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SMARTPHONE MEDICAL APP USE: A SURVEY AMONG MEDICAL STUDENTS AT ARISTOTLE UNIVERSITY OF THESSALONIKI

Complete Research

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Abstract

Smartphones evolve in a potential learning companion among students. The specific needs of medical education have brought in light, apps dedicated to medical school. Therefore, the impact that arises in academia attracted the focus of scientific world for further research. The aim of this paper is to identify the usage of medical apps among medical students, exploring their usage patterns in order to enhance their educational activities. For that purpose, 381 students were asked to fulfill a 16-item questionnaire. The respondents (300 students) constitute a 78.7% response rate, with a Cronbach's α = 0.95. According to the survey, 93.6% (n: 281/300) of medical students own smartphones, 64.8% (n: 182/281) of them use Android devices and 17.1% (n: 48/281) iOS devices.

The majority of students, that is 57.7% (n: 173/300) have downloaded 1 to 5 medical apps, whereas the number of students with more than 10 apps is significant lower. There is noteworthy to mention that a meaningful segment uses rarely or never the installed medical apps (59.3% and 36.7% respectively). The future development and use of medical apps to support both education and clinical practice, seems to attract the majority of the respondents.

Keywords: Smartphones, App usage, medical students, survey.

1 Introduction

Through the last decades education and technology are strictly combined, as education, the cornerstone of academic related professions, has to follow the technology imperatives and technology constitutes a means for education. Therefore, scientists have defined the modern era as "information age", "computer age" (Abu-faraj Ziad O, Chaleby, M. H., Barakat, S.S., Zaklit, J.D. 2011) or "digital age". The constant evolution of medical science in general, and especially of medical services, has created the necessity of innovations and alterations in medical education. The medical science adopted the new status quo in all its facets and this inevitably assimilated to education.

The debut of Personal Digital Assistants (PDAs) helped medical students to find a useful companion in their campus lives (Lindquist, Johansson, Petersson, Saveman, & Nilsson, 2008), (Economides & Nikolaou, 2006). Particularly, they utilize the device's high portability, small size and large computational power to assess them in classroom for formal instruction (Kho, Henderson, Dressler, & Kripalani, 2006) as well as in clinics (Littman-quinn et al., 2011). In 2007, the scenery changed more by the introduction of Apple's smartphone, iPhone (Wallace, Clark, & White, 2012). The large, high sensitivity touchscreen (Hakobyan, Lumsden, O'Sullivan, & Bartlett, 2013), the high performance processors (Gutierrez et al., 2011), the ease of use (Franko &Tirrell, 2012) and the massive increase of mobile internet bandwidth are the key components that made smartphones omnipresent in academia (Vinay & Vishal, 2013). Tablets and smartwatches, as well, endow medical students with innovative means of education. In addition to the aforementioned advantages, smartphones are equipped with microsensors and a high resolution camera, possible to collect patients' data (Vinay & Vishal, 2013). These last additions boost the use of such tools among students, professors and patients, especially with the advent of smartphone initiating the use of apps.

Recent studies (Robinson et al., 2013), (Payne, Wharrad, Watts, & Payne, 2012)(Rung, Warnke, &Mattheos, 2014)show a continuously increase of medical app usage among students. This distinct group of students is described by singularities, such as preclinical and clinical curricula. In this point of view, studying apps' usage among medical students differs significantly across other students. Understanding all the aspects around apps, smartphones and academic life regarding medical students, is therefore crucial. The contribution of this paper is to examine the use of smartphones among medical students as an m-learning tool. Furthermore, the results distinguish between the most preferred apps taking into consideration the frequency of their usage. Finally, the paper contributes by firstly reporting the current situation on the field on Greek universities.

The paper is organized as follows: Section 2 presents the methodology that followed to design and distributes the questionnaires; Section 3 describes the results; Section 4 discusses the results; Section 5 adds limitation to the research; finally in Section 6 concludes the paper and presents future work that can be applied.

