Computers in the Exam Room: Differences in Physician–Patient Interaction May Be Due to Physician Experience

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BACKGROUND: The use of electronic medical records can improve the technical quality of care, but requires a computer in the exam room. This could adversely affect interpersonal aspects of care, particularly when physicians are inexperienced users of exam room computers.

OBJECTIVE: To determine whether physician experience modifies the impact of exam room computers on the physician–patient interaction.

DESIGN: Cross-sectional surveys of patients and physicians.

SETTING AND PARTICIPANTS: One hundred fifty five adults seen for scheduled visits by 11 faculty internists and 12 internal medicine residents in a VA primary care clinic.

MEASUREMENTS: Physician and patient assessment of the effect of the computer on the clinical encounter.

MAIN RESULTS: Patients seeing residents, compared to those seeing faculty, were more likely to agree that the computer adversely affected the amount of time the physician spent talking to (34% vs 15%, *P*=0.01), looking at (45% vs 24%, *P*=0.02), and examining them (32% vs 13%, *P*=0.009). Moreover, they were more likely to agree that the computer made the visit feel less personal (20% vs 5%, *P*=0.017). Few patients thought the computer interfered with their relationship with their physicians (8% vs 8%). Residents were more likely than faculty to report these same adverse effects, but these differences were smaller and not statistically significant.

CONCLUSION: Patients seen by residents more often agreed that exam room computers decreased the amount of interpersonal contact. More research is needed to elucidate key tasks and behaviors that facilitate doctor–patient communication in such a setting.

BACKGROUND

Effective doctor–patient communication can influence a number of important outcomes, such as patient satisfaction, adherence with provider recommendations, resolution of concerns, pain control, and physiologic measures like blood pressure and blood sugar.[1,2] Likewise, the doctor–patient relationship has been linked with physician behaviors during visits and to improved functional health status, increased adherence to antiretroviral therapy.[3–5] Giving information and patient counseling during clinical encounters, in particular, were associated with patient satisfaction.[6] Poor doctor–patient communication, including poor delivery of information and failure to understand patient perspectives, can have litigious outcomes.[7,8] Compared to other western countries, patients in the United States often experience breakdowns in communication with physicians.[9] Communication problems among colleagues and with patients can result in medical errors.[10] Effective communication facilitated participatory decision-making and was associated with lower levels of medical errors.[11,12]

Computers and electronic medical records (EMR) have been adopted in healthcare settings in an attempt to provide efficient care and to reduce medical errors. Computerized physician order entry and clinical decision support systems have been effective in reducing medication errors.[13] While fewer than 1 in 5 practices in the United States currently use EMR in the examination room,[14] it is certain that the use of EMR will become increasingly widespread over the next several years. The Institute of Medicine has strongly argued for increased use of EMRs [15] based on considerable evidence that they will improve the technical quality of care, including provision of preventive services, monitoring of drug therapy, and adherence to evidence-based guidelines.[16–18]

The doctor–patient interaction is likely to be influenced by additional computer-related tasks and nonverbal behaviors related to further advances in information technology. Nonverbal behaviors, associated with emotional aspects of care, may influence patient adherence, satisfaction, and the doctor–patient relationship.[19,20]

Little research has addressed the impact of exam room computers on the doctor–patient interaction in primary care,[21,22] where the development of effective therapeutic relationships may be as important as whether technical measures of quality care are satisfied. It is possible that, as a physician spends more time interacting with the computer, he or she may have less time to interact effectively with the

Table 1. Key Items from Postvisit Questionnaires Completed by Physician and Patient

Patient questions	Physician questions
Because of the computer, the doctor spent *less* time *looking at* me than I liked during the visit	Because of the computer, I spent *less* time *looking at* the patient than I liked during the visit
Because of the computer, the doctor spent *less* time *talking with me* than I liked during the visit	Because of the computer, I spent *less* time *talking with* the patient than I liked during the visit
Because of the computer, the doctor spent *less* time on the *physical examination* than I liked during the visit	Because of the computer, I spent *less* time on the *physical exam* than I liked during the visit
The use of computers in the office interfered with my relationship with my doctor	The use of computers in the office interfered with my relationship with this patient
The use of the computer in the office made the visit with my doctor feel less personal	The use of the computer in the office made the visit feel *less* personal
The use of computers in the clinic has improved my relationship with my doctor	The use of computers in the clinic has improved my relationship with this patient
I am satisfied with the relationship I have with my doctor	I am satisfied with the relationship I have with this patient

Likert scale: strongly agree; agree; neutral; disagree; strongly disagree.

patient. The use of the computer might lead to a loss of eye contact, less psychosocial talk, and decreased sensitivity to patient responses due to loss of access to nonverbal communication. These effects could diminish the quality of the doctor–patient communication.

