

Implementing an Electronic Medical Record at a Residency Site: Physicians' Perceived Effects on Quality of Care, Documentation, and Productivity

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ABSTRACT

Background: Electronic Medical Records (EMRs) are quickly becoming a standard component of medical practices.

Objectives: We longitudinally studied the impact of EMR implementation on physician perceptions of quality of care, documentation, and work hours, as well as on measured physician productivity.

Methods: Physicians were surveyed at 3-month intervals regarding perceived impact of the EMR on quality of care, documentation, and productivity. Relative Value Units (RVUs) per clinic hours were used to measure productivity. Paired t-tests were used to compare the mean RVUs per clinic hour in the pre-EMR with the immediate post-EMR time period and the long-term post-EMR time period.

Results: RVUs per hour increased significantly from the pre-EMR time period to the immediate post-EMR time period (means 1.49 and 1.82, respectively, $P=0.0007$). The long-term post-EMR time period also showed a significant increase over the pre-EMR period (mean 1.79, $P=0.007$). Sixty-six percent of physicians perceived that EMR implementation increased their work amount a little or much more.

Conclusion: Not only did physician production rise immediately, it stayed at the increased level for the duration of our study period. This may be due to improved documentation supporting more appropriate billing. However, physicians also perceived the EMR as taking up more of their time.

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INTRODUCTION

Clinics and hospitals are turning to Electronic Medical Records (EMRs) to improve data access and reduce reliance on cumbersome paper records.¹⁻⁴ Current estimates are that 50% of family physicians are either currently using or implementing an EMR, and another 25% plan to purchase one.⁵ Although there is a significant investment to start up an EMR, there are some reports that subsequent financial benefits and improvement in quality of care outweigh the associated costs of EMR implementation.⁶⁻⁷ More complete and legible documentation helps to support higher (and appropriate) coding levels. One study estimated the net benefit from using an EMR for a 5-year period at \$86,400 per health care professional.⁸ EMRs can also provide decision support to reduce unnecessary ordering of laboratory studies and X-rays.⁸⁻⁹ While the evidence may be mixed,³ EMRs have the potential to improve quality of care by reminding the health care professional to address preventive maintenance issues and to hand out educational material to assist with patient care.^{6,9-12} Certain types of medication prescribing errors are less common (effect size ranging from 12-80%) with EMRs using prescription programs.^{9,13}

EMRs have been successfully implemented in family practice residency programs.^{1,14} While most programs report an overall positive experience, 1 report indicates resident physician ambivalence regarding perceived benefits for implementing an EMR.¹⁴ Areas of concern included adequate training, increased time spent entering data and decreased time actually taking care of patients in the clinical setting. However there is evidence across several specialties that EMRs can be implemented without significantly changing the duration of clinical visits.¹⁵

The objectives of this study were to determine the extent to which EMR implementation was associated

with (1) physician perceptions of the impact on quality of care, patient documentation, and their own productivity, as well as with (2) the effect of implementation on productivity. All these dimensions are posited to be sources of professional satisfaction.

METHODS

The Department of Family and Community Medicine (DFCM) at the Medical College of Wisconsin purchased a license to use the NextGen EMR (NextGen® is a subsidiary of Quality Systems, Inc, Horsham, PA) at its family practice residency clinics. Prior to this study, the DFCM had experience with implementing EMRs at 2 of its other residency programs. The DFCM Columbia-St. Mary's Family Medicine Clinic, which began NextGen implementation in June 2003, was the site used for the current implementation study. Columbia-St. Mary's clinic is located in an urban setting, with 32,000 annual visits provided by faculty and family medicine residents.

This longitudinal study observed 38 health care professionals (13 faculty and 25 residents) at a single family medicine residency clinic. The intervention is defined as the introduction and initial use of the EMR. Subjective measures of the EMR impact were obtained by surveying the participating health care professionals. After obtaining consent, faculty and resident physicians were surveyed at 3-month intervals using a standard computerized interview regarding their perceptions of the impact of the EMR on their quality of patient care, documentation, and productivity. Physicians' perceptions of all 3 of these dimensions were recorded on a 5-point Likert scale ranging from "strongly agree" to "strongly disagree." Due to staggered introduction of study participants to use of the EMR and the progression of residents through the program, study participants were interviewed a varying number of times. Interviews began in December 2003 and ended in May 2005. Each participant's first interview occurred after he or she had begun using the EMR (median time to first interview=3.8 months; range 2.7-7.9 months).

