Original Article

Faculty, Resident, and Clinic Staff’s Evaluation of the Effects of EHR Implementation

Michael V. Bloom, PhD; Mark K. Huntington, MD, PhD

Background and Objectives: There have been few reports on the effect of electronic health record (EHR) implementation as seen by those most responsible for using the system in a residency program. Our objective was to investigate how faculty, residents, and both clinical and nonclinical staff view the effects of EHR implementation on a broad range of issues. Methods: All 72 personnel were surveyed at 8 months (response rate 75%) and 12 months (response rate 57%) following full implementation of the EHR. The survey inquired into subjective perceptions of amount of time spent documenting and occurrence of documentation, effect on patient care, interference with other activities, effect on communication and relationships, coding/billing process, and overall efficiency. Results: Since EHR implementation, faculty and residents perceived documentation as taking 13 minutes per patient. It was seen as interfering with personal and educational time. Perception of all personnel was that the EHR was having a negative effect on patient care. There was no detectable statistically significant change between the 8- and 12-month surveys. Conclusion: A perception of the promised improvement in patient care, provider communications, and billing efficiency due to EHR implementation was not realized in this population.

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While a librarian-aided search of the literature yielded more than 50 articles on the impact of the electronic health record (EHR) on medical care, only the handful reported here were found to directly relate to the impact on users.

There have been some narrow studies on the value of the prompts for body mass index (BMI) and hypertension management tracking with mixed results as far as patient benefit. There have been a few studies that have explored the impact on users.

One study that did explore the impact of EHR on users was done by Sicotte et al, who surveyed hospital nurses and physicians who were using a dual system composed of paper and EHR. Overall they found a wide variation in opinions. Ease of use and quality of information were rated highly, while impact on quality of care and safety were given neutral ratings in both systems. Nurses in general were more satisfied with paper, while physicians liked the EHR better. The researchers did not specify if the EHR was point and click or text based.

A second study was reported by Terry et al who did a qualitative, Delphi model study and found that those most computer literate had the easiest time adapting to the EHR. They found that support personnel who are highly familiar with the EHR system serving as coaches to the others is helpful.

Edsall and Adler did a national survey of American Academy of Family Physicians (AAFP) members and found that of the 13 most widely used systems, there was wide variation on user response. Positive response ranged from more than 80% to less than 40%, depending on the system used. However, they noted that those responding to this survey were self-selected, and perhaps had some vested interest in the outcome of the survey.

A study by Brotzman et al explores these topics in an educational setting. They surveyed faculty and residents at a family medicine residency program at 3-month intervals for over a year. They focused on the EHR’s implementation on quality of care, billing, and required time. They found generally that residents felt the quality of care was improved. Faculty had more of a mixed reaction to quality of care. The respondents reported the amount of time required for input into the electronic medical record had a significant impact on the number of hours spent doing medical records.

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The study reported here investigated the broad impact of EHR implementation on the entire residency clinic work force. We investigated the impact of the electronic medical record on time spent with family as well as educational time. We also investigated the EHR’s effect on communication between professionals. Further, we expanded the survey to include the entire residency staff. It is our view that these additional areas of inquiry are important considerations for a family medicine residency.

Methods
An EHR (EHS, Birmingham, AL) was implemented in a residency’s Family Medicine Center in a multistep process over 8 months. The first module implemented was the electronic superbill, followed by the clinical modules. Prior to implementation, all personnel completed the vendor-recommended training.

The study population consisted of faculty and resident physicians, along with nursing, laboratory, X ray, and business office staff. A total of 72 were surveyed 8 and 12 months after the implementation period was initiated.

Because of the recognized problems, during the period between 8 and 12 months an ongoing effort was made to improve the efficiency and time requirements of the system. Super users provided one-on-one tutorials. Efforts were made to resolve problems in the system. Forums were developed so that those who were most capable would educate those who were having more difficulty. The survey at 12 months was aimed at investigating whether or not these efforts to improve efficiency were effective.

