Mobile Technology in Radiology Resident Education

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Purpose: The authors hypothesized that ownership of a mobile electronic device would result in more time spent learning radiology. Current trends in radiology residents' studying habits, their use of electronic and printed radiology learning resources, and how much of the funds allotted to them are being used toward printed vs electronic education tools were assessed in this study.

Methods: A survey study was conducted among radiology residents across the United States from June 13 to July 5, 2011. Program directors listed in the Association of Program Directors in Radiology e-mail list server received an e-mail asking for residents to participate in an online survey. The questionnaire consisted of 12 questions and assessed the type of institution, the levels of training of the respondents, and book funds allocated to residents. It also assessed the residents' study habits, access to portable devices, and use of printed and electronic radiology resources.

Results: Radiology residents are adopters of new technologies, with 74% owning smart phones and 37% owning tablet devices. Respondents spend nearly an equal amount of time learning radiology from printed textbooks as they do from electronic resources. Eighty-one percent of respondents believe that they would spend more time learning radiology if provided with tablet devices.

Conclusions: There is considerable use of online and electronic resources and mobile devices among the current generation of radiology residents. Benefits, such as more study time, may be obtained by radiology programs that incorporate tablet devices into the education of their residents.

Key Words: iPad, tablet, tablet PC, technology, radiology education, resident education

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BACKGROUND

The widespread adoption of mobile devices such as smart phones, laptops, and tablets may have an impact on medical education. A recent survey of health care professionals showed that 79% use iPads (Apple Inc, Cupertino, California) for work [1]. Several medical schools have already incorporated iPads into their curricula, including Stanford University; the University of California, Irvine; the University of Minnesota; and the University of Central Florida [2]. Given the image-based learning in radiology, mobile devices may have a particularly significant impact on education.

Electronic textbooks and online educational resources are now available on mobile devices and have several advantages over traditional printed education materials. The former are more likely to be accessible, to be interactive, to be up to date, and to provide better image quality compared with printed textbooks. The new radiology board "examination of the future" is a reflection of the changing education for future radiologists. The methods used to learn and teach radiology are evolving, and mobile technology is playing a role. It is widely expected that tablet devices will bring change to radiology education. However, few studies have examined the impact of mobile devices on radiology residency education.

In this study, we assessed the current trends in radiology residents' study habits, their use of electronic and printed radiology learning resources, and how much of the funds allotted to them during residency are being used toward printed vs electronic education tools. We hypothesized that ownership of a mobile electronic device would result in more time spent learning radiology.

METHODS

We conducted a multi-institutional survey study among diagnostic radiology residency programs across the United States from June 13 to July 5, 2011. An e-mail was sent to all program directors registered with the Association of Program Directors in Radiology asking for residents to participate in an online survey through a

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Web-based commercial site (http://www.surveymonkey.com). Participation in this study was voluntary, and no compensation was provided. The study and survey were approved by the institutional review board. We have no financial disclosures and no special relationship with Apple.

The questionnaire survey consisted of 12 questions and initially assessed the type of institution, the levels of training of the respondents, and book funds allocated to residents. The remaining questions assessed the residents' study habits, ownership of mobile devices, and use of printed and electronic radiology resources.

Groups of responses were compared using χ^2 tests. Statistical significance was set at the 5% error level ($P < .05$). All analyses were performed using calculators available online (http://faculty.vassar.edu/lowry/newcs.html).

RESULTS

A total of 308 participants took part in the survey, of whom 284 (92%) completed the entire questionnaire. On the basis of 2011 National Resident Matching Program data, we estimate the total number of radiology residents in the United States to be close to 3,600, making our sample about 9% of the total. When asked about their residency programs, 213 of respondents (69%) reported training at academic university hospitals, 62 (20%) at university-affiliated community hospitals, and 33 (11%) at other institutions. Of 307 respondents, 98 (32%) were R1 (postgraduate year [PGY] 2), 87 (28%) were R2 (PGY 3), 66 (22%) were R3 (PGY 4), and 56 (18%) were R4 (PGY 5).

When asked about book funds or educational stipends provided by their residency programs, of 305 respondents, 42 (14%) said that no book funds were provided. On the other hand, 63 (21%) received <$400 per year, 89 (29%) received between $400 and $800 per year, 74 (24%) received between $801 and $1,000 per year, and 37 (12%) received >$1,000 per year.

Of those who indicated receiving book funds, of 260 respondents, 256 (99%) indicated that the allowances could be spent on radiology textbooks, 121 (47%) on educational electronic devices (including laptops, iPads, or other tablet devices), 164 (63%) on online radiologic resources, 155 (60%) on radiology board examination fees, 145 (56%) on conferences, and 21 (8%) on other items. When asked what percentages of these allowances were spent on printed textbooks, of 253 respondents, 77 (30%) spent 0% to 25%, 40 (16%) spent 26% to 50%, 48 (19%) spent 51% to 75%, and 90 (36%) spent 76% to 100%. When asked what percentages of these allowances were spent on electronic resources, of 188 respondents, 136 (72%) spent 0% to 25%, 37 (20%) spent 26% to 50%, 13 (7%) spent 51% to 75%, and 2 (1%) spent 76% to 100% (Table 1).

When asked how many hours per week residents spent learning radiology from printed textbooks, of 298 respondents, 168 (56%) chose 0 to 5 hours, 101 (34%) chose 6 to 10 hours, 19 (6%) chose 11 to 15 hours, and 10 (3%) chose >15 hours. When asked how many hours per week residents spent learning radiology from online or electronic resources, of 296 respondents, 152 (51%) chose 0 to 5 hours, 103 (35%) chose 6 to 10 hours, 24 (8%) chose 11 to 15 hours, and 17 (6%) chose >15 hours.

For online or electronic radiology resources, of 296 respondents, 268 (91%) indicated that they used STATdx, 188 (64%) ACR Case in Point, 181 (61%) electronic journals, 127 (43%) electronic textbooks, 97 (33%) ACR teaching files, 55 (19%) RADPrimer, and 54 (18%) other online or electronic radiology resources, including Google, The Radiology Assistant (http://www.radiologyassistant.nl), and the e-Anatomy iPad application (IMAIOS, Montpelier, France), among others.

Of 297 respondents, 219 (74%) owned smart phones, 99 (33%) owned iPads, 21 (7%) owned Kindles (Amazon.com Inc, Seattle, Washington), 13 (4%) owned other tablet devices, 49 (17%) owned none of these, and 27 (9%) owned other electronic mobile devices. For those who indicated ownership of mobile devices, of 243 respondents, 165 (68%) used their devices for studying and learning radiology, whereas 78 (32%) did not (Figure 1). Residents who owned iPads were more likely to use the devices for studying and learning radiology compared with residents who owned other non-iPad devices ($P < .0001$; Table 2).

When asked "If provided with a mobile tablet device (such as an iPad or tablet PC), would you spend more time studying/learning Radiology?" of 284 respondents, 230 (81%) answered "yes" and 54 (19%) answered "no" (Figure 2).

DISCUSSION

Our survey shows that current radiology residents are adopters of new technologies, with 74% owning smart phones and 37% owning tablet devices. Respondents spent nearly an equal amount of time learning radiology

Table 1. Percentage of book funds or allowances spent

	Percentage Spent			
Resource	**0-25**	**26-50**	**51-75**	**76-100**
Printed textbooks	30% (77)	16% (40)	19% (48)	36% (90)
Electronic resources	72% (136)	20% (37)	7% (13)	1% (2)