

Spectrum of tablet computer use by medical students and residents at an academic medical center

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Introduction: The value of tablet computer use in medical education is an area of considerable interest, with preliminary investigations showing that the majority of medical trainees feel that tablet computers added value to the curriculum. This study investigated potential differences in tablet computer use between medical students and resident physicians. **Materials & Methods:** Data collection for this survey was accomplished with an anonymous online questionnaire shared with the medical students and residents at Southern Illinois University School of Medicine (SIU-SOM) in July and August of 2012. **Results:** There were 76 medical student responses (26% response rate) and 66 resident/fellow responses to this survey (21% response rate). Residents/fellows were more likely to use tablet computers several times daily than medical students (32% vs 20%, $p = 0.035$). The most common reported uses were for accessing medical reference applications (46%), e-Books (45%), and board study (32%). Residents were more likely than students to use a tablet computer to access an electronic medical record (41% vs 21%, $p = 0.010$), review radiology images (27% vs 12%, $p = 0.019$), and enter patient care orders (26% vs 3%, $p < 0.001$). **Discussion:** This study shows a high prevalence and frequency of tablet computer use among physicians in training at this academic medical center. Most residents and students use tablet computers to access medical references, e-books, and to study for board exams. Residents were more likely to use tablet computers to complete clinical tasks. **Conclusions:** Tablet computer use among medical students and resident physicians was common in this survey. All learners used tablet computers for point of care references and board study. Resident physicians were more likely to use tablet computers to access the EMR, enter patient care orders, and review radiology studies. This difference is likely due to the differing educational and professional demands placed on resident physicians. Further study is needed better understand how tablet computers and other mobile devices may assist in medical education and patient care.

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10 Introduction

11 Tablet computers such as the Apple iPad and Kindle Fire are extraordinarily popular with the
12 general public and physicians. These tablet computers generally have wireless networking capability
13 and the ability to be customized by installing user selected “apps”.

14 Apps are self-contained software applications with a diverse array of purposes ranging from
15 entertainment to medical decision support. Over 1,600,000 apps are available for the Apple iOS
16 platform (the operating system for the iPhone and iPad), with over 34,000 categorized as medical apps
17 (PocketGamer, 2015). Medical apps typically cost less than \$5 (Robinson and Burk, 2012), and generally
18 work on smartphones and tablet computers. The essential app for many physicians is their electronic
19 medical record (EMR).

20 Ease of use and large screens make tablet computers a natural fit for EMR access,
21 computerized physician order entry (CPOE), and radiology image review. As many as one-third of
22 physicians in the United States use tablet computers in clinical settings, with 14-35% using these mobile
23 devices to access an EMR (Robinson & Burk, 2012; Sclafani, Tirrell & Franko, 2013). Accessing an EMR
24 via tablet computers can decrease the total time physicians spend logged into workstations while on
25 duty (Hornq et al, 2012), improve the efficiency of inpatient medical care by facilitating earlier order
26 entry (Patel et al, 2012), and appears to be preferred over traditional workstations in a hospital setting
27 (Lehnbom et al, 2014). An observational study showed that tablet computers decrease inpatient data
28 management time while increasing the time physicians spend interacting directly with patients
29 (Fleishmann et al, 2015). These results are supported by systematic reviews that indicate tablet
30 computer use can result in improved documentation, medical decision making, and physician efficiency
31 (Mickan et al, 2013; Mickan et al, 2014). In addition, patients embrace mobile technology and report

32 tablet computer use by physicians as a positive aspect of their medical care (Strayer et al, 2010). These
33 factors are likely to fuel even greater adoption of tablet computers by physicians.

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35 The value of tablet computer use in medical education is an area of considerable interest, with
36 some medical schools integrating tablet computers into their preclinical curriculum (Dolan, 2011).
37 Preliminary investigations shows that the majority of students at a medical school felt that tablet
38 computers were a positive addition that added value to the preclinical curriculum (George et al, 2013),
39 and another medical school reports improved United States Medical Licensing Exam (USMLE) test
40 scores after integration of tablet computers into the curriculum (Comstock, 2013). Studies of tablet
41 computer use by medical trainees in the United States showed that point of care references (i.e. drug
42 guides), board exam study resources, curricular materials, and EMR data were the most common types
43 of medical resources used by medical students and residents on tablet computers during clinical
44 rotations (Sclafani, Tirrell & Franko, 2013; Robinson & Burk, 2013; Nuss et al, 2014; Archibald et al,
45 2014).

46 This study explores differences in tablet computer use between medical students and resident
47 physicians at the same institution in hopes of providing insight into how these devices influence medical
48 care and education. The working hypothesis was that tablet computer use and medical app use would
49 substantially differ between medical students and resident physicians.

50

51 **Materials & Methods**

52 Data collection for this survey was accomplished with an online questionnaire shared with the medical
53 students and residents at Southern Illinois University School of Medicine (SIU-SOM) in July and August of
54 2012. The SIU-SOM is located in Springfield, Illinois and had an enrollment of 298 medical students and
55 314 residents and fellows at the time of this survey. Satellite training sites in Carbondale, Decatur, and
56 Quincy, Illinois were also included. Training sites include 5 hospitals and many outpatient clinics in
57 central and southern Illinois.

