

21st-Century Health Care: The Effect of Computer Use by Physicians on Patient Satisfaction at a Family Medicine Clinic

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Background and Objectives: *Trust and satisfaction in the physician-patient relationship is the cornerstone of family medicine. Today, computers are playing an increasingly prominent role in the delivery of health care, yet recent data detailing their effect on the physician-patient relationship are limited. For physicians to “first do no harm,” it is critical to determine that computers used at the point of care do not decrease patient satisfaction, because this is a good proxy for the physician-patient relationship. This study assessed patients’ views of computer use and its effect on patient satisfaction in a family medicine clinic before and after implementation of an electronic environment developed by our institution.* **Methods:** *A survey was mailed to patients who had been evaluated at a family medicine clinic for hypertension, high blood pressure without hypertension, or hyperlipidemia. These diseases were selected because they are common and require strong physician-patient relationships for successful treatment. The survey assessed patients’ overall satisfaction with health care received at the clinic and their opinions about how their physician’s computer use affected their visit. This survey was compared with a survey done in 1995 at the same clinic, before adoption of the electronic environment.* **Results:** *A total of 478 patients were enrolled in the study; 304 (63.6%) of these returned surveys. A majority of the patients (74.6%) thought that the computer had an overall positive impact on the quality of care provided. There was a positive association between a physician’s computer skills, as rated by patients, and the patients’ satisfaction with the computer’s effect on the visit. There were no differences in overall satisfaction between the 1995 survey and the current survey.* **Conclusions:** *This study shows that physician competence with computers plays an important role in patient satisfaction and that computers can be integrated into the office visit without a detrimental effect on patient satisfaction. Surprisingly, patient familiarity with computers was shown to have a slight negative correlation with patient satisfaction. These findings are significant in view of research indicating that compliance, health outcomes, perception of physician competence, and malpractice suits are all related to physicians’ interpersonal skills and patient satisfaction.*

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Communication skills and information processing are the cornerstones of quality health care. Physicians spend a large portion of their time collecting, retrieving, synthesizing, and communicating information.^{1,2} Computers play a pivotal role in information management for many industries. Their ability to store, correlate, and retrieve enormous quantities of information quickly and

accurately makes them ideally suited to manage voluminous amounts of medical information. However, computers potentially alter the traditional manner that physicians use to communicate with patients.

Increasingly, the medical profession is adopting the use of computers,³ but there has been little rigorous examination of their use in the primary care setting.⁴ The use of an electronic medical record (EMR) was low among family practice residency programs during 1998, but the majority had plans to implement one.⁵ However, adoption of EMR has not been without changes in practice patterns,^{3,6,7} resulting in problems and criticism.⁵

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Computers have been shown to have a significant impact on the physician-patient communication process.⁷ Although several studies suggest that computers have no effect on patient satisfaction,⁸⁻¹³ many of these studies were performed before 1995^{8,10,12,13} or involved small sample sizes.^{12,13}

We believe that the physician-patient relationship is the cornerstone of family practice and that high patient satisfaction is a good proxy for excellent relationships. Research indicates that patient compliance, health outcomes, perception of physician competence, and malpractice suits are closely related to physicians' interpersonal skills.¹⁴ Thus, patient satisfaction with physician-patient communication is extremely important in the treatment and prevention of many common primary care diseases. In view of this, it is important to address how computers affect patient satisfaction during office visits.

Using a survey, we assessed patients' overall satisfaction, their view of the way computers are used in our practice, and the computer's effect on the physician-patient relationship. We compared patients' overall satisfaction with data from a survey done in 1995 at the same clinic, before implementation of the electronic environment.

Methods

Setting

The survey was conducted at a family medicine clinic located in a small upper-Midwestern town. The clinic draws patients from the local community and from a larger city 14 miles away. It serves as the continuity clinic for an 8-8-8 family practice residency program affiliated with a major multispecialty hospital and clinic located in the nearby city. The clinic has 24 residents, two nurse practitioners, and nine staff physicians, and there are approximately 49,000 outpatient visits per year.

The clinic has used an EMR exclusively since 1997. Progress notes (including those from subspecialty care), hospital dismissal summaries, laboratory values, and radiology reports are all available on-line. The client-server system was developed in-house and utilizes some IDX Corporation technology.

Each of 49 examining rooms in the clinic contains a computer that is used to access the EMR at the point of care. The computer is set on a desk next to the patient's chair. Physicians often refer to notes on the computer while interviewing patients. Laboratory values are demonstrated to the patients by swiveling the monitor slightly toward them. In addition, an Internet connection and Web browser make patient education materials and clinical references available. These come from various public sources, such as MayoClinic.com and MDConsult.com and from our own internal on-line library. Printers are located at each of three nurses' stations.

