

Medical Informatics

Electronic Medical Records: The Family Practice Resident Perspective

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Background and Objectives: Few studies have included family practice residents' perceptions regarding the use of electronic medical records (EMR) in a residency program. This study determined residents' perceptions of EMR systems and what variables influenced those perceptions. Specifically, we studied how EMR training and previous computer background influenced resident perception of difficulty in EMR implementation, time efficiency, preventive care opportunities, accuracy of medical records, and desired future use of EMR systems. Questions targeted the use of the EMR in the resident continuity clinic. **Methods:** Survey questionnaires about the use of EMR systems in the residents' continuity clinic were mailed to residency directors and residents of 219 family practice residency programs. Respondents were given the opportunity to comment on benefits of and concerns about EMR. **Results:** Resident response rate was 46% in programs using EMR systems. Findings revealed that the length of EMR training a resident received was unrelated to the perceived adequacy of training but was related to the residents' assessment of the difficulty of implementing the EMR in their continuity clinic. Residents who perceived training to be adequate and perceived a relative ease of implementing the EMR were more likely to perceive the EMR to be beneficial and were more likely to choose the EMR over traditional paper records for future use. Computer background/experience was not related to perceived satisfaction with the EMR, nor was it related to perceived difficulty of implementation, adequacy of training, or anticipated future use of an EMR system. **Conclusions:** Although residents recognize the benefits of the EMR, our study demonstrates an overall ambivalence and frustration toward EMR systems currently in use in family practice residency continuity clinics. However, the training they receive regarding EMR use in their residency may influence not only the perceived ease of EMR implementation but attitudes regarding the ability of the EMR to assist them with preventive opportunities, time management, and medical record accuracy. This may in turn have influence on the use of EMR systems in their practices after residency.

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Although the medical literature is rich with information about electronic medical records (EMR) systems,¹⁻¹⁹ few studies have examined EMR use by family practice residents in an ambulatory clinic setting.²⁰ This study evaluated the perceptions of residents using an EMR and what factors influenced those perceptions. We were specifically interested in whether EMR training and previous background in computer use were associated with any of the following: residents' perception of the difficulty of EMR implementation into their practice routine, the perceived impact of the EMR

system on physicians' time efficiency, the influence of the EMR on residents' preventive care practices, and the residents' perception of the accuracy of medical records when using an EMR system. Further, we inquired if the residents wanted to use an EMR system in their post-residency practice and their perception of how the EMR system influenced physician-patient interactions.

Methods

Survey Methods

In January 1999, a packet consisting of a letter of introduction, two optical scan format surveys, and an addressed/stamped envelope was mailed to 219 family practice residency directors who had responded to an American Academy of Family Physicians (AAFP)

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survey on computerized systems for documentation of resident experiences. These programs were selected since they had previously responded to an AAFP survey and had indicated that they used computers for documentation of resident procedures. We thought that these programs would be more likely to have a computerized system for medical records and be more willing to answer our questionnaire.

In our survey questionnaire, directors were asked if their program currently used EMRs in the residents' ambulatory clinic. Directors who marked yes were asked to respond to additional items and give each of their residents a questionnaire for completion. Directors who marked no were asked to return the survey in an enclosed envelope. Eight weeks after the initial survey packet was mailed, follow-up was conducted with the 125 programs that did not initially respond. For the 97 programs with a listed e-mail address, a message containing the first question of the survey was sent via e-mail. The 28 nonrespondents without a known e-mail address were asked to complete a telephone query using the same question, "Are you currently using electronic medical records in the residents' ambulatory clinic?" If the answer was yes, a complete survey packet was resent. Eleven weeks after the initial survey packet was mailed, 54 program directors who had still not responded to the e-mail survey were contacted via telephone and asked the same question.

