

Students' perception towards using M-Health applications for education in medical colleges of Imam Abdulrahman bin Faisal University

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ABSTRACT

Background: The use of m-health applications contributes to the learning process of medical students. However, no study has been conducted on this topic in Saudi Arabia.

Purpose: The objective of this study was to investigate the use of m-health applications in the medical colleges of Imam Abdulrahman Bin Faisal University, Saudi Arabia, and to assess the impact of their use on the grade point average of medical students.

Method: ology: This research was a randomized quantitative cross-sectional study conducted using a paper-based questionnaire that was distributed to 3646 students from the Abdulrahman Bin Faisal University Medical Colleges. 390 students completed and returned the questionnaire. The real problem to solve in this research was how medical students can increase their grade point averages. The statistical analysis was carried out using the Chi-square test.

Results: The majority of the participants used smartphones (92.8%) and medical applications (80.5%). The results suggested that m-health applications positively influenced the educational process of students. The findings indicated that the participants who used m-health applications tend to get higher grade point averages ($\chi^2 = 26.612$, p-value < 0.05). The participants used m-health applications more frequently for educational and learning purposes. The following applications were significantly associated with the grade point averages: the clinical score systems/medical calculator application ($\chi^2 = 27.298$, p-value < 0.05), the procedure documentation application ($\chi^2 = 10.520$, p-value < 0.05), and the communication application ($\chi^2 = 17.725$, p-value < 0.05). Also, there was an association between the student's medical specialty and the use of the medical applications ($\chi^2 = 25.212$, p-value < 0.05).

Conclusion: The results indicated that a high proportion of medical students at Imam Abdulrahman Bin Faisal University Medical Schools used smartphones and medical applications during the learning process. The students who used medical applications more frequently obtained higher grade point averages. The increased grade point average associated with the use of medical applications suggested that these applications contributed to learning, knowledge acquisition, and academic performance. This outcome indicates that it is convenient to incorporate the use of m-health applications in the curricula of all medical schools of Saudi Arabian universities.

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1. Introduction

The accelerated development of new technologies in the field of communication and information systems is causing a great impact on the different fields of health. These technological advancements have contributed to the evolution of mobile health systems (m-health) defined as “the use of devices such as smartphones or tablets in the practice of medicine, and the downloading of health-related applications or apps to help with the flow of information over a mobile network and improve communication, specifically between individuals and clinicians” [1]. As a result of these advances, numerous applications (apps) have been developed and introduced in many sectors of human activities to meet the needs and requirements of current users. Regarding m-health applications, it is pertinent to indicate that the number of m-health applications increase every day and more than 325,000 m-health apps for smartphones were available in 2017 [2].

In healthcare settings, m-health applications have gained wide acceptance as tools to support medical education and practice. In the field of medical education, the use of m-health applications has contributed to improving the performance and knowledge acquisition of students in medical schools [3–5]. A study on the attitude of medical students towards the use of smartphones and m-health applications suggested that students had positive opinions of these tools because they contribute to reduce medical errors and improve overall patient care [6]. These educational instruments have positively impacted the learning practices of medical students [7]. Some studies indicated that smartphones were widely used by university medical students as educational tools [6,8–12]. In addition, several studies have highlighted the use of m-health applications and smartphones in the acquisition of knowledge during the teaching-learning process in different areas of the medical field [4,11,13]. For example, Dunleavy et al. suggested that m-learning was an effective instrument for health education [4]. Similarly, Masters et al., pointed out that mobile technologies enhanced learning activities in undergraduate and graduate medical education [13]. Also, m-health applications have been adopted by nurses in their educational practices [11,14,15].

On the other hand, some authors have considered that caution must be taken in the use of medical apps because many existing applications on the market have not been developed by medical experts, so the information available in these apps can be erroneous, inaccurate or incomplete [16–19]. On this matter, it is important that the medical information contained in the applications must be safe, reliable, real, and effective [16].

Regarding Saudi Arabia, no studies have been conducted on the influence of m-health technologies on the learning process of medical students at universities in this country. Since smartphones are one of the fundamental tools in the use of m-health technologies, it is pertinent to mention that the penetration rate of smartphones in Saudi Arabia was 87% in 2020 [20]. This high penetration rate suggests that the Kingdom of Saudi Arabia has great potential to implement m-health technologies in the teaching-learning processes of medical students.

The medical colleges of the Imam Abdulrahman Bin Faisal University, Saudi Arabia, were selected as a case of study in this research because they are leading teaching centers in the field of medicine in this country. These colleges provide high quality teaching and education, medical and clinical research, medical consultations, and community services [21]. Over the years, university authorities have worked with effort and dedication to placing the medical colleges at the forefront of excellence in medical education [21].

