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Do electronic medical record (EMR) demonstrations change attitudes, knowledge, skills or needs?

Patrick A Beiter MD
Madeira Family Practice, Cincinnati, OH, USA

Jonathan Sorscher MD MSEd
Bethesda Family Practice, Bethesda Hospital, Cincinnati, OH, USA

Carol J Henderson PhD RD
E Kenneth Hatton MD Institute for Research and Education, Good Samaritan Hospital, Cincinnati, OH, USA

Mary Talen PhD
MacNeal Family Medicine Residency Program, Berwyn, IL, USA

ABSTRACT

Introduction Electronic medical records (EMRs) are the future of primary care. Transition to electronic records can have a significant impact on physicians, office staff, nursing staff and patients. There are no published EMR studies combining these four populations or studies that have evaluated the impact of EMR demonstrations. To better understand the impact of EMRs, an online survey was administered before and after EMR demonstrations.

Methods A longitudinal cohort survey design was used to assess primary outcomes (attitudes, knowledge, skills and needs) related to EMRs in four populations that were divided into two groups – one of physicians and the other of nursing staff, office staff and patients. A total of 39 participants (19 physicians and 20 staff/patients) completed a pretest survey four weeks prior to and post-test surveys at four and ten weeks after EMR demonstrations. Mean composite scores for each primary outcome were calculated for each group and mean differences were calculated and compared within and between groups – from baseline to four weeks and four to ten weeks using paired *t*-tests and Student's *t*-tests, respectively.

Results Groups differed in several areas: physicians were younger, had more education and had fewer years of experience in a primary care office. There were no significant differences in gender or computer experience between groups. Staff/patients reported significant improvements in attitudes, knowledge and needs from baseline to four weeks ($P<0.05$, $P<0.01$ and $P<0.05$). Physician attitudes, knowledge and needs significantly increased at week four ($P<0.05$, $P<0.01$ and $P<0.05$). Attitudes, knowledge and needs were sustained in both groups from week four through to week ten.

Conclusion EMR demonstrations improved attitudes, knowledge and needs of staff/patients and physicians. EMR demonstrations may be effective in favorably influencing healthcare personnel towards EMRs.

Keywords: attitudes, electronic medical records, knowledge

Introduction

Electronic medical records (EMRs) are the future of primary care. The vision statement for the National Alliance for Primary Care Informatics states that:

> In order to provide all US citizens with high-quality, affordable health care, every primary care provider must be given the opportunity of using an electronic ambulatory information system, including a fully functional electronic medical record, and with ability to access needed clinical information at the time and place of care.[1]

Both the Future of Family Medicine Project and the Institute of Medicine recommend using EMR technology to improve patient care quality in primary care settings.[2–4] There is a national momentum in family medicine and primary care in the USA towards making the transition to EMRs. In a qualitative study, Crosson *et al* explored how the unique aspects of a family medicine office culture affect the initial implementation of an EMR, and concluded that future research should test implementation strategies that can improve existing communication patterns, relationships and decision-making processes.[4]

Traditional paper records have many drawbacks including the non-availability of the chart, important data missing from the chart, poor legibility, chart and storage space costs and difficulty in accurately maintaining problem lists and tracking preventative services.[2,5]

Many barriers exist related to EMR transition and implementation, including (but not limited to) high initial costs, cost of maintenance and support, restructuring workflow, inadequate training or knowledge, inadequate space, computer malfunctions, temporary reduction in productivity, fear associated with change, lack of interoperability with outside systems and a potential shift in the physician–patient relationship.[2,6–11] Ventres *et al* concluded that the patients' comfort with computers influenced their beliefs and concerns.[12] It has also been reported that computers in the examination room affect physician–patient communication by changing the verbal, visual and postural connection between the physician and patient.[13]

Benefits related to EMR use that have been reported include improved billing and cash flow, enhanced revenue, reduced paper, printing and transcribing costs, improved utilisation of tests, improved availability of charts, reduced recruitment costs (due to retention), improved quality of care, improved safety, improved patient education, improved co-ordination of care, simplification of research-related processes and increased legibility.[10,14]

The transition from paper to electronic records has a significant impact on physicians, office staff, nursing staff and patients.[13] Physicians have reported concerns that EMRs take more time, decrease their rapport with patients and may increase patient anxiety. Moreover, they have expressed concern that computer use may negatively impact on personal and professional privacy. However, physicians have also reported that computer use may benefit health care by improving the entering and sharing of data.[15,16]

Hier *et al* demonstrated that physicians' attitudes are a key factor in successfully implementing EMRs.[7] There is a paucity of publications that address resident physicians and their perceptions related to EMR use. In 1999, Aaronson *et al* evaluated family practice residents' perceptions related to EMR and determined that they were ambivalent and frustrated by the EMR used in their clinics.[17] However, several studies that surveyed family practice residents reported that accuracy and legibility of medical records seemed improved with EMR, but the amount of time spent with patients was reduced. Moreover, EMR use detracted from the physician–patient interactions and in general physicians' workload increased.[7,17,18]

