Computer Use among Community-Based Primary Care Physician Preceptors

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ABSTRACT

Purpose. Use of the Internet to access biomedical information in patient care has important implications in medical education. Little is known about how community-based clinical teachers use computers in their offices and what factors, such as age, may influence use.

Method. A total of 178 active community-based primary care preceptors were mailed a 15-item questionnaire about their computer equipment; Internet use; and specific applications in patient care, patients' education, medical students' or residents' education, or accessing other clinical and/or research information. Data analysis used descriptive statistics, chi-square for comparisons of categorical data and analysis of variance (ANOVA) mixed model for comparisons of continuous variables. All tests were two-tailed with alpha set at .05 to determine statistical significance.

Results. In all, 129 preceptors responded (73%). Office computer availability was high (92%). The Internet as a clinical information resource was used most frequently (98%) and MD Consult and Medline-EBM were used less frequently (20% and 21%, respectively). No statistical differences were found in routine use by age of preceptor; frequency of use did differ. Preceptors 60 years or older were four times more likely to use the Internet to assist in students' and residents' education ($p = .02$) and at least twice as likely to use full text Medline articles for patient care decisions ($p = .05$) than their younger colleagues. Decreased computer use was related to lack of time (45%) or other logistical reasons (40%), such as the computer's distance from the patient care areas or slow connections.

Conclusions. Rates of computer access and Internet connectivity were high among community-based preceptors of all ages. Uses of specific online clinical and/or educational resources varied by preceptors' age with more rather than less use among older preceptors, an unexpected finding.

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Medical practice is evolving toward use of the Internet to access the biomedical information needed to provide the most up-to-date care to patients.[1,2] This trend raises two important questions. First, are medical schools providing learning experiences that prepare future physicians for such an intensive, computer-based medical practice? Several reports address this topic[3–12] and indicate that the clinical education of medical students increasingly relies on online materials and advanced computer technology to deliver course content,[3–9] communicate with students,[7] and prepare students for information management and technology in medical practice,[8] which is a recommendation of nine major reports on medical training.[9]

Second, are the community-based clinical settings where students are placed prepared for these computer-based curricular innovations? This question is especially important given the dramatic shift away from inpatient clinical training at academic institutions to outpatient clinical training at a variety of clinical settings.[10–12] In many of these community-based settings the educational infrastructure is unknown.[13] Although we can reliably assume that computer access to online resources and course material are equally available to academic preceptors and students alike, we know much less about computer connectivity and use among communi-

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ty-based preceptors. Further, we do not know what factors, such as age, might influence their computer use. We found no published analytic research reports on computer connectivity and use among community-based faculty involved in medical students' and residents' education.

Three recent reports describe community-based and primary care physicians' access to and use of the Internet,[14–16] but these do not address the extent to which these physicians are clinical teachers. The studies suggest that most physicians (82% to 85%) have connections to the Internet and use e-mail frequently, but few (12% to 27%) use the Internet regularly (defined as at least once per week) to access online medical resources, such as online medical journals or continuing medical education courses.[16] Community-based faculty and the settings where they practice must be better prepared to teach students using computer-based technology and to model how these new clinical activities fit into patient care. At the very least, community-based preceptors should have access to the same online resources and computer-based technologies available to students.[17]

Computer connectivity was a top priority at our institution (Dartmouth Medical School) in the mid- to late 1990s when we provided hardware (Power Macintoshes and modems) for no or little cost (50% subsidy); software, including a local e-mail network (Blitzmail®); access to the Internet (via Netscape®) and the biomedical libraries at our institution; and initial onsite technical computer support to our preceptors.[18,19] The computer support services were reduced greatly after installation and training were completed, although access to biomedical library-supported software and other support services continue to be available.[20]

In April 2001, we surveyed 178 active community-based primary care preceptors to determine the current status of their computer connectivity and use. More specifically, we wanted to determine whether students in clinical clerkships that required online access could conduct their assignments in community-based settings, and whether e-mail provides an efficient means for communicating with the community-based faculty. We were also interested in determining if the support services and training needs for computer connectivity and use of online resources and course materials were being adequately addressed for community-based faculty and whether it might be feasible to deliver faculty development online. Last, we wanted to determine what occurred after the hardware, software, and support services were reduced.

