Uses of Smart Device Technology in Medical Field among Clinical Physicians: Is It Important?

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Abstract

Background: Smart devices have effective role in medical education and practice. **Objective**: The aim of the study was to assess the prevalence of smart devices usage between medical practitioners and their perceptions towards its benefits in clinical practice. **Method**: A cross sectional study was conducted, targeting clinical physicians at Tanta University Hospitals. A self-administered questionnaire was used to collect sociodemographic information, data related to frequency of using smart device in medical field and common uses. The respondents' perception towards smart device technology during clinical practice were also assessed. **Results**: the study included 748 clinicians, with mean age of 33.7±2.8 years, 36% of them were registrar. The adoption rate of smart device was 72%. Amongst the three groups, the often group showed predominant of clinicians whose ages between 31 to 35 years (39.6%), female (63.6%), and registrars (54.3%) and non-surgical specialties clinicians (56.3%) with statistically significant difference. Most of participants agreed that their institution should provide them with valid medical applications (apps) (70.3%), integrating hospital information system through personal devices (77.7%) and providing patients' laboratory and radiological data on smart devices (78.7%). **Conclusions**: Smart devices technology is beneficial to healthcare physicians, who support using this technology for efficient patient care particularly among young clinicians.

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Introduction

Over the last decade, smart devices have been evolving rapidly in functionality and propagation. Smart devices combine a mobile phone with other functions that turn the smartphone into a portable computer.[1] They have an elementary role in the medical education and clinical settings as they allow clinical practitioners and students to access resources efficiently in a short time and support better patient care.[2-4]

Health care workflow is highly dynamic, compromising varied settings of care such as emergency departments, outpatient clinics, inpatient wards, diagnostic radiology and laboratory departments, etc.[4]

Consequently, working in the health care system requires extensive mobility of medical practitioners besides communication and cooperation among the medical team, including colleagues, senior staff, multidisciplinary specialties and patients.[5]

Specific assessments of smart devices use in the clinical setting have also started to appear in the literature. A previous publication found Internal Medicine residents felt subjectively more efficient on the wards when they were provided with smart devices loaded with the hospital electronic medical record access program.[6]

Table 1: Social, demographic and work characteristics of studied physicians

Characteristics	Number (n=748)	%
Age		
- 25-29	224	29.9
- 29-34	209	27.9
- >34	315	42.2
Gender		
- Male	426	57
- Female	322	43
Clinical level		
- Residents	221	29.6
- Registrars	269	36
- Consultants	258	34.4
Source of medical information		
- Senior staff	249	33.3
- Colleagues	165	22.1
- Text books	494	66.7
- Formal training/workshops	291	38.9
- Network	540	72.2
Duration of using smart device in in issues related to clinical field		
- < 60 mins/day	208	27.8
- 60-120 mins/day	249	33.3
- > 120 mins/day	291	38.9
Having mHealth applications on personal device		
- No	658	87.9
- Yes	90	12.1

It's believed that the use of smart-device medical app has improved physician productivity, efficiency, and accuracy.[7] It also improved patients' access to medical care[8] as they may help reduce hospital congestion, improve access to medical care, and reduce medical care costs.[9]

The technology of smart device is not only important for doctors but also for patients, according to a review directed by UAE's Mobile Show , most of respondents agreed that health care in the Middle East, could be improved by the mHealth applications and different obstacles should be overcomed especially, the beliefs of the patients and physicians about benefits of these apps [10].

A previous Egyptian review noted that the utilization of mHealth applications was about one third of Egyptian patients, and a big proportion of those clients demonstrated exceptionally positive demeanors towards the utilization of these applications, since they take into consideration simple spread of data and are portrayed as effectively got to. They additionally demonstrated some negative demeanors, since they are addictive, interfere privacy, exaggerate social isolation, and require language ability.[11]

According to a survey conducted by UAE's Mobile Show (Messieh, 2011), about 93% of respondents believed that

Table 2: Frequency of using smart devices in clinical practice among the studied physicians in relation to their characteristics

Characteristics	Frequency of using smart devices in medical practice			Total	P- value
	Rare/ (n=208)	Sometimes (n=249)	Often (n=291)	(n=748)	
Age :					
- 25-29	68(32.7)	58(23.3)	98(33.6)	224	**56.3**
- 29-34	39(18.8)	55(22.1)	115(39.6)	209	**<0.0001***
- >34	101(48.5)	136(54.6)	78(26.8)	315	
Gender:		.			
- Male	136(65.4)	184(73.8)	106(36.4)	426	**85.9**
- Female	72(34.6)	65(26.2)	185(63.6)	322	**0.0001***
Clinical training level:					
- Residents	66(31.7)	50(20)	105(36)	221	**148.2**
- Registrar	34(16.3)	77(31)	158(54.3)	269	**<0.0001***
- Consultant	108(52)	122(49)	28(9.7)	258	
Specialty					
- Non-surgical	86(41.3)	129(51.8)	164(56.3)	379	**11.12**
- Surgical	122(58.7)	120(48.2)	127(43.7)	369	**0.003***