Bostrom *et al* reported that nurses believed that EMR improved the delivery and quality of health care.[19] In a Korean study, nurses' attitudes and perceptions were generally positive toward EMR.[20] However, one US study surveyed nurses and office staff and discovered reduced patient privacy and confidentiality was a primary concern.[14]

A recurrent concern expressed by many people working with EMRs involves the potential for altered patient perspectives and physician–patient relationship related to EMR use.[7,12,13,18] A previous study showed that patients thought computers would have an overall positive impact on quality of care.[21] Despite these findings, results from a 2005 national survey revealed that over 60% of 1012 American adults were concerned about the security of their medical information within an EMR and concerned that computerisation could increase medical errors.[22] In the same survey, approximately 50% of respondents stated that EMR benefits outweighed potential risks.[22]

To date there are no known published studies related to EMR, or studies that determine the impact of EMR demonstration interventions, which evaluate the attitudes, knowledge, skills and needs of physicians, office staff, nursing staff and patients. However, tools and checklists used to evaluate different EMR systems based on their functionality and/or EMR demonstrations for individuals and groups when considering EMR purchase are available.[19]

To better understand the transition to EMR and to promote the adoption of EMR, we surveyed four stakeholder populations (physicians, office staff, nursing staff and patients) before and after their exposure to two EMR demonstration interventions, assessing their attitudes, knowledge, skills and needs. The primary objectives of this study were (1) to determine if

EMR demonstrations were effective in improving attitudes, knowledge, skills and needs of physicians, office staff, nursing staff and patients and (2) to qualitatively identify potential benefits and drawbacks of an EMR and identify stakeholders' concerns. A secondary objective was to determine if the impact of EMR demonstrations was sustainable over time.

Methods

Instrument/assessment

This longitudinal prospective cohort survey design used an online survey that assessed changes in attitudes, knowledge, skills and needs related to EMRs. Outcomes measured included pro-EMR attitudes such as EMRs' positive impact on accuracy, privacy, errors and patient flow. In addition EMR specific knowledge such as capabilities of, exposure to and experience with EMRs were assessed as well as general computer skills and computer experience. Needs that would be usefully addressed such as ordering and reviewing labs/studies, referrals, monitoring medications, immunisations, messages, etc. were also measured.

The four discrete populations were divided into two groups – one consisting of nursing staff, office staff and patients and the other of physicians. All participants included completed a pretest survey four weeks prior to EMR demonstrations. Two follow-up surveys were administered at four and ten weeks after EMR demonstrations. The survey consisted of 25 questions and took about five minutes to complete. This survey was piloted on non-participants to evaluate clarity, readability and ease of use. Survey questions were adapted from previously published EMR-related surveys.[4,5,16,17,23–34] This study was approved by the TriHealth Institutional Review Board prior to its initiation. Participants were informed that their responses would remain confidential and anonymous, and that only group results would be reported.

Participants/setting

Purposive sampling was used to recruit attending physicians, resident physicians, medical students, nursing staff and office staff in a family medicine outpatient primary care setting that has a residency program and is located in a large Midwest American city. Convenience sampling was used to recruit patients seen in the same setting. Subjects were included if they were physicians, staff, and/or patients that worked or received care from this office, were 18 years of age or older, were willing to participate and were able to read English. Subjects were excluded if they were unable to attend both EMR demonstrations. The percentage of eligible participants who participated in this study included 50% (3/6) of attending physicians, 65% (11/17) of resident physicians, 83% (5/6) of medical students, 90% (9/10) of nursing staff and 80% (8/10) of office staff. Of the 37 patients recruited, 15 (41%) volunteered to participate, 7/15 (47%) completed the baseline survey and 3/7 (43%) completed the study. A total of 39 participants including 19 physicians (attendings, residents and medical students), 17 office/nursing staff and three patients successfully completed this study.

Nursing and office staff were grouped together because both of these groups have somewhat peripheral interactions with paper or electronic records (e.g. retrieving charts, recording vitals, chief complaints, billing), and therefore have similar attitudes. Patients were included with the office/nursing staff group for similar reasons. The addition of patients to this group did not change the outcomes. Resident and attending physicians as well as medical students were grouped together because these health professionals create most of the documentation in the medical record and they also utilise all components of the medical record to render patient care.

Intervention

Participants attended two different EMR demonstrations offered consecutively and sponsored by two EMR companies. Each of the two EMR demonstrations were approximately one hour in length, were led by the respective vendor representatives, and detailed the functions and features of each EMR followed by questions from the participants. Each demonstration was held on a weekday afternoon in an off-site (non-clinic) location.

