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Utility and perception of smartphone related medical apps among medical students during full-time virtual learning

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ABSTRACT

Objectives: This article investigated the purposes and medical students' perception of using smartphone medical applications, as well as the impacts on their clinical practice during full-time virtual learning due to the COVID-19 pandemic. *Methods:* Between March and August 2020, an anonymous online survey was distributed among 338 undergraduate medical students (second to six year) who were randomly selected from different colleges of medicine, Riyadh, Saudi Arabia. *Results:* Our findings revealed that almost all students have smartphones, and that clinical skill guide was the most prevalent reason for utilizing medical apps. Most of our participants thought these apps were useful in saving time, simple to obtain, and safe tools for patient care. *Conclusions:* Our research highlights medical students' positive sentiments toward using medical applications in their studies, particularly during full-time virtual learning. Using these medical apps might help medical students and the education system to narrow the gaps that had been emerged during the lockdown.

Keyword: Medical apps, smartphones, full-time virtual learning, medical students, perception

1. INTRODUCTION

Medical education worldwide has been greatly disrupted by the COVID-19 situation as it put medical students away from their classes and clinical training (Belfi et al., 2021). At the beginning of this pandemic, the lock down of educational institutes was an urgent and compulsory response that was primarily aiming to keep the students and teachers safe. A big number of medical institutes had to urgently shift to exclusive online learning to continue with medical educational services (Binks et al., 2021). However, during the following academic year, the situation was different as using

hybrid learning which combines both remote and face-to-face teaching was more satisfactory especially for clinical year students (Hattar et al., 2021). Indeed, using technology was necessary to meet the challenges in medical education (Guze, 2015). Broad categories of technology have greatly impacted mostly everyday activities such as computers, tablets, and smartphones. Smartphone can easily replace other computer devices especially with the continuous technological advancement that guarantee diverse functionality (Murfin, 2013). Currently, health care professionals and medical students tend to use smartphones as hand held computers for many purposes such as easily accessing information and decision support using different websites, eBooks, and medical applications. According to estimates, there are thousands of smartphone related medical apps in different operating system stores such as Medscape, UpToDate, Medical encyclopedia, and Epocrates (Boulos et al., 2011).

Medical apps had several good upsides that granted medical students some merits especially during the time of online learning. In addition to keeping students away from COVID-19 risks, it saved students time giving them more free time to study or to look for other online learning resources. Using these applications in medical education has been reported to have a positive impact on the students learning, their performance in clinical practice, and on the students' grades (Murfin, 2013). However, medical students are not that confident to use these medical applications on a regular basis for their studies (Chase et al., 2018; Sayedalamin et al., 2016). Without a doubt, medical education is one of the disciplines that can be greatly affected by the convenience of smartphone-related applications (Ventola, 2014). Therefore,it is crucial to understand how medical apps can improve medical education and which apps will be most useful for medical students especially during the era of full-time e-learning (Rose, 2020).

This paper aims to examine the purposes of using smart phone related medical applications among medical students during the COVID-19 pandemic in Kingdom of Saudi Arabia. We also sought to assess the students' perception of using smartphone medical apps and the impacts on their clinical practice during COVID-19 time.

2. MATERIALS AND METHODS

Subjects

A descriptive quantitative cross-sectional study was conducted from March 2020 to August 2020. Our study was conducted among 338 undergraduate medical students (second to sixth year) who were randomly selected from different colleges of medicine, Riyadh, Saudi Arabia. First-year students were excluded from our study as they are in the preparatory year where they study general subjects such as English, physics, and biology. The study was started after obtaining the ethical approval of the College of Medicine Dar Al Uloom University, Riyadh, Saudi Arabia.

Data collection

The data were acquired anonymously through an online questionnaire that has previously been utilized in other studies (Koehler et al., 2012; Sayedalamin et al., 2016). The questionnaire is composed of many parts: an introduction where the objectives of the study were explained to the participants and they were informed that their participation is voluntary, and they can refuse to participate or withdraw from the study at any time without any penalty or disadvantages related to your choice; part I included sociodemographic data of the participants; part II included questions that were designed to evaluate the purpose of using the smartphone related medical applications; part III included questions that assess the students' perceptions about the value of having smartphone-related Medical Apps on and their impact on clinical practice; part IV included questions were framed to assess the most commonly used medical apps amongst students at colleges of Medicine. In part III, Likert scale was used to indicate the students' agreement with statements about their attitude toward the usage of smartphone-related medical apps and their impact on clinical practice on a scale ranging from 1 to 5 (1= strongly disagree, 2= disagree, 3= not sure, 4= agree, 5= strongly agree). The mean and standard deviations were calculated for each response. Incompletely filled surveys were excluded from the study. Students who did not own a smartphone were excluded from the study.

