An assessment of the level of awareness of e-health among Saudi medical students

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Abstract

Background: Previous studies described the levels of awareness of patients and health care providers on e-health in general and on e-health for a certain condition/disease. However, none of these studies was conducted in Saudi Arabia. The aims of this study were 1) To determine the levels of knowledge, attitude and practice of medical students on e-health, and 2) To identify the predictors of e-health practice among medical students.

Methods: A cross-sectional survey of 440 medical students at the college of medicine, King Saud bin-Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia, was conducted, during October/November 2019, using a previously validated questionnaire, to assess: (1) knowledge in three domains; e-health definition (13 statements), fields of application of e-health (8 statements), methods of using e-health (7 statements), (2) attitude toward using e-health (8 statements) and (3) reported practice of e-health in medical training (5 statements). A scoring system was used to calculate the total and percentage score of knowledge, attitude and practice for each student. Multiple regression analysis was applied to identify predictors of e-health practice. Significance was considered at $p < 0.05$.

Results: Of the 440 medical students surveyed, the majority were females (55.7%), of stream type1 (79.8%) and from families whose monthly income was more than 10,000SR (82.8%). Overall knowledge about e-health was unsatisfactory (PMS=71.62%), with only 43.6% of all students reporting satisfactory level. However, this level was satisfactory for fields of application (Percentage mean score-PMS=76.43%) and unsatisfactory for definition of e-health (PMS=70.69%) and methods of its use (PMS=65.69%) domains. Overall attitude towards e-health use was positive (PMS=82.32%), with nearly three-quarters of all students (73.4%) reporting positive attitude. Generally, good level of practice of e-health was reported by students (PMS=84.27%), with more than three-quarters of medical students (78.4%) reporting good practice. Adjusting for age, gender, stream, educational grade and family monthly income, good practice was significantly predicted with higher knowledge ($t=2.219$, $p=0.027$) and attitude ($t=2.114$, $p=0.035$) scores.

Conclusion: This study provides basic information regarding medical students' knowledge, attitude, and practice on e-health. More resources should be directed to elevate medical students' knowledge and to motivate them to practice e-health using the available tools.

Background

Information technology (IT) methods in healthcare are well known to provide clinicians with health-related information and tools, such as clinical decision supportive systems. These softwares are expected to improve patient care and minimize medical errors.[1]. In other words, the rising demand to improve the healthcare processes via technical products and services has led to a tremendous development of wireless technologies worldwide [2].

E-health has been discussed widely in literature, workshops, scientific meetings, and the popular press. At the end of 2011, studies on e-health accounted for 659 research data in PubMed, 18,600 in Google scholar, 2,420,000 in Yahoo search and 29,500,000 in [Google.com](https://www.google.com) [3]. Globally, the functions of e-health services have been expanding rapidly, with the aim to improve health, reduce costs of healthcare, increase equity and quality of healthcare, and improve communication between healthcare providers and patients [4].

There are many definitions of e-health, however no universal agreement is there on any of them [3]. Moreover, there remains a lack of consistency in the use of the e-health research [4]. A broad range of digital technologies and interventions used by stakeholders in many diverse settings have been described by e-health[5,6]. The World Health Organization defines e-health as “the combined use of electronic communication and information technology in the health sector” [7]. E-health was also defined as internet-based health-related information seeking and developing to support health services locally, regionally, and globally [8].

E-health was recently defined by Shaw et al [9] as an emerging field in the intersection of medical informatics, public health, and business. The term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked global thinking, to improve healthcare locally, regionally, and worldwide by using information and communication technology.

Previous studies described the levels of awareness of patients and health care providers on e-health in general and on e-health for a certain condition/disease [10,11]. All these studies revealed modest levels of awareness of e-health. However, none of these studies was conducted in Saudi Arabia. Thus, the aim of the present study is to determine e-health awareness among Saudi medical students at the college of medicine, King Saud bin-Abdulaziz University for Health Sciences (KSAU-HS).through the following objectives: 1)To determine the levels of knowledge of medical students about e-health, 2) To determine the level of attitude towards e-health use in medical practice, 3) To determine the field of practice of e-health among medical students, and 4) To identify the predictors of e-health practice among medical students.

