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Original Article

Information Technologies: When Will They Make It Into Physicians' Black Bags?

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Abstract and Introduction

Abstract

Context: Physicians in the United States are only slowly adopting information technology (IT) tools, despite studies demonstrating their clinical benefits. More is known about IT use within institutional settings than by individual physicians.
Objectives: This study investigates physicians' current use of, future plans for, and perceived barriers to adopting electronic medical records (EMRs), computerized prescribing and order entry, clinical decision support systems, and electronic communication (email) with other physicians and with patients.
Design: Self-administered mail surveys were completed between March and May 2003 among a national random sample of physicians involved in direct patient care of adults. A total of 1837 surveys were returned for a response rate of 52.8%.
Results: Physicians most commonly use IT for billing. For clinical management, the most common tool is computerized access to laboratory results (59%). Other tools are less prevalent: Twenty-seven percent of respondents use EMRs routinely or occasionally; 27% prescribe or order tests electronically; and 12% receive electronic alerts about potential drug-prescribing problems. Only 24% of surveyed physicians practice in a "high-tech" office setting. Physicians in groups of 50 or more are significantly more likely to use any IT tools and to practice in a high-tech office, as compared with physicians in solo practice (odds ratio = 7.7). The top 3 barriers to adoption of IT are start-up costs (56%), lack of uniform standards (44%), and lack of time (39%).
Conclusion: Most physicians do not use EMRs and related technologies. Adoption is uneven, and a technologic divide exists between physicians depending on their practice environment and mode of compensation. Cost remains the most important barrier to adoption. Attention needs to be focused on policies and business models that will make IT tools accessible and affordable to all physicians.

Introduction

The diffusion of information technology (IT) in healthcare has been modest, at best.[1-3] Few healthcare organizations use electronic medical records (EMRs), although they have become a highly sophisticated and powerful tool since the first rudimentary ones were trialed nearly 30 years ago.[4-7] The situation is similar for related technologies, such as clinical decision support systems (CDSSs) and computerized prescribing and order entry. Perhaps 90% to 96% of physicians make personal use of the Internet, yet less than 20% of physicians in office-based practices may use EMRs.[3,8,9]

IT can, however, improve healthcare's efficiency and quality.[10-14] Computerized drug order entry reduces costly and dangerous medication prescribing errors.[12, 15-17] The benefits of CDSSs in preventive care[14,18] and management of chronic diseases[10,19] have also been documented. However, there is little published information about their actual or possible adoption by US physicians, and about the factors that may affect physicians' resistance or ability to adopt such tools. Financial and cultural factors are likely to play a role in physicians' attitudes and behaviors. Adopting various technologies requires an investment of resources for the tools themselves and time to learn how to use and then maintain these systems, which for clinicians translates in time away from direct patient care. Practice settings and mode of compensation could affect the degree to which physicians are willing or able to invest and adopt IT in their practices.[20] Cultural issues may also affect their readiness to change.[21] For example, compared with physicians who choose the independence of solo practice, those who practice in larger groups or institutional settings could be more likely to respond favorably to peer recommendations and to adopt practices similar to others in the group, thus becoming part of an early majority or even late majority of adopters, as opposed to lagging behind.[22] The purpose of this study is to gain a better understanding of the extent to which physicians are using IT in their daily practices. We also explore the factors that are associated with physicians' use and attitudes toward IT.

Methods

Our data were obtained from the 2003 Commonwealth Fund National Survey of Physicians and Quality of Care. Between March and May 2003, the self-administered questionnaire was mailed to 3598 US physicians, randomly selected from an American Medical Association (AMA) list; the list included AMA members and nonmembers. All physicians in the sample were involved in direct care of adults and had been in practice at least 3 years post residency. Specialists unlikely to be involved in patient care long term (eg, radiologists, anesthesiologists, pathologists, and dermatologists) were excluded. Data were weighted by sex, age, and practice setting. Physicians were given the option of completing the survey via mail or via the Internet.

Study variables included physician demographics, practice size, mode of compensation, use of a number of different IT tools, and barriers to adoption of IT in clinical practice. Demographic variables included sex, age, and type of physician (primary care provider or specialist). Practice size was defined as solo, small (2-9 physicians), medium (10-49 physicians), or large (50 or more physicians). Mode of compensation was defined as salaried or not salaried.

