Use of computers and the Internet by residents in US family medicine programmes

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Abstract
Computers, personal digital assistants (PDA), and the Internet are widely used as resources in medical education and clinical care. Educators who intend to incorporate these resources effectively into residency education programmes can benefit from understanding how residents currently use these tools, their skills, and their preferences. The researchers sent questionnaires to 306 US family medicine residency programmes for all of their residents to complete. Respondents were 1177 residents from 125 (41%) programmes. Access to a computer was reported by 95% of respondents. Of these, 97% of desktop and 89% of laptop computers could access the Internet. Residents accessed various educational and clinical resources. Half felt they had ‘intermediate’ skills at Web searches, 23% had ‘some skills,’ and 27% were ‘quite skilled.’ Those under 30 years of age reported higher skill levels. Those who experienced a Web-based curriculum in medical school reported higher search skills and greater success in finding clinical information. Respondents preferred to use technology to supplement the didactic sessions offered in resident teaching conferences. Favourable conditions exist in family medicine residency programmes to implement a blend of traditional and technology-based learning experiences. These conditions include residents’ experience, skills, and preferences.

Keywords: Internship and residency, graduate medical education, family medicine, competency-based education, curriculum, computers, Internet, computer literacy, medical informatics, attitude to computers

1. Introduction
Resident training typically has relied on the noon ‘conference’ to deliver core content. These conferences consist mainly of lectures in which time for discussion and problem-solving is minimal.

In recent years, computers, personal digital assistants (PDAs) and the Internet have increased dramatically and become widely used by family medicine residents as resources for their own education and patient care [1–11].
In 1993, Rowe et al. [1] surveyed family medicine residents throughout Canada. At that time, only 38% of the respondents reported owning a computer, and 13% were ‘very’ or ‘extremely’ comfortable using computers. By contrast, in 1998, Jerant and Lloyd [2] surveyed first-year medical students, family medicine residents, and family medicine faculty at their own institution and identified much higher rates of computer ownership: 91% of faculty, 79% of residents, and 86% of students. They also found that senior residents were not as confident as were faculty, students, and junior residents in their computer skills (e.g. ability to do MEDLINE searches). They concluded that senior residents may require remedial computer training, and faculty might not be prepared to offer the advanced computer training that students and interns may need and demand. In 2001, Jerant et al. [3] repeated that survey and found that computer ownership had risen significantly to 100% of faculty, 100% of residents, and 92% of students. The use of e-mail and the Internet also had increased, and senior residents had gained skills and confidence in their general computer abilities. Based on these new findings, the researchers concluded that the remedial training they had recommended in their earlier study may no longer be necessary.

Today’s family medicine residents are very likely to have computers and to have used them in their undergraduate medical education programmes. Leong et al. (2000) [4] reported widespread use of e-mail and departmental websites among US pre-doctoral family medicine programmes. These websites typically posted schedules and syllabi. The researchers also found that 80% of the responding medical schools had some instructional content on the Web (50% of the family medicine clerkships). Furthermore, a third of family medicine clerkships used the Web to facilitate evaluation of student achievement (e.g. online logs of patient encounters).

Other researchers have investigated the use of personal digital assistants (PDAs) in resident training. PDA usage has increased rapidly and is now widespread. In 2000, Criswell and Parchman [5] surveyed family medicine programme directors. They found that residents used PDAs in about two-thirds of the responding programmes. Kho et al. [6] performed a systematic review of literature from 1993 through 2004 and estimated that 60–70% of medical students and residents use PDAs for educational purposes or patient care. The researchers concluded that PDAs are a valuable resource for both medical students and residents, one that many programmes have incorporated into medical education and patient care activities. Barrett et al. [7] surveyed residents in seven programmes at their own institution during the 2001–2002 academic year and found PDA usage widespread, especially among residents in internal medicine and family medicine. The family medicine residency programme at this institution ‘strongly encouraged’ PDA usage by providing PDAs to all incoming residents. Approximately 90% of these residents were found to use their PDAs on a daily basis. Jerant et al. [3] also reported a PDA ownership rate of 100% among family medicine residents, which reflected their ‘current program policy of issuing PDAs to all residents.’ Garrity and El Emam [11], in a systematic review of PDA usage surveys published between 2000 and 2005, found that ‘younger physicians and residents and those working in large and hospital-based practices are more likely to use a PDA.’

Today’s residents use PDAs for a variety of educational, clinical, and administrative purposes, such as electronic textbooks, medication references, clinical consultation guides, clinical computation, clinical procedure tracking and documentation, e-mail, and personal organization [3,5–11]. With residents’ increased experience in using computers and PDAs, they have gained skill and confidence [3].