Methods

Study Setting

College of Medicine (COM-R), King Saud bin-Abdulaziz University for Health Sciences, Ministry of National Guard Health Affairs, Riyadh, Saudi Arabia. COM-R admits Saudi national mainly and awards a bachelor of medicine to two educational streams. Stream 1 has secondary school graduates and follows what is known as the conventional program. Stream 2 allows holders of Bachelor of Science degrees. These students follow what is known as the Graduate Entry Accelerated Program. This program is the first of its kind in the kingdom of Saudi Arabia and is designed to expedite the process of graduation by recognizing these students' previous learning, thus, helping increase market supply of physicians faster

[12]. Medical students of both sexes, in both streams, during the study period will make the target of this study.

Study Subjects

The study population is the students of College of Medicine (COM-R), King Saud bin-Abdulaziz University for Health Sciences, Ministry of National Guard Health Affairs, Riyadh, Saudi Arabia.

Study Design

A cross-sectional study to assess the levels of knowledge, attitude and practice of medical students on e-health in medical field. Students will be contacted once

Sample size and sampling technique:

Assuming a prevalence of 50% satisfactory level of knowledge of e-health among students, a confidence interval of 95%, and a margin of error of 5%, the estimated sample size was 384 students. To compensate for non-response of 20%, a total of 460 questionnaires were distributed to students of different educational grades, using an equal allocation method of sampling.

Data Collection

A previously validated self-administered questionnaire [11] was utilized to assess awareness of medical students on e-health. Based on test re-test reliability, correlations for overall knowledge score, attitude score and practice score were: $r = 0.89$, $r = 0.80$ and $r = 0.46$ respectively. Internal consistency was high [Average Cronbach's $\alpha = 0.80$].

Knowledge: Knowledge about e-health was assessed in terms of: what is e-health, where and when to apply e-health. Factual statements were responded by "yes", "No" or "Do not know". Knowledge score was calculated as follows: 1 point for correct answer and 0 point for don't know & wrong answer. The total score for each student was calculated by summing scores for all responses, and then a percentage score was calculated. This percentage score was categorized into satisfactory ($\geq 75\%$) and unsatisfactory ($< 75\%$).

Attitude: Attitude towards e-health was assessed in terms of; interest in receiving e-health training, use of patient electronic medical records in health settings, use of internet in health service/research, does the use of computer by physician save time, should computer be used in all health centers, does the use of computer relieve pressure on hospital outpatients, how it is difficult to use the internet in the field of health. Attitudinal statements were responded to by "strongly agree", "agree", "not sure", "disagree" or "strongly disagree". Attitude score was calculated by using 5-point Likert scale ranging from 0 to 4 points; 4 points for strongly agree on positive attitude sentence, to 0 point for "strongly disagree". The total score for each student was calculated by summing scores for all responses, and then a percentage score was calculated. This percentage score was categorized into positive ($> 75\%$), neutral (50-75%) and negative ($< 50\%$) attitudes.

Practice of e-health: Practice of students was assessed as regards: participation in video conference, use of the internet for health related information, and use of patient electronic records, program, and. Statements related to practice will be responded to by “No” or “Yes”. Practice score was calculated by giving a score 1 for practicing and 0 for non-practicing. The total score for each student was calculated by summing scores for all responses, and then a percentage score was calculated. This percentage score was categorized into good (>75%), average (50-75%) and poor (<50%) levels.

The questionnaire includes questions on personal characteristics and previous experience in computer use. The investigator distributed an anonymous self administered English based questionnaire inside an envelope, to ensure confidentiality, with a cover letter. Each envelope was handed to the student in his/her classroom. Students were expected to fill the questionnaire and return it in the envelope sealed with no identifiers. The cover letter served as the front page that explained the purpose of the study and invited the student to participate voluntarily. Agreement to fill the questionnaire was considered as a consent.