Statistical analysis

The Statistical Package for the Social Sciences Software (SPSS) version 22 was used to analyze the data. Descriptive statistics including frequencies, percentages, and means were used to describe the characteristics of the sample.

3. RESULT

Demographic Data of the Participants

An online survey was sent to 420 medical students at the beginning of the COVID-19 pandemic in the duration March 2020-August 2020. In total, 343 medical students have completely filled the survey with an 82% response rate. As demonstrated in Table 1, the

majority of the participants were female (No. = 262, 76.38%) and only 81(23.62%) were male students. The vast majority of the participants use smartphones (No. =338, 98.54%). Students without a smart device (No= 5, 1.46%) were excluded from the study. Among the 338 students who were included in our study, the majority of participants (No= 308, 91.12%) were aware of the availability of medical applications on smart devices before taking the survey and 252(74.56%) of them installed the medical apps on their smart devices. However, 199 (58.88%) stated that their medical educators did not recommend installing specific medical applications on their mobiles.

Table 1 Demographic data of medical students

	Frequency	Percentage
Total participants	343	100
Gender		
Male	81	23.62
Female	262	76.38
Using smart devices		
Yes	338	98.54
No	5	1.46
Awareness about availability of medical apps on smart devices		
Yes	308	91.12
No	35	10.36
Installed medical apps on your smart device		
Yes	252	74.56
No	86	25.44
Medical educator recommended to install a specific medical application in mobile		
Yes	139	41.12
No	199	58.88

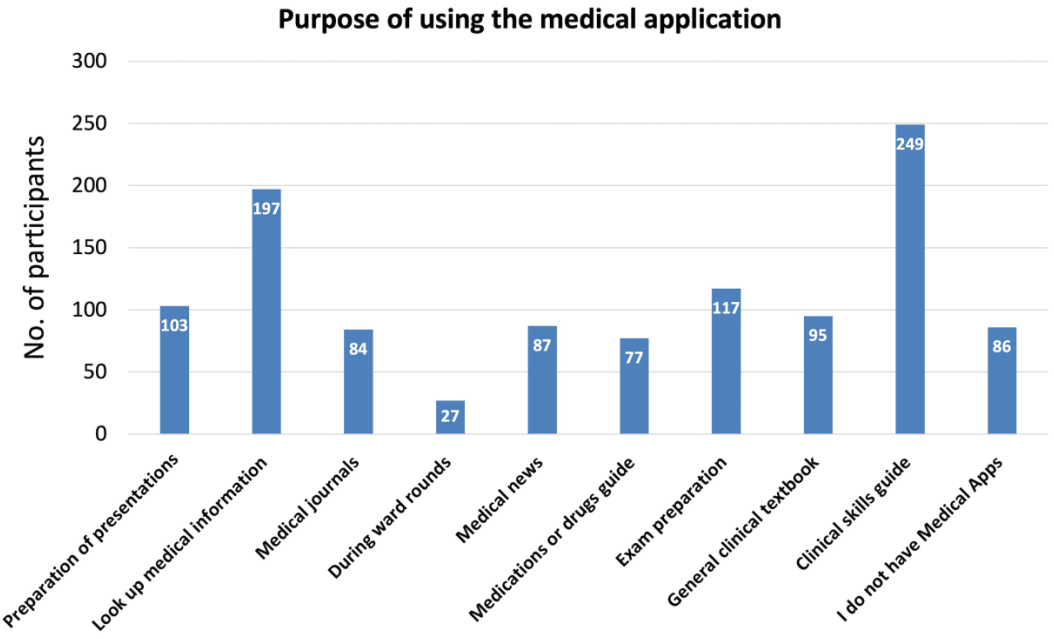

Figure 1 The purposes of using medical applications among medical students.

Purpose of Using the Medical Applications

Next, we aimed to assess the purposes of using medical applications on smartphones among medical students especially during this exceptional situation of full-time virtual learning. Our results have shown that most of the participants are using medical apps on their smartphones for clinical skill guides (No= 249, 73.67%), looking up medical information (No = 197, 58.28%), exam preparation (No. = 117, 34.62%), and preparation of presentations (No. = 103, 30.47%), (Figure 1). Other uses of medical apps such as accessing medical journals, medical news, using medication or drug guides, and accessing general clinical text books have been reported by around 25% of the participants. As expected, only 7.99% (No. = 27) of the participants used the medical apps during the ward rounds.

Students' perceptions of medical apps on smartphones and their potential effects on clinical practice

The students were asked to rate how useful they found medical apps on a scale from 1 (strongly disagree) to 5 (strongly agree). The mean and SD of students' ratings were calculated for each question. As shown in Table 2, students who had medical apps installed on their smart devices were generally with the opinion that they are looking to obtain more medical apps in the future as well as they would recommend other fellow students to use these apps. Furthermore, they consider medical apps as useful to provide useful medical information at 'point-of-care', and to supplement medical books. Regarding the students' perception about the influence of Medical Apps on clinical practice, they consider these apps as a tool that saves time, helps in making differential diagnoses, and performs useful medical related calculations (e.g. estimate creatinine). However, many students do not depend on medical apps in their study, and they considered medical books as a better source of information than using medical apps (Table 3).