58 This anonymous survey was approved by the Springfield Committee for Research Involving Human
59 Subjects (SCRIHS), the local institutional review board.

60 This survey asked respondents about tablet computer use, type of tablet computer (iPad, Android,
61 other), medical app use, and frequency of medical app use. A scale for the frequency of medical app use
62 was used. This scale of frequency included several times daily, daily, weekly, monthly, and never. Never
63 was included because it was possible that students might only use tablet computers for personal
64 purposes (email, games, etc.) and not use applications designed for medical purposes.

65 Qualitative variables were compared using Pearson χ^2 or Fisher's exact test and reported as frequency
66 (%), and p values less than 0.05 were considered statistically significant. SPSS version 17.0 was used for
67 data analysis.

68 An inactive copy of the survey instrument can be accessed at: <http://goo.gl/wn5QU>

69 SIU-SOM or any affiliated hospitals do not require or issue tablet computers to students or residents.

70 The training hospitals at SIU-SOM and the faculty outpatient practice have electronic medical records
71 that are accessible via tablet computers in accordance with SIU-SOM and hospital policies.

72

73 **Results**

74 There were 76 medical student responses (26% response rate) and 66 resident/fellow responses to this
75 survey (21% response rate). Slightly over 50% of respondents used a tablet computer, with the Apple
76 iPad being the most popular type of tablet computer used (Table 1). Tablet computer based use of
77 medical apps one or more times daily was reported by 40% of respondents (Table 2). Residents/fellows
78 were more likely to use tablet computers several times daily for medical apps than medical students
79 (32% vs 20%, $p = 0.035$). A high percentage of medical students (54%) and residents (50%) report never
80 using their tablet computers to access medical applications.

81 Respondents were asked about how they use tablet computers (Figure 1). The most common reported
82 uses were for accessing medical reference applications, e-Books, and board study. Residents were more
83 likely than students to use a tablet computer to access an electronic medical record (41% vs 21%, $p =$
84 0.010), review radiology images (27% vs 12%, $p = 0.019$), and enter patient care orders (26% vs 3%, $p <$
85 0.001).

86

87 **Discussion**

88 This study shows a high prevalence and frequency of tablet computer use, primarily in the form of iPads,
89 among physicians in training at this academic medical center. Most residents and students use tablet
90 computers to access medical references, e-books, and to study for board exams. The high frequency of
91 e-book and other educational material use on tablet computers suggest that this may be an important
92 avenue for medical educators to investigate.

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94 These results show a higher rate of resident tablet computer use (50% vs. 13-19%) in clinical settings
95 and a higher rate of EMR access (41% vs. 14%) than reported in a similar study investigating attending,
96 resident and fellow tablet computer use in other institutions (Sclafani J, Tirrell T and Franko O, 2013).
97 Rates of tablet computer use by medical students are similar to the results in a previously published
98 nationwide survey (Robinson and Burk, 2013). These differences in tablet computer utilization between
99 these studies may be related to information needs at different levels of training, the level of institutional
100 support for tablet computers, or other factors such as survey design.

101 Residents were more likely to use tablet computers for direct patient care such as accessing an EMR,
102 reviewing radiographs, and CPOE. This suggests that computers become integrated into the workflow of
103 residents at SIU-SOM, which is not unexpected given reports of improved resident efficiency and
104 increased time in direct patient care with tablet computer use (Hornq et al, 2012; Patel et al, 2012). This
105 also is likely a reflection of the transition of mobile computing needs from that of a student to that of a
106 practitioner.

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108 Tablet computer use is likely complementary to high rates of smartphone use for many medical tasks by
109 medical students and residents (Franko O and Tirrell T 2012; Payne K, Wharrad H and Watts K 2012).
110 Further investigation is needed to determine the preferred platform (phone vs. tablet) for access of
111 healthcare information.

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113 One concern regarding the prevalence of a “bring your own” tablet computer for accessing healthcare
114 information is the relative ease in which information can be shared within a tablet computer. Text can

115 be cut and pasted, images saved, and information shared through other applications. This is because
116 less than half of third year medical students think sharing patient photographs via social media is
117 “definitely a privacy concern” (Whipple E, Allgood K and Larue E, 2010) and 1% of medical student and
118 resident Facebook profiles include identifiable photographs of patients in healthcare settings
119 (Thompson et al., 2011). Less than half of medical students password-protect patient data on their
120 mobile devices (Whipple E, Allgood K and Larue E, 2010). Medical schools must implement policies and
121 procedures sensitive to technological improvements that protect patient privacy in the new mobile
122 world.

123 As a single center study, the results of this survey may not be generalizable. Local factors, such as the
124 availability of EMR access via a tablet computer, are likely to have had significant effects on the patterns
125 of tablet computer use in this study. Additionally, this survey may have selection bias given the
126 voluntary nature of this survey. Despite these limitations, this survey shows widespread adoption and
127 daily clinical use of tablet computers in an academic medical center by medical students and residents.