To explore these issues we compared the impact of an exam room computer on doctor–patient interactions at the New York VA Medical Center during clinic encounters with faculty physicians versus those with resident physicians. We hypothesized that the computer would interfere less with the interaction when the physician was a faculty member because faculty are likely more experienced than residents at integrating clinical and computer tasks during a visit. This paper is a secondary analysis of data collected to compare patient and physician perceptions of the quality of care of individual visits.

METHODS
Physician and Patient Recruitment

All Internal Medicine residents [32 post graduate year (PGY)-2 and PGY-3] and primary care faculty (18 internists) who were practicing at the VA New York Harbor Healthcare System Primary Care Clinic for at least 1 year were eligible to participate. Eligible physicians were recruited and enrolled if they signed an informed consent. We planned to recruit patients over a 4-month enrollment period (between March and June of 2003). All patients who had at least 2 visits with respective study physicians during the preceding 2 years were eligible. On each half-day of clinic, we created a list of eligible patients who had scheduled follow-up visits with study physicians. A research assistant asked eligible patients to participate at the time they arrived for their appointment. Both physicians and patients provided informed consent prior to participation. Participating physicians completed a baseline questionnaire at the time they agreed to participate. Immediately following a visit

with a participating patient, both enrolled physicians and their patients were given questionnaires. Physicians completed a 1-page questionnaire in their office. Patients completed a 4-page questionnaire while waiting to be checked out in the waiting room. To optimize the distribution of patients among physicians, we sought to complete data collection on at least 6 patients for each physician and stopped enrollment when each had 10. The Institutional Review Boards at New York University and VA New York Harbor Healthcare System approved the study.
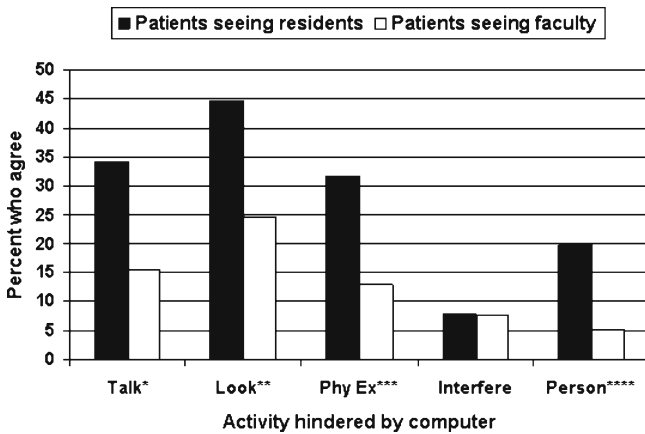
Study Questionnaires

We developed 3 questionnaires for the present study. The patient questionnaire had 32 items to determine patient demographics, visit satisfaction, quality of care, and the impact of the computer on doctor–patient interaction. We used a 5-point Likert scale (1=poor, 5=excellent) for visit satisfaction and quality-of-care items. The visit satisfaction items were taken from an instrument used in the Medical Outcomes Study to measure overall satisfaction and satisfaction with the most recent physician visit.[23] Several clinician-educators experienced with the use of computers in patient care settings reviewed the instruments for face validity. We did cognitive

Table 2. Characteristics of Study Population by Status of Physician

	Residents *n*=12	Faculty physicians *n*=11	*P* value*
Characteristics of physicians			
Age in years (mean, SD)	30.1 (2.7)	42.3 (9.7)	0.002
Gender (% male)	66.7	36.4	0.22
Years at VA (mean, SD)	2.2 (0.39)	6.0 (4.8)	0.02
Typing skills (mean, SD)	3.2 (1.1)	3.6 (0.67)	0.24
Skill with CPRS (mean, SD)	3.7 (0.89)	3.9 (0.54)	0.44
General computer skills (mean, SD)	3.2 (0.94)	3.4 (0.92)	0.62
Knowledge of EMR (mean, SD)	3.3 (0.78)	3.9 (0.54)	0.05
Medical computing skills (mean, SD)	2.9 (0.79)	3.6 (0.92)	0.06
Characteristics of patients (*N*=155)			
Patient age in years (mean, SD)	69.5 (11)	71.8 (11)	0.19
Patient race (% non-Hispanic white)	64.9	57.7	0.35
Patient gender (% male)	100	93.5	0.06
Years going to VA (%)			
1–5	32.5	29.5	
6–19	37.7	33.3	0.43
20 or more	30.0	37.2	
Number of medications (mean, SD)	7.2 (4.8)	7.0 (4.7)	0.73
Number of prior visits to this doctor (%)			
1–3	28.6	30.8	
4–5	44.2	15.4	0.001
6–10	26.0	23.1	
More than 10	1.3	30.8	
Marital status			
Single	35.5	18.4	
Married/domestic partner	32.9	40.8	0.06
Divorced/separated	23.7	23.7	
Widowed	7.9	17.1	
At least some college (%)	40.3	49.3	0.26

