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User Perceptions and Use of Decision Support Medical Apps Among Medical Students: Cross-Sectional Study

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Abstract. We aimed to assess medical students' use of decision-support medical apps and evaluate their perception of app use. A cross-sectional multi-center observational study was conducted among medical students with and without a medical informatics course as part of their undergraduate medical curriculum. We assessed trust, perceptions, patient impression, reliability, and comfort using an online survey. A total of 439 responses were received. There were significant differences between the two groups when indicating which apps, they trust. Students agreed that using apps enhanced knowledge (91%), saved time (88%), improved patient care (85%), and increased diagnostic accuracy (82%). Students indicated that patients would think that students didn't know what they were doing (63%) or students were fresh out of training (53%) when using apps in the presence of patients. Incorporating medical app usage as part of learning may increase trust and comfort with using medical apps in medical practice.

Keywords. Workforce Development; Medical apps; Decision Support; Medical Students.

1. Introduction

Health applications (apps) had unprecedented growth driven by the COVID-19 pandemic, with 2.6 billion downloads for health and fitness apps in 2021 [1]. With an emphasis on evidence-based medicine and ever-evolving medical information, apps assist medical professionals in processing enormous amounts of data and being updated on topics of interest. These apps influence patients' healthcare interactions, support clinical decision-making [2], and can augment medical education.

While apps facilitate medical education, medical students are concerned about negative perceptions of smartphone use in healthcare settings. Payne et al. [3] and Robinson et al. [4] point to medical students' concern about using apps for patient care due to the perception of disengagement. Quant et al. [5] highlight hesitancy in using a

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mobile device in front of patients to look up information. These studies highlight the importance of socio-technical context in using health informatics tools, including apps.

The AMIA core competencies for applied health informatics (HI) education includes socio-technical aspects in the foundational domains [6]. Experts in Saudi Arabia (SA) developed a HI competency framework adapting this to align with the national digital health transformation [7]. Saudi Vision 2030 positions e-Health as an enabler of high-quality patient-centric care [8], with e-Health apps introduced by the Ministry of Health [9]. Given the country's rapidly progressing e-Health context, it's essential to understand the perceptions surrounding the use of medical apps by medical students in SA.

2. Methods

We conducted a cross-sectional multi-center observational study using an online survey. Two groups of medical students with (#1) and without (#2) a medical informatics course as part of their undergraduate medical curriculum were included: (#1) King Saud University (KSU) and (#2) Imam Abdulrahman Bin Faisal University (IAU). Medical students at KSU are required to take the "Introduction to Medical Informatics" course during their third year. While students at IAU are not taught a mandatory course in informatics, they are given lectures on the use of technology as part of different courses.

The questionnaire was based on a validated survey [5]. To align with the Saudi context, the top 25 grossing medical apps in SA for July 2021 were included [10]. Closed-ended questions in a multiple-choice format were designed to collect demographic information, use of medical information resources and medical apps across five domains: trust, perceptions, patient impression, reliability, and comfort.

Before distribution in the Fall of 2021, the survey was validated, and pilot tested. Medical students in their pre-clinical, clinical, and internship years at both universities, were sent a link through their respective medical college's student council using text messages. Three reminders were sent approximately 1, 2, and 3 weeks after the initial invitation. As an incentive, students were sent a non-monetary educational gift card.

Data analysis was performed using SPSS version 26 (Armonk, NY: IBM Corp. USA). Descriptive statistics were used to summarize the five study variables. o A Chi-square test or a Fisher's exact test was used to test the association between variables and considered to be significantly different when the p value was less than 0.05.

3. Results

A total of 439 medical students completed the survey (248 from KSU and 191 from IAU). Overall, there was an equal representation of students based on gender and clinical year. Around 30% of IAU students reported not taking any lectures on using information technology in medical decision-making. About 60% of students reported using a smartphone or tablet to share information daily or multiple times per day (Table 1).

Among both groups, the use of medical apps to seek medical information was the third most used resource (n=225, 51.25%) reported after the use of websites (n=380, 86.56%) and textbooks (n=344, 78.36%). Regarding the use of medical apps, the app "UpToDate" was the most used app (n=259, 59.0%), with higher use among IAU students compared to KSU students (76.96% vs. 45.16%). Students reported the most used app for creating a differential diagnosis was "UpToDate" (n=245, 55.80%). The

percentage of using "UpToDate" in creating a differential diagnosis among IAU students (n=139, 72.77%) was reported more than KSU students (n=106, 42.74%).

Table 1. Participants' demographic and background characteristics (n= 439).