Data analysis

The Wilcoxon signed-rank test was used to compare pretest and post-test survey results for each cohort group. No/yes questions were coded 1 for no and 2 for yes and Likert questions (interval data) were coded from –2 to +2 with the lowest code assigned to the most negative response. The Wilcoxon signed-rank test is a non-parametric alternative to the paired Student's *t*-test for repeated measurements on a single sample. Like the *t*-test, the Wilcoxon test involves comparison of differences between measurements, so it required that the data be measured at intervals and assumptions about the form of the distribution of the measurement were not required. A higher score represented a more favourable response toward EMR. Three qualitative, open-ended questions were included

in the survey, relating to: (1) problems, concerns or worries, (2) positive aspects and (3) any other comments pertaining to EMR. Discrete variables were expressed as counts (percentages) and continuous variables as means (+SD). Frequency comparisons were performed using Chi-square or Fisher's exact tests.

Mean composite scores were calculated for each group and mean differences were calculated and compared within and between groups at two time intervals – baseline to four weeks and four to ten weeks using paired and Student's *t*-tests. A *P*-value of <0.05 using two-tailed tests was considered significant. The online survey was administered using SurveyMonkey™. Survey responses were automatically recorded in an Excel spreadsheet (Microsoft 2000). Data analysis was performed using SPSS, version 15.0 (Chicago, IL, USA).

Results

Pre-intervention data

All 39 participants (100%) observed the two EMR demonstrations and completed each survey administered. Participants' demographic characteristics are shown in Table 1. The groups differed in several areas: physicians were younger, had more education and had fewer years of experience in a primary care office. There were no significant differences in gender or computer experience between groups.

Table 1 Staff/patients' and physicians' demographic data at baseline, *n*=39

Characteristics	Value	*P* value*
Groups *n* (%)		
Staff and patients	20 (51.3)	–
Physicians	19 (48.7)	
Age (years)		
Staff and patients	43.4 (12.67)	<0.001
Physicians	30.2 (6.5)	
Gender *n* (%)		
Staff and patients		
Males	2 (10)	0.127†
Females	18 (90)	
Physicians		
Males	6 (31.6)	
Females	13 (68.4)	
Level of education *n* (%)		
Staff and patients		
Some college or less	19 (95)	<0.001†
Bachelor's or Master's degree	1 (5)	
MD/DO/PhD	0 (0)	
Physicians		
MD/DO/PhD	19 (100)	
Length of time associated with BFP (years)		
Staff and patients	9.9 (7.1)	<0.001
Physicians	2.0 (2.9)	
Length of time using a computer (year)		
Staff and patients	16.9 (8.5)	0.585
Physicians	15.7 (4.7)	

*Values are mean (SD) unless otherwise indicated; †Values determined by Chi-square or Fischer's exact tests

Post-intervention data

Main outcomes

Staff/patients reported a significant improvement in attitudes, knowledge and needs related to EMR from baseline to four weeks ($P<0.05$, $P<0.01$, and $P<0.05$) (see Figures 1–5). Similarly, physician attitudes, knowledge and needs significantly increased from baseline to week four ($P<0.05$, $P<0.01$, and $P<0.05$). Attitudes, knowledge and needs were sustained in both groups at both time intervals (week four and week ten) measured following EMR demonstrations. Skills were unchanged from baseline.

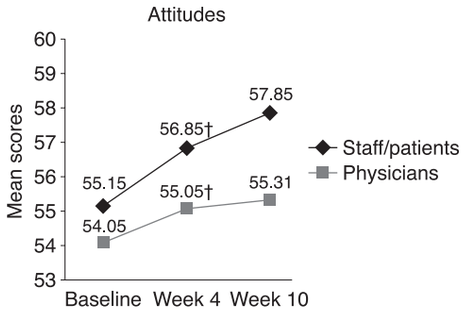

Figure 1 Results of attitudes for staff/patients and physicians († *P* value <0.05)

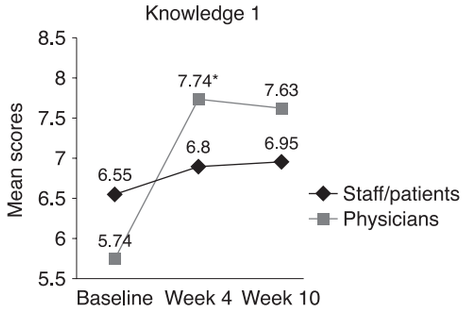

Figure 2 Results of knowledge (yes/no questions) for staff/patients and physicians (**P* value <0.01)