Table 2 Students perceptions about Medical Apps on smartphone

	Mean (total score=5)	**SD**
Medical apps are easy to obtain	3.61	1.04
I am looking to obtain more medical apps in the future	4.03	1.03
I would recommend the use of medical apps to my fellow medical students	3.97	0.97
I do most of my medical learning using medical apps	2.80	1.18
Medical Apps are essential tools for undergraduate medical studies	3.58	1.04
Medical Apps are superior to medical books	2.87	1.07
Medical Apps are as good as medical books	3.13	1.09
Medical Apps are inferior to medical books	3.22	0.98
Medical Apps can replace medical books	2.83	1.13
Medical Apps supplement medical books	3.89	0.91
Medical Apps provide useful medical information at 'point-of-care'	3.91	0.75
Free Medical Apps are inferior in quality compared to paid apps	3.43	1.03
No dangers in using Medical Apps for patient care	3.50	0.92

Table 3 Students perceptions about the impact of Medical Apps on clinical practice

	Mean (total score=5)	**SD**
Medical Apps improve clinical decision-making	3.75	0.81
Medical Apps save time	4.13	0.89
Medical Apps allow faster access to national clinical practice guidelines	3.72	0.94

Medical Apps allow faster access to common laboratory reference values	3.80	0.91
Medical Apps help in making differential diagnoses	3.89	0.98
Medical Apps perform useful medical-related calculations (e.g. estimate creatinine)	3.79	0.93
Medical Apps allow faster access to reliable sources of medical knowledge	3.76	0.84
Medical Apps allow faster access to reliable sources of clinical skills	3.72	0.89
Medical Apps allow accurate medicine dosage calculation	3.58	0.85
Medical Apps allow easier medicine dosage calculation	3.69	0.94
Medical Apps allow faster access to evidence-based medical practice	3.62	0.95

The most popular medical apps used among medical students.

As depicted in Figure 2, our findings revealed that Medscape, PubMed Mobile, Gray's Anatomy, and UpToDate are the most common medical apps used among medical students.

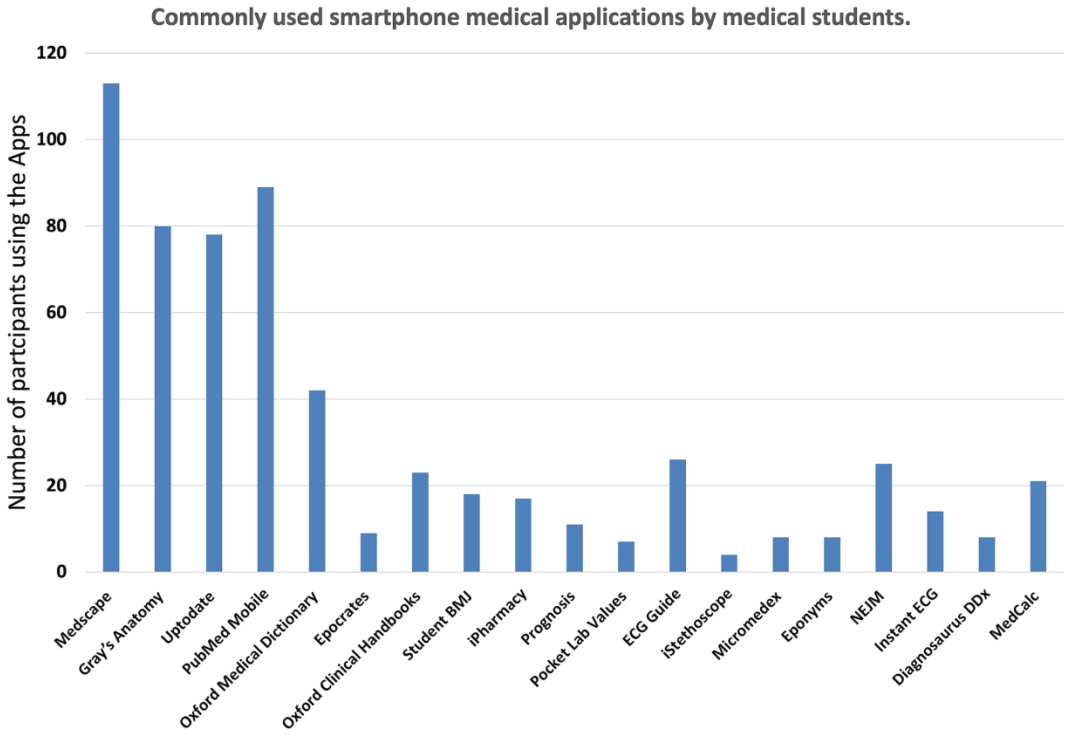

Figure 2 Commonly used smartphone medical applications by medical student

4. DISCUSSION

In the present study, we aimed to examine the purposes of using smartphone-related medical Apps among colleges of Medicine students in Saudi Arabia during the full-time virtual learning due to the COVID-19 pandemic. We also sought to assess the students' perception of using smartphone medical apps and the impacts on their clinical practice during that time. Of note, our data