the mHealth industry could improve the quality of healthcare (Mansour, 2016) in the Middle East. Despite their belief that mobile technologies can play a positive role in the health sector, there are barriers that need to be overcome to have a regional impact, such as the confidence of both patients and doctors about this industry.   According to a survey conducted by UAE's Mobile Show (Messieh, 2011), about 93% of respondents believed that the mHealth industry could improve the quality of health care in the Middle East. Despite their belief that mobile technologies can play a positive role in the health sector, there are barriers that need to be overcome to have a regional impact, such as the confidence of both patients and doctors about this industry.

Several regional studies stated that mobile phones play a weighty role in clinicians' day-to-day medical practice and use them for purposes rather than communication.

This should attract the attention of research and academic institutes towards the appropriate utilization of these devices in medical training and medical decision making.[3,5] However, physicians gave both positive & negative opinions towards medical apps.[12]

Though the use of smart devices in medicine is rapidly growing, there are limited researches conducted in this discipline [3] and shortage of information regarding mHealth usage by clinicians in Egypt.   Therefore, it is important to understand how smart-devices technology can improve provider efficiency and patient healthcare as well as how medical apps will be more useful to specific healthcare systems.

This study aimed to assess the use of smart devices among the medical practitioners at Tanta University hospitals, their perceptions towards its uses in academic and clinical practice and its impact on medical care.

Table 3: perception of the studied physicians towards smart device technology in clinical practice

Perceptions towards smart device technology in medical practice	Clinician Category			Total	p-value
	Resident (n=221)	Registrar (n= 269)	Consultant (n=258)	(n=748)	
The clinical institutes should provide physicians with the valid updated mHealth smart device applications					62.8
- Agree	183 (83.2)	208 (77.5)	135 (52.7)	526 (70.3)	<0.0001*
- Disagree	38 (16.8)	61 (22.5)	123 (47.3)	222 (29.7)	
mHealth applications help to speed up daily work and tasks					
- Agree	190 (86.4)	166 (62.3)	146 (56.9)	502 (67.1)	52.1
- Disagree	31 (13.6)	103 (37.7)	112 (43.1)	246 (32.9)	<0.0001*
mHealth applications would make your clinical roles more accountable					25.1
- Agree	164 (74.2)	152 (56.5)	137 (53.1)	453 (60.5)	<0.0001*
- Disagree	57 (25.8)	117 (43.5)	121 (46.9)	295 (39.5)	
Smart device mHealth information help in clinical decision					
- Agree	191 (86.5)	241 (88.6)	233 (90.3)	665 (88.9)	2.02
- Disagree	30 (13.5)	28 (11.4)	25 (9.7)	83 (11.1)	0.36
Integration hospital information system through personal devices					
- Agree	207 (93.8)	239 (88.9)	135 (52.3)	581 (77.7)	147.55
- Disagree	14 (6.2)	30 (11.1)	123 (47.7)	167 (22.3)	<0.0001*
Providing patients' laboratory and radiological data on smart devices					
- Agree	212 (96.3)	210 (78.1)	167 (64.7)	58 9(78.7)	69.3
- Disagree	9 (3.7)	59 (21.9)	91 (35.3)	159 (21.3)	<0.0001*

Method

Study Design and settings: A cross-sectional study was carried out at Tanta University Hospitals, the largest tertiary care referral teaching hospitals in the Delta region of Egypt, during the period from November 2017 through April 2018.

Study subjects: The study targeted actively working physicians enrolled in 14 different clinical departments at Tanta University Hospitals. Whose number was 1162 clinicians according to the data base at the official website of Tanta University. Most of them were invited verbally to participate in the study. The training graduated physicians in the internship year were

excluded from the study. The total number of recruited clinicians was (n= 748).

Instrument: A self-administered structured questionnaire in the English language, consisted of 3 parts; a) general demographic and specialty related data, b) the frequency & purposes of smart device use in clinical practice, c) perception of clinicians towards the benefits of smart devices and medical app in clinical field practice. The questions were generated based on review of literature and tested for its validity and reliability. This measure has an alpha Cronbach reliability was 0.85.

A pilot study was performed, where the initial draft was distributed to 35 professionals at the outpatient clinics in

Tanta University hospitals, in order to ensure that questions are clear and applicable. Notes from pilot respondents were taken and questions were modified accordingly.

