USE OF MEDICAL APPLICATIONS AND TOOLS IN SMARTPHONES AND TABLETS AMONG KING SAUD UNIVERSITY MEDICAL STUDENTS: A CROSS SECTIONAL STUDY

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Abstract

Due to the prevalence of students using medical applications and tools in smart devices, the question arises, "What is the use of medical related applications and tools in Smartphone and tablets among medical students?". We distributed a web-based questionnaire to 355 randomly selected medical students in King Saud University regarding use of medical apps among medical students. A total of 315 medical students participated in the study.97% owned Smartphone and 66.1%of students owned both Smartphone & tablet. We have found that the most used type of applications was web browser (96.2%). The least used type of applications was medical calculators/clinical scores system (7.7%).Concerning disease diagnosis/management and medical dictionaries type of apps we have found difference between pre-clinical students and clinical students, which turned out to be significant. Most students use the application for education purposes with higher percentage for clinical students. On the other hand the clinical use results were much higher in the clinical years' students than the pre-clinical students.

Keywords: *medical apps, apps, tablets, medical students.*

Introduction

Nowadays, it is not hidden that smartphones and tablets become wide spread between public. They can provide a very useful features ranging from Internet browsing to complex operations offered by applications (apps). In the last years, these devices become widely used by medical personnel since the presence of variety of health related and medical applications. Study has been conducted in university of Alberta in Canada revealed the most powerful features reported by the medical students and residents were "portability, flexibility, access to multi-media and ability to look up the information quickly"(1).

Apple iOS® and AndroidOS® platforms are more common among the others. At 2013, App store® offered by Apple contains 875,522 apps out of them there are 19,449 medical apps (2.22%). Compared to Google Play store® contains 857,278 apps out of them 9,292 medical apps (1.1%) (2). Two studies were conducted in U.S.A at 2012 and 2013 to evaluate the Knowledge, attitude and practice among demographic variations revealed that medical personnel using Apple iOS® like iPad® (86%) and iPhone® (48%) more than Android® tablets (8%) and Android®Smartphone's (19%) (3, 4). Other study was conducted in U.K at 2012 upon junior doctors and medical students showed also that Apple® iPhone is the most used Smartphone followed by Google Android®Smartphone(5).

In the nineties and early twenties, there were PDAs (Personal digital Assistant). Those devices were similar to the smart devices except they do not have cellular networks. Many studies were published in this area and were reviewed in a systematic review in 2006 (6). Some of the reviewed studies described the purposes of PDAs usage among health care providers in general. For example in medical students and residents the most used purpose was patient administration, tracking and diagnosis(6). Other study was done in 2008 to evaluate the spread and usage of PDAs in University of Alberta's medical students in Canada concludes that (64%) of the students used PDAs and the most common usage were Medication/Drug guidelines (7).Drugs references apps were also reported by a study done upon physician involved in acute admissions (8).

Age, clinical category and time when the study conducted were a very important factor determining the purpose of using Smartphone's in medical practice. There was a study at 2013 showed that the older the age of the medical professional the less he would use the tablet device(3), whereas in Payne study which was done at 2012, the experience was different since it was applied on medical students. Year 5 clinical students were the highest proportion (5). In addition, clinical-year-students usually using apps related to the clinical sets compared to the pre-clinical years, who use educational apps (5). A study was conducted in Birmingham, UK; at 2013found that about 66% of the clinical years students were interested in emerging the Smartphone and apps on the curriculum (9).In the literature, there were apps commonly used by medical students. For instance, drug references were reported by 3 studies (5, 7, 10). On the other hand, Abu Saleh Mohammad Mosa did one systematic review and the most used apps by medical professionals were disease diagnosis (11). Even more there was one study conducted in our country but concentrated on the residents of military hospital. The study was conducted on 2008(12).