χ^2 test; Mantel–Haenszel χ^2 test for trend; 2-sample t test as appropriate
CPRS computerized patient record system, EMR electronic medical record.

Figure 1. Patient report of whether the computer adversely affects the doctor–patient interaction at a given clinic visit, comparing visits to resident and faculty physicians.

testing of the questionnaire with nonenrolled patients to assess feasibility.

The baseline physician questionnaire had 31 items. It assessed the demographics of the study physicians, as well as their experience with computers and EMR as pertinent to clinical care. The postvisit physician questionnaire had 13 items and assessed visit satisfaction, quality of care, and the effect of the computer on the doctor–patient interaction. They were pilot tested prior to use.

We developed 7 items that assessed the impact of the exam room computer on the doctor–patient interaction, embedded in the postvisit questionnaires. We hypothesized that, in the presence of a computer in the room, a set of verbal and nonverbal behaviors may change, depending on the experience with EMR and medical use of computers. Therefore, in developing the doctor–patient interaction assessment tool, we asked physicians and patients to give opinions on the following: the degree to which the use of the computer decreased the time physicians spent talking to, looking at, and examining the patients; to what extent the computer interfered with the doctor–patient relationship; and to what extent the physician's use of the computer made the visit feel less personal. These items used a 5-point Likert scale with the following anchors: 1=strongly disagree, 3=neutral, and 5=strongly agree. Physicians and patients were also asked to estimate the duration of the visit, and the proportion of visit time that the doctor spent interacting directly with the computer. They were told that this included time spent working with the mouse or keyboard or looking at the computer screen. The wording of each item is presented in Table 1. Medical records were reviewed following the visit to determine the number of prior visits with the same provider, number of medical illnesses, history of psychiatric disorders, and number of active prescriptions.

Statistical Analyses

We compared characteristics of resident and faculty physicians using simple χ^2 and t tests, as appropriate. We compared characteristics of patients seeing resident and faculty physicians using similar tests because there was no reason to suspect clustering by physician.

We created a dichotomous variable by collapsing the responses strongly agree, and agree to "agree" and strongly disagree, disagree, and neutral to "do not agree." We had qualitatively similar results if neutral responses were dropped or if the Likert scale was not converted to a dichotomous variable.

For our analyses of items addressing the visit, we used the physician–patient dyad as the unit of analysis. Because it was likely that there would be clustering at the physician level, we adjusted for clustering using mixed effects models.[24] We compared visits to attending and resident physicians using generalized estimating equations score tests, based on the mixed effects logistic models. We used these same models to control for potential confounders. For clarity, we present results as means and proportions, not adjusted for clustering, as is appropriate for this type of data. We report 2-sided *P* values. We considered *P* values less than 0.05 to be significant, without correction for multiple comparisons. We collected all data onto paper forms and transferred them to an Excel spreadsheet. We performed analyses using PC-SAS version 8.2.