Since in this research, the performance of the students will be evaluated through the grade point average (GPA) of medical students, then the research question that guided this study was: what is the impact of the use of m-health applications on the average grade point (GPA) of students from Imam Abdulrahman Bin Faisal University medical schools in Saudi Arabia? Given that the grade point average (GPA) is a measure of students' academic performance [22], and m-health technologies are

beneficial in the learning process [4,11,13], then the hypothesis of this research was: the use of m-health applications in the medical schools of Imam Abdulrahman Bin Faisal University in Saudi Arabia is beneficial for learning and increases the grade point average (GPA) of medical students. It is pertinent to note that previous studies have revealed that the average grade point of medical students in some universities in Saudi Arabia ranges between 1.36 and 3.90 on the 0–4 scale [23]. Additionally, 36.3% of medical students have low grade point averages [24]. Then, the real problem to solve in this research was how medical students can increase their grade point averages.

The importance of this study lies in the fact that the outcomes will show the current use of m-health applications in the medical schools of Imam Abdulrahman Bin Faisal University, Saudi Arabia, and will evaluate the impact of their use on the GPA of medical students. Overall, this research can help improve the educational process of medical students in Saudi Arabia. On this basis, this study aimed to investigate the use of m-health applications in the medical schools of Imam Abdulrahman Bin Faisal University, Saudi Arabia, and to assess the impact of their use on the grade point average (GPA) of medical students.

2. Methodology

This research was a randomized quantitative cross-sectional study conducted through a paper-based questionnaire that was distributed among 3646 students from the medical colleges of Abdulrahman Bin Faisal University in Saudi Arabia. 390 students completed and returned the questionnaire. The questionnaire was designed to investigate the use of m-health applications at the aforementioned university and to assess the impact of their use on the grade point average (GPA) of medical students.

2.1. Study settings

The study was conducted at Imam Abdulrahman Bin Faisal University Medical Colleges on the Al Rakkah and Jubail campuses. Seven medical colleges were investigated: 6 on Al Rakkah campus, and 1 on the Jubail campus. The colleges selected on the Al Rakkah campus were the College of Dentistry, the College of Clinical Pharmacy, the College of Medicine, the College of Applied Medical Science, the College of Nursing, and the College of Public Health. The college investigated on the Jubail campus was the College of Applied Medical Science. The total number of students from the mentioned colleges was 3646, and the sample size was 390 students.

The participation in this research was voluntary, and ethical approval and informed consent were obtained from the Institutional Review Board of the Imam Abdulrahman Bin Faisal University.

2.2. Inclusion and exclusion criteria

The participants included in this study were students from the medical colleges of Imam Abdulrahman Bin Faisal University located on the Al Rakkah and Jubail campuses: 2nd, 3rd, 4th, 5th, and 6th year students from the College of Dentistry (Al Rakkah); 2nd, 3rd, 4th, and 5th year students from the College of Clinical Pharmacy (Al Rakkah); 2nd, 3rd, 4th, and 5th year students from the College of Medicine (Al Rakkah); 2nd, 3rd, and 4th year students from the College of Applied Medical Science (Al Rakkah); 2nd, 3rd, and 4th year students from the College of Nursing (Al Rakkah); 2nd, 3rd, and 4th year students from the College of Public Health (Al Rakkah); and, 2nd year students from the College of Applied Medical Science (Jubail).

Students from the preparatory and internship year of the mentioned Colleges were excluded.

2.3. Data collection

The data was collected using a paper-based questionnaire which was

distributed among the students of the medical colleges of Abdulrahman Bin Faisal University located on Al Rakkah and Jubail campuses. The questionnaire was designed based on a questionnaire published in a previous study [6]. As shown in Appendix 1, the questionnaire was slightly modified and the questions were adapted to the educational context of the medical colleges of Imam Abdulrahman Bin Faisal University, Saudi Arabia.

It is pertinent to indicate that a pilot study was conducted to ensure the validity and reliability of the questionnaire.

2.4. Statistical analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 24. The statistical analysis was carried out using the Chi-square statistical test that allowed assessing the impact of the use of m-health applications on the GPA of the students. The Chi-square test determines whether there is an association between categorical variables such as those used in this study. The significance level of these results was based on a p-value equal to 0.05.

3. Results

The demographic information of the participants of this research carried out at Imam Abdulrahman Bin Faisal University Medical Colleges on the Al Rakkah and Jubail campuses is shown in Table 1. According to this table, 6 medical colleges were investigated on the Al Rakkah campus, and 1 on the Jubail campus. This table indicates that most of the participants had an average age of 21 years, and the majority

Table 1
Demographic information (n = 390).