2 Methodology

Firstly, it is necessary to make a note regarding the specific medical school, in order to clarify the particularities and the differences from other relevant schools, globally. In Greek medical schools, there is no specific separation between preclinical and clinical courses in relation with the years of study. Precisely, at the first five semesters, students attend both theoretical and laboratory courses. From the sixth semester and thereafter, clinical courses are incorporated to the syllabus as well. Specifically, students must attend theoretical and clinical courses as well as laboratories. Though, during these seven semesters, laboratory courses are continuously decreasing, but clinical courses are increasing. Finally, to clarify more the Greek medical school system, it can be noticed that each clinical course is accompanied by the equivalent theoretical course. Hereinafter the theoretical and laboratory courses will be called Education and the rest Clinical in order to facilitate the reading.

We designed a 16-items (both multiple choice and free response question) questionnaire which was distributed on person and the answers were collected manually. We collected data from 300 medical undergraduate students of Aristotle's University of Thessaloniki in Greece. 81 students left the questionnaire unfilled, achieving a response rate equal to 78.7%. The high response rate is due to the manually procedure of collecting data we followed. The Aristotle University is the biggest academic institute in Greece with more than 90000 active students and among them 4000 medical students. Our sample represents a 7.5% of medical students in Thessaloniki. The answers derived from students of all academic year range.

Our survey was based on previous literature (Garritty & El Emam, 2006), (Payne et al., 2012), (Robinson et al., 2013), (Rung et al., 2014). Before the distribution, the questionnaire was revised by physicians and consequently was tested on a short number of medical undergraduate students in order to check the content's comprehensiveness, validity and reliability.

The questionnaire was structured in four sessions: Demographic and mobile device ownership, installed medical apps, medical apps usage and medical app proposed improvement.

The first session, encapsulates, except the demographic, the main mobile device used by students, as well as its operation system (OS). The second session consists on the assessment of certain app use. Specifically, we asked students which type of apps they use related to their specific objectives. The students, in the

third session, were called to answer about the frequency of app usage. Furthermore, they responded about the specific app use, on the exercise of their medical duties. The questionnaire concludes with questions about medical app proposed improvement.

The collected numerical data were entered, processed and analyzed with the statistical software SPSS (version 22). For the evaluation of our findings and the statistical significance we conducted inferential analysis (Chi square and linear regression).

3 Results

We first tested the 16 items on their internal consistency. Using reliability analysis we obtained a Cronbach's Alpha of 0.95, indicating a very acceptable fit.

3.1 Demographic characteristics

In total 300 medical students answered the questionnaire giving a response rate equal to 78.7%. Of these, 144 (48%) are males and 156 (52%) are females. From a total of 300 students, 26 (8.67%) are first-year students, 14 (4.67%) second-year, 69 (23.00%) third, 117 (39.33%) fourth, 28 (9.33%) fifth and 45 (15.00%) are sixth-year students of the medical school.

3.2 Type of mobile devices and operating systems

A total of 1(0.3%) student owns feature phone (Schiefer& Decker, 2005), 281 (93.6%) use smartphones, and 18 (6.0%) use both smartphones and tablets.

Android is the main and most common operating system used by 182 users (64.8%), and iOS with 17.1% and 48 users, the second most used. Symbian is used by the 11.00% and 33 users.

3.3 Installed medical Apps

The highest percentage of students own from 1 to 5 medical applications. On the other hand, 33.7% of the students do not own any medical application (Table 1).

Table1: Number and percentage of health applications

Number of medical applications	Percentage of use among users (number of users/ total users)
None	33.7%
1 – 5	57.7%
6 – 10	6.3%
11 – 15	1.0%
16+	1.3%

Students were asked, further, if fee is an inhibitory factor for the app acquisition. Observing the results, 2% of the students paid to purchase a medical app against 87.9% who preferred not to.

3.4 Medical Apps Usage

Among those who have at least one medical app, 159 responded that they use these apps to support their education on medical school and 114 use the apps in clinics. Table 2 represents the percentages of app usage per year of study. We divide the categories of usage in two segments: education and clinical.

Further on, students were asked about the frequency of usage. Table 3 collects these results dividing apps in education and clinical, as on Table 2.