In addition to physician perceptions of clinical productivity, Relative Value Units (RVUs) per clinic hours were used as an objective measure of productivity by the health care professional on a monthly basis. Work RVUs are determined by Medicare based on CPT codes and are intended to quantify the relative work, practice expense, and malpractice costs for specific physician services provided to a patient. An RVU is a number assigned to a service that establishes its work relative to the number assigned to another service.¹⁶ Use of

RVU data allows for an objective benchmark in assessing changes in physician productivity. RVU data were obtained from the clinic's administrative billing records, and physician hours in clinic were obtained from scheduling archives. Using our institution's standard formula, mean RVUs were calculated for each health care professional in each time period. For the examination of RVUs, 3 time periods related to EMR use by individual providers were defined to provide stable estimates: pre-intervention (prior to EMR introduction); intervention (the month the EMR was introduced to a provider and the 5 subsequent months); and long term post-intervention (≥ 7 months post introduction of the EMR). Monthly RVU and clinic hour totals were obtained for each health care professional. Mean RVUs per clinic hour were computed for each of the 3 periods described above. Twenty providers had RVU data for all 3 time periods.

Statistical Methods

Paired t-tests were used to compare the mean RVUs per clinic hour in the pre-EMR with the immediate post-EMR time period and the long-term post-EMR time period. Multivariate generalized estimating equations were used to analyze the 5 point Likert scale responses to survey items in the combined faculty and resident data. These models accounted for the ordinal nature of the outcomes and the repeated measures on providers; odds ratios (ORs) and their 95% confidence intervals (CIs) are reported. Predictor variables considered in these models included interview number (1-5; measure of time since implementation for an individual health care professional), faculty versus resident, reported comfort level with implementing the EMR (very or somewhat comfortable versus all other responses) and use of EMR only (no experience with paper records). Figures were created to show how both faculty and residents chose a response of "strongly agree" or "agree somewhat" (>3 on the Likert scale) for each of the 3 subjective measures of EMR impact. Analyses were conducted using Stata 9.0 and SAS/STAT version 8 software.¹⁷⁻¹⁸