Physicians were asked whether they routinely or occasionally used the following IT tools, and if they did not currently use them, whether or not they planned to use them within the next year: electronic billing; electronic access to information, such as patients' test results; electronic access to medical records; electronic ordering of drugs, tests, or procedures; alerts about potential drug-prescribing problems; alerts about abnormal test results needing special follow-up care; electronically generated reminder notices; CDSSs; electronic communication (ie, email) with other physicians; and electronic communication with patients. We also created a variable that describes a "high-tech" office, that is, one in which physicians say they use routinely or occasionally at least 4 of the following tools:

1. EMRs;
2. Electronic ordering of tests/procedures/drugs;
3. Electronic access to test results;
4. Electronic decision support;
5. Email to patients;
6. Email to physicians;
7. Currently uses electronic reminders;
8. Currently uses electronic alerts about drug prescriptions; and/or

9. Electronic alerts when special follow-up care is needed.

Physicians were asked to rate 6 factors as major or minor barriers to personal use of IT: start-up costs (investment in new equipment and training); lack of uniform local, regional, and national system standards; lack of time to acquire, become competent in, and use new technologies; maintenance costs; lack of convincing evidence about IT effectiveness; and lack of knowledge or training in use of IT.

Data Analysis

We describe physicians' professional use of IT and examine barriers to adopting these technologies. Next, we examine how IT use varies by physician and practice characteristics, and report chi-square tests with the .05 level as a cutoff for significant differences. Finally, we use logistic regression to model the use and adoption of IT as functions of practice size and mode of compensation. We report adjusted odds ratios (ORs), which control for practice size and salaried status. Statistical analyses, conducted with STATA version 7.0 (Stata Corp, College Station, Texas), adjusted the estimates and standard errors for the stratified sampling and differential weighting.

Results

A total of 1837 surveys were returned, with a response rate of 52.8% (calculated with the Response Rate #1 definition of the American Association for Public Opinion Research).[23] The majority of physicians completed the survey by mail (91%); 9% completed it online. There were no differences between respondents and nonrespondents according to sex, age, solo vs other practice size, specialty, or years in practice.

Physician and Practice Characteristics

The characteristics of the respondents and their practices are shown in Table 1. The majority are men and under 54 years of age. The most common practice type is a small group (41%) and the least common is a large group (12%). Overall, 41% of the respondents are salaried; however, 72% of physicians in large practices are salaried compared with only 16% of solo-practice physicians (data not shown, *P* < .05). The majority (71%) of respondents are specialists.

Use of IT in Clinical Practice

Over three fourths of the respondents use electronic billing routinely or occasionally. Far fewer make use of IT to improve practice efficiency and quality or to communicate with other physicians or patients (Table 1). Fifty-nine percent of the respondents report electronic access to patients' test results either routinely (37%) or occasionally (21%) (Table 2). About one fourth (27%) of physicians use an EMR routinely or occasionally. One fourth (27%) order tests, procedures, or drugs electronically, but only 17% routinely. Although 38% of physicians receive alerts about drug-prescribing problems, only 12% of these say that the alerts are electronically generated. The numbers are similar for abnormal test results that require special follow-up. Fifty-four percent of the respondents send reminders to their patients regarding routine preventive care, but only 21% have automated the process. One fourth of physicians use electronic CDSSs, but the majority only occasionally.

Routine or occasional use of an EMR is most often (90% of respondents) coupled to electronic access of laboratory results, but less so to other technologies: 55% to electronic ordering, 40% to CDSSs, 30% to alerts about drug-prescribing problems, and 30% to electronic patient reminders

(data not shown). Using the definition described in the methods section, 24% of physicians practice in a high-tech office setting (Table 1).

Twenty-eight percent of physicians use email at least occasionally to communicate with other doctors (Table 2); only 7% use email routinely for this purpose. Eighteen percent of physicians communicate with patients at least occasionally via email, but only 3% communicate this way routinely.