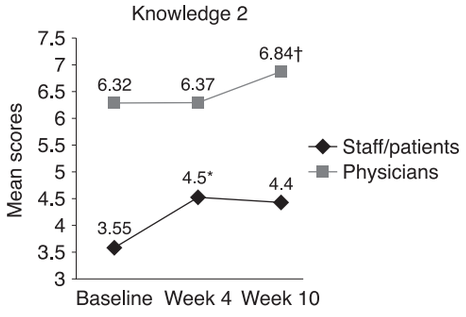

Figure 3 Results of knowledge (Likert-type questions) for staff/patients and physicians (**P* value <0.01 and † *P* value <0.05)

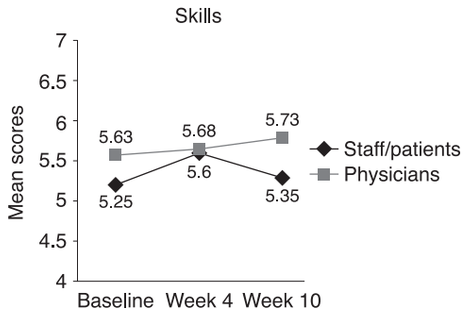

Figure 4 Results of skills for staff/patients and physicians

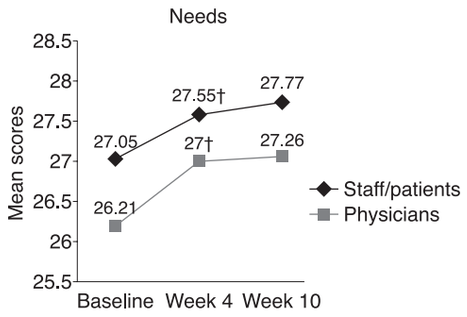

Figure 5 Results of needs for staff/patients and physicians (†*P* value <0.05)

Qualitative survey responses supported a positive response toward EMRs. Ninety percent of participants provided qualitative responses to one or more questions at varying survey time intervals. Total positive responses outnumbered negative responses on each survey time interval and in aggregate (160 vs 131 responses, respectively). The positive responses focused on efficiency, accuracy, reminders, access, legibility and health maintenance/preventative care. The negative responses addressed problems related to getting old records into the new system, time required to become experienced/efficient with EMR, computer difficulties and confidentiality issues.

Discussion

Previous research surveyed nurses to determine attitudes and expectations prior to implementing an EMR and to dispel myths and increase specific communication in an effort to improve 'buy-in'.[14] To date, EMR demonstrations have not been evaluated as a way to improve stakeholder 'buy-in'. Prior to changing to an EMR, attaining stakeholder 'buy-in' and achieving high user satisfaction have been shown to be more important than the budget, technology and sophistication of the vendor.[19]

Limitations of this study include the use of self-reported data ascertained in a self-administered survey. It is unknown if the use of self-reported data impacts on study results in a favourable or a negative manner. Results of this study have limited external validity, relating only to this particular practice and the two EMRs demonstrated. Therefore, these conclusions may not be valid for other clinical settings such as different specialty or private practices, different geographical areas, different EMRs and different sample populations.

Considerable efforts were made to recruit patients. Few patients participated, perhaps because this study required attending two EMR demonstrations held on a weekday in a potentially unfamiliar offsite location. Patients stated that they declined to participate due to work or school conflicts or an inability to obtain transport. Owing to the small number of patients, conclusions solely related to patient outcomes are not possible.

The survey utilised in this study was not assessed for validity and reliability; however, the questions were designed using pre-existing survey questions reported in the literature (many of the questions used were validated in previous research[27]).

Future studies are needed to determine EMR survey psychometrics and to examine different settings, specialties and practice sizes. It would be helpful to determine how EMR demonstrations might impact on patients and to assess if EMR demonstrations are effective in defining and/or improving the physician–patient relationship when using EMRs. It would also be beneficial to explore the participants' level of readiness for change when changing to an EMR.

Qualitative results showed that EMR demonstrations improve practice-specific EMR needs. Therefore, an EMR demonstration may be used as a tool to identify practice needs prior to EMR implementation.

In conclusion, this study revealed that EMR intervention demonstrations significantly improved attitudes, knowledge and needs of staff/patients and physicians. EMR demonstrations did not improve EMR skills, which probably occurred because the intervention was a demonstration, not an in-depth, hands-on training session. EMR demonstrations are a low cost intervention, which can be used early in the planning stages prior to implementing an EMR. Based on this study, the authors believe that presenting EMR demonstrations to all stakeholders (physicians, office and nursing staff, and patients) prior to selecting, purchasing and implementing an EMR helps improve 'buy-in' and creates favourable excitement towards the implementation, training and utilisation of an EMR.

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The original survey and original data sets are available on request from the author.

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ADDRESS FOR CORRESPONDENCE

Patrick A Beiter
7829 Laurel Ave
Cincinnati, OH 45243
USA
Tel: +1 (513) 561–6266
Fax: +1 (513) 561–0149
Email: pbeiter@cinci.rr.com

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