RESULTS

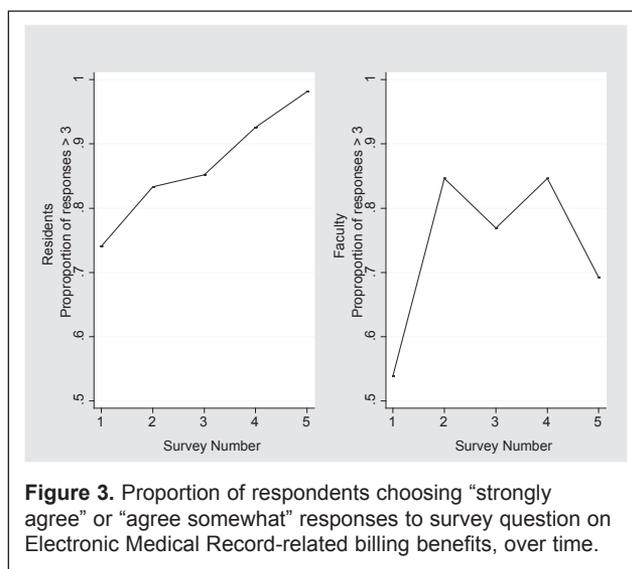
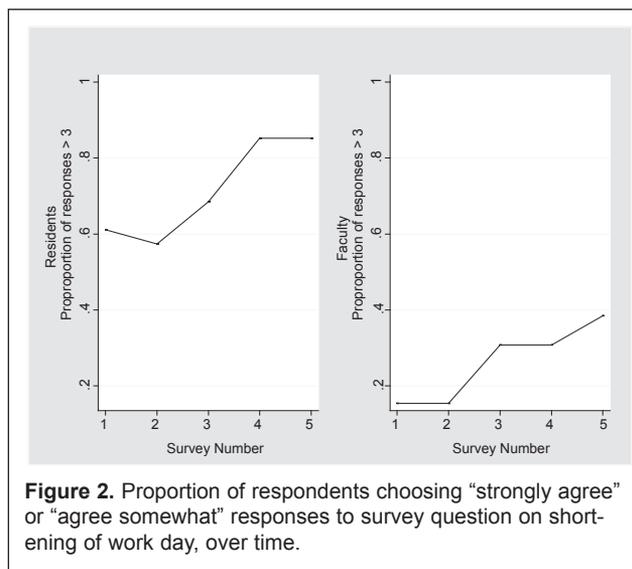
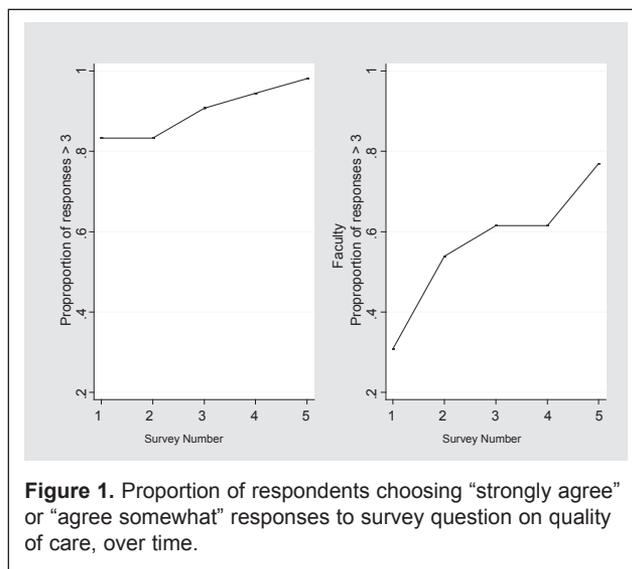
Thirty-eight health care professionals were surveyed. Participants were interviewed from 1 to 8 times, with 32 (84%) surveyed 3 or more times, and a median of 5 surveys. At the time of the first survey, 87% (33/38) of health care professionals felt very or somewhat comfortable about implementing the EMR. Sixty-six percent felt that implementation of the EMR had increased their work time a little or much more.

Complete data on RVUs and number of clinic hours per month were available on 20 health care professionals for the pre-intervention, intervention, and long-term post-intervention time periods. RVUs per hour increased significantly from the pre-intervention time period compared to the intervention period (means 1.49 and 1.82, respectively, $P=0.0007$). The long-term post-intervention time period also showed a significant increase over the pre-intervention period (mean 1.79, $P=0.007$).

Figures 1 through 3 show the changes over time in faculty and resident physician perceptions of the impact of the EMR on the 3 dimensions of quality of care, shorter workday, and billing benefits. In Figure 1, it is apparent that high proportions of residents endorsed positive effects of the EMR on quality of care, even early in implementation. Among faculty, the initial survey indicates a minority endorsed the view that the EMR enhances quality of care, but the proportion with this opinion more than doubled by the final survey. In multivariate analyses, the adjusted odds of responding more favorably regarding the quality of care were increased on successive interviews compared to the initial interview, though this difference did not reach statistical significance until the fifth interview response (OR=3.4; 95% CI=1.3-8.9; $P=0.01$). Generally, faculty were 62% less likely (95% CI=3%-85%, $P=0.04$) than residents to respond more positively, and those who reported being very or somewhat comfortable with EMR implementation were 4.8 times (95% CI=1.7-13.1, $P=0.002$) more likely to respond at a more favorable level regarding EMR effects on quality.

Figure 2 shows a pattern similar to Figure 1, with increasing proportions of both residents and faculty responding more favorably to the statement that the EMR was shortening their work day on subsequent interviews. In multivariate analyses, the odds ratio of a favorable response for the third through fifth interviews was significantly higher (ORs=2.0; 95% CI=1.2-3.5; $P=0.01$, 4.3; 95% CI=1.9-9.4; $P=0.0003$ and 4.3; 95% CI=1.6-11.5; $P=0.003$, respectively). Those who reported being very or somewhat comfortable with EMR implementation were 3.5 times (95% CI=1.2-10.0, $P=0.02$) more likely to respond at a more favorable level. Similarly those who had used only an EMR and never paper records were 3.0 times more likely to respond more favorably (95% CI=1.04-8.88; $P=0.04$). Faculty and resident responses did not differ significantly for this item.