We also used this study to measure the effect of a preceptor's age on computer use. Although the effect of a physician's age on computer connectivity and use of online resources is not known,[15,16] personal computers were not widely available until the mid- to late 1980s, and Internet access has only been widely available in the last eight years. We hypothesized that younger community-based preceptors would have more computer experience and be more comfortable integrating computer use into their practices when educating students. Thus, we included the age of the preceptor in our data analysis.

Method

Study Population

After obtaining approval from the Committee on the Protection of Human Subjects, we used our institution's preceptor-placement database to identify community-based primary care preceptors who actively taught medical students in any required clinical course or clerkship between September 1, 1998 and April 30, 2001. Primary care was defined as general internists, family physicians, general pediatricians, and general obstetrician/gynecologists. A total of 264 preceptors met the criteria. Eighty-six (32.6%) of these preceptors who were located at distant sites (e.g., Bethel, Alaska; Tuba City, Arizona; Miami, Florida), which represent very different teaching experiences than those provided at local community sites (within Maine, New Hampshire, and Vermont), were excluded, leaving 178 eligible preceptors for inclusion in the study.

Instrumentation and Data Collection

We developed a 15-item questionnaire (see Appendix), designed for self-administration, to determine the preceptors' computer equipment and service use as well as specific-application use in four categories (patient-care decisions, patients' education, medical students' or residents' education, and accessing other clinical and research information). Both junior and senior physicians and nonphysician faculty members reviewed the questionnaire to ensure construct and content validity. It was further pilot tested prior to implementation by having several community-based preceptors complete it and participate in cognitive interviews regarding its clarity, relevance, and understandability. The questionnaire, along with a cover letter signed by a leader with name recognition among the community-based preceptors, was mailed to the 178 eligible preceptors. The cover letter underscored the importance of the information for educational programs. A second mailing was sent to nonresponders within three weeks. If no response occurred after our second mailing, telephone follow-up was conducted.

Data Management and Analysis

Demographic and practice characteristics of the participants, such as date of birth (available for 69% of respondents) and year of medical school graduation (available for 100% of respondents), were obtained from the preceptor-place-

Table 1

Mean Priority Ranking (SD) for Clinical and Educational Computer Applications Available to Community-Based Preceptors (by Preceptor's Age), Dartmouth Medical School, 2001*

Computer Application	All Ages (n = 119)	Preceptor's Age				p Value
		<40 (n = 17)	40–49 (n = 51)	50–59 (n = 35)	≥60 (n = 16)	
E-mail	1.8 (1.2)	1.8 (1.4)	1.7 (1.1)	1.7 (1.2)	1.8 (1.0)	.98
WWW/Internet	2.9 (1.2)	2.7 (1.0)	2.9 (1.1)	3.0 (1.3)	2.8 (1.2)	.85
Word processing	**3.2 (1.4)**	**3.4 (1.4)**	**2.8 (1.4)**	**2.5 (1.5)**	**4.2 (1.4)**	**.05**
Affiliate/clinical information systems	3.2 (1.7)	2.7 (1.5)	3.4 (1.5)	3.4 (1.7)	3.3 (2.1)	.69
Dartmouth Medical School's Web site†	**4.6 (1.1)**	**4.0 (1.3)**	**4.2 (1.2)**	**4.9 (1.0)**	**5.2 (.9)**	**.03**
Other software	3.5 (2.9)	4.5 (3.0)	4.3 (3.2)	3.0 (2.4)	3.0 (3.5)	.51

*1 = most important, 6 = least important.

†Provides community physicians with access to clinical records of patients they refer to Dartmouth-Hitchcock Medical Center physicians.

ment database and included in the analysis file. When date of birth was not available, we estimated age using year of graduation from medical school. To determine how strong a proxy year of graduation from medical school was for age, we assessed the correlation between these two variables using the Pearson correlation coefficient, which was .96 ($p < .001$). Preceptor's age was then classified into four categories (<40, 40–49, 50–59, ≥60) for analysis.