The original intent of this study was to monitor perceptions as part of our internal, change management, and quality improvement processes. The survey instruments inquired into subjective perception of the amount of time spent documenting and the occurrence of the documentation. We also requested their impression of the EHR’s effect on patient care, interference with other activities (eg, home life, keeping current in the medical literature, etc), interpersonal relations among the clinic staff, the coding/billing process, and overall efficiency.

Data were analyzed utilizing chi square and Mann-Whitney U tests. Significance level was defined as $P<.05$. All tests were one-tailed, based on the assumption of improvement over time. Data in one response category with an extreme outlier, defined as more than 20-fold beyond the nearest data point, were Winsorized. Statistical power was calculated at 86% and 76% to detect a 20% difference between surveys for physicians and nonphysician staff, respectively.

Initially an internal quality improvement activity, the use of the data for the study reported here was reviewed by the University of South Dakota Institutional Review Board and granted a Category 4 exemption.

Results
The initial survey generated responses from 10 of 14 faculty (71%), 22 of 24 residents (91%), and 22 of 34 nonphysicians (65%). This gave an overall response rate of 75%. The follow-up survey received 10 (71%), 13 (54%), and 18 (53%), respectively, for a 57% response rate overall for the second survey.

At the initial inquiry, physicians reported an average of 16 minutes spent in documentation (range 1 to 120 minutes) (Figure 1). This decreased to 13 minutes (range 2 to 60 minutes) (Table 1A). Both mean longest time spent documenting and shortest time spent documenting diminished between the two surveys. None of these changes attained significance.
The occurrence of documentation remained essentially constant between the surveys, with just under 20% of dictation occurring at the time the patient was in the room, 40% at the day’s end, and the remainder after the encounter but before moving on to the next patient. This was reported to represent a change in occurrence of documentation since EHR implementation by 55% of the physician respondents (Table 1A). The type of documentation, ie, dictate and transcribe into EHR versus point and click, though not significant ($P=.125$), showed a trend toward increasing use of dictation.

None of the perceived effects of EHR on patient care or clinic efficiency demonstrated a difference between the two surveys. Minimal decrease in time spent documenting was noted by physicians, and negative effects on patient care and other activities were unchanged. There were no differences in perceived coding or documentation efficiency, and overall physician attitudes toward the EHR remained constant. These data are shown in Table 1B.

Among the nonphysician staff, no significant change was found in documentation time (Table 2A). With the exception of interference of data entry functions with other life and job activities ($P=.047$), none of the perceived effects of EHR on patient care, professional communications, and clinical or office efficiency demonstrated a difference between the two surveys of nonphysician staff (Table 2B).

### Table 1

**Physician Perceptions**

A. Documentation Time, Occurrence, and Type

<table>
<thead>
<tr>
<th>Survey</th>
<th>Mean Minutes Spent Documenting</th>
<th>Occurrence of Documentation (%)</th>
<th>% of Documentation That Is Dictated Rather Than “Clicked”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Longest</td>
<td>Shortest</td>
</tr>
<tr>
<td>Initial</td>
<td>16</td>
<td>34.1</td>
<td>7.7</td>
</tr>
<tr>
<td>Follow-up</td>
<td>13</td>
<td>26.4</td>
<td>5.2</td>
</tr>
</tbody>
</table>

EHR—electronic health records

There were no significant changes in perception between surveys. Initial survey $n=32$, follow-up survey $n=23$.

