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Original Contributions

THE ECONOMIC EFFECT OF IMPLEMENTING AN EMR IN AN OUTPATIENT CLINICAL SETTING

SCOTT BARLOW, MBA, JEFFREY JOHNSON, MD, JAMIE STECK, MBA

A B S T R A C T

Central Utah Multi-Specialty Clinic, a 59-physician group with practices in nine locations treating 200,000 active patients, documented the economic impact of implementing an electronic medical record. During the one-year period of the study, the clinic experienced direct reductions in spending and increases in revenue of more than \$952,000 compared with the prior year, and anticipates cumulative savings of more than \$8.2 million over the next five years.

K E Y W O R D S

- *Electronic medical record (EMR)*
- *Electronic health record*
- *Document imaging*
- *Coding*
- *Evaluation and management (E/M) codes*

Interest in using information technology to quickly create and easily access a complete clinical note as well as automate clinical workflow has led many healthcare institutions to consider adopting an electronic medical record (EMR). The EMR is widely assumed to provide qualitative benefits (easier access to information, greater patient and provider satisfaction, improved patient safety, etc.), yet there is limited data regarding the economic benefits of EMR to an institution. This dearth of evidence is especially vexing because a majority of healthcare organizations cite lack of funding as the most common constraint in implementing clinical information technology solutions like an EMR.¹

To better understand the financial impact of an EMR, we conducted an extensive evaluation of an EMR at a large, multi-specialty and multi-site ambulatory physician practice. Our study analyzed expenditures related to maintaining patient records at Central Utah Multi-Specialty Clinic (CUMC) in the 12 months following the EMR's implementation (April 1, 2002 to May 30, 2003) and then compared these figures with identical data collected during the prior 12-month period (April 1, 2001 to May 30, 2002).

CUMC is the largest independent multi-specialty group in the state of Utah, with 59 physicians and nine locations. The organization has been growing rapidly, more than doubling the number of physician specialists on staff in less than two years – from 26 in 2001 to 59 in 2003 – and CUMC's strategic plan projects this growth to continue for the foreseeable future. The high growth rate, multi-specialty focus of the organization, and multiple sites pose significant challenges to the clinic's ability to manage patients' clinical records. On April 1, 2002, CUMC implemented the TouchWorks™ electronic medical record, developed by Allscripts Healthcare Solutions of Chicago, IL.

Expenditures analyzed by the study related to five primary areas that were directly affected by the clinic's implementation of an EMR: (1) expenses for transcription of physicians' dictated clinical notes; (2) expenses for pulling, filing,

and maintaining charts for current patients; (3) expenses for developing charts for new patients, including the purchase of paper supplies and personnel costs; (4) changes in reimbursement due to coding levels; and (5) physical space requirements for storage of patient charts.

Study Data

Transcription. Prior to April 1, 2002, the clinic experienced significant clinical and financial challenges to the management of patients' clinical records. These challenges, such as the expense of medical transcription, are identical to those faced daily at tens of thousands of healthcare facilities worldwide. It has been estimated that the medical industry spends between \$10 billion and \$12 billion per year on transcription and managing medical records.

At CUMC, by the time the EMR was implemented, transcription expenses for physicians had begun to exceed \$1 million per year. These costs were incurred whenever physicians chose to dictate their clinical notes into a recording device rather than handwrite them into the paper chart. The dictated note was then transmitted via phone line to a professional transcription service, which turned it into a paper record and faxed it back to the clinic for filing. The process resulted in delays of up to three weeks before the transcribed note was added to a patient's master chart.

The study analyzed expenses for transcription services over the 12 months prior to EMR implementation, considering expenditures at the level of individual physicians, entire specialties, and the organization as a whole. We analyzed the subsequent impact of implementing the EMR's note application – which reduced or, in some cases, eliminated the need for transcription – by comparing these figures with post-implementation expenditures on transcription.

Chart Maintenance. Among the biggest challenges faced by CUMC prior to implementation of the EMR was the difficulty of accessing clinical information stored in paper charts across multiple locations (the clinic, which currently has

nine sites, had eight during the study period). CUMC was developing more than 20,000 charts per year, significantly complicating the issue of limited physician space available in the clinic.

Physicians and nurses frustrated by delays in accessing patient charts commonly created so-called "shadow charts," or multiple charts for the same patient, and kept them at their desks for easy access. This practice typically resulted in delays in the delivery of patient care as clinical personnel were forced to search the facility for a complete record.

Expensive clinical tests were occasionally repeated unnecessarily because a portion of the paper record could not be located. Moreover, maintaining CUMC's nearly 200,000 paper charts (130,000 of them active) required expensive staffing of the chart room and chart-management process, diverting resources from CUMC's core mission of patient care.

The study analyzed expenses for pulling, filing, and maintaining charts for current patients, based on an estimate of the amount of time devoted to current patients' records by the 10.2 full-time-equivalent (FTE) employees involved in chart management during the study period. Expenses for developing charts for new patients were analyzed, assessing an average cost of developing a new chart, both in terms of labor and supplies.

Coding Levels. Prior to the implementation of the EMR, CUMC physicians faced a challenge that is typical in the healthcare industry – appropriate documentation for the appropriate level of care. In general, the more highly compensated interactions (and thus codes) require the most stringent documentation. Physicians often lacked confidence in their documentation and, as a result, were likely to "downcode," choosing the less restrictive (and lower compensated) reimbursement codes, thereby causing significant monetary losses for their practices.

