using a Likert scale. The mean attitude score was 66.2 ± 18, indicating a neutral to positive attitude overall. The attitude score was calculated from different attitude questions presented in Table **3**, where the answer always scored 5, almost scored 4, sometimes scored 3, rarely scored 2 and never scored 1. There was a significant difference in attitude scores among physicians, pharmacists, and nurses ($p < 0.05$). Table **3** presents the attitudes of HCPs regarding Halal pharmaceuticals. In terms of awareness, a significant proportion reported being almost aware of the concept of Halal pharmaceuticals (30.7%), while others reported being fully aware (25.1%). However, a notable percentage of participants indicated limited awareness, with some reporting being sometimes (25.1%), rarely (10.6%), or never (8.5%) aware of the concept.

Regarding information-seeking behavior, a considerable number of HCPs stated that they sometimes used to acquire information about the sources of pharmaceutical ingredients they prescribe to patients (26.5%). However, a substantial portion indicated a lack of such information-seeking behavior, with responses ranging from rarely (22.2%) to never (18.5%) seeking information. The results also revealed the practices of obtaining patient consent when prescribing non-halal pharmaceuticals, considering the religious beliefs of patients during prescription, and making efforts to find Halal alternatives. These practices varied among HCPs. Furthermore, the results also revealed the role of pharmacists; a considerable percentage of HCPs viewed pharmacists as a good source of information about the sources and ingredients of pharmaceuticals (40.7%). Finally, HCPs expressed their preference for seeing the “Halal Logo” on various pharmaceuticals, with a significant proportion indicating a preference (50.7%).

Table 3. The attitude of the healthcare providers regarding Halal pharmaceuticals.

Parameter (N*)	N (%)				
	Always	Almost	Sometimes	Rarely	Never
I am fully aware of the concept of halal pharmaceuticals. **(N=378)**	95 (25.1)	116 (30.7)	95 (25.1)	40 (10.6)	32 (8.5)
I used to get information about the sources of pharmaceutical ingredients that I prescribe to patients. **(N=378)**	44 (11.6)	80 (21.2)	100 (26.5)	84 (22.2)	70 (18.5)
I am discussing with patients about non-halal ingredients in their prescribed pharmaceuticals. **(N=379)**	34 (9.0)	45 (11.9)	84 (22.2)	94 (24.8)	122 (32.2)
I feel an ethical obligation to disclose the exact source of non-halal ingredients to patients. **(N=379)**	86 (22.7)	86 (22.7)	91 (24.0)	59 (15.6)	57 (15.0)
I get patient consent if I know that pharmaceuticals are not halal. **(N=378)**	95 (25.1)	73 (19.3)	79 (20.9)	66 (17.5)	65 (17.2)
I consider the patient's religious beliefs when prescribing pharmaceuticals to the patient. **(N=375)**	101 (26.9)	73 (19.5)	88 (23.5)	68 (18.1)	45 (12.0)
I make an effort to look for any Halal alternatives available. **(N=378)**	102 (27.0)	68 (18.0)	83 (22.0)	66 (17.5)	59 (15.6)
I educate the patient about Halal alternatives to pharmaceuticals. **(N=374)**	76 (20.3)	69 (18.4)	89 (23.8)	77 (20.6)	63 (16.8)
I prefer to use halal pharmaceuticals during my medical practice. **(N=376)**	171 (45.5)	78 (20.7)	62 (16.5)	31 (8.2)	34 (9.0)
I recommend patients to buy halal alternatives which may be more expensive. **(N=374)**	110 (29.4)	67 (17.9)	79 (21.1)	51 (13.6)	67 (17.9)
For me I feel that pharmacists are a good source of information about the sources and ingredients of pharmaceuticals. **(N=376)**	153 (40.7)	91 (24.2)	83 (22.1)	31 (8.2)	18 (4.8)
I talk to the pharmacist about the sources of pharmaceutical ingredients before prescribing them to patients. **(N=360)**	83 (23.1)	66 (18.3)	101 (28.1)	51 (14.2)	59 (16.4)
As a physician, I am relieved if the pharmacist, after my discussion, changes the prescription to give the patient a halal alternative pharmaceutical. **(N=310)**	100 (32.3)	79 (25.5)	66 (21.3)	28 (9.0)	37 (11.9)
I like and prefer to see the “Halal Logo” on various pharmaceuticals. **(N=375)**	190 (50.7)	69 (18.4)	58 (15.5)	27 (7.2)	31 (8.3)

Note: *: the number of participants per each parameter is different because of the presence of some missing data.