Data analysis

SPSS software Ver. 25 was used for data entry and analysis. Descriptive statistics such as mean score and standard deviation, as well as frequency and percentages of all independent variables (age, gender, educational grade, etc...) were used. Responses were scored by frequency and percentage then converted to percentage mean scores, then transformed to qualitative data as mentioned previously. Analytic statistics were applied to test associations of the student's practice, attitude and knowledge with the personal characteristics. Chi-square test will be used for qualitative data and student t-test, ANOVA for quantitative data. To predict the significant predictors of student's practice, multiple regression analysis was applied. Significance will be considered at p-value <0.05.

Ethical Considerations

The survey was introduced to the students in an envelope, with a cover letter, explaining the aims of the study. Participation in the study was voluntary. The envelope was not recognized by the instructors. The cover letter assured the students that their feedback would not affect their academic evaluation. Agreement to participate was considered as a consent. The collection of data sheets was framed with confidentiality in a matter where the student's name, contact information, or badge number would not be identified or traced by anyone. This study was approved by the IRB of the Ministry of National Guard-Health Affairs [Ref. #SP18/488/R].

Results

A total of 440 medical students were surveyed for their levels of awareness of e-health, the majority were females (55.7%), of stream 1 (79.8%) and of families whose monthly income was more than 10,000 SR (82.8%). Those students were distributed nearly equally on the four educational grades.

Table 1 shows the distribution of students according to their responses to factual statements on knowledge about e-health. With regard to the definition of e-health, the majority of students responded correctly to 11 statements, and incorrectly to 2 statements; they incorrectly agreed that e-health is “patient examination through the use of internet” (65%) and “organization of health care for patients, including surgical operations, via the internet” (58.6%). With regard to the fields of application of e-health, the majority of students correctly agreed on the following applications; clinical (80.5%), educational (89.5%), administrative (74.5%), policy-making (57.8%) and research (83.6%). However, the majority incorrectly agreed that video games and watching entertainment movies are applications of e-health (74.5% & 73.9% respectively). Regarding the methods of using e-health, the majority of the students correctly agreed that visual communication (74.7%), internet (91.3%) and e-mail (81.1%) were methods of e-health, while around one-half of them incorrectly agreed on paper-post (44.7%), fax (51.4%) and landline telephone (50.2%) as methods of using e-health.

The percentage mean scores for the three domains of knowledge about e-health, namely e-health definition (70.69%, unsatisfactory level of knowledge), fields of its application (76.43%, satisfactory level of knowledge) and methods of its use (65.69%, unsatisfactory level of knowledge). The percentage mean score of overall knowledge about e-health was 71.62% (unsatisfactory level). Only 43.6% of all students reported satisfactory level of overall knowledge about e-health, Table 1.

Table 2 shows the responses of medical students to 8 attitudinal statements on using e-health. Generally speaking, the majority of students responded positively to the statements. However, less than two-thirds of them agreed or strongly agreed that “doctor use of computer during patient interview saves time” (64.9%), and less than two-thirds disagreed that “the use of internet in the field of health is difficult”(63.2%). The percentage mean score of attitude towards the use of e-health was 82.32% (positive attitude). Nearly three-quarters of all students reported positive attitude to e-health use (73.4%), with only 2% of them who reported a negative attitude.

Table 3 shows the forms of practice of e-health during medical training as reported by the medical students. Using electronic medical records and searching for health information ranked first (92.6% & 91.7% respectively), followed by using e-health in medical training (85.2%), while attending e-health training programs and participation in visual communication came last (77.5% & 74.1% respectively). The percentage mean score of overall practice was 84.27% (good level of practice). More than three-quarters of medical students (78.4%) reported good practice, only 9.1% of them reported poor practice.

Table 4 shows the results of a multiple regression analysis of e-health practice among medical students and the independent variables; gender, age, educational grade, stream type, monthly income attitude score and knowledge score. It shows that higher e-health practice score was significantly predicted by higher knowledge ($t=2.219$, $p=0.027$) and attitude ($t=2.114$, $p=0.035$) scores, after adjusting for other variables in the regression model.