Factors Affecting Use of IT

The results in Table 1 show a consistent pattern that applies to every type of technology that was included in the study -- IT is used by a significantly greater percentage of physicians in large-group practices and salaried physicians. Physicians' sex and age are not significant differentiating factors. Practice size appears to be the predominant factor affecting use of IT. Eighty-seven percent of large-group practice physicians have access to test results electronically compared with 36% of solo-practice physicians ($P < .05$), and 57% of physicians in groups greater than 50 use an EMR routinely or occasionally, whereas 13% of solo physicians do ($P < .05$). Among solo physicians, 6% receive electronic drug alerts; more than 4 times that number (27%) of physicians in groups larger than 50 do ($P < .05$). Physicians in large groups are also more likely to use email to communicate with colleagues and patients, as compared with physicians in smaller or solo practice. Only 17% of solo physicians communicate with other doctors via email vs 61% of those who practice in groups larger than 50 ($P < .05$, Table 1). Thirty-three percent of physicians in groups larger than 50 use email to communicate with patients, as compared with 16% of those in solo practice ($P < .05$, Table 1). Only 12% of solo physicians practice in a high-tech office, as compared with 56% of physicians in large group settings of 50 or more ($P < .001$).

Mode of compensation (salary or nonsalary) also significantly affects use of IT. For example, 69% of salaried physicians have electronic access to test results, as compared with about a half of nonsalaried physicians (51%, $P < .05$). Thirty-five percent of salaried physicians use an EMR compared with 21% of nonsalaried physicians ($P < .05$), and twice the number of salaried than nonsalaried physicians use email to communicate with other doctors (39% vs 20%, $P < .05$, Table 1). Thirty-four percent of salaried physicians are high-tech compared with 17% of nonsalaried physicians ($P < .001$).

Specialists are significantly more likely than primary care physicians to use electronic patient reminders (24% vs 14%, $P < .05$) and to communicate with other doctors with email (30% vs 22%, $P < .05$).

In multivariate analyses, practice size and mode of compensation were the only 2 variables that remained significant predictors of use of IT (Table 3). After controlling for salary status, physicians in groups larger than 50 were significantly more likely to be users of IT than solo-practice physicians, and that pattern was consistent regardless of the type of technology. The odds of practicing in a high-tech office were nearly 8 times greater for physicians practicing in groups larger than 50 than for solo physicians (Table 3). Salaried physicians were also more likely than nonsalaried physicians to use an EMR (adjusted odds ratio [OR] = 1.44, $P < .01$). Salaried physicians were also more likely than nonsalaried physicians to receive electronic drug alerts (adjusted OR = 2.03, $P < .001$) but less likely to generate patient reminders electronically (adjusted OR = .69, $P < .01$). Salaried physicians were more likely to practice in a high-tech office (adjusted OR = 1.75, $P < .001$).

Diffusion of IT Into Clinical Practice

We asked physicians whether they planned to adopt any new IT within the next year (Table 2).

After billing, the most widely adopted clinical IT tool is electronic access to patient test results. Fifty-nine percent of respondents have computer access to such results and 14% plan to have it within the next year.

Twenty percent of respondents say that they plan to begin using EMRs within the next year, which would bring the total to nearly 50%; a similar pattern applies to computerized test ordering and prescribing. Twice as many physicians in large groups as solo practitioners plan to adopt EMRs within the next year (22% vs 13%, $P < .01$). Twenty-two percent of physicians in large groups do not plan to adopt EMRs compared with 73% of solo practitioners ($P < .05$).
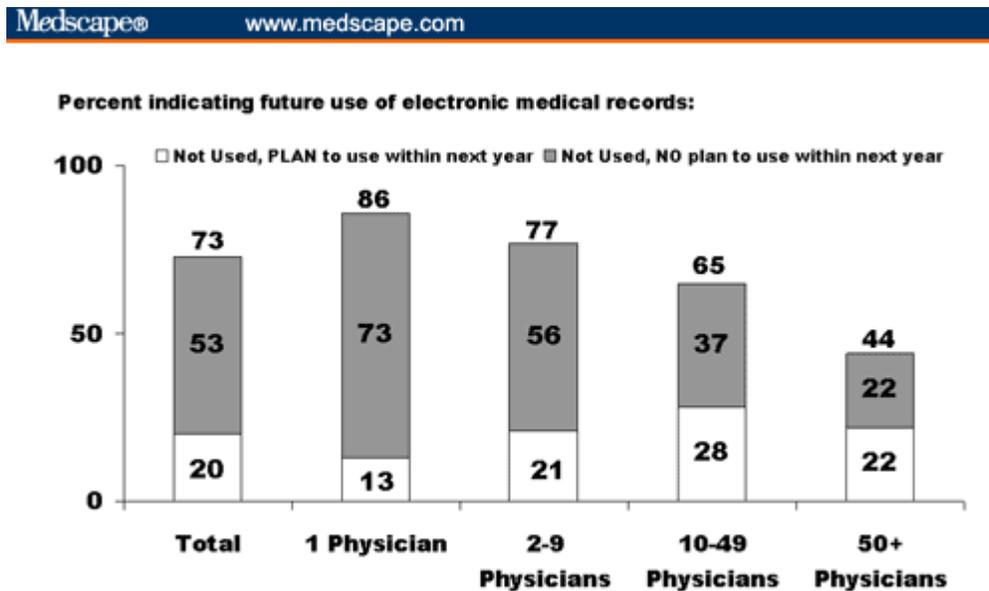
Source: The 2003 Commonwealth Fund National Survey of Physicians and Quality of Care