Data collection and analysis: Respondents informally approached individually and kindly invited to participate in the study. The number of physicians who received the questionnaire during the study period from February to April 2018 , was 826 through different clinical departments, then these sheets were recollected .There was 78 questionnaire sheets were incomplete and excluded from the study, .the final number was   748 sheets which were fully completed

Respondents cooperatively completed the questionnaire and rated each item according to the extent to which they perceived on a 5-points Likert scale ranged from (0= strongly disagree) to (5=strongly agree). Responses were then converted into disagree, and agree.

Data were processed using SPSS program version Data was processed using SPSS program version 21, Descriptive statistics and chi-square test were performed in the following analysis, *p-value* < 0.05 was considered statistically significant.

Ethical Consideration:

Approval for this study was taken from Ethical Committee in Faculty of Medicine at Tanta University. The purpose of the study was fully explained to every participant. Written informed consents were obtained before enrollment in the study. Privacy and confidentiality were assured.

Results

The current study included 748 clinicians with a mean age of 33.7± 2.8 years, 42.2% of them were more than 35 years, 57% were males and about 36% of physicians were registrars. The network was encountered as the most frequent source of information in medical practice (72.2%), followed by textbooks (66.7%). About 39% of the respondents spent more than 2 hours per day using their smart device in clinical settings and the majority don't adopt any kind of mHealth applications on their personal devices.   The research respondents represented 14 different specialties, including general surgery (25%), Internal Medicine (17 %), Pediatrics (15 %) & Orthopedic surgery (11 %). These specialties had the highest number of survey responses.

Table 2 showed that frequency of using smart devices in the clinical practice varied from rarely (<60 mins/day) (27.8%), sometimes (60-120mins/day) (33.2%) and often (>120 mins/day) (39%). Among the often group, the age group most frequently used smartphones was between 29 to 34 years (39.6%). The female physicians used smartphones more significantly (63.6%) than males (36.4%). Amongst the three groups, more than half of the often group were registrars and non-surgical clinicians, while in the rare group, consultants and of surgical specialties clinicians were 52% and 58.7% respectively, with a statistically significant difference.

Table 3 revealed that most residents (83.2%) and registrars (77.5%) significantly agreed than consultants (52.7%) that institutes should provide their candidates with valid up to date medical app (p< 0.0001). When asked whether smartphones mHealth applications help in speeding up daily work and making your clinical roles more accountable, there was a decreasing trend for positive responses relative to clinal level significantly; [86.4%, 74.2 %] of residents ,[62.3%, 56.5%] of registrar and [56.9%, 53.1%] of consultants p= <0.0001).

Most of participants agreed with the possible benefits of medical use of smart

devices during decision making process with no significant difference between clinical level categories (p=0.36). Most participants recommended for integrating hospital information system with clinical staff personal devices, significantly more between residents physicians (93.8%, p=<0.0001). Whereas, majority of residents, registrars and consultants supported the idea of providing patients' laboratory and radiological investigations results through a mobile version of electronic health records (96.3%, 78.1%, 64.7% respectively).

Discussion

The universal adoption and integration of smart devices technology (smartphones and tablets) by medical practitioners is promoting the current medical perspectives. These devices offer help in different fields, including medical education dissemination, remote patient data access and patient medical care. Quantifying usage forms of this technology is important to explore how these technologies are reformatting current clinical practice.[11]

The adoption of smartphone technology in medical practice was found to be 72 % in our study, which matches with two studies in the United Kingdom and the United States detected a prevalence of 75% and 80% respectively.[12,13] A comparable study conducted in Saudi Arabia, but in a much smaller sample detected a higher adoption rate of 99% among resident physicians.[5]

Among the studied groups, the one who used smart devices > 120 mins per day, showed a significant association between younger age groups of participants and usage of smart devices in their career, where about (33.6% and 39.6%) of them were at age groups of 25-29 yrs and 29-34 yrs respectively. This could be explained by that younger physicians are more familiar with advanced smart devices technology
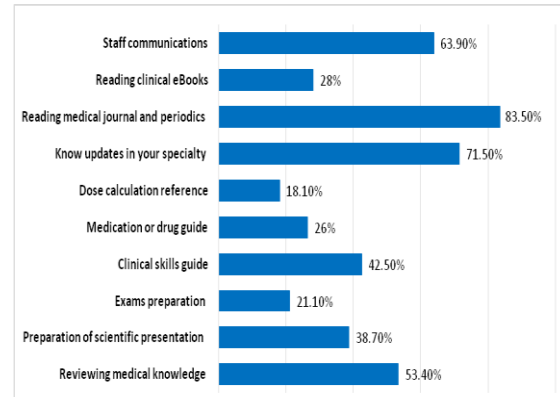

Figure 1: Uses of smart device in medical field practice among the studied physicians.