Statistical analysis included descriptive statistics, chi-square for comparisons of categorical data, and analysis of variance (ANOVA) mixed model for comparisons of continuous variables. All tests were two-tailed with the alpha level set at .05 to determine statistical significance.

Results

A total of 129 responses (73%) were obtained. Thirty-seven percent of respondents were general internists, 33% were family physicians, 23% were general pediatricians, and 7% were general obstetrician/gynecologists. Thirty percent of the responding community preceptors were women. The mean age among the 89 respondents for whom age was available was 49.8 years (SD = 8.9) with a range of 29 to 73 years. The mean number of years since graduation for the remaining 40 preceptors was estimated to be 21.6 years (SD = 9.6) with a range of two to 48 years. When we applied our four age categories, 13% of respondents were younger than 40, with a mean of 36 years (SD = 3.1); 45% were between 40 and 49, with a mean of 45 years (SD = 3.0); 30% were between 50 and 59, with a mean of 55 years (SD = 2.6); and 12% were 60 or older, with a mean of 63 years (SD = 4.4).

We found statistical differences by preceptor's gender across age categories ($p < .01$). All preceptors 60 years or older were men. Among those 50–59, 77% were men; among those 40–49, 65% were men, and among those < 40, 47% were men. We, therefore, evaluated the impact of gender controlling for age in our study variables and found no differences between men and women preceptors. The data presented here represent combined analysis.

Overall, we found a high degree (92%) of computer availability (defined as computer designated for clinical or educational use, exclusive of billing computer). Only ten preceptors (8%) reported that computers designated for clinical or educational purposes were not available to them. Most preceptors (74%) used PC-compatible computers running some version of Windows, while the remaining preceptors (26%) used Macintosh computers. We found no significant differences by age of respondent for type of computer used (p = .38). Approximately 88% of preceptors reported that their primary computer for clinical- or education-related computer applications was located at their office, with 12% reporting that home was the location for their primary computer. Because our interest was in office computer use, where students would have access, we restricted further analyses to those reporting clinically available computer use.

The community preceptors ranked key applications in order of importance to their daily work (see Table 1). E-mail and the Internet were the two most important applications and other software and the medical school's Web site were least important. There were differences by age in the importance respondents assigned to word processing applications (middle-aged physicians ranked this application higher than older and younger physicians, p = .05), and the medical school's Web site, where a great deal of curricular information is available (younger physicians ranked this

Table 2

Percentage of Community-Based Preceptors Reporting Availability and Routine Use of Clinical/Educational Computer Applications (by Preceptor's Age), Dartmouth Medical School, 2001*

Computer Application	All Ages (n = 119)	Preceptor's Age				p Value†
		<40 (n = 17)	40–49 (n = 51)	50–59 (n = 39)	≥60 (n = 16)	
Used						
Medline—abstracts (OVID)	41	59	40	36	40	.44
Medline—full-text articles	29	47	29	21	27	.12
Medline—evidence-based medicine tools	21	24	22	18	20	.63
Online text—MD Consult	20	29	22	15	13	.55
Affiliate/clinical information systems‡	35	41	34	39	20	.37
WWW/Internet	98	94	98	97	100	.71
E-mail	59	65	62	59	40	.44
Available but not used						
Medline—abstracts (OVID)	31	29	33	39	60	.09
Medline—full-text articles	36	35	31	49	20	.16
Medline—evidence-based medicine tools	42	65	36	51	13	.01
Online text—MD Consult	41	41	40	51	20	.21
Affiliate/clinical information systems‡	24	35	26	23	6	.07
WWW/Internet	2	6	0	3	0	.32
E-mail	15	18	12	21	60	.52

*Routine defined as at least once per week; applications NOT available constitute the remaining % to reach 100% for each application.

†For age–category comparisons.

‡Provides community physicians with access to clinical records of patients they refer to Dartmouth-Hitchcock Medical Center physicians.

higher in importance with the priority ranking decreasing with age across all age groups, $p = .03$).