Figure. Diffusion of electronic medical records into medical practice by practice size.

Use of CDSSs, patient reminders, and alert systems can be predicted to grow more slowly. For instance, 58% of physicians do not plan to adopt CDSSs within the next year. Including current users and those planning to adopt, 64% will have implemented systems for patient reminders (either electronic or manual), and 54% plan to implement systems to receive automatic prompts about potential drug-prescribing problems or abnormal test results.

The use of email between physicians is likely to grow faster than between physicians and patients. Only about 11% of respondents who do not currently use email to communicate with their patients expect to do so within the next year.

Perceived Barriers to Adoption

The top 3 reported barriers to IT adoption are cost of system start-up and maintenance; lack of local, regional, and national standards; and lack of time to consider acquiring, implementing, and using a new system (Table 4). Practice size was the only factor that significantly affected the degree of importance of each barrier. For example, 62% of physicians in solo practice and 59% of those in small groups say that start-up costs are a major barrier compared with 43% of physicians in large groups. Solo- and small-group-practice physicians are also more skeptical about the effectiveness of such technologies than are physicians in large groups. Forty percent of solo-practice physicians and 24% of physicians in small groups say that lack of scientific evidence is a concern compared with 11% of physicians in large groups. Physicians in solo practice are more likely (30%) than physicians

in other practice types (15% to 19%) to cite privacy concerns as a barrier to adoption of new IT ([Table 4](#)).

Comment

The use of IT in medical practices is growing, but slowly. In this survey, only one fourth of physicians were found to practice in a high-tech office setting, with a significant technologic divide between physicians who practice in large groups vs small or solo settings, and between salaried and nonsalaried physicians. Electronic billing is the only routinely used IT application, despite reported benefits for others. Users of EMRs have reported more efficient clinical operations, attributable to better accessibility and organization of information.[8,11,24,25] Electronic access to diagnostic test information allows results to be viewed earlier, facilitates more timely intervention, decreases the ordering of unnecessary tests by 10% to 15%,[13] and decreases the amount of time spent charting. Use of the EMR increases billing revenue as a result of more complete capture of services, more accurate coding,[25] and more timely collection of payments. Less of a need for transcription, data entry, reception, and management of medical records reduces physicians' office operating costs.[25]

Patient reminders have been shown to improve care,[14] but their use has not diffused broadly into medical practice. More than half of the physicians surveyed generate patient reminders, but only 21% have automated the process. Decision support tools have also been shown to improve clinical practice and patient outcomes. (In 65 studies assessed by Hunt and coworkers,[10] 43% or 66% reported beneficial effects of CDSSs on physician performance.) However, less than one fourth of surveyed physicians say that they use a CDSS routinely or even occasionally. In a small study of EMR use, Miller and Sim[25] found that almost all users who reported improved clinical effectiveness did so because of better access to clinical information.

The most significant barrier to use of IT systems by US physicians is their cost, and the financial barriers are greatest for solo and small-group practices. The initial costs of acquiring EMR capability have been estimated at $15,000 to $50,000 per physician (ongoing maintenance costs less). This estimate excludes the cost of decreased productivity early in an implementation plan.[25] Miller and Sim[25] found that IT could have financial benefits, but they varied by practice from no gains to more than $20,000 per year.