Sample

Overall patient satisfaction with the health care provided at the clinic was the primary outcome measured in this study. In previous satisfaction studies performed at our institution, approximately 80% of patients rated the care received as "excellent" or "very good." To have an 80% chance of detecting a change in satisfaction from 80% to 70% (based on a χ^2 test assuming a type I error of 5% and a two-sided alternative hypothesis), we needed 300 completed surveys. We assumed a response rate of at least 60%; therefore, approximately 500 surveys were mailed. On the basis of the average number of patients evaluated at our clinic who would meet the eligibility criteria, we determined that the enrollment period would need to last 4 to 8 weeks.

Patients were eligible for enrollment in the study if they were evaluated at the family medicine clinic for any of the following diagnoses: hypertension (*International Classification of Diseases, Ninth Revision* [ICD-9], 401.9), high blood pressure without hypertension (ICD-9, 796.2), or hyperlipidemia (ICD-9, 272.4). In these common primary care diagnoses, the physician-patient relationship plays a central role because lifestyle modification and compliance determine ultimate treatment success. To determine initial eligibility, we used billing records listing a diagnosis submitted by their physician or nurse practitioner.

Procedures

Generally within 2 weeks of the patients' visits, those eligible for enrollment were mailed a packet that consisted of a cover letter and a survey form with a postage-paid return envelope. The cover letter described the study and sought informed consent. Survey forms were to be returned for data entry in the postage-paid envelope. Those who had not replied within 1 month were mailed a follow-up packet that again requested their participation and supplied a second copy of the survey. Because some patients likely would be evaluated multiple times during the enrollment period, only the first visit was considered eligible for enrollment.

Questionnaire

A questionnaire was designed to assess the patients' views of the following: (1) overall satisfaction with health care, (2) effect of computers on the physician-patient relationship and patient satisfaction, and (3) patients' use of and comfort with computers.

Responses to questions were either nominal (such as yes or no) or ordinal (such as very positive, somewhat positive, no effect, somewhat negative, very negative). For comparison purposes, many questions regarding overall patient satisfaction were taken from previous studies conducted by our institution.

Each questionnaire contained a unique identifier keyed to the recipient. The cover letter seeking informed

consent explained this to patients and assured them that all responses would be kept private. Specifically, patient responses would not be relayed to the patients' individual health care providers. Uniquely identifying the questionnaires provided several benefits. First, we identified and targeted nonrespondents for a reminder mailing. Second, fewer demographic and medical history questions were needed because this information was readily available in the medical record. Third, it gave us the ability to correlate responses with clinical outcomes data in the future.

The questionnaire's readability and comprehension were checked by pretesting seven patients. Their responses were excluded from the data set. The seven patients reported that the questionnaire was easily understood, and no major changes were made. Subsequently, all materials were reviewed and approved by our departmental Research Committee, departmental Practice Committee, and the Institutional Review Board.

Data Collection and Analysis

Respondent bias was assessed by comparing the age, gender, and diagnosis distributions between respondents and nonrespondents. Differences in age were evaluated with the two-sample *t* test, and differences in gender and diagnosis were evaluated with the χ^2 test.

The responses of each survey item were summarized by frequencies and percentages. Associations between survey response items were measured by the Spearman rank correlation coefficient for items with ordinal response scales. Associations between items with nominal scales and items with ordinal responses were assessed with the Wilcoxon rank sum test. All calculated *P* values were two-sided, and *P* values less than .05 were considered statistically significant.

Results on overall satisfaction were compared with the results of a 5-year-old patient satisfaction survey that was performed while the clinic still used a paper chart.

Table 1
Comparison of Respondents and Nonrespondents by Age, Gender, and Diagnosis

	Respondents (n=304)		Nonrespondents (n=174)		P Value (two-sided)
	#	%	#	%	
Age, years					.02
Mean ± SD	64.2 ± 14.3		60.5 ± 18.1		
Gender					.21
Female	172	56.5	88	50.6	
Male	132	43.4	86	49.4	
Diagnosis					.47
Hypertension only (401.9)*	186	61.2	116	66.7	
Hypertlipidemia only (272.4)	76	25.0	36	20.7	
Both	42	13.8	22	12.6	

* Also includes high blood pressure without hypertension (796.2). Numbers in parentheses correspond to the *International Classification of Disease, Ninth Revision*.