		n (%)
Average Age (years)		21 (100)
Gender		
Male		168 (40.1)
Female		222 (56.9)
Medical Specialty		
College of Medicine - Al Rakkah	Medicine and surgery	90 (23.1)
College of Dentistry - Al Rakkah	Dental surgery	47 (12.1)
College of Clinical Pharmacy- Al Rakkah	PharmaD	34 (8.7)
College of Nursing - Al Rakkah	Nursing	37 (9.5)
College of Applied Medical Sciences - Al Rakkah	Clinical Laboratory Sciences	11 (2.8)
	Respiratory Care	39 (10)
	Physical Therapy	13 (3.3)
	Radiology Sciences	11 (2.8)
	Cardiac Technology	13 (3.3)
	Clinical Nutrition	14 (3.6)
	Emergency Medical Services	11 (2.8)
College of Public Health – Al Rakkah	Information Management & Technology	10 (2.6)
	Environmental Health	10 (2.6)
	Public Health	11 (2.8)
College of Applied Medical Sciences-Jubail	Anesthesia	13 (3.3)
	Neuroscience	12 (3.1)
	Respiratory Care	14 (3.6)
Year of study		
Second year		121 (31)
Third year		96 (24.6)
Fourth year		106 (27.2)
Fifth year		51 (13.1)
Sixth year		16 (4.1)

of them (56.9%) were female. Medicine and Surgery in the College of Medicine on the Al Rakkah campus was the medical specialty with the highest number of participants (23.1%). The specialties with the lowest number of participants were Anesthesia (2.6%) and Neuroscience (2.6%) in the College of Applied Medical Sciences on the Jubail campus. The highest response rate to the questionnaire was given by the second-year students (31%). The lowest response was given by the sixth-year students (3.8%).

On the other hand, Fig. 1 suggests that most of the students (54.4%) obtained a grade point average (GPA) between 3.75 and 4.49 points. Similarly, Fig. 2 depicts that the largest proportion of participants (92.8%) owned smartphones, and Fig. 3 illustrates that the majority of participants (80.5%) used medical apps.

Fig. 4 shows the usage given by the participants to the m-health applications. This figure indicates that the students were using medical applications for learning, clinical training in hospital environments, and revision purposes.

Besides, Tables 2 and 3 describe the frequency and the time spent by the participants using medical applications, respectively. In these tables, the highlighted bold numbers indicate the higher frequencies and the higher time spent using applications in each medical college.

Fig. 5 shows the types of medical applications used by the students in all medical colleges. The participants utilized applications for communications, disease diagnosis/management, medication formulary/drug reference, clinical score systems/medical calculator, procedure documentation, web access for information, evidence-based databases, and calendar and time management. Furthermore, Table 4 illustrates some medical apps used by the students.

Regarding the statistical analysis, the results of the application of the Chi-square test to the data are shown in Table 5. The outcomes indicated that there was an association between the GPA of the students and the m-health applications frequently used for educational purposes. Also, there was an association between student's medical specialty and the use of medical apps.

4. Discussion

This descriptive study about the use of m-health applications in the medical colleges of Imam Abdulrahman Bin Faisal University, Saudi Arabia, suggested that m-health applications positively influenced the educational process of medical students.

In this sense, the results indicated that the participants who used m-health applications tend to get higher grade point averages ($\chi^2 = 26.612$, p-value < 0.05). Regarding this finding, preceding studies have found that the use of mobile applications improved the learning process and scores of medical students [25–27].

Furthermore, the participants used more frequently m-health applications for educational and learning purposes. Other studies have observed similar results and detected that m-health applications were accepted and frequently utilized for educational objectives in the medical field [6,9,10,25,26]. Moreover, the students learning process has been enhanced by the use of these applications [15,28,29].

The kind of m-health applications that contributed to the learning process of the students of the medical colleges of Imam Abdulrahman Bin Faisal University are shown in Table 4. In general, the applications presented in this table provide useful medical information on dermatology, cardiology, oncology, rheumatology, hematology, endocrinology, urology, diabetes, neurology, pediatrics, dentistry, gastroenterology, gynecology, immunology, allergy, HIV, internal medicine, surgical procedures, preventive medicine, drug information (prescription and drug interaction), information of diseases (diagnosis, management and treatment), nutrition habits, clinical practices, medical calculations (anesthesia dose), medical images (X-rays, CD scanners), 3D anatomy graphics (skeletal, skin, veins, muscles, dental, connective tissue, nerves, arteries, respiratory system, digestive organs, heart, brain), definitions of medical terms (medical dictionary), interpretation