There was a diverse range (20% to 98%) in preceptors' routine use (defined as at least once per week) of the clinical practice applications we asked about in our survey (see Table 2). The Internet, in general, was used most frequently (98%) and MD Consult and Medline-EBM were used least often (20% and 21%, respectively). We found no differences by age in routine use of any of these software applications. Table 2 also contains results for applications that preceptors knew were available to them but did not use. Again, we found a range in responses (2% for the Internet to 42% for Medline-EBM). For one factor, software availability without use for Medline-EBM, responses differed by age (65% of preceptors <40 reported availability without use compared with 13% of preceptors ≥60, $p = .01$). Routine use of e-mail was about 20% lower in older preceptors compared with all other age groups of preceptors, though this difference was not significant ($p = .44$).

We asked the preceptors for the primary reason they did not use their computer more frequently for clinical or educational purposes (see Table 3). The most frequent responses were not having time (45%) or other reasons (40%) (e.g., the computer's distance from where patients are seen or that the computer is too slow to be effective). Age did not affect these responses ($p = .23$).

Table 4 shows the frequency of using different computer applications per week for patient-care decisions, patients' education, medical students' and residents' education, and other clinical or research interests. Results revealed that e-mail was used more frequently than other applications in most of these areas, and this did not differ by age. In general, we found no differences by age in the use of other applications in these areas, with most applications being used one to two times per week or less, including for students' and residents' education. However, older preceptors were four times more likely to use the Internet for students' and residents' education ($p = .02$) and were at least twice as likely to use full-text Medline articles for patient-care decisions ($p = .05$) compared with younger preceptors.

We asked about the types of e-mail applications our respondents used, mainly because access to Blitzmail (Dartmouth's e-mail program) has education and communication implications for the institution. Most preceptors used Blitzmail (59%), followed by Outlook Express (26%) and Netscape (10%). Three preceptors used Eudora or America Online. We noted no differences by

Table 3

Percentage of Community-Based Preceptors' Reporting Reasons for Not Using a Computer (by Preceptor's Age), Dartmouth Medical School, 2001*

Reason	All Ages (n = 119)	Preceptor's Age <40 (n = 17)	40–49 (n = 51)	50–59 (n = 39)	≥60 (n = 16)
No time	45	71	44	32	71
No interest	8	0	3	18	0
Don't understand it	8	14	8	7	0
Other†	40	14	44	43	29

*p = .23 for comparisons across age for any reason.

†For example, computer too far away, computer too slow.

age for type of e-mail program used (p = .56). We found that 74% of preceptors did not know what their browser program was (12% used Netscape and 14% used Internet Explorer). No statistical differences were noted by preceptor age (p = .23).

About what preceptors do when they have hardware or software problems (see Table 5), we learned that most accessed a local hospital or practice employee (62% for hardware, 71% for software) or used a local computer contractor (28% for hardware, 19% for software); 10% or fewer fixed problems themselves. Again, responses did not differ by age. A total of 47% of preceptors planed to upgrade their current computers within the next two years.

Discussion

Our study of computer connectivity and use among regional community-based preceptors revealed several interesting findings. First, many preceptors (approximately 90%) had a computer designated for clinical and educational use at the office. This finding differs from other studies. Ely and colleagues[16] determined that only 26% of family physicians in clinical practice had computers designated for clinical use in their offices. Further, each physician kept an average of 56 medical books in the office with 74% of them being up-to-date (copyright date within five years). Lacher and colleagues[15] found only 19% of physicians in their study had partial or complete clinical computer functions in their office, while noting that use was greater among preceptors who had academic appointments compared with those who did not. Community-based preceptors may believe they need to be more connected to remain up-to-date when they have taken on teaching responsibilities

Our findings, however, are more in line with those of Kalsman and colleagues,[16] who determined that 85% of health care providers had computer and Internet access in the office. It may be that the high level of computer availability we found related to our institution's providing computer hardware, software, network services, and support mid- to late 1990s. Only five preceptors were still using the initial hardware, however, which is now five to seven years old. If the provision of equipment and services had any effect, it is, perhaps, more likely that the services stimulated preceptors' interest and commitment to educational and clinical computing that may not have occurred otherwise.