Furthermore, we asked, which app is used more frequently during the courses, education and clinical. Results show that students use: 60.8% (n: 171/281) informative medical app for education support, 34.5% (n: 97/281) diagnosis-related apps, 27.4% (n: 77/281) first-aid apps, 19.6% (n: 55/281) clinical score apps (bpm etc.), 8.9% (n: 25/281) health record management apps, and finally 1.8% (n: 5/281) other medical apps.

Next figure depicts the frequency of use, correlated with the different medical app categories.

Table 1: Medical app usage / Year of study

Year of study	Education (number of students/ number of total students per specific year)	Clinical (number of students/ number of total students per specific year)
1st	50%(13)	35% (9)
2nd	28% (4)	33% (3)
3rd	52% (36)	33% (23)
4th	58% (68)	41% (48)
5th	61% (17)	50% (14)
6th	47% (21)	38% (17)

Table 2: Medical app frequency of use

Frequency	Education (number of students/ number of total students per specific year)	Clinical (number of students/ number of total students per specific year)
Many times/day	17.1% (34)	8.6% (17)
1-2 times/day	14.6% (29)	9.0% (18)
Many times/week	20.1% (40)	9.0% (18)
1-2 times/week	14% (28)	11.6% (23)
Rarely	19.1% (38)	40.2% (80)
Never	15.1% (30)	21.6% (43)