Of note, in addition to issues of resources (costs and time), each of the factors that could affect IT use, such as privacy concerns and lack of scientific evidence, was reported as a barrier to adoption by a significantly higher percentage of solo-practice physicians. Historically, physicians have been shown to be skeptical toward innovations that change the way they practice.[26] These findings suggest that in the case of clinical IT, the barriers to entry for solo physicians are higher than they are for physicians who practice in larger groups. Solo physicians may thus be using stricter criteria before they adopt IT than those in more "organized" settings. The policy implications are important, because solo and small-group practices are the settings in which 75% of US physicians provide their care.

It is unlikely that a robust IT infrastructure will be established in the healthcare system of the United States without some type of federal leadership.[27] Possibilities are federal grants, annexes to the Medicare diagnosis-related group physician reimbursement, and revolving loans (which have been particularly successful in transportation and environmental protection).[3,28] In both the United Kingdom and Sweden, physicians who invest in EMRs receive government subsidies (so that now 58% of physicians in the United Kingdom and 90% of physicians in Sweden use them).[29]

Also, it is unlikely that further diffusion of IT will occur without standardization. It is encouraging, however, that in March 2003, 20 federal agencies (including the US Department of Health and Human Services, US Department of Defense, and US Department of Veterans Affairs) agreed to

adopt Health Information Exchange Standards as part of the Health Informatics Initiative, whose goal is to improve healthcare by strengthening the information base for decision making and action.[30] The implementation of local or regional standards with "community-based interconnectivity" models is under way; these may also significantly decrease the cost of investment and make it feasible for individual or small groups of physicians to acquire these technologies.[31]

Physicians believe that they cannot afford the necessary time to learn how to use new IT. This is not surprising, given that according to the physicians surveyed, productivity is the number 1 criterion used to determine physician compensation (data not shown). Ultimately, payment policies will need to reflect the impact on quality that results from the use of IT tools.

There are limitations to our study. Although the response rate was 52.8%, it is difficult to know whether nonrespondents were more or less likely than respondents to be users of IT. We did not find any basic demographic differences between respondents and nonrespondents (age, sex, practice size, and years in practice).

But given that the survey was self-reported, it is more likely that respondents overreported (vs underreported) IT use, given the social desirability bias inherent in the nature of the questions. It is also interesting to note that only 9% of physicians selected the electronic route to answer the survey, another fact substantiating physicians' reluctance to make use of technology in their daily work routines. This may have produced biased results in the other direction (ie, respondents may be representative of physicians less technologically inclined).

Our survey confirms that clinical IT use is at the early adoption stage, and the predominant focus is operational (ie, billing). However, as barriers to implementation decrease along with increased pressure to improve efficiency and quality, more and more physicians will incorporate IT into their practices. The EMR and CDSSs will, like the stethoscope, finally make it into all physicians' black bags.

Tables

Table 1. Current Use of Information Technologies in Clinical Practice, According to Selected Characteristics of US Physicians, 2003

Characteristics of Physicians	Total (N = 1837)	Electronic Billing* (N = 1837)	Electronic Access to Test Results* (N = 1837)	EMRs* (N = 1837)	Electronic Ordering* (N = 1837)	Electronic Drug Alerts[†] (N = 1837)	Electronic Follow-Up Alerts[†] (N = 1837)
Total	100%	79%	59%	27%	27%	12%	10%
Sex							
Men	77	80[‡]	59	27	27	13	10
Women	23	74	58	25	25	12	11
Age							
Under 45	32	83[‡]	61[‡]	28	29	12	11
45-54	35	82	61	28	25	13	9
55-64	22	78	54	23	26	10	9
65 or older	12	62	51	26	26	14	12

Practice size							
1 physician	27	68‡	36‡	13‡	14‡	6‡	5‡
2-9 physicians	41	85	61	23	25	10	9
10-49 physicians	17	84	66	35	37	17	11
50+ physicians	12	77	87	57	46	27	21
Salary status							
Salaried	41	77	69‡	35‡	35‡	19‡	14‡
Not salaried	56	81	51	21	20	8	8
Physician type							
PCP	29	79	56	23‡	26	16‡	8
Specialist	71	79	59	28	27	11	11