Opinions regarding effects of the EMRs on improved billing improved steadily for residents across all inter-



views, but were variable for faculty (Figure 3). In adjusted multivariable analyses, the odds of a favorable response increased significantly in the second through fourth interviews as compared to the initial interview (ORs=1.8 [95% CI=1.002-3.2], 2.0 [95% CI=1.03-3.8], and 3.7 [95% CI=1.5-9.2], respectively), but then declined somewhat in the fifth interview (OR=2.1; 95% CI=0.9-5.0). Faculty status versus resident status, comfort level with the EMR, and use of the EMR only (as compared to those who had previously used paper medical records) were not significantly associated with responses to the statement that the health care professional's billing benefited from thorough documentation with the EMR.

DISCUSSION

Contrary to what we had expected, we found no decrement in physician productivity based on RVUs during the time immediately following implementation of the EMR. Not only did physician productivity rise immediately, it stayed at an increased level for the duration of our study period. Despite this, a majority of physicians initially perceived the EMR as taking up more of their time. Our findings agree with those of Pizziferri et al,¹⁹ which showed that physicians spent less time in patient visits despite their perceptions to the contrary. One reason for this may be that physicians are now performing more clerical functions as they enter data.²⁰ Physicians have traditionally felt that clerical work is not their proper role, but physicians who have become accustomed to data entry may be proficient at the task; this may lead to the consistent finding that while they are more efficient with the EMR, they feel more bogged down. Another possible reason for the rise in productivity is that RVU generation had been limited by poor documentation of services provided to patients prior to implementation of the EMR.

Quality of care issues are among the strongest incentives for the adoption of EMRs,²⁰⁻²¹ although outcomes-based data are lacking on whether morbidity or mortality are affected.²¹⁻²² Despite the perception that the EMR was increasing their workload, physicians generally had a positive opinion of the EMR. This, again, is likely due to having become accustomed to the now ubiquitous computer in daily life, as well as the sense that the EMR increased the quality of care they could provide.

Faculty were significantly less likely to have a positive perception of the EMR's effect on quality of care. Faculty skepticism may be well founded, as a recent observational study by Linder et al³ found no association of EMR use with improved quality of care as

measured by common process of care metrics. Faculty having less positive perceptions also corroborates what Hier et al²³ found in a study looking at how faculty and residents differed in their acceptance of EMRs, although they were unable to identify any particular factor that would explain this finding. Differential acceptance by residents and faculty may reflect the fact that almost all residents have come of age in the computer era and have had extensive experience with computers throughout their education, while some faculty have used paper records for the majority of their careers. In other words, residents may have been "imprinted" by computers whereas faculty may have been "imprinted" via paper. This is bolstered by our finding that those who had never experienced a paper record were significantly more likely to respond favorably to the EMR implementation. Another explanation may be that residents are more likely to be willing to change their behavior, something that physicians have traditionally been slow to do, especially regarding the adoption of the EMR.²⁴

Ventres et al noted that patient perceptions of EMR usage can be viewed in both a positive and negative light. Indeed, introduction of an EMR may influence many aspects of the clinical encounter from the clinician and the patient's perspective. While noting increased efficiency, patients may be put off by the physician's attention being directed toward the computer screen rather than at them.²⁵ As EMRs become an increasingly integral component of our health care system, physicians must strive to maintain the humanistic aspect of the physician-patient encounter and avoid distancing themselves in favor of interacting with the computer screen.²⁶

One of the strengths of our study was the completion of the study protocol by all physicians. In addition, one would expect that frequent surveys (every 3 months) helped to reduce recall bias.

Our study may have been limited by the use of RVUs to measure productivity. Unfortunately there is no perfect measure of physician productivity;¹⁶ since our clinical system uses RVUs to measure productivity, this metric was the most conveniently available to us. For this reason, we felt that it best reflected physician work at our institution. Results may also be susceptible to confounding: we are measuring RVUs to determine productivity, but use of EMRs is likely to increase apparent RVUs due to documentation improvements. Another limitation may have been the disparity in the number of surveys per individual caused by a staggered implementation schedule. It is unlikely, however, that either of these potential limitations greatly influenced our data.

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