RESULTS

Baseline Characteristics of Physicians and Patients

Eleven faculty members (61%) agreed to participate, as did 12 (PGY-2 and PGY-3) residents (38%), giving us a sample of 23 physicians for analysis. As expected, resident physicians were younger and had not been working at the VA as long as faculty physicians. Resident and faculty physicians reported generally similar computer skills, but faculty rated their knowledge of EMR and medical computing skills slightly higher than that of resident physicians. As expected in a VA population, the 155 patient participants were elderly (mean age=70.7 years old), male (97%), and on multiple medications (mean=7.1). Patients seen by the resident and faculty physicians were similar. Nearly one-third of the patients in each group had 3 or fewer visits with the same physician. As expected, patients who saw resident physicians were less likely to have long-term relationships (10 or more visits) (Table 2).
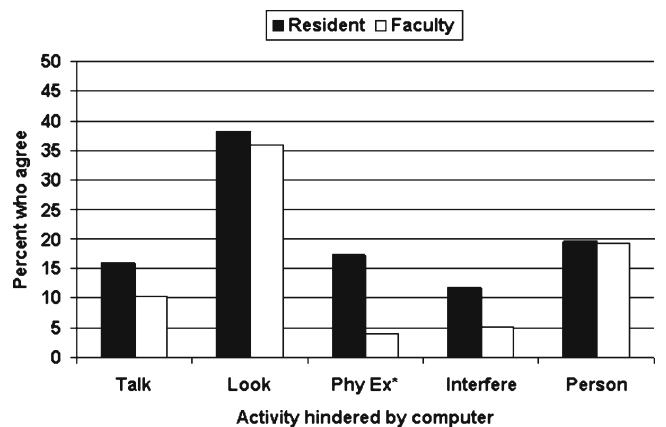
Figure 2. Physician report of whether the computer adversely affects the doctor–patient interaction at a given clinic visit, comparing visits to resident and faculty physicians.

Table 3. Comparison of Computer Use during Resident and Faculty Physician Visits as Reported by Patients

	Residents n=12	Faculty n=11	P value*
Patient report			
Visit duration in minutes (%)			
0–20	33.8	35.9	
20–30	33.8	42.3	0.28
31–40	19.5	12.8	
>40	13.0	9.0	
Proportion of visit where physician was interacting with the computer (%)			
0–10%	29.3	41.3	
11–25%	28.0	34.7	0.028
25–50%	29.3	16.0	
50–100%	13.3	8.0	
Physician report			
Visit duration in minutes (%)			
0–20	40.3	37.2	
20–30	39.0	38.5	0.45
31–40	18.2	18.0	
>40	2.6	6.4	
Proportion of visit where physician was interacting with the computer (%)			
0–10%	9.1	9.0	
11–25%	27.3	47.4	0.10
25–50%	41.6	25.6	
50–100%	22.1	18.0	

P values calculated with Mantel–Haenszel χ^2 test for trend.

Patients seeing resident physicians were less likely than patients seeing faculty to strongly agree that they were satisfied with their overall relationship with the physician (50% vs 71%, P=0.02). Moreover, patients seeing resident physicians were less likely to rate the quality of the index visit as excellent (38% vs 62%, P=0.005).

Effect of the Exam Room Computer on Doctor–Patient Interaction

Patients seeing residents, compared to those seeing faculty, were more likely to agree that the computer adversely affected the amount of time the physician spent talking to (34% vs 15%, P=0.01), looking at (45% vs 24%, P=0.02), and examining them (32% vs 13%, P=0.009). They were also more likely to agree that the computer made the visit feel less personal (20% vs 5%, P=0.017). However, very few patients (8%) thought that the computer interfered with their relationship with the physician, and this was similar for patients seeing both residents and faculty (Fig. 1).

The pattern of responses was similar when physicians rated the effect of the exam room computer on the same activities (Fig. 2). None of the differences between resident and faculty physicians were statistically significant for physician ratings, though residents tended to be more likely to report that the presence of an exam room computer led them to spend less time performing the physical exam (17% vs 4%, P=0.07).

Patients seeing faculty physicians estimated the physician spent a smaller proportion of visit time interacting with the computer than patients seeing resident physicians, although their estimates of visit duration were similar. This pattern was also seen in physician estimates, but did not achieve statistical significance (Table 3).

DISCUSSION

There are theoretical reasons to suspect both positive and negative effects of the computer on doctor–patient interaction and relationship. For example, more ready access to clinical data might allow the physician to devote more time to the interpersonal aspects of patient care. On the other hand, if significant time and effort is required for data entry, there may be less time for those same aspects of patient care. Experience with computers and EMR may significantly impact interpersonal aspects of care. In a VA setting where the computer is an essential part of nearly every doctor–patient interaction, we found that patients seeing trainees were much more likely to report potentially negative effects of computers on the clinical interaction compared with patients seeing faculty physicians. In addition, 8% of patients seen by faculty and resident physicians agreed that the exam room computer interfered with their relationship with the doctor.