128

129 **Conclusions**

130 Tablet computer use among medical students and resident physicians was common in this
131 survey. All learners used tablet computers for point of care references and board study. Resident
132 physicians were more likely to use tablet computers to access the EMR, enter patient care orders, and
133 review radiology studies. This difference is likely due to the differing educational and professional
134 demands placed on resident physicians. Further study is needed better understand when and how
135 tablet computers and other mobile devices may assist in medical education and patient care.

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Figure 1. Tablet computers use by stage of medical education

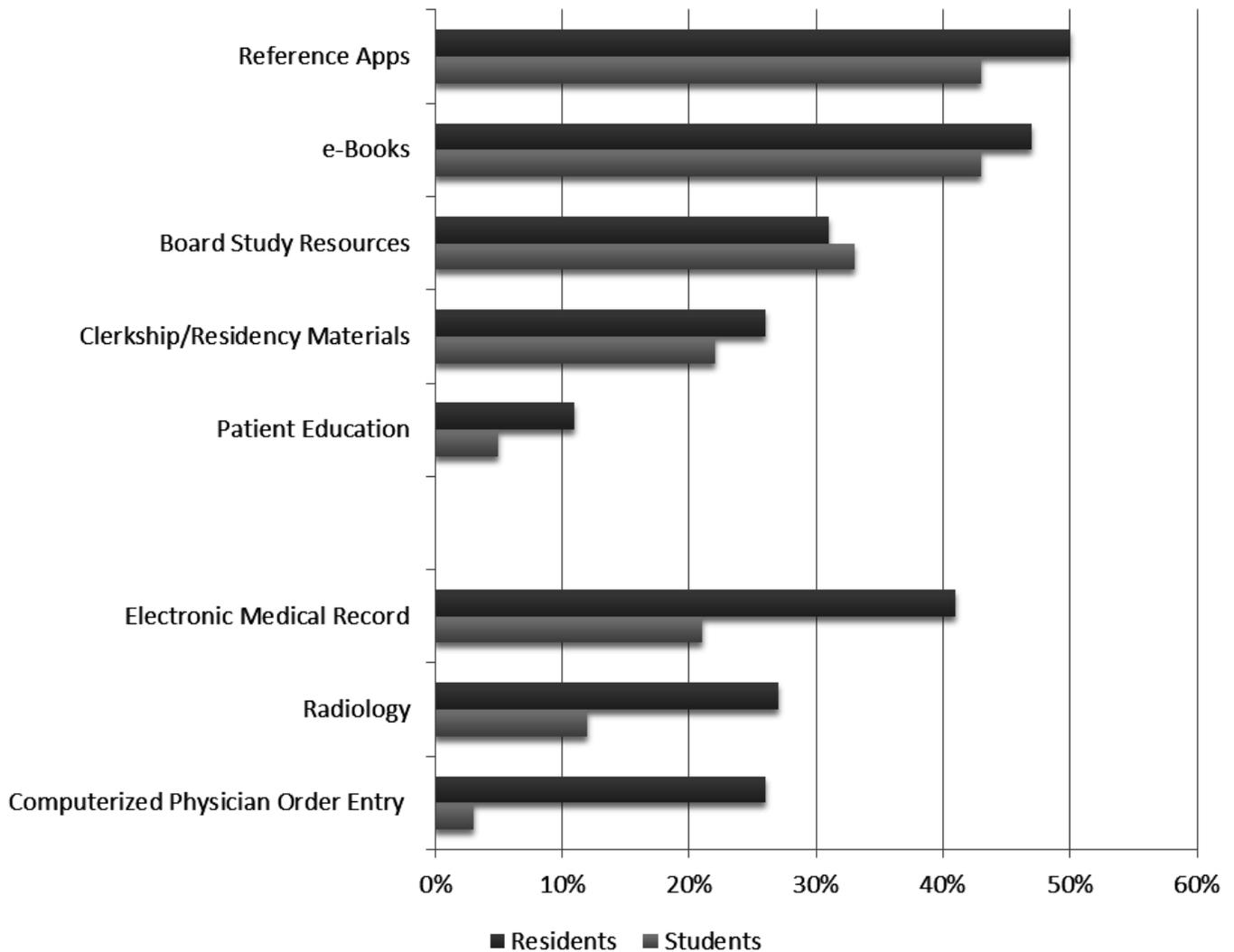


Table 1 (on next page)

Tablet computer use by physicians in training

Table 1. Tablet computer use by physicians in training

	Medical Students	Residents/Fellows
Total respondents	76	66
Use a tablet computer	39 (51%)	33 (50%)
Use an iPad	35 (46%)	27 (41%)
Use an Android Tablet	4 (5%)	6 (9%)

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Table 2 (on next page)

Frequency of medical app use by physicians in training

Table 2. Frequency of medical app use by physicians in training

	Medical Students	Residents/Fellows
Total respondents	76	66
Use medical apps	35 (46%)	33 (50%)
Several times daily	15 (20%)	21 (32%)
Daily	10 (13%)	11 (17%)
Weekly	10 (13%)	1 (2%)
Monthly	0 (0%)	0 (0%)
Never	41 (54%)	33 (50%)

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