EMRs = electronic medical records; PCP = primary care provider

Those responding "yes, used routinely" or "yes, used occasionally" vs "no, not used, plan to use in next year" or "no, not used, no plan to use in next year"

†*Those responding "yes, using a computerized system" vs "yes, using a manual system" or "no, not used, plan to use in next year" or "no, not used, no plan to use in next year"*

‡*Significant difference between groups at a 95% confidence level*

Table 1b. Current Use of Information Technologies in Clinical Practice, According to Selected Characteristics of US Physicians, 2003 (Continued)

Characteristics of Physicians	Total (N = 1837)	Electronic Reminders* (N = 1837)	Clinical Decision Support† (N = 1837)	Email With Other Doctors† (N = 1837)	Email With Patient† (N = 1837)	Hi-Tech Office‡ (N = 1837)
Total	100%	21%	24%	28%	18%	24%
Sex						
Men	77	22	24	27	18	25
Women	23	18	25	29	17	22
Age						
Under 45	32	19	26	28	17	25
45-54	35	23	23	27	19	21
55-64	22	23	23	28	18	24
65 or older	12	17	27	27	15	26
Practice size						
1 physician	27	13§	19§	17§	16§	12§
2-9 physicians	41	22	21	21	13	18

10-49 physicians	17	23	29	35	19	35
50+ physicians	12	31	40	61	33	56
Salary status						
Salaried	41	20	32§	39§	21§	34§
Not salaried	56	22	19	20	15	17
Physician type						
PCP	29	14§	28	22§	16	22
Specialist	71	24	23	30	18	25

EMRs = electronic medical records; PCP = primary care provider
*Those responding "yes, used routinely" or "yes, used occasionally" vs. "no, not used, plan to use in next year" or "no, not used, no plan to use in next year"
†Those responding "yes, using a computerized system" vs. "yes, using a manual system" or "no, not used, plan to use in next year" or "no, not used, no plan to use in next year"
‡Physician offices that have adopted at least 4 of the 9 following information technology tools -- routine or occasional use of:

1. *EMRs;*
2. *Electronic ordering of test/procedures/drugs;*
3. *Access to electronic test results;*
4. *Electronic decision support systems;*
5. *Electronic communication with other physicians'*
6. *Electronic communication with patients; and*
7. *Currently has an electronic system for patient reminders, alerts about potential drug interactions, and/or alerts when special follow-up care is needed.*

Source: The 2003 Commonwealth Fund National Survey of Physicians and Quality of Care
§Significant difference between groups at a 95% level of confidence

Table 2. Diffusion of Information Technologies in Clinical Practice

Physician use	Total (N = 1837)
Electronic billing	
"Used routinely"	73%
"Used occasionally"	6

"No, plan to use in next year"	6
"No, don't plan to use next year"	15
Electronic access to patients' test results	
"Used routinely"	37
"Used occasionally"	21
"No, plan to use in next year"	14
"No, don't plan to use next year"	27
Electronic patient medical records	
"Used routinely"	18
"Used occasionally"	9
"No, plan to use in next year"	20
"No, don't plan to use next year"	53
Electronic ordering	
"Used routinely"	17
"Used occasionally"	9
"No, plan to use in next year"	19
"No, don't plan to use next year"	53
Drug alerts	
"Using computerized system"	12
"Using manual system"	26
"No, plan to use in next year"	16
"No, don't plan to use next year"	44
Follow-up alerts	
"Using computerized system"	10
"Using manual system"	31
"No, plan to use in next year"	13
"No, don't plan to use next year"	43
Patient reminders	
"Using computerized system"	21
"Using manual system"	33
"No, plan to use in next year"	10
"No, don't plan to use next year"	34
Electronic clinical decision support	
"Used routinely"	6
"Used occasionally"	18

"No, plan to use in next year"	17
"No, don't plan to use next year"	58
Email with other doctors	
"Used routinely"	7
"Used occasionally"	21
"No, plan to use in next year"	12
"No, don't plan to use next year"	57

Source: The 2003 Commonwealth Fund National Survey of Physicians and Quality of Care

Table 2b. Diffusion of Information Technologies in Clinical Practice (Continued)

Physician Use	Total (*N* = 1837)
Email with patients	
"Used routinely"	3
"Used occasionally"	14
"No, plan to use in next year"	11
"No, don't plan to use next year"	71