Accessing Up-to-Date Information

With the ever-expanding knowledge base of medicine, it is highly unlikely that medical textbooks will provide as effective an avenue for up-to-date clinical information as will computers, considering speed of information retrieval, ease of interaction, and accuracy of information. A shift from textbooks to Internet-based resources represents a significant transition in clinical behavior with important educational implications. In theory, our findings indicate that preceptors' use of e-mail and the Internet are enough that both electronic communication between preceptors and the educational institution and access to online assignments are possible. Fitting these activities into busy clinical settings, however, may not be feasible without changing the culture of clinical and educational office operations.

We were surprised to find that routine use of the clinical computer applications, such as Medline (abstracts, full-text articles, and evidence-based medicine tools), online textbooks (MD Consult), affiliate/clinical information systems, e-mail, and Internet did not differ by age, although use ranged from 20% for online textbooks to 98% for the Internet. We found that, for the most part, our preceptors were fairly similar in their frequency of online resource use for patient-care decisions, patients' education, and students' and residents' education or for other clinical or research interests. They used most applications at least once a week. It is likely that preceptors' interest in educating future physicians extends to educating themselves. Although we have no direct evidence that this finding is typical of all primary care physicians, at least one other study of Internet use by academic-affiliated physicians[15] suggests it may be.

Table 4

Mean (Standard Deviation) Frequency Scores for Clinical/Educational Computer Application Use per Week (by Preceptor's Age), Dartmouth Medical School, 2001

Computer Application and Purpose	All Ages (n = 1999)	Preceptor's Age <40 (n = 17)	40–49 (n = 51)	50–59 (n = 35)	≥60 (n = 16)	p Value
Medline—abstracts (OVID)						
For patient-care decisions	1.2 (1.1)	1.7 (2.8)	1.1 (1.3)	.6 (1.1)	1.8 (1.9)	.26
For patients' education	.2 (.5)	.9 (1.6)	.4 (1.2)	.1 (.3)	0 (0)	.32
For students' or residents' education	.6 (.6)	.8 (.8)	.5 (1.2)	.4 (.8)	.5 (.7)	.83
For other clinical/research interest	.9 (.8)	1.1 (1.7)	.5 (.9)	.3 (.5)	1.0 (0)	.32
Medline—full-text articles						
For patient-care decisions	**.9 (.5)**	**.6 (.7)**	**.9 (1.3)**	**.4 (.5)**	**2.0 (.5)**	**.05**
For patients' education	.9 (.5)	.1 (.4)	.4 (1.3)	.1 (.3)	0 (0)	.61
For students' or residents' education	.9 (1.8)	.7 (.9)	.5 (1.2)	.6 (1.3)	2.7 (3.8)	.13
For other clinical/research interest	.9 (1.6)	.7 (1.6)	1.2 (1.7)	.8 (2.4)	.5 (.7)	.90
Medline—evidence-based medicine tools						
For patient-care decisions	.7 (1.5)	1.4 (3.1)	.7 (1.2)	.5 (1.1)	.5 (.7)	.54
For patients' education	.3 (.5)	.2 (.4)	.5 (1.3)	.1 (.3)	0 (0)	.63
For students' or residents' education	.7 (1.5)	1.1 (2.8)	.6 (1.3)	.5 (1.3)	.7 (.6)	.83
For other clinical/research interest	.3 (.2)	.1 (.3)	.7 (1.3)	0 (0)	0 (0)	.15
Online text—MD Consult						
For patient-care decisions	1.2 (2.3)	1.5 (3.5)	1.3 (2.3)	.5 (1.2)	1.7 (2.1)	.55
For patients' education	.6 (1.0)	1.0 (1.9)	1.1 (1.9)	1.2 (.3)	0 (0)	.27
For students' or residents' education	.5 (.9)	.5 (.8)	.6 (1.4)	.5 (1.3)	0 (0)	.95
For other clinical/research interest	.4 (.7)	.4 (.7)	.8 (1.6)	.2 (.5)	0 (0)	.44
Affiliate/clinical information systems*						
For patient-care decisions	3.9 (7.0)	6.1 (10.2)	4 (8.2)	4.3 (7.0)	.7 (.6)	.78
For patients' education	.6 (.6)	2.0 (4.0)	.6 (1.4)	.3 (.6)	0 (0)	.28
For students' or residents' education	.4 (.8)	.6 (1.1)	.5 (1.3)	.3 (.6)	0 (0)	.90
For other clinical/research interest	.9 (2.0)	.4 (.7)	.6 (1.5)	1.2 (3.6)	1.5 (2.1)	.80
WWW/Internet						
For patient-care decisions	1.6 (2.0)	.9 (1.5)	1.9 (2.3)	.9 (1.4)	2.6 (2.7)	.12
For patients' education	1.3 (1.9)	.5 (.7)	2.0 (4.2)	1.1 (1.9)	.5 (.7)	.48
For students' or residents' education	**1.3 (2.0)**	**.1 (.3)**	**1.0 (2.2)**	**.8 (1.7)**	**4.3 (3.8)**	**.02**
For other clinical/research interest	1.9 (3.3)	.6 (1.0)	2.0 (2.9)	2.0 (5.4)	2.8 (4.1)	.68
E-mail						
For patient-care decisions	6.7 (11.9)	7.0 (13.9)	6.7 (10.0)	4.2 (4.9)	11.3 (19.0)	.52
For patients' education	2.1 (4.9)	2.7 (7.8)	1.0 (1.6)	1.7 (3.0)	5.0 (7.1)	.49
For students' or residents' education	.9 (2.4)	0.4 (1.0)	1.2 (2.3)	1.5 (2.8)	2.5 (3.5)	.57
For other clinical/research interest	3.3 (2.4)	1.4 (3.2)	1.9 (3.0)	5.7 (21.3)	4.0 (1)	.73