3.4. Perception of Halal Pharmaceuticals

The perceptions of participants of Halal Pharmaceuticals were examined through items related to availability, accessibility, and information dissemination. The mean perception score was 81.2 ± 13.1, indicating a positive perception overall. The perception score was calculated from different attitude questions presented in Table **3**, where the answer always scored 5, almost scored 4, sometimes scored 3, rarely scored 2 and never scored 1. There was a significant difference in perception scores among physicians, pharmacists, and nurses ($p < 0.05$). Table **4** indicates the perceptions of HCPs regarding Halal pharmaceuticals. Overall, a majority of HCPs strongly agreed or agreed with the importance of patients’ right to request information about the sources of ingredients in pharmaceuticals (49.7% and 30.8%, respectively).

Table 4. The perception of healthcare providers regarding Halal pharmaceuticals.

Parameter (N*)	N (%)				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The patient has the right to request information about the sources of ingredients that make up pharmaceuticals. **(N=380)**	189 (49.7)	117 (30.8)	46 (12.1)	18 (4.7)	10 (2.6)
It is important that the healthcare provider explains the sources and ingredients of pharmaceuticals to the extent possible and encourages patients to ask questions. **(N=381)**	144 (37.8)	144 (37.8)	55 (14.4)	23 (6.0)	14 (3.7)
Since it is not a common practice for healthcare providers to inform patients about the sources of pharmaceutical ingredients, it is necessary to improve. **(N=381)**	136 (35.7)	146 (38.3)	58 (15.2)	27 (7.1)	14 (3.7)
Drug manufacturers should provide healthcare providers with a list of their products that contain ingredients derived from animal sources. **(N=379)**	233 (61.5)	98 (25.9)	33 (8.7)	8 (2.1)	7 (1.8)
Pharmaceutical companies should clearly label pharmaceutical wrappers with the logo “halal” or “non-halal”. **(N=381)**	210 (55.1)	78 (20.5)	49 (12.9)	22 (5.8)	22 (5.8)
Healthcare providers, in general, should be educated about the sources of non-halal drug components. **(N=380)**	238 (62.6)	98 (25.8)	33 (8.7)	5 (1.3)	6 (1.6)
The religious beliefs of the patients should be taken into account by healthcare providers when deciding which pharmaceuticals are right for them. **(N=381)**	201 (52.8)	100 (26.2)	59 (15.5)	11 (2.9)	10 (2.6)
The religious beliefs of the patients affect his or her commitment to taking treatment. **(N=379)**	172 (45.4)	115 (30.6)	66 (17.4)	11 (2.9)	14 (3.7)
Pharmaceutical companies should consider patients' requirements for halal ingredients and try to secure halal alternatives as much as possible. **(N=379)**	236 (62.3)	95 (25.1)	33 (8.7)	7 (1.8)	8 (2.1)
Clear and understandable guidelines are needed for healthcare providers to overcome religious conflicts regarding the use of pharmaceuticals. **(N=381)**	182 (47.8)	137 (36.0)	44 (11.5)	9 (2.4)	9 (2.4)

(Table 4) contd.....