Results

A total of 478 patients were enrolled during the study period from January 10, 2000, to February 25, 2000. Of these, 304 (63.6%) returned surveys. Table 1 compares the demographic data for respondents and nonrespondents. The only statistically significant difference between the groups was age. Older patients were more likely to return surveys (*P*=.02). This finding corresponds with our experience in previous survey research.

Satisfaction With Computer Use

Patients reported that their health care provider used a computer in the examining room during 93.4% (284) of all visits. A majority of patients thought that computer

Table 2

Effect of Computer Use on Patient Satisfaction

What effect did the computer have on the overall quality of care provided at this visit?	#	%
Very positive	149	52.5
Somewhat positive	63	22.2
No effect	59	20.8
Somewhat negative	5	1.8
Very negative	0	0
No answer	8	2.8

Table 3

Comparison of Overall Satisfaction in 1995 and 2000

How would you rate the overall care you received?	1995 Survey (n=200)		2000 Survey (n=304)	
	#	%	#	%
Excellent	91	45.5	132	43.4
Very good	70	35.0	122	40.1
Good	37	18.5	42	13.8
Fair	1	0.5	4	1.3
Poor	1	0.5	2	.7
No answer	0	0	2	.7

Figure 1

Patients' Responses to Questions Regarding the Effect of a Computer on Several Aspects of the Physician-Patient Relationship*

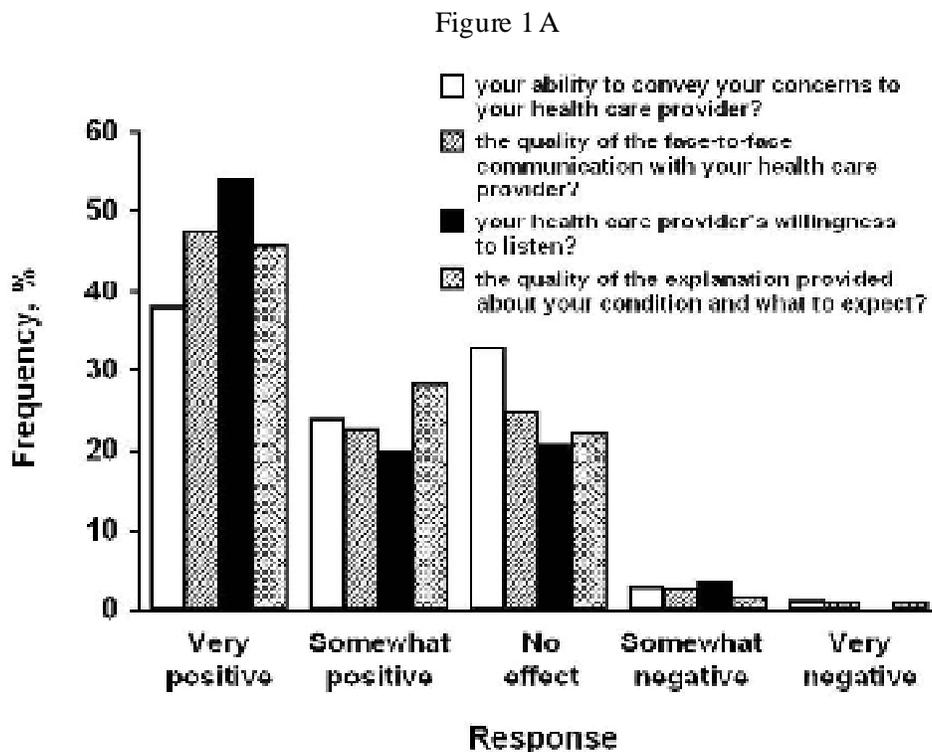
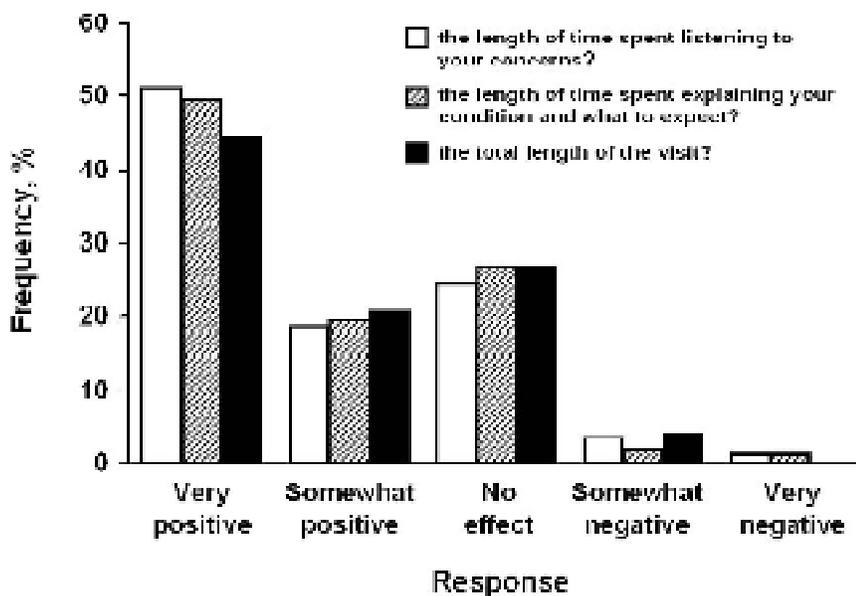