*Provides community physicians with access to clinical records of patients they refer to Dartmouth-Hitchcock Medical Center physicians.

Computer Use and Preceptors' Age

We were surprised to find that preceptors in our oldest group differed from their younger colleagues in using more rather than less online resources. For example, we found that older preceptors were more likely to use the Internet as part of their work as educators with medical students and residents and to use full-text articles when making patient-care decisions. Our findings differ

Table 5

Percentage of Preceptors Responding Use of a Method of Fixing Hardware and Software Problems (by Preceptor Age), Dartmouth Medical School, 2001*

Repair Type	All Age (n = 119)	Preceptor's Age <40 (n = 17)	40–49 (n = 51)	50–59 (n = 35)	≥60 (n = 16)
Hardware					
Fix self	9	9	11	7	9
Return to vendor	1	0	0	3	0
Hospital/practice employee	62	64	59	66	64
Local computer contractor (Code 5)	28	27	30	24	27
Software					
Fix self	10	8	12	10	0
Hospital/practice employee	71	75	69	72	73
Local computer contractor (Code 5)	19	17	19	17	27

*Comparisons across age for any hardware or software repair method were not significant (.96 and .93, respectively).

from Lacher and colleagues,[15] who found that 82% of internists used computers for personal or professional use and that physicians under 50 with full- or part-time academic affiliations used computerized medical applications more often than older physicians. (The 21% response rate, however, limits the generalizability of their findings.)

Four possible explanations may account for our different findings. First, older preceptors may be more interested in using the Internet for patient-care decisions because they want to model this behavior for their students and encourage them to do the same. Second, it may be that older preceptors, who are far from their own undergraduate medical education, perceive deficits in their current clinical knowledge, a perception that maybe reinforced by the presence of students. They may use the online resources to keep themselves up-to-date with what is being taught at the medical school. Third, the well-established network of community-based primary care physicians who are very active in research and educational activities being conducted at the medical school (The Dartmouth COOP Project) may have motivated physicians' involvement in computer connectivity and use.[21] Lastly, and perhaps most likely, preceptors in the older group are beginning to reduce their clinical practice and serve as mentors not only to students and residents but also to their younger colleagues who have recently joined their practice. Having smaller practices and taking on fewer administrative commitments may allow for more computing time. This last explanation would additionally contribute to the first two interpretations of our data.