Parameter (N*)	N (%)				
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Healthcare providers should identify the urgency of having and discovering halal alternatives to pharmaceuticals. **(N=379)**	190 (50.1)	133 (35.1)	42 (11.1)	7 (1.8)	7 (1.8)
If patients were provided with relatively more expensive halal alternatives, the majority would be reluctant to use them. **(N=377)**	96 (25.5)	151 (40.1)	89 (23.6)	21 (5.6)	20 (5.3)
Patients should learn about halal pharmaceuticals. **(N=378)**	167 (44.2)	124 (32.8)	61 (16.1)	14 (3.7)	12 (3.2)
The health care provider must inform patients about the non-halal ingredients in the pharmaceutical according to their religious beliefs. **(N=378)**	159 (42.1)	114 (30.2)	62 (16.4)	29 (7.7)	14 (3.7)
Healthcare providers should adopt a list of the most commonly used pharmaceuticals derived from non-halal animals and their halal alternatives. **(N=381)**	165 (43.3)	139 (36.5)	53 (13.9)	9 (2.4)	15 (3.9)
We should seek guidance from the Fatwa Department to correct the interpretation of laws regarding the use of pharmaceuticals that are considered non-halal or contain non-halal ingredients. **(N=381)**	187 (49.1)	103 (27.0)	52 (13.6)	17 (4.5)	22 (5.8)

Note: *the number of participants per each parameter is different because of the presence of some missing data.

Similarly, a significant proportion of participants agreed that it is important for HCPs to explain the sources and ingredients of pharmaceuticals to the extent possible and encourage patients to ask questions (75.6%). Regarding the practice of informing patients about the sources of pharmaceutical ingredients, a considerable number of HCPs believed that improvement is necessary, as it is not a common practice (74.0%). Moreover, the majority of participants agreed that drug manufacturers should provide HCPs with a list of their products containing ingredients derived from animal sources (87.4%), and pharmaceutical companies should clearly label their wrappers with the logo “halal” or “non-halal” (75.6%). In terms of education, a significant number of HCPs agreed that they should be educated about the sources of non-halal drug components (88.4%), and religious beliefs of the patients should be taken into account when deciding which pharmaceuticals are suitable for them (79.0%). The participants also acknowledged the influence of the religious beliefs of the patients on their commitment to treatment (76.0%).

Additionally, a majority of HCPs believed that pharmaceutical companies should consider patients’ requirements for halal ingredients and strive to secure halal alternatives as much as possible (87.4%). Clear and understandable guidelines were deemed necessary to help HCPs overcome religious conflicts related to the use of pharmaceuticals (83.8%). Furthermore, participants recognized the urgency of having and discovering halal alternatives to pharmaceuticals (85.2%). Regarding cost considerations, a significant proportion of HCPs believed that if patients were provided with relatively more expensive halal alternatives, the majority would be reluctant to use them (65.6%). However, it is important to note that a considerable number of participants expressed positive perceptions towards patients learning about halal pharmaceuticals (77.0%). Lastly, HCPs strongly agreed that they should inform patients about non-halal ingredients in pharmaceuticals based on their religious beliefs (42.1%) and adopt a list of commonly used pharmaceuticals derived from non-halal animals and their halal alternatives (43.3%). Seeking guidance from the Fatwa Department to clarify the interpretation of laws related to the use of non-halal pharmaceuticals was also seen as an important factor (49.1%).

Table 5. Factors affecting knowledge, perception, attitude, and total KAP scores.