Instrument

The survey instrument, developed by the authors specifically for this study, was tested after input was received from a convenience sample of family practice residents and faculty. The survey took approximately 10 minutes to complete and included 15 questions regarding performance of routine tasks oriented to patient care and documentation in their continuity clinic using the EMR system. These questions were scored using a 5-point Likert scale (1=strongly agree to 5=strongly disagree) (Table 1). The survey items were designed to gather information about the possible beneficial effects of the EMR in three general areas: accuracy in the patient-physician encounter (three questions), delivery of preventive care (five questions), and time-related concerns (seven questions) (Table 2). Additional questions addressed residents' previous computer experience, EMR training, perceived adequacy of training, and the potential for using an EMR in their future practice. Residents were also asked to comment on any special concerns or benefits of using an EMR in their continuity clinic.

Data Analysis

Surveys were formatted for optical scanning using Teleform 4.0.[®] All written comments were entered by hand for data analysis.

Statistical significance was assessed using chi-square for associations, *t* tests for independent variables, and Pearson Correlation using SPSS Version 8.0.[®] For the

Table 1

Family Practice Resident Perceptions of Benefits Regarding Electronic Medical Records

<i>Survey Statement</i>	<i>% Agree</i>	<i>% Neutral</i>	<i>% Disagree</i>	<i>No Answer</i>	<i># of Total Responses</i>
Greater ability to perform chart checks	54	16	10	20	194
Rapid access to patient data	52	11	13	25	183
Increases documentation accuracy	47	21	23	20	195
See another physician's patients easily	45	13	10	22	190
Increases consistency of health maintenance	44	22	17	16	204
Decreases time to review past records	41	11	26	19	198
Increases opportunity for research	39	27	09	25	182
Decreases redundant data entry	30	18	30	22	190
Concerns for patient privacy	29	21	31	18	200
Decreases time for health maintenance	28	24	30	18	200
Increases physician efficiency	23	26	32	20	195
Reduces clinical errors	22	35	18	26	184
Bill for services more accurately	18	46	10	26	183
Decreases physician time per encounter	14	26	45	17	203
Increased physician-patient interaction	10	28	41	20	194

On a 5-point Likert scale, results for *agree* and *disagree* represent grouped responses for *strongly agree/agree* and *strongly disagree/disagree*.

Results were sorted based on resident agreement with questions, as stated in the affirmative.

Table 2

Resident Perception Question Grouping

ACCURACY

The EMR:

- increases documentation accuracy
- reduces clinical errors
- helps me bill for services more accurately

PREVENTION

The EMR:

- decreases physician time necessary for health maintenance issues
- increases consistency of health maintenance
- decreases physician time necessary to review past medical records
- allows for greater ability to perform chart checks/reminders for follow-ups
- provides an opportunity for increased physician-patient interaction

TIME

The EMR:

- decreases physician time per patient encounter
- decreases physician time necessary for health maintenance issues
- decreases physician time necessary to review past medical records
- decreases redundant data entry
- increases physician efficiency
- provides more rapid access to patient data
- helps me see another physician's patients more easily

These logical groupings of Likert scale questions are sorted by order of occurrence on the survey instrument.

purpose of analysis, each of the groupings was combined as a summative rating index, and reliability coefficients (Cronbach's alpha) were calculated for each of the subsets—accuracy (.648), time (.7503), and prevention (.8462). The hand-written comments regarding concerns and benefits were reviewed and categorized based on grouped responses.

Results

Of the 219 mailed surveys, 92 programs (42%) initially responded. Follow-up contacts via e-mail and telephone added 81 programs and increased the response rate from 42% to 78%.

Of the total 173 residency programs that responded to the survey, only 24 programs (14%) reported current use of EMR in their residents' ambulatory clinic. There were 563 resident positions in these 24 programs, and 261 (46%) of the residents' surveys were returned. Seventeen were unusable, leaving 244 questionnaires for inclusion in data analysis.