### Table 1B

B. Perceived Effects of EHR (Likert Scale Means [1-5])

<table>
<thead>
<tr>
<th>Survey</th>
<th>Documentation Time Over the Last 3 Months ($1=\text{no change}, \ 5=\text{marked decrease}$)</th>
<th>Effect on Patient Care ($1=\text{positively}, \ 5=\text{negatively}$)</th>
<th>Data Entry Interferes With Other Activities ($1=\text{a little,} \ 5=\text{a lot}$)</th>
<th>Helps Code Appropriately ($1=\text{absolutely,} \ 5=\text{no effect}$)</th>
<th>Overall Documentation Efficiency ($1=\text{worse,} \ 5=\text{better}$)</th>
<th>Attitude Toward EHR ($1=\text{love it,} \ 5=\text{hate it}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>2</td>
<td>3.7</td>
<td>3.8</td>
<td>3.9</td>
<td>2.3</td>
<td>3.6</td>
</tr>
<tr>
<td>Follow-up</td>
<td>1.9</td>
<td>3.7</td>
<td>3.7</td>
<td>3.9</td>
<td>2</td>
<td>3.8</td>
</tr>
</tbody>
</table>

The occurrence of documentation remained essentially constant between the surveys, with just under 20% of dictation occurring at the time the patient was in the room, 40% at the day’s end, and the remainder after the encounter but before moving on to the next patient. This was reported to represent a change in occurrence of documentation since EHR implementation by 55% of the physician respondents (Table 1A). The type of documentation, ie, dictate and transcribe into EHR versus point and click, though not significant ($P=.125$), showed a trend toward increasing use of dictation.

None of the perceived effects of EHR on patient care or clinic efficiency demonstrated a difference between the two surveys. Minimal decrease in time spent documenting was noted by physicians, and negative effects on patient care and other activities were unchanged. There were no differences in perceived coding or documentation efficiency, and overall physician attitudes toward the EHR remained constant. These data are shown in Table 1B.

Among the nonphysician staff, no significant change was found in documentation time (Table 2A). With the exception of interference of data entry functions with other life and job activities ($P=.047$), none of the perceived effects of EHR on patient care, professional communications, and clinical or office efficiency demonstrated a difference between the two surveys of nonphysician staff (Table 2B).

**Discussion**

A number of conclusions can be drawn from the study. Physicians and residents are very dissatisfied with the amount of time required for documentation using the EHR system. Further, despite a concerted effort to improve efficiency and time required for documentation between 8 and 12 months, little improvement in physician perception was experienced. Faculty, residents, and clinic staff did not observe a benefit of the EHR system to patient care. Physician and office staff saw no meaningful improvement in the coding and billing process.

Physician perceptions of time requirements for data entry were about 16 minutes on the first survey, reducing to 13 minutes on the second, an insignificant change. This is a lot of time devoted to what is most often a 15-minute patient encounter, and the rate of
improved efficiency is likely to flatten even if it were significant. It is not surprising then that, while the clinic staff’s attitude toward the EHR is somewhat positive, physician attitude tends toward more negative (Table 1). This is likely interpreted by the physician response that it is interfering with their social life and educational activities. Staff clock out at the end of the day, while the physicians must remain to complete their documentation or complete their documentation from home.

The finding that physicians, and especially office staff, saw no meaningful improvement in the coding and billing process was unexpected. One of the major arguments for EHR adoption, despite an acknowledged decrease in physician efficiency, is that improved coding will compensate the fewer number of patient encounters (or the longer hours spent on the same number) with higher reimbursement per encounter.

A point-and-click system such as ours might maximize billing and data retrieval through the expense of clinical impression, which for the family physician may be the most important part of the record. Compared to a dictation system, it transfers responsibility for data entry from highly trained technicians, ie, transcriptionists, to physicians who are less efficient at entering text and whose time is better spent on patient care. While there has been no cost comparison data generated, it is likely that such systems that require more physician time are not financially beneficial, since when one includes excess physician time as a cost, this may negate any benefit retrieved from higher coding levels.

Most concerning is the view by physicians and staff that the EHR is adversely affecting patient care and communications between personnel. Others have reported similar issues. Although the specific reasons for this are not clear from the data in this study, it certainly warrants further investigation. This is consistent with previous studies that found that the favorability toward EHRs declined as the level of training increased, suggesting that the more-experienced clinicians recognized its interference with patient care. This was independent of computer literacy; perceptions will not be changed merely by blaming computer literacy.