Items		Knowledge Score (%)		Perception Score (%)		Attitude Score (%)		Total KAP Score (%)	
		Mean ± SD	*p*-value	Mean ± SD	*p*-value	Mean ± SD	*p*-value	Mean ± SD	*p*-value
Gender	Male	79.4 ± 20.8	0.668*	79.8 ± 14.4	0.117*	66.3 ± 19.0	0.914*	74.8 ± 12.9	0.341*
	Female	80.4 ± 20.3		82.1 ± 12.6		66.1 ± 18.6		76.3 ± 13.2	
Age	18-25	74.2 ± 21.2	**<0.001$**	79.2 ± 13.6	0.261$	65.5 ± 18.2	**0.041$**	73.8 ± 12.6	**0.020$**
	26-30	78.4 ± 20.7		82.4 ± 13.5		65.7 ± 18.5		75.2 ± 13.7	
	31-40	84.6 ± 17.9		82.1 ± 10.9		63.6 ± 19.2		76.2 ± 12.0	
	More than 40	90.8 ± 15.5		81.9 ± 15.1		73.6 ± 18.5		81.4 ± 13.1	
Nationality	Jordan	80.3 ± 20.9	0.421*	82.1 ± 12.8	**0.001***	66.7 ± 18.4	0.071*	76.6 ± 12.7	**0.001***
	Others	78.0 ± 17.0		74.6 ± 15.5		60.8 ± 20.8		68.7 ± 14.9	
Marital Status	Single	76.6 ± 20.4	**<0.001***	80.0 ± 13.5	**0.047***	64.7 ± 18.0	0.124*	74.0 ± 12.7	**0.007***
	Married	84.0 ± 19.8		82.8 ± 12.9		67.8 ± 19.3		77.9 ± 13.2	
Smoking Status	Smoker	79.3 ± 20.2	0.708*	81.0 ± 12.6	0.771*	64.6 ± 19.3	0.399*	74.3 ± 12.5	0.283*
	Non-Smoker	80.3 ± 20.5		81.4 ± 13.5		66.6 ± 18.5		76.2 ± 13.2	
Religion	Muslim	80.9 ± 19.6	**<0.001***	82.1 ± 12.1	**0.014***	66.7 ± 18.2	**0.003***	76.4 ± 12.1	**0.030***
	Non-Muslim	53.4 ± 28.0		60.6 ± 25.4		48.0 ± 27.8		54.5 ± 24.8	

(Table 5) contd.....

Items		Knowledge Score (%)		Perception Score (%)		Attitude Score (%)		Total KAP Score (%)	
		Mean ± SD	*p*-value	Mean ± SD	*p*-value	Mean ± SD	*p*-value	Mean ± SD	*p*-value
Medical Profession	Intern physician	64.2 ± 17.2	**<0.001**$^{\$}$	74.2 ± 14.7	**0.018**$^{\$}$	60.2 ± 17.8	**0.034**$^{\$}$	67.9 ± 11.6	**<0.001**$^{\$}$
	Resident physician	72.7 ± 20.2		81.0 ± 12.0		61.7 ± 15.2		72.8 ± 11.3	
	Fellow physician	84.2 ± 16.7		80.6 ± 16.6		61.1 ± 22.9		75.1 ± 16.2	
	Consultant physician	80.1 ± 22.6		81.3 ± 13.4		64.9 ± 24.7		75.3 ± 16.9	
	Pharmacist	87.6 ± 16.1		82.8 ± 13.0		69.1 ± 18.7		79.0 ± 12.4	
	Nurse	79.6 ± 22.5		82.2 ± 12.5		67.5 ± 18.0		76.4 ± 13.3	
	Dentist	60.2 ± 22.2		84.1 ± 8.0		72.7 ± 14.2		75.4 ± 7.7	
Education Level	BSc or less	79.3 ± 20.9	0.113*	81.4 ± 13.2	0.837*	66.4 ± 18.5	0.680*	75.7 ± 13.0	0.642*
	Postgraduate	83.9 ± 17.7		81.0 ± 14.2		65.3 ± 20.1		76.6 ± 13.7	
Having Insurance	Yes	80.4 ± 20.7	0.508*	82.1 ± 12.4	0.053*	67 ± 18	0.061*	76.5 ± 12.2	0.059*
	No	78.7 ± 18.8		78 ± 16.1		61.7 ± 21.7		71.8 ± 16.7	
Insurance Type	MOH	82.9 ± 20.2	0.179$^{\$}$	82.2 ± 9.9	0.128$^{\$}$	67.0 ± 15.8	**0.048**$^{\$}$	77.3 ± 9.7	0.148$^{\$}$
	JUH	77.4 ± 20.6		81.6 ± 12.3		66.2 ± 17.7		75.5 ± 12.4	
	RMS	81.8 ± 20.4		81.8 ± 13.5		63.1 ± 17.2		75.4 ± 12.4	
	Private	83.3 ± 22.0		86.5 ± 11.4		73.7 ± 21.4		80.5 ± 14.1	
Work Place	University Hospital	76.5 ± 20.9	**<0.001**$^{\$}$	81.4 ± 12.4	0.921$^{\$}$	65.8 ± 18.0	0.678$^{\$}$	75.2 ± 12.4	0.671$^{\$}$
	Private Hospital or Clinic	76.1 ± 21.9		82.4 ± 14.6		66.5 ± 23.3		74.8 ± 16.3	
	Community Pharmacy	85.8 ± 17.3		80.8 ± 14.7		68.2 ± 19.8		77.4 ± 13.7	
	Others	84.4 ± 20.0		81.0 ± 12.1		64.3 ± 14.7		76.0 ± 11.2	
Years of Experience	1-4 years	76.2 ± 20.7	**<0.001**$^{\$}$	80.6 ± 13.1	0.440$^{\$}$	65.9 ± 17.5	0.238$^{\$}$	74.8 ± 12.5	0.071$^{\$}$
	5-9 years	81.5 ± 20.6		81.3 ± 14.2		64.2 ± 20.6		75.1 ± 14.5	
	More than 10 years	87.5 ± 17.5		82.8 ± 13.0		69.1 ± 19.0		79.0 ± 12.7	