Discussion

It is believed that the use of information and communication technologies (ICT) can be a potential alternative to address some of the daunting problems in healthcare sector in developing countries. Knowledge, skills and acceptance of e-health by health professionals are essential attributes of a successful integration of this new tool. In a study on medical students in Sri Lanka [13], fifty one percent rated their knowledge of e-health applications as minimal, and 43% were familiar with the term e-health. This finding was comparable with the findings of our study, where only 43.6% of all students reported satisfactory level of overall knowledge about e-health. This lack of knowledge on e-health could be attributed to the absence of formalized e-health educational components in the medical curriculum. On the other hand, nearly three-quarters of all students reported positive attitude to e-health use, in our study. This finding was in agreement with the finding of a study in Sri Lanka [13], where over 80% believed that e-health had an important role to play in the current and future health sector, and another study in Bangladesh, where the majority of students believed the internet was useful for helping to make health decisions [14].

Medical educators recognize that electronic health record (EHR) proficiency is a skill required for students to succeed after medical school [15]. Medical students need hands-on experience documenting clinical encounters as well as entering orders to prepare for residency and become competent physicians. A 2012 survey of clerkship directors by the Alliance for Clinical Education and the University of Michigan Medical School also showed the limited scope of EHR use by students [16]. In the study of Sri Lanka, respondents had very poor access to computers and internet use was rare. In Bangladesh study of e-health literacy among university students [14], the majority of students used the internet to find health information, although a little over half of students were competent in computer. However, in the present study, using electronic medical records and searching for health information, and using e-health in medical training were reported by almost all students, and attending e-health training programs and participation in visual communication were reported by three-quarters of students, with an overall good level of practice.

It has been reported that some factors such as; level of education [14,17-20], electronic device use[14,19], advanced age [14,19] and gender [19] influenced the use of internet for health-related information [19]. In Bangladesh study [14], e-health literacy was found to be influenced by age, education and marital status, computer knowledge used to search for health information. In the present study, e-health practice score was significantly predicted by both the knowledge and attitude scores, after adjusting for age, gender, stream type, educational grade and family monthly income. This finding reflect the need for an educational e-health program for medical students.

This study has some limitations. Conduction of this survey on the medical students of one university would not allow for generalizing its conclusion. However, this study may open the door for investigating the challenges for upgrading the knowledge on e-health and the use of its applications by medical students in Saudi Arabia. The cross sectional design of the study would not guarantee the causal association between the practice of e-health and the predictors of this practice among students. Longitudinal studies are recommended in the future to control for this limitation.

Conclusion

Overall knowledge of students about e-health was less than satisfactory, while their attitudes were satisfactory and their practices were good. Students' practice of e-health was significantly predicted by their levels of knowledge and attitude on e-health. This study could provide basic information regarding medical students' knowledge, attitude, and practice on e-health.

More resources should be directed to elevate medical students' knowledge and to motivate them to practice e-health using the available tools. It would help policy makers and education planners in developing appropriate evidence-based strategies and curriculum in medical and health institutes for successful implementation and use of e-health systems. Implementation of formalized e-health educational components in the medical curriculum is necessary, to provide knowledge about the fundamentals of e-health, basic concepts and various applications. Such education must also include a practical component to provide medical students with necessary hands-on skills. Educational simulations without prior EHR training help students develop EHR competence [21].

List Of Abbreviations

PMS__ percentage mean score, KAMC—King Abdulaziz Medical city, MNG-HA—Ministry of National Guard-Health Affairs, IRB—Institutional Review Board.

Declarations

Ethics approval and consent to participate

This study was approved by the institutional review board of the Ministry of National Guard-Health Affairs in Riyadh, Saudi Arabia [Ref# SP18/488/R].

Consent to publish

Not applicable

Availability of data and materials

Most of the data supporting our findings is contained within the manuscript, and all others, excluding identifying/confidential respondent data should, will be shared upon request.

Competing interest

The authors declare that they have no competing interests.

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None

Author contributions

MAA and BD contributed to concept development, manuscript preparation and final writing, BD and AIA and SN contributed to concept development, research proposal writing and data collection, analysis and interpretation, and manuscript drafting. All authors read and approved the final manuscript.