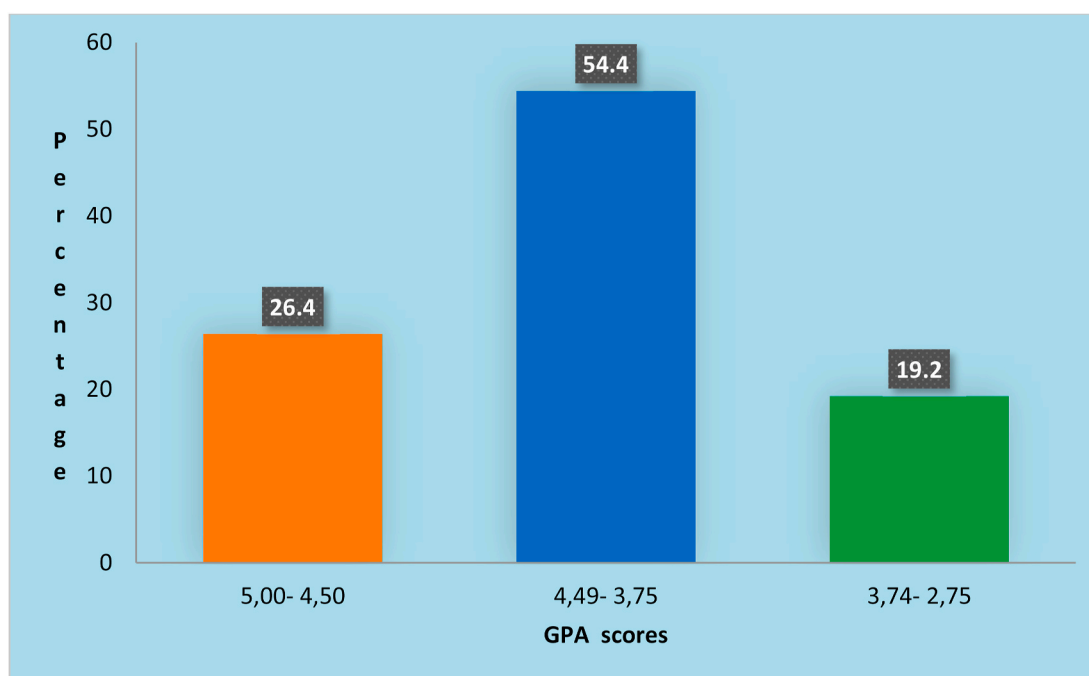


Fig. 1. GPA of the students in all medical colleges (n = 390).

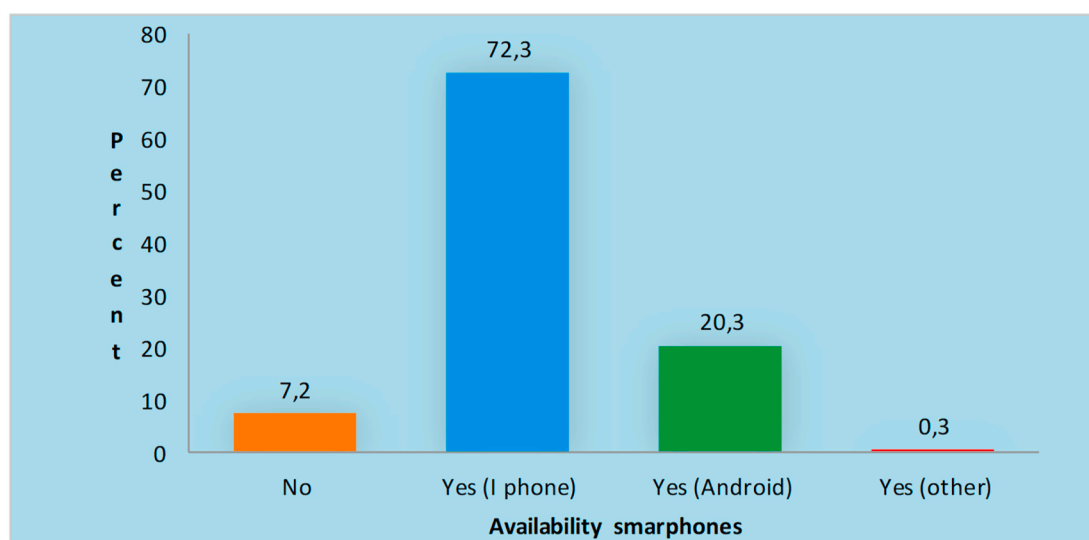


Fig. 2. Availability of smartphones among students in all medical colleges (n = 390).

of laboratory results, development and analysis of patient medical records, and other topics [30–38]. The applications described in Table 4 use practical illustrations, diagrams, tables, 3-D graphics, photos, videos, sounds, simulations, and experiences that make the learning process interactive, interesting, dynamic, and effective [39,40]. M-health technologies facilitate students to instantly obtain medical information like the one mentioned above anywhere and at any time [39]. This possibility indicates that students can view, analyze, and reflect on these medical topics whenever they want [39]. In this sense, it is possible to suggest that continuous observation, analysis, and reflection on the medical information available on the m-health apps enable knowledge consolidation, and consequently students increase their grade point averages [39]. Additionally, m-health applications allow students to engage in continuous self-directed learning on topics that interest them [40].