Note: * *p*-values were calculated using an independent sample *t*-test.
$^{\$}$*p*-values were calculated using the ANOVA test.

Table 6. Comparison of KAP scores between healthcare providers (N= 316).

Variable	Mean ± SD	Pearson Correlation Coefficient (*r*)	*p*-value*
Total Knowledge Score (%)	79.8 ± 20.8	.671	**<0.001**
Total Perception Score (%)	81.4 ± 13.0	.818	**<0.001**
Total Attitude Score (%)	66.0 ± 18.6	.858	**<0.001**
Total KAP Score (%)	75.8 ± 13.1	1	**<0.001**

Note: * A *p*-value of less than 0.05 indicates statistical significance, calculated by Pearson's *r*.

3.5. Factors Affecting KAP Score

The study also investigated the factors affecting knowledge, attitude, perception, and total KAP scores among the participants. Table **5** presents the mean values and standard deviations of the scores, along with the corresponding *p*-values for various factors. Significant differences were observed in the knowledge score ($p < 0.001$) attitude score ($p = 0.041$), and total KAP score ($p = 0.02$) among different age groups. Participants aged 18–25 had lower knowledge scores compared to other age groups, while those above 40 years of age had the highest knowledge and total KAP scores. Significant differences were found in the scores based on marital status. Married participants had higher scores compared to single participants in term of knowledge, perception and total KAP scores ($p < 0.001$, $p = 0.047$ and $p = 0.007$, respectively). Participants belonging to the Islamic religion had significantly higher scores in knowledge, perception, attitude, and total KAP ($p < 0.001$, $p = 0.014$, $p = 0.003$, and $p = p = 0.030$, respectively) compared to non-Muslim participants. Significant differences were found in the scores among different education types. Pharmacists of Halal pharmaceuticals were more aware regarding Halal pharmaceuticals ($p < 0.001$), perception ($p = 0.018$), attitude ($p = 0.034$), and total KAP scores ($p < 0.001$). Significant differences were observed in the knowledge score ($p < 0.001$) among different workplaces. Participants working in community pharmacies had the highest knowledge score. However, no significant differences were found in the perception, attitude, or total KAP scores based on the workplace ($p > 0.05$). Significant differences were found in the knowledge score ($p < 0.001$) based on years of experience. Participants with more than 10 years of experience had higher scores compared to those with fewer years of experience.