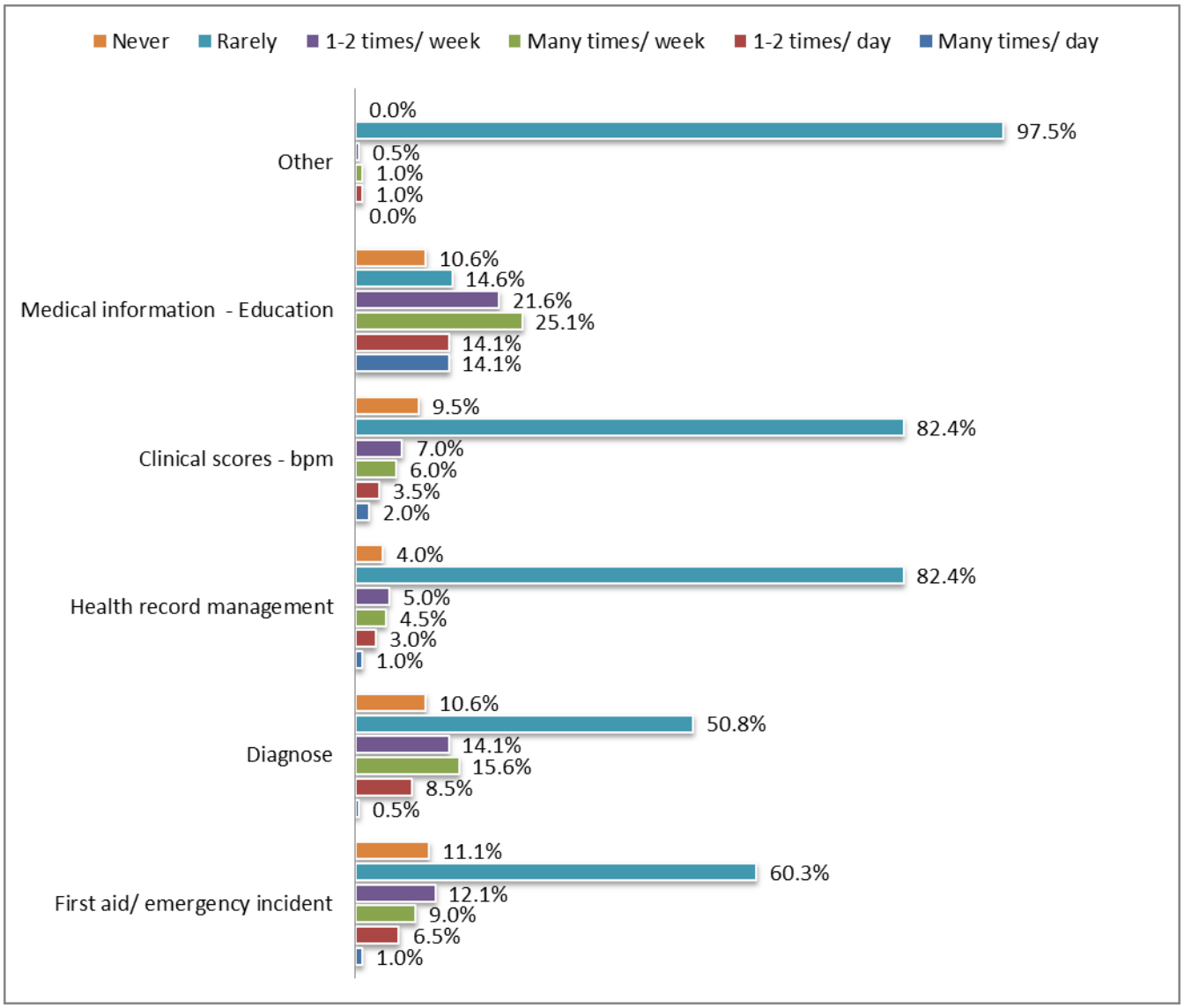

Figure 1: Medical app category - frequency of use

3.5 Future App Design

Lastly we have asked students if they have an opportunity to design an app in which specific field might it be. The majority chooses apps related to medical information and education in a percentage of 33.7% (n: 101/300). In continuous, 11.7% (n: 35/300) answer clinical scores, 15.3% (n: 46/300) health record management, 21.3% (n: 64/300) diagnose, 13.3% (n: 40/300) emergency incidents and 4.7% (n: 14/300) other categories.

4 Discussion of results

To our knowledge, this is the first study to examine examines smartphone ownership and usage between medical students in Greece. The collected data could be a useful component to form smartphone ownership and usage landscape. More general, it can be observed a European tendency on health apps promotion. This can be extended in medical education rendering our research timely (European commission, Brussels, Green paper on mobile Health).

4.1 Smartphone ownership

Previous research by Payne et al. (2012) finds smartphone ownership equal to 79% and shows an equal preclinical and clinical distribution. Our study finds a 96.6% ownership percentage. This contrast of 17.6% can be explained by the increased penetration of smartphones in worldwide population that occurred in the two year period between Payne's and present research.

In our case preclinical and clinical students possess smartphones by100% both (n1: 40/40, n2: 190/190). Because of the separation that occurs in fifth semester, it is impossible to identify which students of the third year belong to which semester (preclinical and clinical. This is why the third year results about smartphone ownership are excluded from being summarized.