and medical app. These observations replicate findings by other studies.[5,11]

Likewise, the most frequent users were registrars (54.3%), followed by residents (36%) and the least were consultants (9.7%). This could be attributed to the fact that junior doctors are young in the medical professional career, still in training and may need to verify their medical information for provisional diagnosis and management. This observation supported by Patel et al., 2012 who found that juniors frequently use smartphones medical applications as compared to their seniors, and reported that they were able to access more information.[6] Since residents may not find plenty of time because of heavy loads, prolonged working hours and periodic night shifts, this could clarify the detected lower adoption rate than registrar.[16]

The Current study demonstrated that male physicians use smart devices less frequently than females at level of significance p<0.0001, this finding goes in agreement with the study of Lewis and Wyatt [17]. However, two studies reported that female physicians more strongly agreed that personal digital devices improved their clinical performance compared to their counterparts.[5,19]

A significant indirect correlation between duration of usage and age was observed (*P* =.02), but it was not strong (*r* = - 0.27), this

was in concordance with findings by Jamal et al, 2012, and could be explained by the expectation that younger physicians have been exposed to technology from an early age and used smart devices earlier during their medical education and clinical training.

Therefore, the younger physicians exhibit positive attitudes toward innovative technology. This explains the supportive agreement among recruited residents and registrars that their corresponding institutes should provide them with valid, unpaid and updated medical apps (83.2%, 77.5% respectively).

The impact of recommending use of medical app in hospitals is that it will increase access to patient records and save time.[6] Our study shows acceptance by 70% that goes in line with another study in USA, in which 94 %of participated resident physicians believe that hospitals should support medical apps and wireless technology.[13]

As for implications of smart devices in clinical practice, our study showed about two thirds of participants (67.1%) agreed that mHealth apps could speed up their daily tasks, which cope with a related study, in which the majority of their medical trainees (82.8%) and nursing staff (78.3%) agreed with this point.[18]

Correspondingly, Saddik B et al., 2012 and Wu R et al .,2015[18,19] reported a higher percentage (about 90%) of health care physicians at different levels strongly agreed that medical app improved their performance, compared to the agree percentage in our findings (60.5%), since the concept of medical app is still not widely established in medical field practice in Egypt, as well as, some researches demonstrated that hospitals in some countries are also recommending the usage of the medical applications.[17, 20]

Related studies showed that the majority of physicians agreed that medical app improve clinical decision making.[12,13] Our study also supported this perception too (88.9%), largely because of influences of smart device technology on confirming/assigning diagnoses and determining treatment options.

Most respondents of all clinical levels overwhelmingly supported the idea of integrating the hospital information system (95%), as well as patients' data and investigations (91%) on their personal digital devices, since the use of smart devices has improved patient documentation, fewer documentation errors, and increased efficiency. Besides, easy access to clinical decision support systems and patient management systems that improved decision making for patient care.[21]

The greatest agreement took place between residents' respondents, because of being more aware that technologies could promote patients clinical care, perform their duties faster and help inform the senior staff with patients data regularly and quickly.

Regarding the purpose of using smart devices in medical field in current study, they were commonly used for reading medical journals, knowing the updates in medicine and revision of medical knowledge. While a recent study conducted in Saudi Arabia showed that smart devices were useful for revision of medical knowledge (82.3%), presentation preparation (75.3%), during ward rounds (71%), medical information look-up (70%), for medical news updates (70%), for clinical skills guidance (69.7%), and for medical journal viewing (68.7%) [10]. These findings were higher than ours.

In the present study, fewer participants noted using smartphones as a medication guide and a reference for dose calculation and exam preparation compared to

Alghamadi et al., 2018 who reported using smart devices as a medication and drug guide (65%) and for preparing for exams (65.7%).[12] This difference could be due delayed use of technology in medical education and the different exam structure in Egypt which is still widely based on essay questions. However, nowadays, innovation sparkles are expected in Egyptian medication education competency.

Staff communication was reported to be a common use among our respondents similar to another study which reported (89%) of the residents noted using their personal cell phones to email or text patient related information, and more than one third of participants described that the communication with patients through mobile phone as harmful.[5] However doctor/patients communications wasn't screened in this present research. which need further research to investigate the effectiveness of this kind of patients' communication.

Conclusions

Smart devices technology sounds to be beneficial to clinical physicians, as it makes up-to-date medical knowledge more easily available and save time. There was a significant difference between gender, age, medical rank of respondents and frequency of use. Clinicians across all levels had positive perception towards the benefits of smart devices technology in medical field practice. Therefore, there is a need to integrate hospital information system and medical app through staff personal devices to enhance patients point of care.

Conflict of Interest
The author had no conflict of interest

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