In respect to this variability in the literature because of the time of conduction, age of users and clinical category of the medical student participated on the studies along with the significance of the field, we decided to throw some light in exploring the use of medical related applications & tools in Smartphone's& tablets among KSU medical students. Lack of local studies conducted in Saudi Arabia was a motivate factor to conduct the study. In addition, according to the researcher's observation, there was variation among the medical students in regard to the use of medical apps. The research team observed some variation in the degree of using mobile apps students' way of their studying behavior that some of them were using medical apps. The good point of this research is to see what could be the most effective application used by the students.

The aim of this study was to assess the knowledge, attitude, and practice of medical students toward Smartphones and tablets concern medical related applications and tools and to determine the factors affecting their attitude and practice.

Materials and Methods

Study Design
We have conducted a quantitative observational cross-sectional study. Because this type of design we determined the prevalence of student who are using medical applications. Also, we assessed the knowledge, attitude and practice of medical student towards medical applications by distributing web-based questionnaire and paper-based questionnaire to the students.

Participants and Setting
We conducted our study on the student of King Saud University in college of medicine.

Sample Size

We used the single proportion formula with 95% confidence level and 5% confidence interval ($Z_\alpha = 1.96 , d = 0.05$) to determine our sample. Through a literature review we have estimated the prevalence (p) = %63.58. After doing a calculation, we found that our sample size is 355 students, which mean about 71 students for each year level, and each year divided into two groups, which mean 35 students for each group.

Sampling Technique

Our sample frame (list of medical students in King Saud University), which was provided by Medical Education Center, we randomly selected our sample by using Microsoft Office Excel 2007. However, every student has equal opportunity to be selected. All students were included except those students who are not in the list and non-attendant student.

Data Collection instrument

The questionnaire questions were modified from two different studies(5, 10). How many questions in how many sections. Describe the questionnaire

We have made our questionnaire based on 4 principals:

1. Assessment of the level and of participant (demographic variables).
2. To see the practice of participant.
3. To determine their knowledge about medical application and tools in their study.
4. Evaluation of students' attitude regarding medical application and tools.

Validation and Pilot Study

In addition, we have done a pilot study on 20 medical students which means 4 students from each year in King Saud University. The aim of pilot study is to assess our questionnaire to see if we need clarification of any question. The result of pilot study was not included in our data analysis. Pilot studies have been conducted in three phases among 20 medical students at KSU in January and February. The first two phases were conducted in January among 9 students and we came out with some notes from the students about some questions that are not clear and may be misunderstood. So, we clarified and corrected the questions and we transformed the paper-based questionnaire to electronic form. The third phase was conducted in February among 11 students to analyze the obtained data using SPSS and EXEL programs and the data have been sent to statistician to be used and to get the questionnaire valid.

Data Collection Methods

the usage of e-mail survey may create some bias as long as the study is a bit about the technology and many of those who participated may be interested in IT. Finally, we suffer from the incompletion of some surveys and that may be explained, as the questionnaire we used is a bit complex. {How many did we approach as paper-based, How many reminders}

Data Analysis Plan

We have used a suitable biostatical technique for data analysis. Which is IBM Statistical Package for the Social Sciences (SPSS) version 21.

Ethical Considerations

The consent form was clear and it indicates the aim of the study. The participant had the right to withdraw at any time in the study. Additionally, anonymity and confidentiality of participant have been assured by not revealing their identity. There were not any incentives or reward to be given to the participant. IRB approval. Voluntary based.