Characteristic	KSU (n= 248) *n (%)*	IAU (n= 191) *n (%)*	Total *n (%)*
Gender			
Male	137 (55)	107 (56)	244 (56)
Female	111 (45)	84 (44)	195 (44)
Medical Years			
3rd year	62 (25)	34 (18)	96 (22)
4th year	62 (25)	60 (32)	122 (28)
5th year	42 (17)	37 (19)	79 (18)
6th year	66 (27)	37 (19)	103 (23)
Internship	16 (6)	23 (12)	39 (9)
Lectures teaching use of information technology in medical decision making			
0 lectures	37 (15)	57 (30)	94 (21)
1 - 2 lectures	106 (43)	74 (39)	180 (41)
3 - 4 lectures	56 (22)	26 (13)	82 (19)
>4 lectures	49 (20)	34 (18)	83 (19)

There were significant differences between KSU and IAU students' perceptions regarding trust in the following apps: "UpToDate", "Isabel", "Medscape", "The BMJ", and "USMLE Pediatrics Q&A". The proportion of students that trust "UpToDate", "The BMJ", and "USMLE Pediatrics Q&A" apps were more among IAU students compared to KSU students (92% vs. 83.7%, 78.9% vs. 71.8% and 59.7% vs. 39.5% respectively). However, the proportion of students that trust "Isabel" and "Medscape" apps was more among KSU students than among IAU students (31.8% vs. 12.1%, 70.9% vs. 67.3%, respectively) (Table 2).

Table 2. Perceptions of medical app trust among medical students (n = 439).

App	KSU (n= 248)			IAU (n= 191)			Total	p-value
	No trust n (%)	Neutral n (%)	Trust n (%)	No trust n (%)	Neutral n (%)	Trust n (%)		
UpToDate	2 (1)	31(15)	170 (84)	8 (4)	7 (4)	172 (92)	390	0.00
Isabel	4 (5)	54 (64)	27 (32)	5 (15)	24 (73)	4 (12)	118	0.02
Medscape	4 (2)	51 (27)	134 (71)	13 (8)	42 (25)	113 (67)	357	0.04
The BMJ	2 (1)	42 (27)	112 (72)	7 (5)	21 (16)	105 (79)	289	0.01
USMLE	4 (5)	48 (56)	34 (40)	4 (6)	23 (34)	40 (60)	153	0.02

Most students agreed that using medical apps enhanced knowledge (91%), saved time (88%), improved patient care (82%), and increased diagnostic accuracy (74%). More than 50% of students believed that younger doctors are more comfortable using mobile technologies to access knowledge, with less adoption among older doctors (Figure 1). Only one statement "using medical apps can improve the care of my patients." had a significant difference between KSU and IAU students (87.4% vs. 77%).

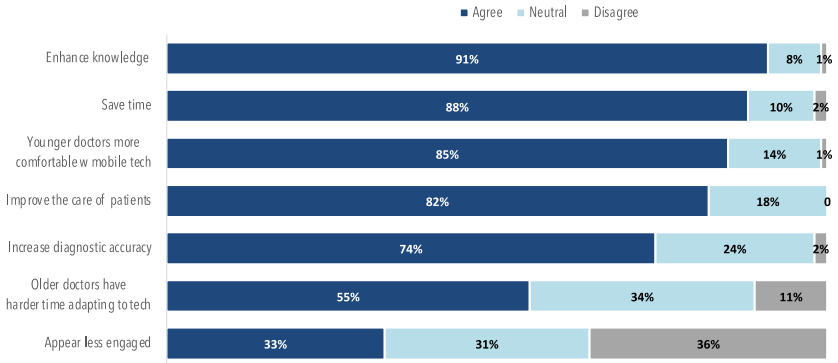

Figure 1. Perceptions of medical app use amongst medical students (n=439).

When students were asked about patients' impressions when students use apps in the presence of patients, most reported a negative association indicating that patients would think that students didn't know what they were doing (63%), or students were fresh out of training (53%). Other students (23%) indicated that it may show that they care enough about their patients to double check their work, while only 12% indicated that it may seem like students knew a lot about modern technology. No significant differences between medical students' perceptions from both universities were found. Most students reported that medical apps were as reliable as textbooks and felt neither comfortable nor uncomfortable using medical apps in front of a patient. There were no significant differences found in reliability and comfort between the two groups of students.

4. Discussion

The present study explored the usage of medical apps among medical students to support decision-making and their perceptions of using medical apps at two universities in Saudi Arabia. While mobile phone use among medical residents has been previously reported [11], our findings add valuable insight into SA's evolution of digital health by capturing medical students' use of specific medical apps.

This research is timely since Saudi's vision 2030 healthcare sector transformation plan outlines e-Health as a significant initiative. The use of medical apps to support clinical decision-making was reported by students, though findings showed that medical apps were not the primary resource used. A search on Sensor Tower [10] did not yield any medical student-orientated SA medical college/hospital-associated apps. Given the study results on disease diagnosis app usage, the possibility of developing medical apps specific to the SA population, which are linked to academic hospital sites and disease registries, should be explored in future research. This may increase and support the use of trusted and validated medical apps during the early clinical training years.

While many students recognize the benefits of using medical apps in clinical practice, differences in the perceptions of trust were found, which may be due specific training given to KSU students. Students also reported negative association with using medical apps in the presence of patients and were neutral in reporting their comfort levels. Incorporating medical apps use as part of learning may potentially increase trust and comfort with using medical apps in medical practice. This is especially vital given the

healthcare digital transformation plan, where future doctors are expected to utilize different technology platforms to care for their patients. The generalizability of this study conducted with undergraduate medical students at two universities can be increased by expanding to other educational institutions in future research.

5. Conclusions

Understanding patterns of medical apps use in healthcare education is a key step in designing new medical curriculums to support digital transformation, which reflect the current and future state of medical practice and facilitate workforce development. Future studies should focus on assessing the effect of implementing specific training on student competencies in finding medical information using medical apps.

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