In Table **6**, the comparison of KAP scores between HCPs is presented. The Pearson correlation coefficient (*r*) was used to assess the relationships between variables. The total knowledge score, expressed as a percentage, was found to be 79.8 ± 20.8. There was a significant positive correlation ($r = 0.671$, $p < 0.001$) between the total knowledge score and the other variables. Similarly,

the total perception score, representing the perceptions of the participants about halal and non-halal pharmaceuticals, was 81.4 ± 13.0. It showed a strong positive correlation (r = 0.818, p < 0.001) with the other variables. The total attitude score, reflecting the attitude of the participants towards the concept of halal and non-halal pharmaceuticals, was 66.0 ± 18.6. A significant positive correlation (r = 0.858, p < 0.001) was observed with the other variables. Lastly, the total KAP score, which combines the knowledge, perception, and attitude scores, was found to be 75.8 ± 13.1. This score showed a perfect positive correlation (r = 1) with the other variables, indicating their interdependence.

4. DISCUSSION

The current investigation sought to evaluate the knowledge, attitudes, and perceptions of HCPs regarding Halal pharmaceuticals. The study uncovered significant insights into the perspectives of HCPs on this matter. Heightened consumer and patient concerns about Halal pharmaceuticals necessitate increased efforts from HCPs, including physicians and pharmacists, to address patient inquiries in this realm. The creation of scientifically sound reference materials tailored for doctors, pharmacists, general HCPs, and factory workers can offer valuable services to over one billion Muslims worldwide [18]. Conversely, the dominance of non-Muslims in the production of cosmetics has generated mistrust among Muslim consumers, prompting scrutiny of global cosmetics and pharmaceutical products [23].

In Jordan, the pharmaceutical industry holds a substantial position in the country's economy, ranking second in its contribution to the national GDP in 2012 [24]. Despite this significance, the Halal pharmaceutical industry in Jordan remains largely unexplored and under-researched [25]. The socio-demographic characteristics outlined in this study provide a diverse profile of HCPs, showcasing variations in gender, age, nationality, professional background, education level, and experience. The findings indicate that factors, such as age, marital status, religion, education type, insurance type, working place, and years of experience significantly influence the knowledge, perception, attitude, and overall KAP scores of participants regarding Halal and non-Halal pharmaceuticals.

It is crucial to consider these factors when devising educational interventions and policies to enhance comprehension and practices related to Halal pharmaceuticals. The association between years of experience and knowledge scores can be attributed to continuous professional development activities and exposure to new information, aligning with previous studies [26, 27]. Similarly, the link between education type and knowledge scores may stem from variations in the curriculum and training received during HCPs' education.

University sources were acknowledged by participants, underscoring the vital role of academic institutions in disseminating pertinent knowledge. HCPs, notably physicians, were identified as crucial sources, with 26.0% of participants seeking guidance from these professionals. Pharmacists, another subset of HCPs, were deemed valuable by a small percentage of participants. Religious and educational books were cited as important sources by less than one fourth of participants for acquiring information in this domain. The Internet, encompassing search engines like Google and social media platforms, emerged as a prevalent source, with around one-third of participants relying on online resources. This underscores the escalating influence of digital platforms in providing information about halal and non-halal pharmaceuticals [28]. These diverse sources underline the need for informed development of educational initiatives and targeted interventions to ensure accurate and reliable information dissemination to both HCPs and the general public.

In our investigation, HCPs demonstrated a generally high level of knowledge concerning Halal pharmaceuticals, aligning with similar findings reported in Malaysia by a previous study [29]. This suggests that HCPs are adept at accessing and utilizing relevant information sources to enhance their understanding of this crucial aspect of patient care. However, a smaller percentage of participants were aware of the term "Halal Pharmaceuticals," indicating a considerable need for improved dissemination of knowledge on this specific concept within the HCPs community.

In terms of understanding the Islamic prohibitions related to certain substances, a positive trend was observed. A substantial high proportion of HCPs were knowledgeable about the substances forbidden for Muslims, except when necessary. This awareness is vital for identifying non-halal ingredients to be avoided in pharmaceuticals [30]. Regarding the availability of Halal alternatives to pharmaceuticals containing non-Halal ingredients, the majority of HCPs were aware of such alternatives. However, a noteworthy around one third percentage expressed a lack of knowledge in this area, indicating the necessity for heightened awareness regarding resources offering Halal alternatives.