Barriers to Accessing Computer-Based Information

Accessing online resources can be time-consuming, especially when using a telephone modem. Almost half of all preceptors who responded to our survey did not use their computer for clinical and educational activities because they lacked time. Another 40% cited other related logistical issues, such as the computer's location being inconvenient or the slowness of their computer's operations. Although we asked physicians technical questions about their computer equipment and Internet connections to determine speed of use and other time-related factors, more than 80% respondents left these questions blank, which limited our study of connectivity issues. The current configuration for access to online resources for students and residents is the library-based desktop computer. The usefulness of applying this configuration to community-based clinical settings is highly questionable. The design of devices for accessing online clinical and educational information must take into consideration the active practice of medicine, which may differ by setting. In some settings, wireless hand-held devices (PDAs) can be carried by the physician as they see patients. These "peripheral brains" provide easy and rapid access to the information physicians may need to call upon in dealing with unfamiliar clinical problems. In other settings, where wireless devices do not work, reconfiguring the work of office staff to support the use of online information using either desktop or laptop computers may prove beneficial. In either case, these are important areas for further investigation.

Another factor that can affect computing time is a change in network security procedures. Sometimes these changes are implemented by computer network administrators without warning or consideration for the impact on practitioners. Such a change can make consistent access to the Internet very difficult. Some interpret recent HIPPA regulations[22] to require limiting Web access in patient-care settings, and network administrators are working hard to implement this change. Because precep-

tors in the middle two age groups were more likely to report being too busy to use online resources, we suspect that they may have more local or regional administrative demands on their time and are either less likely to invest the time in using online resources or have less patience for what appears to be an unreliable resource.

When we asked our preceptors to rank their computer applications in order of importance, we found that e-mail and Internet access were most important from a clinical and educational perspective. We found age differences in two other related areas. First, preceptors in the middle two age categories ranked word processing as more important than either the youngest or oldest preceptors did. Perhaps preceptors in this age group have more administrative responsibilities that require word processing than either their younger or older colleagues. Second, we found that the medical school Web site was ranked higher in importance by younger preceptors. The medical school Web site contains all the curricular information about the medical school program. It may be that younger physicians are more interested in seeing how the work they do with students fits into the bigger academic picture.

Lastly, we learned that preceptors primarily obtain computer support locally. This finding was important to us because as an institution we struggle with the extent to which we can and should provide computer support for clinical activities, which have important educational implications. Although we deem educational features to be critical, we recognize that such support should be shared between the practice entity and the educational institution sending students to those sites, especially because this technology is changing so rapidly. As such, we have adjusted our approach to providing support by actively attempting to connect clinical teachers to existing computer support and then providing training about how best to use existing online resources for educational purposes.

Conclusions

The strengths of our study include a high response rate to a mailed survey, the diversity in age and gender, the disciplines represented, and the immediacy of active teaching by the preceptors surveyed. The study is not, however, without limitations. The data are self-reported by design, which has been associated with recall bias.[23] We believe our extensive pilot testing prior to implementation reduced the impact of either of these problems on our data collection and interpretation. Also, as mentioned, we did not ascertain information that would allow us to pursue all our questions about connectivity. The physicians in our sample were clinical teachers and, as such, may be more interested in educating themselves and others than the general pool of community-based clinicians. Thus, our results are not generalizable to computer connectivity and use among primary care physicians in general clinical practice.

In conclusion, the rates of computer access and Internet connectivity are high among community-based preceptors of all ages. Uses of specific online resources for different clinical or educational purposes varied and preceptor's age was more consistently associated with more rather than less use, which may be an indication of more available time among older compared to younger preceptors. With ongoing improvements in computer technology and medical software, academic medicine must prepare its learners for the future. An effective integrated electronic medical record (one that can relate to different clinical information systems) is almost a reality.[24] It is logical and highly likely that such an electronic medical record will involve the Internet,[25] and that this revolution will forever change the everyday practice of medicine. Are we ready?