The Accreditation Council for Graduate Medical Education (ACGME) requires that residency programmes develop the competency of residents to ‘use information technology to
manage information, access online medical information; and support their own education’ [12]. Programmes must define the specific knowledge, skills, and attitudes; and they must provide the needed educational experiences for residents to demonstrate these competencies.

The American Academy of Family Physicians (AAFP) has recommended curriculum guidelines (last revised June 2002) which state, ‘In addition to the more traditional sources of information, computers now represent one increasingly important tool in managing information. Therefore, some basic familiarity with this medium is critical for the family physician.’ Furthermore, all family medicine residents should ‘commit to self-directed learning principles and practice,’ ‘value new sources of learning and information,’ and acquire the computer skills that will ‘enhance access to timely information’ [13].

Computers, PDAs, and Internet-based educational applications can be used for self-directed learning and to reinforce and supplement the core content currently presented in resident conferences. These tools also have utility in clinical settings, and their introduction in instructional conferences may facilitate their clinical use. By offering a variety of engaging teaching and learning activities, programmes may foster adaptability and better meet the needs of increasingly computer-savvy residents.

As family medicine programmes continue to incorporate computers, PDAs, and the Internet, it will be helpful for educators to be informed about residents’ current and preferred usage of these tools. Our study surveyed US family medicine residents to provide this information.

2. Methods

In the spring of 2003, the investigators sent a survey to family medicine Residency Programmes listed in the AAFP 2002 Directory, which includes 456 programmes divided into five categories based on their affiliation and structure. We surveyed only those programmes in the first four categories: community-based (CB), community-based and medical-school-affiliated (CBMSAff), community-based and medical-school-administered (CBMSAdm), and medical-school-based (MSB). Military programmes were excluded from the study.

We selected a random sample of programmes from each category for a total of 306 programmes. Each residency programme director or coordinator received a survey packet including a 14-item questionnaire for each resident; an addressed, stamped return envelope; and a letter of explanation about the study. The letter requested that the questionnaires be distributed, collected, and returned in the envelope provided. After the initial mailing, contacts at programmes not responding received reminders via e-mail, in which we offered to send another survey packet if needed. If the programme was in an under-represented category, one of the authors also telephoned the programme coordinator to further encourage their participation.

The questionnaire asked residents whether they had access to a desktop computer, laptop, or PDA; the frequency with which they accessed the Web for personal use and for clinical information; the types of clinical information resources used; the kinds of educational experiences made available in their residency programme’s teaching conferences, including any instruction on accessing electronic or Web-based clinical information resources; their ability to find useful clinical information on the Web; and their preferences about how to access information, including the information currently presented in their teaching conferences, information for preparing for national board examinations, and in-depth clinical information about patients, including at the point of care.

Descriptive statistics and chi-square analysis were completed using SAS version 9.0.
3. Results

3.1. Responses

Of the 4212 resident positions listed in the directory for the programmes we surveyed, a total of 1177 residents completed the survey (return rate of 28%). Of the 306 programmes surveyed, we received responses from 125 programmes (41%). Community-based and medical-school-affiliated had the highest representation ($n = 64, 51\%$), followed by community-based and medical-school-administered ($n = 32, 26\%$), medical-school-based ($n = 21, 17\%$), and community-based ($n = 8, 6\%$).

3.2. Respondent characteristics

About one-third of respondents represented each of the 3 years of residency: PG1 (35\%), PG2 (32\%), and PG3 (32\%). Most (62\%) were white. Other ethnic groups included Asian/Pacific Islander (18\%), Hispanic (7\%), black (5\%), and other (8\%). Nearly half (49\%) were from community-based and medical-school-affiliated programmes. Next were community-based and medical-school-administered programmes (26\%), medical-school-based programmes (20\%), and community-based (5\%).

3.3. Familiarity with computers

Most residents (66\%) began using computers at a young age, either as teens (41\%) or as pre-teens (26\%). Another sizeable group (28\%) started in their 20s: early 20s (15\%), mid-20s (6\%), and late 20s (7\%). Less than 7\% started in their 30s or later.

3.4. Web curriculum in medical school

When asked, ‘Did your medical school provide Web-based curriculum opportunities?’, 60\% of respondents answered ‘yes.’

3.5. Access to computers

Eighty-nine per cent of respondents had access to a desktop, and 49\% had access to a laptop computer; in total, 95\% had access to a computer. A CD-ROM was reported to be present in 98\% of the desktops and 93\% of the laptops. The Internet was accessible from 97\% of the desktops and 89\% of the laptops.

3.6. Access to PDAs

Ninety-three per cent of respondents reported having a PDA. Of those, 83\% were based on the Palm operating system (vs. Windows CE and others).