According to Table 5, among the seven types of m-health applications used by the participants, the Chi-square test showed that only three types of those applications were significantly associated with the grade point average (GPA) of the students: the clinical score systems/medical calculator application ($\chi^2 = 27.298$, p-value < 0.05), the procedure documentation application ($\chi^2 = 10.520$, p-value < 0.05), and the communication application ($\chi^2 = 17.725$, p-value < 0.05). The majority of the students used medical applications for learning purposes, while the minority utilized them for revision and clinical training in hospital environments. Besides, the analysis of the results showed that there was an association between the student's medical specialty and the use of medical applications ($\chi^2 = 25.212$, p-value < 0.05). The medicine and surgery participants of the College of Medicine (Al Rakkah) used the maximum number of medical applications, while the radiological sciences participants of the College of Applied Medical Sciences (Al

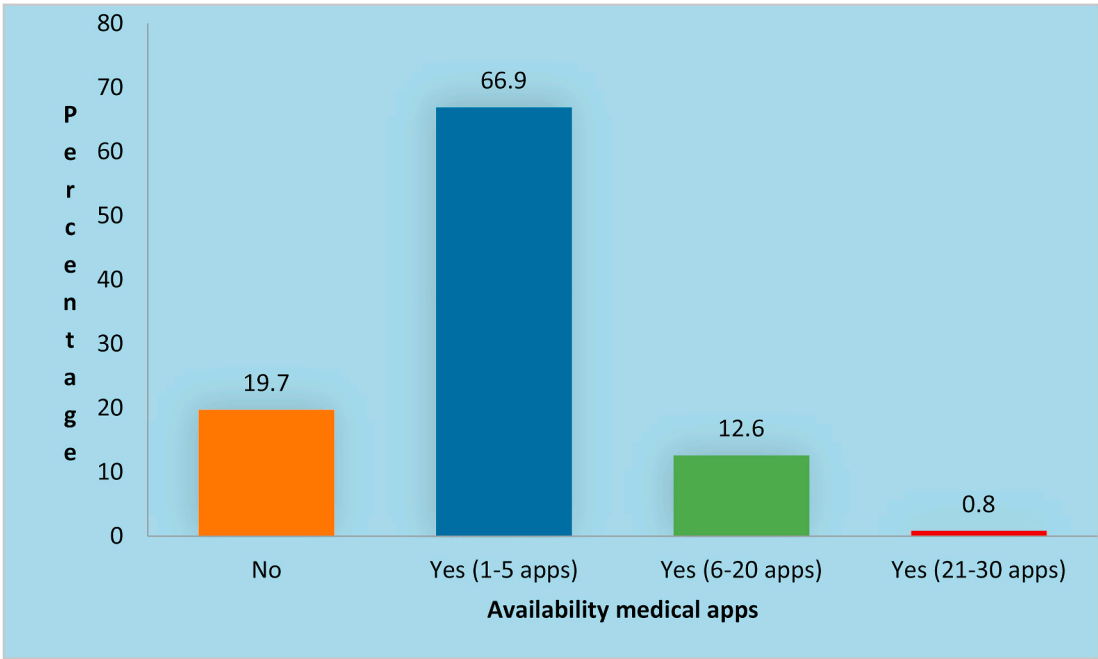


Fig. 3. Availability of medical apps among students in all medical colleges (n = 390).