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Appendix

Dartmouth Medical School Computer-Connectivity Survey for Community-Based Preceptors, 2001

ID:_____

Dartmouth Medical School Computer Connectivity Survey

Instructions: Please complete the survey by indicating your responses in the spaces provided. If you do not know the answer to any of the questions in Part 2 (back page), please have someone in your office complete that section. **This survey will take approximately 10 minutes to complete**

Part 1—Computer Uses

1. Indicate the number of times **per week** you use the computer application listed on the left for the following activities.

Use "0" to indicate you have but do not use that application. Use N/A to indicate you do not have it.

Computer Application	*Making a Patient Care Decision*		*Educating a Patient*		*Educating a Student or Resident*		*Accessing Information for Clinical/Research Interests*	
	Home	**Office**	**Home**	**Office**	**Home**	**Office**	**Home**	**Office**
Medline™-Abstracts *(OVID)*								
Medline™-Full Text Articles								
Medline™-EBM*								
Online Text™-MD Consult								
AIS/CIS								
WWW/Internet								
E-Mail								
Other-specify:								

*EBM = Evidence Based Medicine

2. Which computer do you consider to be your primary clinical/educational computer?
☐ Office ☐ Home

3. If you do not use any of the applications listed above, what is preventing you from using it? (Check all that apply)
☐ No time ☐ No interest ☐ Don't understand what it is for ☐ Other (specify: _____)

4. Please rank in order of importance the following computer uses for you in your practice (1 = most important; 6 = least important):
____ Word Processing ____ General Internet Access ____ Access to DHMC AIS/CIS
____ E-mail ____ Access to DMS Website ____ Other (specify: _____)

Part 2—Computer Equipment & Services You Use

Please complete this section about your primary Clinical/Educational computer (Home or Office)

5. Type of computer you use in your office for clinical or educational (non-billing) purposes:
☐ Macintosh → Model: ____ Year: ____ RAM: ____ Hard Disk Size: ____
☐ Windows → Model: ____ Year: ____ RAM: ____ Hard Disk Size: ____

APPENDIX *(Continued)*

6. Do you plan to upgrade in the future? ☐ Yes ☐ No **If yes,** when: ____

7. What Operating System do you use?
☐ Macintosh OS → Version: ____ √ here if don't know version: ____
☐ UNIX/LINUX
☐ Windows → Version: ____ √ here if don't know version: ____
☐ Don't Know

8. What Internet Browser do you use? (Check all that apply)
☐ Netscape → Version: ____ √ here if don't know version: ____
☐ Internet Explorer → Version: ____ √ here if don't know version: ____
☐ None
☐ Don't know

9. What email program do you use? (Check all that apply)
☐ Blitz ☐ Eudora ☐ Netscape ☐ Outlook Express ☐ Other (specify): ____

10. How do you gain access to the Internet? (Check all that apply)
☐ Telephone dialup connection via: ☐ Internet Service Provider (specify provider: ____)
☐ America Online
☐ Direct dialup to Dartmouth College or DHMC
☐ High speed connection via: ☐ Cable modem from home (specify provider: ____)
☐ Network connection available at work

11. If you use a modem connection, is it a local call? ☐ Yes ☐ No

12. Is your computer currently operational? ☐ Yes ☐ No

12a. **If no** how long have you been without it? ____ months

13. When something goes wrong with your computer **hardware** do you:
☐ Fix it yourself ☐ Send it to a computer store for repair
☐ Access other local computer support services (specify where: ____)

14. If your computer is not operating, what is preventing you from repairing it? (Check all that apply)
☐ No time ☐ No interest ☐ No practice funds available ☐ Other (specify: ____)

15. When something goes wrong with your computer **software** (including network/Internet connections) do you:
☐ Fix it yourself ☐ Send it to a computer store for repair
☐ Access other local computer support services (specify where: ____)