EMR Training and Implementation

For the 244 residents who responded to the survey, the length of training a resident received on the EMR (measured in hours) was unrelated to the perceived adequacy of training. However, the length of training was inversely related to the resident's assessment of

the ease of implementing the EMR system ($P=.005$) in their continuity clinic. Those residents who felt that the training was adequate were more likely to report that the EMR was beneficial with respect to time- ($P=.000$), prevention- ($P=.004$) and accuracy- ($P=.018$) related issues.

Fifty-four percent of the residents reported that the EMR system was in place when they arrived in the program, and they considered adjustment to the EMR to be moderately difficult (58%). The majority (73%) stated that they received training in EMR use. Nineteen percent reported training for 1 day or less, 24% for 1 half day or less, 11% for 2 hours, and the remainder received training for other lengths of time. This training was given predominantly by faculty and staff, but less than half (49%) considered the training to be adequate. Residents who perceived a relative ease of implementing/adjusting to the EMR were more likely to perceive a benefit with respect to time- and prevention-related issues ($P=.001$). Those residents who considered the EMR to be beneficial ($P=.000$) and those who perceived the EMR to be relatively easier to implement ($P=.001$) were also more likely to choose the EMR over traditional paper records for future use.

Resident Background

Residents' prior computer background/experience was not a factor in any of the measured variables. Residents' prior computer background/experience also was not significantly related to perceived difficulty of implementation, adequacy of training, effect on time efficiency, preventive care practices, perceived accuracy of medical records, or anticipated future use of EMR (Table 3).

Benefits/Concerns Regarding EMR

Residents' written responses to the open-ended questions about the perceived benefits of EMR included rapid access to patient records, increased chart availability, ease of data retrieval, ease of seeing another physician's patients, health maintenance/lab flags, legibility, problem/medication/patient lists, and remote access. Written responses indicated concerns with lack of privacy, uneasiness about patient confidentiality, time needed for entering data, hardware problems, computer downtime, inefficiency, limited availability of data entry sites, and lack or inadequacy of training. Forty-one percent of respondents stated that the EMR had a negative effect on or decreased physician-patient interaction. However, given a choice, 46% of residents stated that they would choose EMR over traditional paper records, which were selected by only 19% of residents. (Table 4).

Discussion

The results revealed an overall ambivalence regarding the perceived benefits of EMR systems currently used in family practice residency programs. The potential advantages of EMR are recognized by residents and reflect benefits previously reported in the literature.^{1,3,6,8,10-14,19} However, residents' responses also indicate that EMR systems currently in use in residency programs often seem to slow them down and increase their workload in the continuity clinic setting. Our survey also revealed that residents were concerned that the EMR detracted from physician-patient interactions. This is in contrast to a report by Solomon and Dechter, which found that computers in the exam room did not interfere with physician-patient interactions.¹⁴ Our survey reflects that the increased time the resident physician spends finding and entering data interferes with this important relationship. As possible further support that this may be happening, Lenhart et al¹⁹ reported that the biggest obstacles to maintaining the EMR systems were patient care data entry and resident/faculty resistance to use. Perceived interference with the doctor-patient relationship may be at the core of this resistance.

The EMR has the capability to facilitate workflow by reducing the time spent recording information and by improving data management.^{1,11-13,15,16} The EMR also has the potential to be an excellent tool for monitoring health maintenance and doing reminders.^{5,7,9-11} Frustrations, however, may result when the desired improvements do not materialize.¹⁸ Our findings suggest that the EMR systems currently in use in many residency programs are adequate for basic functions (eg, rapid access to patient data, greater ability to perform chart checks, and legibility). However, residents consider the EMR less helpful for performing functions such as decreasing physician time per encounter, decreasing time needed for health maintenance activities, increasing physician efficiency, reducing clinical errors, and billing for services more accurately. This suggests that either training is not adequate, full EMR capabilities are not being employed, or current EMR systems used in family practice residency continuity clinics are not yet sophisticated enough to perform the functions for which they were designed. The relatively high cost of a state-of-the-art EMR system often makes it difficult for individual residencies to purchase these systems. This may result in residents being exposed to less than adequate systems, which may in turn produce negative perceptions and frustrations regarding EMR systems.^{4,19}