Our data, and a review of the literature, permit no definitive conclusions about whether computers have a negative effect on the doctor–patient interaction overall. Makoul and colleagues found that the use of an exam room computer was associated with a more active (better) role in encouraging questions and clarifying information, but less attention to outlining the patient's agenda and exploring psychosocial issues.[25] Work by Frankel and colleagues suggests a similar tension. In their qualitative study of videotaped encounters, the computer seemed to amplify both poor and good organizational and behavioral skills (both verbal and nonverbal).[22] Interestingly, they found that facility with the use of the computer and optimizing location of the computer could facilitate communication, suggesting a mechanism for our observation of a more favorable effect of the computer for more experienced users.[22] Although other studies have reached more positive [26–31] or negative [32–34] conclusions about the effect of computers on communication, methodological differences preclude direct comparisons with our findings.[21]

Prior research about residents' use of computers focused on physician acceptance, which typically was dominated by usability concerns. A 1995 Canadian study found that first-year family medicine residents had limited computer knowledge and skills.[35] In a 2001 study, residents recognized the benefits of computers and EMR in outpatient clinics, but showed ambivalence and frustration toward using EMR.[36] Embi and colleagues found that both faculty and resident physicians in a VA setting felt that EMR could negatively affect communication and patient care.[37] Our study, which assessed actual patient perceptions, confirms that suspicion, and suggests that residents may be more at risk for these negative effects. In the same vein, we found residents were less satisfied than faculty with visit quality and their relationship with patients and perceived that they spent more visit time directly interacting with the computer. One possible explanation is facility with the software. Although resident physicians reported as much general computer knowledge as faculty, they had less familiarity with the use of EMR. Although it is likely that both residents and faculty have limited formal training in exam room computing, experience may be able to compensate for the lack of training.

Our study has several limitations. Most importantly, the fact that exam room computing competence was the independent variable of interest, we did not measure this directly. Rather, we

relied on comparison of resident versus faculty status. Because the patients of faculty physicians tended to rate their overall care more highly than those seeing residents, the association of physician experience with the effect of the computer may represent a halo effect in which patients rate faculty physicians more favorably in all areas, including use of the computer. Arguing against this conclusion is the fact that factor analyses statistically confirmed that the patients' answers to the computer questions and their ratings of quality and general satisfaction loaded on distinct factors.

Additionally, controlling for patient-rated quality of care or satisfaction in multivariable analyses did not attenuate the relationship between resident status and patient reports of negative effects of the computer. Finally, we note that faculty rated their knowledge of EMR and their medical computing skills more highly than residents, even though residents and faculty gave similar ratings to their own general computer skills. This supports our theoretical assumption that faculty status is a reasonable surrogate for skill in using an exam room computer. We used faculty status rather than self-reported knowledge of EMR because it is less susceptible to bias. However, we did note a relationship between self-reported knowledge of the EMR and patient responses to several of the questions about negative effects of the computer on doctor–patient interaction (data not shown).

A second limitation is the possibility that our results might reflect patients' greater familiarity with faculty   physicians because of their longer time at the VA. We found, however, that years at the VA and number of previous visits were unrelated to negative patient ratings of faculty. Unfortunately, the high correlation between these variables and faculty versus resident status precluded multivariable analysis.

As the third limitation, because we studied physicians at a single site during a 4-month window, we may have discovered some deficit in the orientation of residents to the computerized record at that site. This particular clinical site has an overwhelmingly white, male, elderly patient population. However, all the residents had been using the computer for a year in the ambulatory setting and ward rotations and rated their familiarity with the software similar to the faculty. We have no reason to believe that these findings are somehow unique to the demographic group we studied, although certainly replication in other settings is warranted. Similarly, our low response rate among both faculty (61%) and residents (38%) raises the possibility that this is a biased sample. Again, we acknowledge that replication of our results in larger, more representative samples is warranted. Finally, because our data are based on surveys, we cannot comment on the behaviors that led to the differences in perception. Certainly, the observation that residents spent a greater proportion of the encounter interacting with the computer suggests that paying attention to the patient rather than the computer may be part of the effect.

Despite these limitations, we think that our study raises key issues about doctor–patient communication in the presence of a computer and has implications for communication skills training when a computer is an integral part of the primary care encounter. Future research should attempt to analyze videotaped clinical encounters of physicians and patients to determine key human- and technology-related factors that can positively or negatively influence doctor–patient interaction. Structured interviews and focus group studies of residents,

faculty physicians, and patients should also be conducted on this topic to highlight specific issues and concerns that may lead to the different perceptions of exam room computing among different groups. With this knowledge in hand, communication skills curricula can be developed and refined to include relationship building tasks and behaviors that optimize the doctor–patient relationship where a computer is actively used in the care process.

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