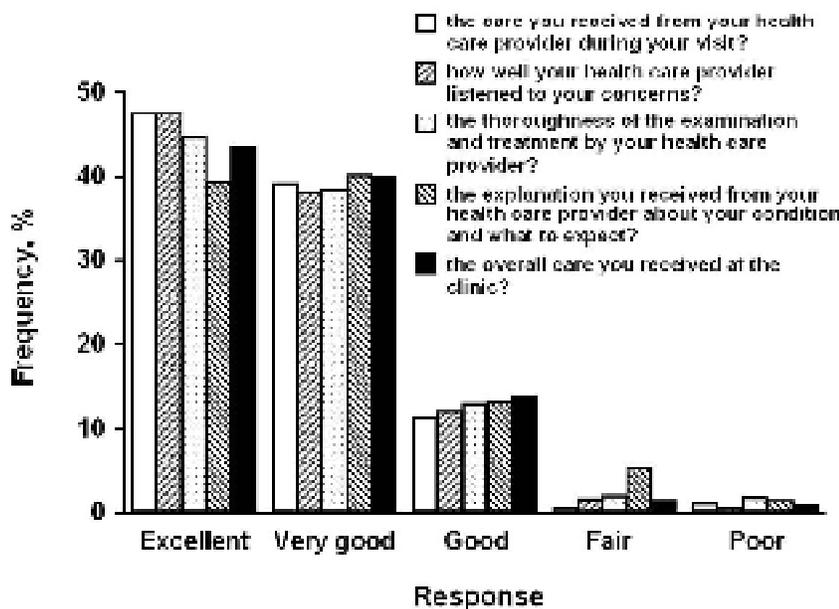
Figure 1 B



* Each question began with the phrase, "What effect did the computer have on . . .?"

Figure 2

Patients' Responses to Questions Regarding General Satisfaction*



* Each question began with the phrase, "How would you rate . . .?"

use had a positive effect on the overall quality of care at the visit; 74.6% (212) reported that it had a "very positive" or "somewhat positive" effect. Table 2 summarizes the patients' responses to the question, "What effect did the computer have on the overall quality of care provided at this visit?"

Patients were remarkably consistent in their responses to questions regarding the effect of computers on their visit. Figure 1 shows their responses to questions regarding the effect of the computer on several aspects of the physician-patient relationship. The association between responses to these questions was high; Spearman rank correlation coefficients ranged from .67 to .85 ($P=.0001$).

Patients were asked to assess their physician's skill at using a computer. Most, 62.0%, rated their physicians as "very skilled" at efficiently using a computer during the office visit. There was a moderate association between the computer skill rating of the physician and the patient's responses to questions regarding the computer's effect on physician-patient communication ($r=.45$ to $.50$, $P=.0001$).

Almost half of patients, 46.7% (142), reported that they used a computer at home or at work, and 28.0% (85) stated that they used one "frequently." These figures match 1997 US Census data showing that 47% of adults used a computer at work, home, or school.¹⁵ The majority of computer users (78.2%) were either "very comfortable" or "somewhat comfortable" using one. There was a small negative association between a patient's personal use of ($r= -.12$, $P=.04$) or comfort with computers ($r= -.13$, $P=.03$) and their satisfaction with physician-patient communication. Patients who used a computer more often and were more comfortable using it rated its effect on their satisfaction with physician-patient communication slightly lower. It is recognized that this association is weak but nonetheless statistically significant.

Overall Satisfaction

As expected, overall satisfaction with the health care received at the clinic was high; 83.5% (254) of the patients rated it either "excellent" or "very good."