### Table 2

Nonphysician Staff Perceptions

A. Documentation Time

<table>
<thead>
<tr>
<th>Survey</th>
<th>Mean Minutes Spent Documenting</th>
<th>Documentation Time Over the Last 3 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Longest</td>
</tr>
<tr>
<td>Initial</td>
<td>6.6</td>
<td>18.9</td>
</tr>
<tr>
<td>Follow-up</td>
<td>7</td>
<td>18.7</td>
</tr>
</tbody>
</table>

B. Perceived Effects of EHR (Likert Scale Means [1-5])

<table>
<thead>
<tr>
<th>Survey</th>
<th>Effect on Patient Care</th>
<th>Data Entry Interferes With Other Activities</th>
<th>Efficiency of Billing Process?</th>
<th>Overall Documentation Efficiency</th>
<th>Attitude Toward:</th>
<th>Information Sharing Between Staff</th>
<th>Efficiency of Phone Calls</th>
<th>Get Information I Need for Good Patient Care</th>
<th>Effect on Staff Interpersonal Relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1=negative, 5=positive)</td>
<td>(1=a lot, 5=a little)</td>
<td>(1=less, 5=more)</td>
<td>(1=worse, 5=better)</td>
<td>EHRs in General</td>
<td>This Specific EHR</td>
<td>(1=less efficient, 5=more efficient)</td>
<td>(1=less, 5=more)</td>
<td>(1=never, 5=always)</td>
</tr>
<tr>
<td>Initial</td>
<td>2.7</td>
<td>4.3</td>
<td>3</td>
<td>3.4</td>
<td>3.5</td>
<td>2.8</td>
<td>3.1</td>
<td>3.9</td>
<td>3.1</td>
</tr>
<tr>
<td>Follow-up</td>
<td>2.8</td>
<td>2.9*</td>
<td>2.5</td>
<td>2.7</td>
<td>3.1</td>
<td>2.3</td>
<td>2.9</td>
<td>3.2</td>
<td>2.8</td>
</tr>
</tbody>
</table>

EHR—electronic health records

* P<.05. Initial survey n=22, follow-up survey n=18.
The primary limitation of our study is that it is site specific and does not have a large number of participants, especially when looking at subgroups. Increased statistical power in a larger investigation of perceptions across multiple sites, currently being planned, may overcome this limitation. With the exception of perceived interference on staff members’ other activities, which met statistical significance but may be of little practical significance, none of the variables investigated showed a significant change over the duration of the study. It is also possible that, at least with this particular EHR, major achievements in efficiency in utilization of the system occur early, with changes after 3 months of use being only incremental. Alternatively, a longer learning curve may be the case, and surveying after a longer interval could demonstrate a significant difference. It must be kept in mind that the focus of this study was perceptions; actual objective measurements, eg, time spent documenting, might produce different results.

In response to our experiences and the data presented here, our family practice center has already begun to make adjustments in our use of the EHR. Data entry in the patient room has almost entirely ceased in our program, because clinicians recognized this as interfering with the doctor-patient relationship. Many of the point-and-click features have been abandoned in favor of increased dictation, with a return to the use of select paper information at the point of care. We’ve learned that dictation-based data entry, including voice recognition, should be the mainstay for most physician users. This can be supplemented by a simple, efficient data entry process. An alternative is the use of a “scribe.”

When evaluating financial benefit of our EHR, we consider physician time for data entry as a cost. As a residency program, we’ve begun to recognize that the EHR should not interfere with time available for educational activities of our residents or faculty.

In conclusion, the anticipated improvement in patient care, provider communications, or billing efficiency due to EHR implementation was not realized in this population; rather, the converse was perceived. Further studies of the experiences of typical users of EHR are warranted before widespread adoption of EHRs should be promoted.

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References