Results

### *Response rate and number of smart devices users*

From 355 randomly approached medical students, 315 (88.7%) students responded by starting answering the questionnaires. However, only 289 (81.4%) students completed all questionnaire questions. A total of 112 complete responses were from students in their pre-clinical years (i.e. first and second years) and 177 complete responses were from students in their clinical years (i.e. third, fourth, and fifth years). Of those who participated, 66.1% (191/289) of students owned both Smartphone & tablet, 31.1% (90/289) of students owned a Smartphone only, 1.7% (5/289) of students owned a tablet only, and 1% (3/289) students owned none.(see Figure 1).
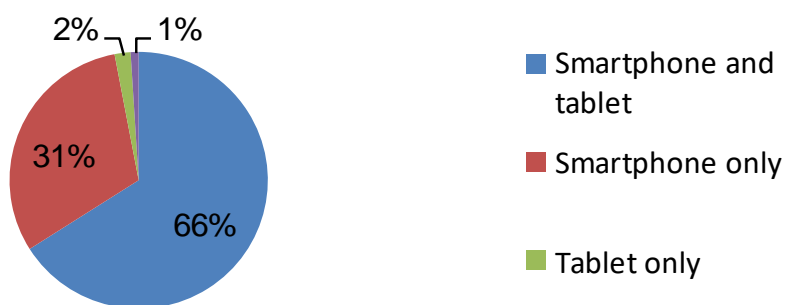

Figure 1. Smartphone/tablet owners

Platform Prevalence

Among Smartphone users (with or without tablet), the most prevalent platform used was Apple iOS® (48.4%;154/318) followed by Google Android®(43.1%; 137/318), Blackberry®(7.5%; 24/318) and Windows phone® (0.9%; 3/318)(see Figure 2). Among tablet users, the most prevalent platform used was AppleiOS® (79.6%; 180/226); followed by Google Android®(18.1%; 41/226), Blackberry® (1.3%; 3/226) and Windows phone®(0.9%; 2/226)(see Figure 3).
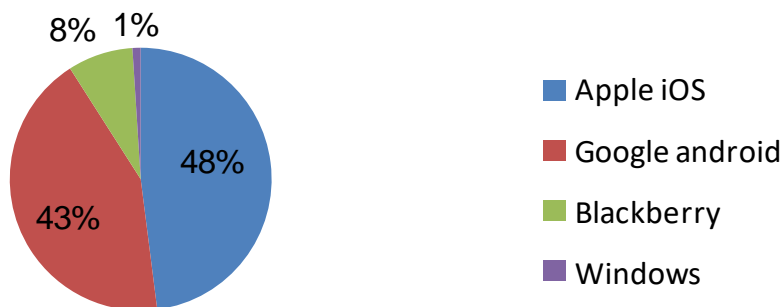
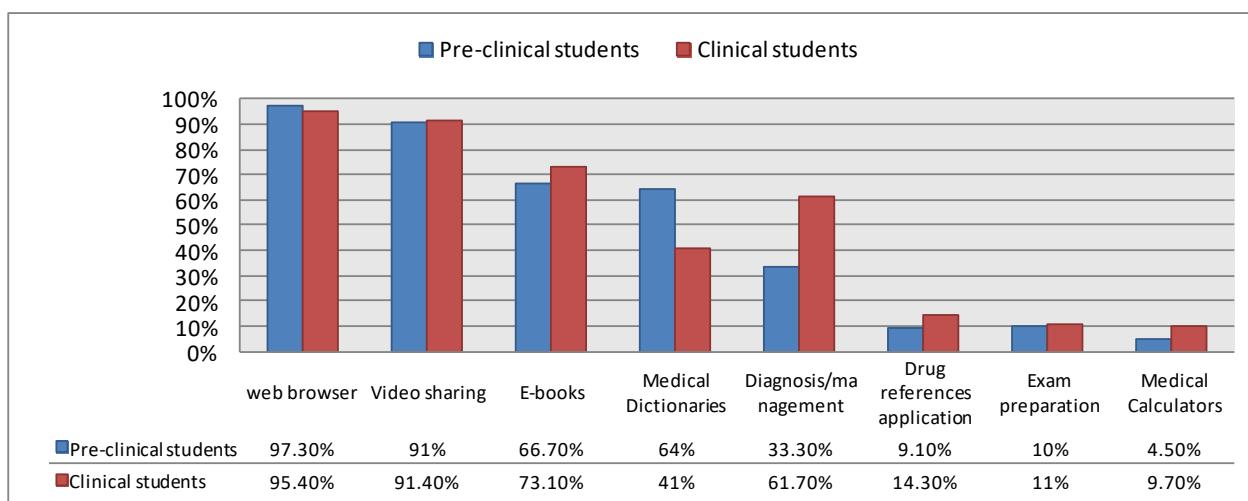**Figure2.** Smartphone platform types
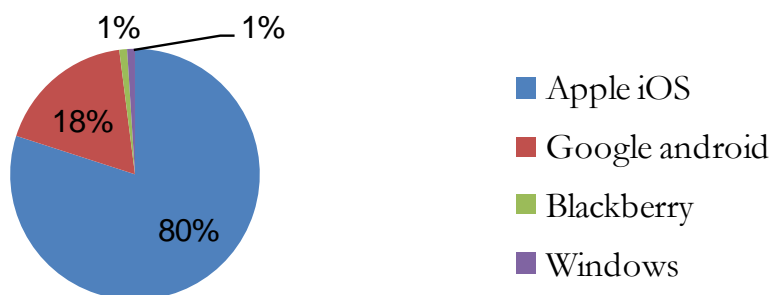
Figure 3. Tablet platform types