These results were compared with the results of a 1995 patient satisfaction survey performed at the same clinic. In 1995, the clinic still used a paper chart. In that survey, 200 patients, selected at random from recent visits, returned surveys. Responses to the question "Looking back at this experience at the clinic, how would you rate the overall care you received?" were compared with the current survey's question "Looking back at this visit, how would you rate the overall care you received?" Although the patient groups were slightly different (our current survey used only patients with three diagnoses instead of all patients), there was no statistically significant difference in the number rating satisfaction "excellent" or "very good" (81%). Table 3 compares the responses from the current survey and the 1995 survey.

The majority of patients, 77.6% (236), would recommend the clinic to family and friends, and 73.0% (222) would recommend their personal health care provider to family and friends. These results represent no statistical change in results from the 1995 patient satisfaction survey in which 81% indicated they would recommend the clinic to family and friends.

The results of several other questions regarding general patient satisfaction are summarized in Figure 2. The association between each of these questions was high; Spearman rank correlation coefficients ranged from .73 to .82 ($P=.0001$).

Discussion

This study demonstrated that there was no difference in patient satisfaction after the introduction of point-of-care computers at our clinic. In fact, patients were comfortable with the use of computers during their visit, and they also thought computers had a positive effect on the quality of care they received. Their responses to several questions regarding computer use and the physician-patient relationship were consistently positive. These findings add to research that indicates patients accept computer use during primary care visits.⁸⁻¹³

Ridsdale and Hudd¹² found that patients expect their physician to have acquired computer skills if a computer is to be used during the examination. As expected, our study found that the patient-rated computer literacy of the physician enhanced patient satisfaction with computer use during the visit. Users of computer systems that have awkward interfaces, forcing them to stumble around during the visit, are likely to lead to patients viewing physicians as "computer illiterate." Obviously, system designers must take this into account and deliver computer systems that integrate naturally into the work flow of busy physicians. Technology that is transparent to the user is the most effective. Additionally, training physicians, nurses, and other health care staff in the efficient use of computers is an important step in the implementation of any electronic medical record system.

Surprisingly, our study found that a patient's personal use and familiarity with computers had a slightly negative effect on satisfaction with the use of computers during an office visit. Solomon and Dechter¹¹ found that this factor had no effect during their earlier study. Our observation presents an interesting question: do patients who are computer literate judge the physician's computer skills more critically and thus rate satisfaction lower when the physician is not as skilled a computer user as the patient?

The reasons for patient perception of increased quality of care with computer use in this survey remain unclear. Patients may be correct in this regard because computers have been linked to more complete documentation¹⁶ and increased performance of preventive tasks.⁴ Patients may appreciate the easy access to medical histories and patient education materials. Perhaps computers have become so ubiquitous in 21st-century society that patients have come to expect them in their physicians' offices as a symbol of modern health care.¹²

Limitations

The study examines a single family medicine clinic that has implemented an electronic environment designed in-house. Obviously, this raises the question of whether these results extend to clinics that use different vendors' installations. This is a common problem when studying computer implementations because they can vary widely in power, design, and ease of use. We are able to compare part of our results with other published results, and they seem to agree that computers do not affect patient satisfaction.⁸⁻¹³ Thus, we believe that the other results are not strictly limited to one data set.

Our study was purposefully limited to patients with hypertension, high blood pressure without hypertension, or hyperlipidemia. These are common primary care diagnoses for which lifestyle modification and compliance play a large role in successful treatment. Therefore, the physician-patient relationship is paramount. Typically, patients with these conditions are older than the general primary care patient population; however, they account for a large portion of office visits. We have no reason to doubt that our findings would extend to the full range of primary care patients, but additional research for proof is required.

Our comparison to the 1995 survey was limited by the fact that in 1995 all patients were surveyed, whereas we limited our study to three diagnoses. However, there was no statistically significant difference in overall patient satisfaction, and we do not expect that one would appear with a more inclusive sample.

Although our patients come from a wide socioeconomic background, we did not control for this factor. Additionally, our patients are primarily Caucasian. Larger numbers of patients would need to be surveyed to analyze subgroups accurately.

As is common in many surveys, respondents to our study were slightly older than nonrespondents. We do not believe that the mean age difference of 4 years would significantly skew results. In fact, we find it remarkable that the older adult population was so accepting of computers.

Conclusions

Our study shows that computers can be integrated into the office visit without a detrimental effect on patient satisfaction. Given the expanding role of computers in medicine^{4,5} and the importance of the physician-patient relationship in treating and preventing many common primary care diseases, it is reassuring that our patients accept and even embrace computers in the examining room.

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