3.7. Skills in searching the Web

Half of the respondents felt they had intermediate skills in searching the Web, while 27\% felt they were ‘quite skilled,’ and 23\% had ‘some skills.’ Less than 1\% indicated they did not know how to search the Web. Those under 30 years of age were more likely to report having intermediate skills or being quite skilled vs. basic or no skills ($p = .001, \chi^2 = 11.43$ using the Mantel–Haenszel chi-square), as were those who had experienced a Web-based curriculum ($p = .003, \chi^2 = 8.82$).
3.8. Ability to find useful clinical information on the Web

Nearly all respondents felt they were able to find useful clinical information on the Web. However, exposure to Web-based curriculum in medical school was associated with an increased ability to find useful clinical information: of those who had no Web-based curriculum, 6% disagreed or strongly disagreed that they can find useful clinical information on the Web, compared with 3% of those who had experienced a Web-based curriculum ($p = .01, \chi^2 = 6.31$ using the Mantel–Haenszel chi-square).

3.9. Web-based clinical resources used

The most commonly used Web-based resources were medical journals (81% of respondents), clinical gateway (75%), and medical textbooks (69%). Other commonly used resources were drug information (66%), patient education (58%), and bibliographic information (53%). To indicate their preferences, residents selected one or more choices from a list of four or five preference options.

3.10. Preferences for accessing information taught in conferences

When given a choice of how to access information that is currently offered during resident teaching conferences, 85% of respondents would choose to keep the conferences, 74% would choose self-study of printed articles and other supplementary materials, 72% would choose to preview material on the Web prior to the conference, and 61% would choose self-study of conference material on the Web.

3.11. Preferences for preparing for board examinations

In preparing for national board examinations, residents most preferred self-study of articles and other supplementary materials (88%). Additional preferences included didactic conferences (68%), self-study on the Web (62%), and a combination of Web-based self-study and didactic conference (59%).

3.12. Preferences for clinical research on patients

For in-depth clinical research on a patient, residents most preferred computers (92%). Additional preferences included traditional print information (84%), colleagues/friends (74%), PDAs (59%), and a librarian (54%).

3.13. Preferences for point-of-care information

To obtain clinical information at the point of care, respondents preferred discussing with colleagues or friends (87%), using PDAs (86%), using their computers (83%), and using traditional print information (70%). Some would consult a librarian (27%).

4. Discussion

Despite widespread availability and use of computers, PDAs, and the Internet, resident education has yet to fully integrate these resources. Residents and faculty value highly the traditional didactic conferences. Yet many of today’s residents are well accustomed to these
tools and prefer to use them in their medical education and in patient care. These preferences provide favourable conditions for educators who wish to experiment with various blends of traditional and technology-based solutions intended to make information access and learning more efficient and effective for residents.

By continuing to monitor residents’ preferences and uses of computers, PDAs, and the Internet, educators can better determine how educational interventions should be structured.

The findings in this study suggest several possible educational interventions. Given residents’ preferences for particular Web-based clinical resources, educators could structure conferences dedicated to the critical evaluation of these resources. Conferences, for example, could evaluate time-efficient ways to review medical journals on the Web or assess the various clinical gateways available and provide recommendations.

Noting the clear preference for conferences as learning opportunities for residents, these learners do acknowledge a willingness to use Web-based materials to complement or supplement the conferences. Educators in institutions with a viable computer infrastructure might wish to capitalize on this willingness.

One of the more striking results of the survey was the high percentage (92%) of residents who preferred to use computers for in-depth clinical research on a patient. As such research obviously can have important consequences, educators might wish to take note of this preference. Instructors could design educational experiences that simulate patient encounters and walk residents through computer-based resources that might assist them in providing care for these simulated patients.

At the point of care, similar proportions of residents prefer to talk directly with colleagues (87%), use their PDAs (86%), or use their computers (83%). Clinical supervisors may wish to capitalize on these approaches in the residents’ continuity clinic experiences. By modelling the careful use and efficient use of PDA- and computer-obtained material, supervisors might lay the groundwork for effective use of these tools by the physicians-in-training in their later careers.

The challenge remains to provide faculty with the time, resources, and training needed to plan, develop, and implement new approaches. A general strategy for introducing educational innovations is to experiment with a small, pilot programme. The methods and results should be documented and evaluated so that decision-makers can weigh up the risks and benefits of investing the additional resources required to take the innovation beyond the pilot stage to full implementation. The evaluation should provide data on learner and teacher satisfaction with the programme, learning outcomes (knowledge, skills, or attitudes), observed changes in work behaviours, and other relevant outcomes of interest to decision-makers.

In conclusion, conditions are favourable for implementing a blend of traditional and technology-based learning experiences in family medicine residency programmes. Residents have ready access to computers, PDAs, and the Internet, and most have the basic skills needed to use these tools. Residents prefer a blend of traditional didactic and technology-based learning experiences. As family medicine residency programmes continue to experiment with these tools, it will be important for educators to share their experiences and outcomes so that other programmes may benefit.

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References