Until medical schools begin to graduate students who are trained in the use of EMR, residency programs will be the entry points for the education of future physicians into the use of EMR. In 1995, Ornstein reminded

Table 3

Resident Responses

Relationship	P Value
Length of training	
Ease of implementation	.005
Adequacy of training	
Time	.000
Prevention	.004
Accuracy	.018
Ease of implementation	.000
Choice (EMR versus paper)	
Accuracy	.000
Time	.000
Prevention	.000
Ease of implementation	.001
Ease of implementation	
Prevention	.01
Time	.01

Length of training—distilled to less than, equal to, or greater than 4 hours
 Adequacy of training—yes or no question
 Choice—given the choice after residency, which the resident would choose
 Ease of implementation—Five-point Likert scale, not difficult to extremely difficult
 Time, prevention, accuracy—Five-point Likert scale questions, logically grouped (see Table 2)

With the exception of length of training as related to ease of implementation (inversely related), all variables have a direct correlation.

Table 4

Resident Comments

Benefits

- Remote access
- Rapid access
- Easier information/data retrieval
- Legibility
- Chart availability (no lost charts)
- Health maintenance flags
- Problem list
- Ease of seeing another physician's patients

Concerns

- Too much time spent on data entry
- Slow/inefficient hardware/software
- Negative impact on physician-patient interaction
- Lack of privacy/confidentiality
- Lack/inadequacy of training
- Not user friendly/data access inefficient
- System downtime/lost data
- Lack of data entry sites

Comments represent the most prevalent hand-written responses. The comments have been categorized and listed from the greatest to the least number of responses. Response rate=31% (80/261).

us that family practice residency programs are the training grounds for new technology.³ The Council of Scientific Affairs for the American Medical Association¹⁶ has also prompted us to remember that family physicians must learn to integrate the computer into their practices. This group considers the computer necessary not only to effectively manage increasingly comprehensive data but as a tool for decision support and the implementation of ever-expanding clinical guidelines.

Limitations

A less-than-complete response rate and failure to survey all family practice residency programs nationally limit the findings of our study. In addition, although an attempt was made to define the type of EMR systems in use, our study did not have sufficient power to study the correlation between the type of EMR system and responses and comments regarding residents' experience with an EMR. Training residents in the use of the EMR may be only a marker of other attributes of a residency program that make the use of an EMR a positive experience, but, nonetheless, training appears to be significantly related to resident satisfaction with the system.

Conclusions

Although residents recognize the benefits of the EMR, our study also demonstrates an overall ambivalence and a noticeable frustration toward current EMR systems. Since family practice residents have complex, harried schedules, they understandably resist any innovation that increases their workload without a definite offsetting benefit. Residents indicate that today's EMR systems slow them down, increase their workload in the clinic, and thereby may detract from physician-patient relationships.

It may be that current EMR systems used in residencies are not sophisticated enough to handle the needs of a busy family practice. Residents, however, might also be failing to optimally use the capabilities that exist in their EMR systems, implying a training deficiency. As EMR systems evolve, medical training must better account for use of EMR in the exam room. Since most residencies have yet to implement EMR systems, most faculties have little experience with them and will need extensive training themselves. Nonetheless, as EMR systems become more commonplace, residents must be taught to effectively use them and to incorporate them seamlessly and naturally into their patient encounters. Further investigation of training content and development of training protocols for the use and introduction of electronic medical records systems in a resident's ambulatory clinic seems to be indicated.

Residents' prior experiences with computers do not seem to influence how well they are able to adapt to the use of an EMR in their continuity clinic. However, the training they receive regarding EMR use in their residency may influence not only the perceived ease of EMR implementation but attitudes regarding the ability of the EMR to assist them with preventive opportunities, time management, and medical record accuracy. This may in turn have influence on the use of EMR systems in their practices after residency.

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