Knowledge about capsules made of gelatin derived from non-Halal animal sources was relatively high, with the majority of HCPs being aware of this fact. Nonetheless, a significant percentage, with less than one-third, remained unaware, emphasizing the importance of raising awareness about pharmaceutical composition. Similarly, concerning the presence of alcohol in syrups and elixirs, the majority of HCPs demonstrated awareness. This awareness is critical for considering the appropriateness of such medications for Muslim patients, who may avoid those with high concentrations of alcohol [31]. However, understanding that the alcohol content in medicines, if it exceeds a certain percentage, is considered forbidden had relatively lower awareness among HCPs, emphasizing the need for additional education and clarification on specific thresholds aligning with Halal standards.

These findings underscore the significance of continuous education and awareness campaigns among

HCPs to enhance their knowledge regarding Halal pharmaceuticals. This knowledge is imperative to enable them to make informed decisions, offer suitable advice to patients, and contribute effectively to meeting the religious and cultural needs of Muslim patients. The reliance on Fiqh Fatwas, university sources, HCPs, and online resources as key information sources aligns with a study that identified these sources as commonly utilized in a similar context [32]. However, a notable proportion of participants reported not seeking information from any specific source, suggesting a potential knowledge gap within this subgroup. This underscores the need for further investigation into the reasons behind this finding to address any underlying issues in knowledge acquisition.

Remarkably, our study revealed substantial disparities in knowledge scores among physicians, pharmacists, and nurses, and intriguingly, attitudes and perceptions also displayed significant differences among these professional groups. This contrasts with the findings of a prior study conducted, which reported no significant differences in attitudes towards Halal pharmaceuticals among HCPs of different disciplines [33]. Our results suggest that irrespective of their professional role, HCPs generally share similar views and perspectives towards Halal pharmaceuticals. This shared understanding and acceptance likely stem from the recognized importance of providing Halal-compliant medications to patients, influenced by ethical and religious considerations.

Notably, the average attitude and perception scores in our study leaned towards positive or neutral, indicating a generally favorable outlook. This aligns with the results of another study, which similarly reported positive attitudes towards Halal pharmaceuticals among HCPs [7]. The prevalence of favorable attitudes and perceptions implies that HCPs are not only receptive to but also supportive of the concept of Halal pharmaceuticals. This support is crucial for delivering patient-centered care that aligns with the cultural and religious preferences of individuals adhering to Halal practices. The collective positive stance among HCPs underscores the importance of integrating cultural and religious considerations into healthcare practices to meet the diverse needs of patient populations.

The findings of the study bring to light diverse attitudes among HCPs concerning Halal pharmaceuticals, emphasizing the imperative for further education, standardization of practices, and heightened awareness within this professional community. Additionally, the results underscore the perceptions of HCPs towards Halal pharmaceuticals, underscoring the crucial need to address knowledge gaps, enhance education, and implement strategies supporting patient-centered care in alignment with cultural and religious preferences.

The strong association observed between knowledge, attitude, perception, and overall KAP scores among HCPs underscores the necessity of addressing these factors collectively in interventions aimed at enhancing understanding and practices related to Halal and non-Halal pharmaceuticals. Notably, pharmacists exhibited a higher level of knowledge compared to physicians and nurses, emphasizing the importance of targeted educational interventions for these healthcare professionals.

Furthermore, significant disparities in attitudes and perceptions towards Halal pharmaceuticals among the three professional groups were identified. These variations can be attributed to various factors, including demographic characteristics such as religion, medical profession, years of experience, and working place. Thus, there is a pressing need to increase awareness and education among HCPs regarding Halal pharmaceuticals.

Enhancing knowledge and understanding in this area is not only instrumental for improved patient care and culturally sensitive healthcare delivery but also essential for ethical considerations when prescribing medications [34, 35]. It is imperative for HCPs to be well-acquainted with the concept of Halal pharmaceuticals to effectively meet the needs of culturally diverse communities and ensure the provision of safe and acceptable medications. This emphasis on education and awareness aligns with the broader goal of fostering inclusive and patient-centric healthcare practices [36, 37].