Frequency of applications

The number of medical apps used in tablets (mean=3.35, median=2 and standard deviation=5.87) found to be slightly more than Smartphone's (mean=2.38, median=2 and standard deviation=3.19). However, by using Shapiro-wilk test, the data was found to be non-normally distributed; so we conducted a non-parametric test (Mann-Whitney test) to compare between the usage of tablets and Smartphone's. There was no significant difference between the number of medical apps used in tablets and Smartphone ($p>0.05$).We have found that the most used type of apps among all participants was web browser (96.2%; 275/286). The least used type of apps was medical calculators/clinical scoring system (7.7%; 22/286). Chi-square test indicates that there was no difference in web browser usage between pre-clinical students (97.3%) and clinical students (95.4%) ($\chi^2=0.64$, $p=0.538$ and $df=1$).

Concerning disease diagnosis/management type of apps we have found difference between pre-clinical students (33.3%) and clinical students (61.7%), which turned out to be significant ($\chi^2=21.88$, p<0.001). Also, Medical dictionaries type of apps showed significant difference ($\chi^2=14.86$, p<0.001 and df=1) between pre-clinical students (64%) and clinical students (40.6%)(See Figure 4).

Purposes of usage

The purposes of using medical apps were approximately equal between both groups of students. from educational point of view, learning purpose was chosen by most of pre-clinical (33.3%; 86/258) and clinical students (50.3%; 130/258). While revising purpose was chosen by 24% (62/258) of pre-clinical and 45.7% (118/258) of clinical students. from clinical practice point of view, less pre-clinical students (3.4%; 9/258) and more clinical students (33.3%; 86/258) chose outpatient practice environment. However, in-patient ward environment was the least chosen by pre-clinical (2.3%; 6/258) and clinical students (25.9%; 67/258)(see Table 1). Chi-square test was calculated ($\chi^2=46.86$, $p<0.001$ and $df=3$).

	web browser	Video sharing	E-books	Medical Dictionaries	Diagnosis/management	Drug references application	Exam preparation	Medical Calculators
Pre-clinical students	97.30%	91%	66.70%	64%	33.30%	9.10%	10%	4.50%
Clinical students	95.40%	91.40%	73.10%	41%	61.70%	14.30%	11%	9.70%

Figure 4. Medical Apps

Table 1. Percentage of medical students using apps for the education & clinical purposes (n=258)

	Education/learning	Education/revising	Clinical/in clinic	Clinical/in ward
Pre-clinical students	33.3% (86/258)	24% (62/258)	3.4% (9/258)	2.3% (6/258)
Clinical students	50.3% (130/258)	45.7% (118/258)	33.3% (86/258)	25.9% (67/258)
	Chi-square=46.86, *df*=3, *p*<0.001			

Discussion

These results were obtained from King Saud University medical students. So, we could generalize the results on all medical students in King Saud University. In order to avoid bias the responses was chosen using Microsoft Excel and every students had equal chance to be chosen. Response rate was achieved by sending the surveys four times in one month. In addition, paper-based survey was distributed to those who did not response to the web-based survey. However concerning the reduced number of completed responses, we assume this was due to the time when the surveys were distributed which was during exam preparation period.