collection was done during the complete shutdown of the COVID 19 pandemic (March 2020-August 2020) where all types of teaching were replaced by online education.

Our results demonstrated that 98.54% (No. 338) of the participants are using smart devices. This is consistent with the 2021 US statistics of smartphone ownership among different educational levels in which 93% of people with a college degree or higher, owned a smartphone (O'Dea, 2021). This popularity in using smartphones can be explained by the availability of different models with a wide range of prices, being more portable, and allowing high connectivity in comparison to computers or laptops. About 75% (No. 252) of participants who have smartphones have installed medical apps on their smartphones. This is in line with the previous findings of other studies which reported that 72% and 89% of the individuals included in their studies installed medical apps on their smartphones (Koehler et al., 2012; Sayedalamin et al., 2016). Although about 25% of our participants do not install medical apps on their smartphones, these students are expected to use medical apps during full-time virtual learning especially that they already own a smart device.

Around 60% of the participants reported that medical educators did not recommend the install of medical applications on their smartphones. This agrees with a previous study done in Saudi Arabia (Sayedalamin et al., 2016). This is opposing to another study done in the United Kingdome which observed that several medical schools advised their students to use certain medical apps during some professional courses (Payne et al., 2012). However, our findings can be explained by the engagement of the faculty members in the massive unplanned transition from traditional to virtual education at the beginning of the COVID 19 pandemic. Regarding the most common uses of these apps on the smartphone, most of our participants reported the use of medical apps for clinical skills guide, looking up medical information, exam preparation, and preparation of the presentation. Moreover, our findings showed that around 8% of the participants (all of them were in clinical years) used medical apps during ward rounds. One conceivable explanation of these findings is the entire replacement of the clinical bedside teaching by online education such as utilizing video demonstrations for examinations which enhanced medical students to find other sources for clinical teaching.

When considering the perception of our participants about having medical apps on their smartphone, the majority considered obtaining these apps easy, being a safe tool for patient care, and provide useful information at "point of care". Moreover, many of the participants were with the opinion of looking for having more apps and recommending these apps to their fellow medical students. However, when compared these apps to the medical books, there was controversy as some of the participants considered medical apps inferior or as good as medical books. However, the most popular opinion among our participants was that "medical apps supplement medical books". On the other hand, when considering the perception of our participants about the potential effects of medical apps on clinical practice, most of the opinions support the benefit of using these apps. Most of our participants considered these apps effective in saving time, making differential diagnoses, accessing the common laboratory reference values, and performing medical-related calculations.

Our findings are consistent with other studies which considered these apps as quite useful in clinical practice (Franko & Tirrell, 2012; Tran et al., 2014). However, this is clearly at odds with the observations of another study that reported negative feedback about the influence of medical applications on their clinical practice (Sayedalamin et al., 2016). Medscape, PubMed mobile, Gray's anatomy, and Up To Date are the most commonly used medical apps reported by our participants. When looking at the other medical apps included in our survey, we revealed that iStethoscope and Epocrates are used seldom. Finally, an intrinsic limitation of our study is that it was a questionnaire-based that conducted in medical colleges of Riyadh, Saudi Arabia.

5. CONCLUSION

Our study clearly emphasizes the positive attitudes of medical students toward using medical apps in their medical study especially during the duration of full-time virtual learning. The sudden curricular reform that happened at the beginning of the COVID 19 pandemic might affect how medical students deal with this type of technology as they found themselves facing the unprecedent challenge of being responsible for all the aspects of their studies. Using these medical applications might aid medical students and the educational system in resolving the issues that developed during the lockdown. Further studies are required to assess the medical students' uses and perception of medical apps after adopting blended learning by many medical institutes.

Ethical approval

The study was started after obtaining the ethical approval of the College of Medicine Dar Al Uloom University, Riyadh, Saudi Arabia (PRO19120006, 31/12/2019).

Author's contributions

All authors conceived and designed the study, conducted research, provided research materials, and collected and organized data. EY, AA, and GA analyzed and interpreted data. FA, ZJ, AA, EY wrote initial and final draft of article, and provided logistic support. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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Conflict of Interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are presented in the paper.

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