Source: The 2003 Commonwealth Fund National Survey of Physicians and Quality of Care

Table 3. The Effects of Practice Size and Salary Status on Current Use of Information Technologies*, 2003

Practice Characteristics	Electronic Test Results[†]		Electronic Ordering[†]		EMRs[†]	
	Odds Ratio	*P* Value	Odds Ratio	*P* Value	Odds Ratio	*P* Value
Number of observations	1757		1757		1757	
Practice size						
2-9 physicians	2.58	< .001	1.90	< .001	1.78	< .001
10-49 physicians	3.22	< .001	3.24	< .001	3.14	< .001
50+ physicians	9.52	< .001	4.34	< .001	7.03	< .001
Salary status						
Salaried	1.38	.007	1.56	.001	1.44	.004

EMRs = electronic medical records
*Referent categories are as follows: 1 physician and not salaried
†Those responding "yes, used routinely" or "yes, used occasionally" vs "no, not used, plan to use in next year" or "no, no plan to use in next year"

Table 3b. The Effects of Practice Size and Salary Status on Current Use of Information Technologies*, 2003 (Continued)

Practice Characteristics	Electronic Drug Alerts†		Electronic Patient Reminders†		Clinical Decision Support‡	
	Odds Ratio	*P* Value	Odds Ratio	*P* Value	Odds Ratio	*P* Value
Number of observations	1746		1744		1751	
Practice size						
2-9 physicians	1.39	.136	2.00	< .001	.91	.53
10-49 physicians	2.46	< .001	2.29	< .001	1.39	.07
50+ physicians	4.06	< .001	3.49	< .001	2.10	< .001
Salary status						
Salaried	2.03	< .001	.69	.007	1.6	< .001

*Referent categories are as follows: 1 physician and not salaried
†Those responding "yes, using a computerized system" vs "yes, using a manual system" and "no, not used, plan to use in next year," or "no, not used, no plan to use in next year"
‡Those responding "yes, used routinely" or "yes, used occasionally" vs "no, not used, plan to use in next year" or "no, no plan to use in next year"

Table 3c. The Effects of Practice Size and Salary Status on Current Use of Information Technologies*, 2003 (Continued)

Practice Characteristics	Email to Other MDs†		Email to Patients†		Hi-Tech Office‡	
	Odds Ratio	*P* Value	Odds Ratio	*P* Value	Odds Ratio	*P* Value
Number of observations	1723		1751		1770	
Practice size						
2-9 Physicians	1.03	.851	.68	.027	1.38	.054
10-49 Physicians	2.01	< .001	1.08	.711	3.23	< .001
50+ Physicians	5.04	< .001	2.12	< .001	7.70	< .001

Salary status						
Salaried	1.96	< .001	1.37	.029	1.75	< .001

*Referent categories are as follows: 1 physician and not salaried
†Those responding "yes, used routinely" or "yes, used occasionally" vs "no, not used, plan to use in next year" or "no, no plan to use in next year"
‡Physician offices that have adopted at least 4 of the 9 following information technology tools -- routine or occasional use of:

1. Electronic medical records;
2. Electronic ordering of test/procedures/drugs;
3. Access to electronic test results;
4. Electronic decision support systems;
5. Electronic communication with other physicians;
6. Electronic communication with patients; and
7. Currently has an electronic system for patient reminders, alerts about potential drug interactions, and/or alerts when special follow-up care is needed.

Source: The 2003 Commonwealth Fund National Survey of Physicians and Quality of Care

Table 4. Major Barriers to Physician Adoption of Information Technologies by Practice Size, 2003

Barriers to Physician Adoption	Total (N = 1837)	Practice Size			
		1 Physician (N = 503)	2-9 Physicians (N = 757)	10-49 Physicians (N = 318)	50+ Physicians (N = 226)
Start-up costs*	56%	62%	59%	49%	43%
Lack of uniform standards*	44	53	45	42	33
Lack of time*	39	49	41	30	26
Maintenance costs*	37	48	38	27	25
Lack of evidence of effectiveness*	26	40	24	17	11
Privacy concerns*	21	30	17	19	15
Lack of training*	16	22	17	12	6

*Significant difference between practice size at a 95% confidence level
Source: The 2003 Commonwealth Fund National Survey of Physicians and Quality of Care

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