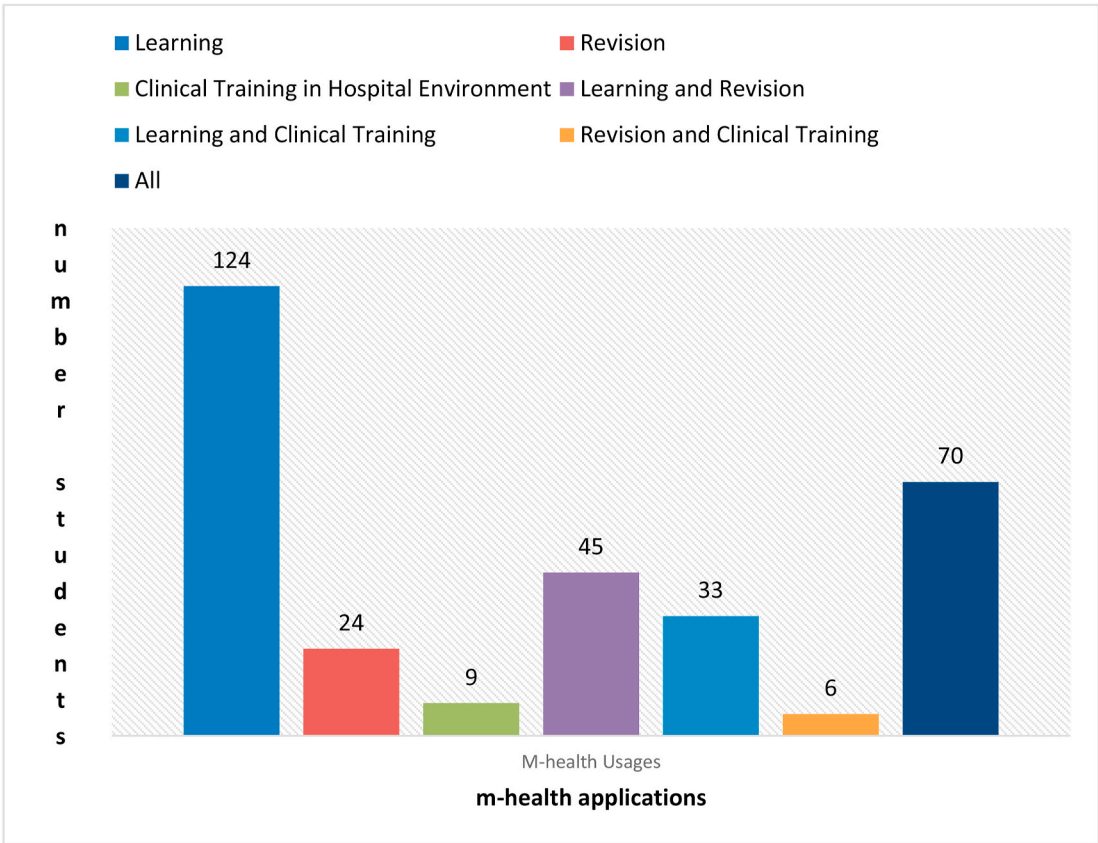


Fig. 4. Usage of medical apps by students in all medical colleges (n = 390).

Rakkah) employed the minimum number of applications. Regarding this result, a previous study found that medical students usually take the lead in utilizing various types of applications in the medical field [41]. In this sense, Medicine and Surgery specialties tended to use more medical applications than other medical specialties due to the complexity of their

medical practice. In general, it is pertinent to comment that since a positive Chi-square test only indicates that there is a positive association between observation A and observation B (no causal interaction). Then, it is possible that students that are smarter, and thus get higher grades, also are more likely to be smart enough to use medical smartphone

Table 2

Frequency of usage of medical apps (n = 390).

Question response	College of Medicine Al Rakkh	College of Dentistry Al Rakkh	College of Clinical Pharmacy Al Rakkh	College of Applied Medical Science Al Rakkh	College of Nursing Al Rakkh	College of Public Health Al Rakkh	College of Applied Medical Science Jubail	All colleges
Several Times a day	13 (14.4%)	1 (2.1%)	2 (5.9%)	10 (8.9%)	6 (16.2%)	3 (7.7%)	4 (12.9%)	39 (10%)
Once or twice a day	18 (20%)	19 (40.4%)	7 (20.6%)	18 (16.1%)	5 (13.5%)	7 (17.9%)	6 (19.4%)	80 (20.5%)
2-3 times a week	27 (30%)	9 (19.1%)	12 (35.3%)	28 (25.0%)	10 (29.7%)	9 (23.1%)	8 (25.8%)	103 (26.4%)
Once a week	3 (3.3%)	1 (2.1%)	2 (5.9%)	14 (12.5%)	2 (5.4%)	6 (15.4%)	4 (12.9%)	32 (8.2%)
Rarely used	13 (14.4%)	6 (12.8%)	4 (11.8%)	14 (12.5%)	5 (13.5%)	5 (12.8%)	8 (25.8%)	55 (14.1%)
Never used	2 (2.2%)	1 (2.1%)	2 (5.9%)	10 (8.9%)	6 (16.2%)	3 (7.7%)	4 (12.9%)	28 (7.2%)

Table 3

Time spent using medical apps per day (n = 390).

Question response	College of Medicine Al Rakkh	College of Dentistry Al Rakkh	College of Clinical Pharmacy Al Rakkh	College of Applied Medical Science Al Rakkh	College of Nursing Al Rakkh	College of Public Health Al Rakkh	College of Applied Medical Science Jubail
None	4 (4.4%)			2 (1.8%)	5 (13.5%)	1 (2.6%)	
1-10 Minutes	23 (25.6%)	12 (25.5%)	2 (5.9%)	25 (22.3%)	6 (16.2%)	12 (30.8%)	12 (38.7%)
11-20 Minutes	12 (13.3%)	7 (14.9%)	6 (17.6%)	19 (17%)	4 (10.8%)	3 (7.7%)	6 (19.4%)
21-30 Minutes	9 (10%)	4 (8.5%)	2 (5.9%)	12 (10.7%)	2 (5.4%)	4 (10.3%)	1 (3.2%)
31-40 Minutes	17 (18.9%)	10 (21.3%)	9(26.5%)	21 (18.8%)	10 (27%)	8 (20.5%)	8 (25.8%)
41-50 Minutes	2 (2.2%)	3 (4.6%)			1 (2.7%)	1 (2.6%)	
51-60 Minutes	1 (1.1%)		2 (5.9%)		1 (2.7%)		1 (3.2%)
61+ Minutes	8 (8.8%)		6 (17.6%)	5 (4.5%)		1 (2.6%)	1 (2.7%)