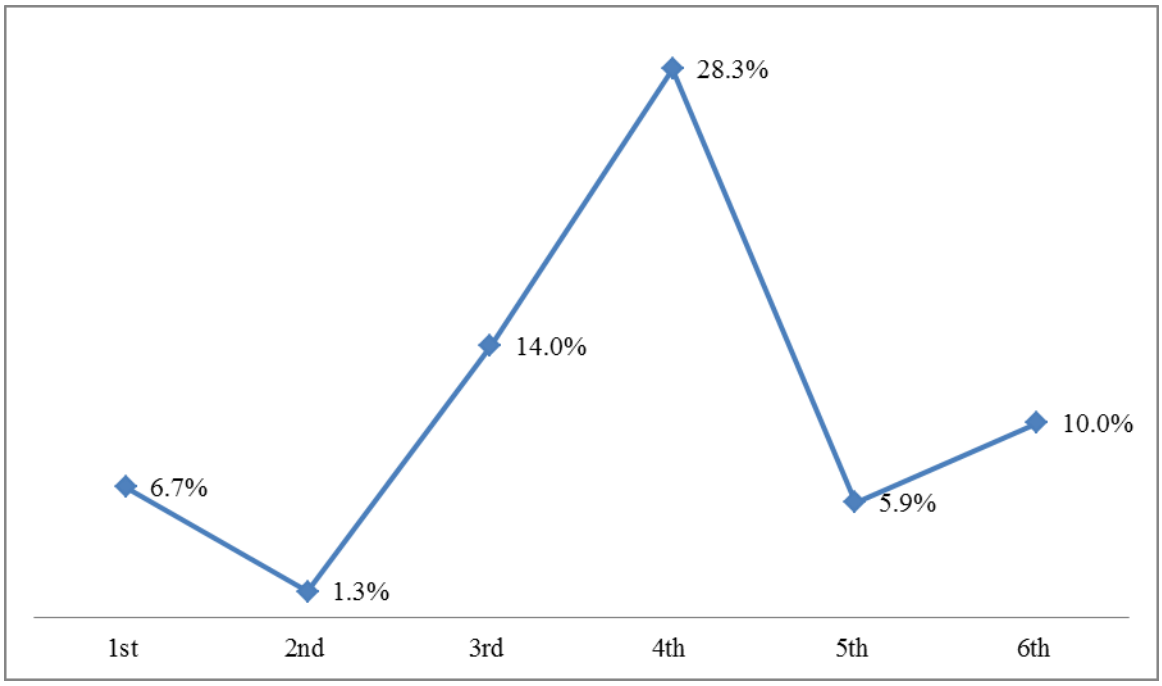

Figure 2: Percentage of installed apps/ year of study

4.2 Number, frequency and type of medical apps

As far as concern, the amount of medical apps that a student has installed, the segment that prevails is *1 to 5 apps* with 57.7% (Table 1). Can be easily noticed (Figure 2) that during the studies, students at fourth year install more apps. This trend starts in the fifth semester, in which clinical courses begin; students tend to experiment in diverse medical apps. In addition, most of the students do not pay to purchase an application but prefer to download free or freemium apps. The aforementioned observations can lead us to the sequent outcome: student lose their interest about medical apps. This statement can be affirmed also from figure 1 where it shows that the majority of the students, 60% and more, have installed apps but use them rarely or never. The only exception is the category *Medical information – Education,* in which the percentage of *Never* and *Rarely* is 25.2%. Expanding this thought we can say that apps in all other categories need a bigger how-to knowledge, so the student installs but quickly abandons, tending to use only apps which are easier to master.

This derives from the lack of proper app consulting by the university personnel, following by a plethora of unregulated (Murfin, 2013) and low quality apps, available on app marketplaces. Lastly, from table 2 we conduct the following conclusion: students, even though in clinical years, they do not lose their interest in education apps.

Another interest outcome arises from the number of the surveyed students who use Android or iOS smartphones associated with the type of app installed, education or clinical. Precisely, 68.6% (n: 114/182) and 48.3% (n: 88/182) of Android users hold education and clinical apps respectively. On the other hand the relative percentages of iOS users are: 18.8% (n: 9/48) and 6.3% (n: 3/48). It is unclear if these significant differences are due to absence of iOS apps and/ or iOS appstore policy.

4.3 Designing a medical app

From students' answers it is clear that the majority concerns about apps related to medical information and education in a percentage of 33.7% (n: 101/300). In combination with figure 2 we notice that students want to design apps that use more frequent. The finding suggests that students can recognize weaknesses of an app by using them during their education and therefore recommend improvements.

5 Limitations

The main concern of the paper was to present data about smartphone ownership and usage among medical students. This study has several limitations. Firstly, there are no questions about postgraduate students, junior doctors or medical professors. In continuous, our study limited to only one university

students. Another limitation of the research was that medical students have a lack of experience in medical app use and tend to experiment in this field. A possible outcome of this behavior is that they can answer in an unpredictable manner .Lastly there was a difficulty to adjust the questionnaire to the Greek medical school curriculum. More specific the segmentation between preclinical and clinical years of study is unclear.

6 Conclusions

The medical profession is undoubtedly correlated with the usage of smartphone technology(Franko &Tirrell, 2012). Particularly there is a constant growth of medical applications globally. Our research focus on medical students in Greece and shows that local reality is far from that standard. This deduction derives from the percentage of students that own smartphone but do not use at all or rarely use medical apps. This amount of students features a lack of usage, penetration and adoption of smartphone technology devices. The previously mentioned conclusion is explained by the skepticism among users in regard of existing medical apps reliability. This outcome is further clarified from the fact that students were asked if an app designed by them would be useful for educational purposes. The majority of them answered positively.

This can reveal opportunities for Greek academia to adopt formally smartphones and consequently medical apps to educational process. In advance new medical apps can be designed to assist furthermore the academic procedure.

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