In the realm of cost considerations related to Halal pharmaceuticals, it is pertinent to highlight a separate study conducted in Jordan that delved into patients' willingness to pay for pharmaceutical care services. Despite concerns voiced by a considerable proportion of HCPs regarding potential reluctance among patients to utilize more expensive Halal alternatives, a study in Jordan uncovered a contrasting perspective. The findings indicated that a significant percentage of patients in Jordan were willing to incur costs for pharmaceutical care services, particularly when provided by pharmacists [38].

This discrepancy in perceptions underscores the importance of a nuanced approach by HCPs, policymakers, and pharmaceutical industry stakeholders. Careful consideration and strategic planning are required to address the economic aspect of Halal medications and pharmaceutical care services. Ensuring equitable access to Halal pharmaceuticals necessitates an understanding of patients' willingness to invest in these services. Consequently, policies and strategies should be formulated with a comprehensive understanding of both HCPs' concerns and patients' preferences to create a balanced and accessible healthcare landscape.

Furthermore, integrating the topic of Halal pharmaceuticals into the curricula of medical and pharmaceutical schools is deemed essential. This approach plays a vital role in preparing future HCPs with the necessary knowledge and understanding. These recommended strategies align with the suggestions made by several studies [39-41], which underscores the significance of educational interventions in enhancing HCPs' proficiency in caring for Muslim patients.

However, it is crucial to acknowledge the limitations of this study. The sample size was relatively small, and participants were drawn from a specific geographical region, potentially limiting the generalizability of the

findings to other populations. Additionally, the utilization of self-reported data introduces the possibility of recall bias or social desirability bias. To address these limitations, future research endeavors should strive to incorporate larger and more diverse samples to enhance the representativeness of the findings. Longitudinal studies could also be conducted to assess the sustained impact of educational interventions on the knowledge, attitudes, and perceptions of HCPs over time.

In summary, the study underscores the critical need for enhancing awareness and education among HCPs regarding Halal pharmaceuticals. The results advocate for interventions that not only aim at increasing knowledge but also focus on cultivating positive attitudes and perceptions toward Halal-compliant medications. These interventions could take the form of targeted educational programs, workshops, and training sessions, addressing specific needs and knowledge gaps identified among various HCP groups.

CONCLUSION

This study provides crucial insights into the knowledge, attitudes, and perceptions of healthcare providers regarding Halal pharmaceuticals. It reveals a generally high level of knowledge among healthcare professionals; however, gaps exist, particularly regarding specific aspects of halal pharmaceuticals. The study underscores the importance of tailored educational interventions to address these gaps, promote positive attitudes, and ensure culturally sensitive healthcare delivery. Healthcare providers rely on diverse information sources, and future initiatives should leverage these sources for effective education. Furthermore, professional disparities in knowledge and attitudes emphasize the need for specialized training, while demographic factors should guide the customization of educational programs. Overall, this study lays the foundation for enhancing awareness and understanding of Halal pharmaceuticals among healthcare providers, contributing to improved patient care and adherence to cultural and religious preferences.

LIST OF ABBREVIATIONS

HCPs	=	Healthcare providers
KAP	=	Knowledge, Attitudes, and Perceptions
JUH	=	Jordan University Hospital
KAUH	=	King Abdullah University Hospital
ANOVA	=	Analysis of Variance

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The questionnaire and methodology for this study were approved by the Clinical Pharmacy Department and the Research Ethics Committee at Zarqa University under the reference number (1/1/2019-2020).

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

CONSENT FOR PUBLICATION

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

STANDARDS OF REPORTING

STROBE guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The dataset used and/or analyzed during the current study is available from the corresponding author on reasonable request [D.J].

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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SUPPLEMENTARY MATERIAL

Supplementary material is available on the publisher's website along with the published article.

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