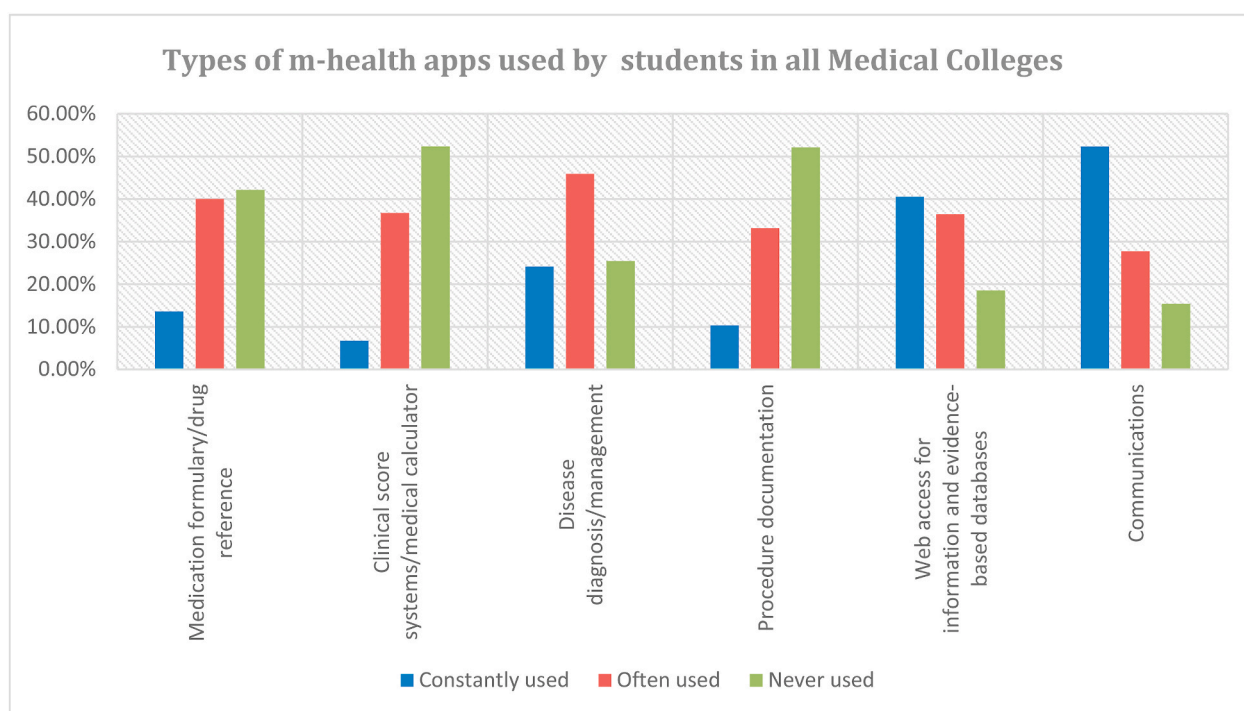
**Fig. 5.** Types of medical apps used by students in all medical colleges (n = 390).

Table 4
Medical apps used by students (n = 390).

Recommended Applications	Frequency	Medical Colleges
Medscape	13	Medicine, Nursing, Applied Medical Sciences-Al Rakkah
Up to date	18	Medicine, Clinical Pharmacy-Al Rakkah
Essential Anatomy	18	Medicine, Nursing-Al Rakkah
Dental Drugs	4	Dentistry-Al Rakkah
NBDE Dental Anatomy	2	Dentistry-Al Rakkah
OMNIC	2	Dentistry-Al Rakkah
OMNIC (of MOH)	2	Nursing-Al Rakkah
Medical Dictionary	7	Applied Medical Sciences, Applied Medical Sciences-Jubail
Anatomy 5	4	Applied Medical Sciences-Al Rakkah
Micromedex	7	Clinical Pharmacy-Al Rakkah
Medical Terminology	1	Public Health-Al Rakkah
SEHA (of MOH)	1	Public Health-Al Rakkah
3D Bones & Organs	3	Applied Medical Sciences-Jubail

Table 5
Results of the application of the Chi-square test to the data (n = 390).

Results Chi -square test	$\chi^2 =$ value	p-value	Df
GPA scores of medical colleges students	$\chi^2 = 26.612$	0.022	14
Medication formulary/drug reference	$\chi^2 = 5.0150$	0.286	4
Score systems/medical calculator	$\chi^2 = 27.298$	0.000	4
Disease diagnosis/management	$\chi^2 = 2.215$	0.696	4
Procedure documentation	$\chi^2 = 10.520$	0.033	4
Web access for information and evidence-based databases	$\chi^2 = 2.338$	0.674	4
Communications	$\chi^2 = 17.725$	0.010	4
Calendar and time management	$\chi^2 = 7.992$	0.092	15
Medical speciality of students	$\chi^2 = 25.212$	0.048	15

applications.

Appendix 1. Questionnaire survey

The main limitation of this study was related to the fact that it was carried out in a single public university in the Eastern Province of Saudi Arabia, so the results of this research cannot be applied to other universities. Another limitation was that a paper-based questionnaire was used for data collection; probably the use of an app for a smartphone would be better for this purpose. Future studies will include other universities of the Kingdom of Saudi Arabia using a better data collection method.