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Tables

Table 1. Response of medical students to factual statements on e-health

What is e-health?	Wrong (%)	Correct (%)
1. Health Care Online	25.4	74.6
2. Use of the Internet and other technology to improve health	9.1	90.9
3. Entertainment between working hours*	27.8	72.2
4. Shopping*	26.0	74.0
5. Social communication between friends*	28.9	71.1
6. Control of medicine supply for patients through electronic software	29.4	70.6
7. Provide medical advice to the patient through the use of the Internet	23.3	76.7
8. Patient examination through the use of the Internet	65.0	35.0
9. Organization of health care for patients, including surgical operations via the Internet	58.6	41.4
10. Provide electronic patient records	19.6	80.4
11. Monitor the health of the patient through electronic technologies	22.1	77.9
12. Education of doctors through the use of electronic sources	27.9	72.1
13. Exchange of medical information and medical communication between doctors	25.5	74.5
Percentage mean score	70.69 [unsatisfactory]	

Fields of applications of e-health	No (%)	Yes (%)
1. Clinical	19.5	80.5
2. Educational	10.5	89.5
3. Administrative	25.5	74.5
4. Policy maker	42.2	57.8
5. Research	16.4	83.6
6. Video games	25.5	74.5
7. Watching entertainment movies	26.1	73.9
Percentage mean score (%)	76.43	
	[satisfactory]	
Methods of using e-health	No (%)	Yes (%)
1. Visual communication	25.3	74.7
2. Paper post	55.3	44.7
3. Fax	48.6	51.4
4. Internet	8.7	91.3
5. Land line telephone	49.8	50.2
6. E-mail	18.9	81.1
Percentage mean score (%)	65.69	
	[unsatisfactory]	
Overall Knowledge (%)		
Satisfactory	43.6	
Unsatisfactory	56.4	
Overall percentage mean score (%)	71.62	[unsatisfactory]

Table 2. Response of medical students on attitudinal statements on using e-health

Statements	SA (%)	AG (%)	NS (%)	DA (%)	SD (%)
1. I think that the use of the Internet is useful in the field of health	85.1	12.0	2.5	0.2	0.2
2. I think that the use of the Internet in the field of health is difficult	5.8	7.1	24.0	36.9	26.3
3. I think that doctor use of computer during patient interview saves time	37.2	27.7	22.4	8.3	4.4
4. I think doctor use of computer must be applied at all health centers	56.4	26.8	12.9	3.7	.2
5. I think that the use of computer relieves pressure on hospital outpatient	46.8	30.3	18.1	2.8	2.1
6. I think that patient's electronic file must be applied in all centers and hospitals	73.9	16.9	7.9	1.2	0.1
7. I think e-Health can be used to increase awareness and control of communicable diseases	61.6	25.5	11.5	1.4	0.0
8. I am interested in receiving training for the use of electronic health	57.0	26.4	12.2	3.0	1.4

Overall attitude levels (%):	Positive	Neutral	Negative
	73.4	24.6	2%

SA—strongly agree, AG—agree, NS—not sure, DA—disagree, SD—strongly disagree.

Table 3. Practice of e-health during medical training among medical students

Practice	No (%)	Yes (%)
Searching for health information	8.3	91.7
Using electronic medical records during medical training	7.4	92.6
Attending e-health training programs	22.5	77.5
Using e-health in medical training	14.8	85.2
Participating in visual communication during medical training	25.9	74.1
Overall practice levels (%):		
Good	78.4	
Average	12.5	
Poor	9.1	
Overall percentage mean score (%)	84.27 [Good]	

Table 4. Predictors of good e-health practice among medical students

Independent variables	B	SE	t-value	p-value
Constant	80.278	29.109	2.758	0.006
Gender	0.628	2.582	0.243	0.808
Age	-1.578	1.166	-1.353	0.177
Educational grade	1.491	1.542	0.967	0.334
Stream	-8.002	5.367	-1.491	0.137
Monthly income	3.722	2.251	1.654	0.099
Attitude score	0.229	0.108	2.114	0.035**
Knowledge score	0.176	0.079	2.219	0.027**

**—statistical significance.

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