Previous study was done in Monash University, Melbourne, Australia, showed that 33% of students did not own a Smartphone while our study revealed only 2.7% of students(10). In our perspective point of view, this is may be explained by the difference in study conducting time. On the other hand more recent study done in UK stated that only 21% do not use (5). With comparison to Robert L. Robinson study, the percentage of tablet usage was 68% to 48%(9). These percentages were considered to be within the expected range due to time convergence Tablet.

Our study showed that Apple's iOS® was the most used Smartphone platform. This is compatible with other study was done in Canada 2013 It's on my iPhone'(1). Google's Android® Smartphone's platform was more prevalent than other study done in the past like in UK(5). We justify this percentage as the Google's market contains more apps than before. Concerning tablets the Apple's iOS® was the most used succeeded by Google's Android® platform. Although there was no significance differences between mean value of the apps used on Smartphone and those on tablet, we could justify this low number of apps used to the fact that student do not know a lot about medical apps.

Previous studies have been done on the PDA usage among medical student shows that the most apps used for medical purposes is Drug references application (77.4% of students)(7) , while in recent studies done in UK 2012 shows that the most frequent used apps are Disease diagnosis / management apps(5). In contrast, our study indicate the mostly use apps for medical purposes is web browser apps (96.2%), and we think the variation on these studies is due to the time difference between each study with different devices because when we compare between Smartphone and PDA the accessibility to internet have been easier and faster than before. For the disease diagnosis / management apps most of these apps, the student can have access via the internet through web browser apps.

In disease diagnosis/management apps there was a significant difference between them; this may be because these kind of apps provide a more reliable clinical information so that the majority of clinical student use them, on the other hand the pre-clinical student are more concern about the basic information and have less exposure to clinical environment. In contrast Medical Dictionaries apps, which showed a significant difference, have been used more by pre-clinical student to meet their need of knowing the definitions of medical terminologies.

The pre-clinical and clinical students asked to inform the purpose of usage of tablets or Smartphone. The question divided into 2 parts the education and clinical purposes; most students use the application for education purposes with higher percentage for clinical students. On the other hand the clinical use results were much higher in the clinical years' students than the pre-clinical students with significant value. Other studies claimed the same results with significance also (5, 10).

Conclusion

The study showed a huge and potential use of Smartphone's and tablets among medical students. As the technology will take a place in the most educational and clinical processes especially in medical and other health fields, implementing well-developed system that particularly deal with the medical students in manner of increasing knowledge like; providing Smartphone's and tablets to medical students, purchasing useful and helpful paid applications and developing programs that enable medical students to upload and download necessary materials provided in the lectures or clinical rotations.We recommend to the researchers in the future to expand the study to include all health care professionals and medical colleges in the Kingdom of Saudi Arabia. Also, try to find relation between GPA and the use of medical apps.

In brief, researcher's findings showed that almost all medical students at King Saud University owned a Smartphone and more than 60% owned a tablet. These findings clearly showed the huge usage of Smartphone and tablet apps in learning issue clinically and educationally in college of medicine at King Saud University.

Conflict of Interest
All authors declare no conflict of interest.

Authors' Contributions
All authors contributed efficiently in all the aspects of this research from reviewing existing literature, conception and design of this study, acquisition of the data, analyzing and interpreting the data, drafting the article to a developed final version.

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