5. Conclusion

The results indicated that a high proportion of medical students at Imam Abdulrahman Bin Faisal University Medical Schools used smartphones and medical apps during the learning process. The students who used medical applications more frequently obtained higher grade point averages. The increased grade point average associated with the use of medical applications suggested that these applications contributed to learning, knowledge acquisition, and academic performance. This outcome indicates that it is convenient to incorporate the use of m-health applications in the curricula of all medical schools of Saudi Arabian universities.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.



College of Public Health
Health Information Management
& Technology Department

Section A (Participant Information)

1. Please choose your gender:

- ☐ Male
☐ Female

2. Please write your age:

..... Year.

3. Please select your Medical college:

- ☐ College of Medicine
☐ College of Dentistry
☐ College of Nursing
☐ College of Applied Medical Sciences
☐ College of Clinical Pharmacy
☐ College of Public Health
☐ College of Applied Medical Sciences – Jubail

4. Please select your specialty?

- | | |
|---|---|
| <input type="checkbox"/> Not applicable | <input type="checkbox"/> Clinical Nutrition |
| <input type="checkbox"/> Clinical Laboratory Sciences | <input type="checkbox"/> Emergency Medical Services |
| <input type="checkbox"/> Respiratory Care | <input type="checkbox"/> Anesthesia |
| <input type="checkbox"/> Physical Therapy | <input type="checkbox"/> Neuroscience |
| <input type="checkbox"/> Radiological Sciences | <input type="checkbox"/> Health Information Management & Technology |
| <input type="checkbox"/> Cardiac Technology | <input type="checkbox"/> Environmental Health |
| | <input type="checkbox"/> Public Health |

5. Please select your current year of study:

- ☐ 2nd year
☐ 3rd year
☐ 4th year
☐ 5th year
☐ 6th year

6. Please select your GPA score currently:

- ☐ 5 - 4.5
☐ 4.49 – 3.75
☐ 3.74 – 2.75
☐ 2.74 – 2.0

Section B (Mobile phones)

7. Do you own an application smartphone?

- ☐ No
- ☐ Yes – iPhone
- ☐ Yes – Android
- ☐ Yes – Other Smartphone

8. Concerning your smartphone, do you own medical related applications that you use in education? (for example Medical dictionary, Anatomy, and Pubmed, medical reference, drugs databases, UpToDate)

- | | |
|---|---|
| <input type="checkbox"/> No | <input type="checkbox"/> Yes – 16–20 apps |
| <input type="checkbox"/> Yes – 1–5 apps | <input type="checkbox"/> Yes – 21–25 apps |
| <input type="checkbox"/> Yes – 6–10 apps | <input type="checkbox"/> Yes – 26–30 apps |
| <input type="checkbox"/> Yes – 11–15 apps | <input type="checkbox"/> Yes – 31+ apps |

*If your answer to this question was "No" please proceed to question 12.

Section C (Mobiles medical applications in education and practice)

9. Please indicate why you use medical related applications in education: (you may choose more than one answer)

- ☐ For learning (for example searching for symptoms of a disease)
- ☐ For revision purposes
- ☐ For clinical training in hospital environment

10. Please select the estimated frequency when you utilize the medical educational applications on your smartphone:

- ☐ Several times a day
- ☐ Once or twice a day
- ☐ 2–3 times a week
- ☐ Once a week
- ☐ Rarely used
- ☐ Never used

11. Please estimate the time you spend per day (in minutes) using smartphone applications related to medical educational activities:

- ☐ None
- ☐ 31–40 minutes

. (continued).

- | | |
|--|--|
| <input type="checkbox"/> 1-10 minutes | <input type="checkbox"/> 41-50 minutes |
| <input type="checkbox"/> 11-20 minutes | <input type="checkbox"/> 51-60 minutes |
| <input type="checkbox"/> 21-30 minutes | <input type="checkbox"/> 61+ minutes |

12. In relation to the following types of medical related applications, Please indicate how you use them in education:

a) Medication formulary / drug reference

- ☐ Constantly used ☐ Often used ☐ Never used

b) Clinical score systems / medical calculator

- ☐ Constantly used ☐ Often used ☐ Never used

c) Disease diagnosis / management

- ☐ Constantly used ☐ Often used ☐ Never used

d) Procedure documentation

- ☐ Constantly used ☐ Often used ☐ Never used

e) Web access for information and evidence-based databases

- ☐ Constantly used ☐ Often used ☐ Never used

f) Communications such as email

- ☐ Constantly used ☐ Often used ☐ Never used

g) Calendar and time management

- ☐ Constantly used ☐ Often used ☐ Never used

13. Would you use a smartphone application specific to your medical college?

- ☐ No
☐ Yes

14. Please detail any further comments you have regarding the following:

- a) Which medical educational applications would you recommend? And what are the features or characteristics that attract you to use them?

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Thank you for your collaboration

. (continued).

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