The study compared the percentage of patient visits that were coded 99213 (problems of low to moderate severity) and 99214 (problems of moderate to high severity) in 2000-2001 and during the study period. The percentage differ-

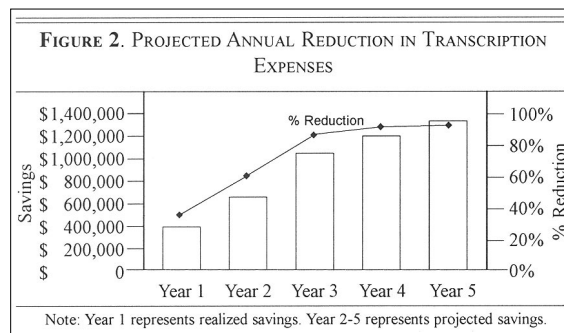
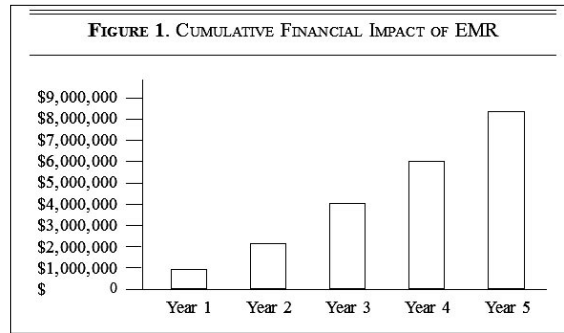
ence over the two periods was used to gauge the revenue impact of implementing the EMR's note application, which provides templates to help better document the level of care provided. The application enhances billing and reimbursement by decreasing the incidence of under- and over-coding by recommending the appropriate evaluation and management (E/M) code based on the level of care that was documented.

Storage Requirements. The necessity of storing vast numbers of patient charts on-site created significant practical problems for CUMC, including a significant negative financial impact. The clinic is currently adding about 20,000 new patient records per year. In the last two years alone, CUMC purchased several large rolling racks to accommodate the growth in the number of paper charts. Pressed for space, the clinic was forced to convert a conference room previously used for meetings of the board of directors and executive management into chart storage. Other space, which might otherwise be used to generate revenue, was also being converted to chart storage.

The study analyzed the amount of space dedicated to chart storage in a new facility under construction by CUMC to gauge the expected space-saving benefit of implementing the EMR. In addition, the required chart racks and miscellaneous build-out expenses were calculated. For the purposes of this analysis, the incremental revenue associated with the use of the additional space for revenue generating activities was not included.

Results

Organization-Wide Financial Impact of the EMR. Soon after CUMC implemented the EMR on April 1, 2002, the clinic's management of patient records began to improve radically. The change followed a nearly five-year search for an EMR, during which time CUMC personnel examined more than 40 different products. In the end, CUMC decided that the EMR offered the best software feature set, a proven ability to integrate with the prac-



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tice management system from IDX Systems used by the clinic, and a track record for quickly gaining physician utilization of the new system.

Today, for the first time, physicians are consistently able to access appropriate clinical information instantly from any of their clinics, as well as any hospital or even from home. As a direct result of implementing the EMR, CUMC has dramatically reduced its transcription expenses; cut its staffing requirements for chart pulling, filing, and maintenance; eliminated the cost of building charts for new patients; eliminated the need for chart storage space in its newest facility; and generated increased revenues through improved E/M coding.

Our analysis indicates that, in its first

year of operation, the EMR had a \$952,000 positive financial impact on the clinic's bottom line, both in terms of increased revenues and reduced operational expenses. Based on these findings, our conservative estimate is a positive financial impact of more than \$8.2 million over the next five years (see figure 1).

Savings from Reduced Need for Transcription Services. The EMR has reduced the need for transcription across CUMC by allowing physicians multiple options for documenting a patient encounter. They can use both structured and unstructured note templates to record certain elements of the patient encounter and limit dictation to more complex citations.

The templates have proven to be a vast improvement over handwritten notes. They leverage the Medcin® database of 200,000 medical terms, utilize structured data entry for standardized clinical terminology and searchable clinical findings, and automatically calculate E/M codes. Additionally, the application automatically populates components of the note as a byproduct of caring for the patient. For example, when writing a prescription, the medication list is automatically updated in the note.

Templates represent a significant transition from dictation and this initially raised some concerns with physicians. In order to address this concern, CUMC provided the option to physicians to continue to use dictation when required. For example, in certain complex encounters it may be more efficient to dictate part of the note. The system allows for this combined approach.

In cases where physicians dictate, the EMR captures the dictation electronically, automatically routes it to the transcription service, and stores the completed transcription in the electronic patient record with an electronic signature. Physicians can then access their completed notes from virtually anywhere, even using a PDA. Where dictation is still used, it is combined with templates to create a compound note. This further limits spending on dictation.

As a result of these improvements to

the physician record-keeping process, CUMC physicians reduced their expenditures on transcription services by 35 percent or \$380,000 in the one-year period of the study. As physicians' comfort levels with templates further increase, we estimate CUMC physicians will reduce their use of dictation by 90 percent, representing a \$4.5 million savings over five years (see figure 2).

Savings from Decreased Labor and Supply Costs for Chart Maintenance and Creation. In recent years, CUMC's physician staff and patient population have both expanded rapidly. During the course of this study, the clinic doubled physician staff (from 26 to 52 physicians) and acquired thousands of new patients. This rapid growth rate placed added pressure on the clinic's paper chart management system. Prior to implementation of the EMR, CUMC staff pulled nearly 1,000 charts per day, including approximately 450 to 550 for scheduled patients and another 450 for walk-ins or individual chart requests. To meet this demand, at the beginning of the study period CUMC had 10.2 FTEs dedicated to managing charts (e.g., file clerks).

The implementation of the EMR allowed CUMC to dramatically reduce its reliance on paper charts. During the study period, the number of chart requests to the records room fell by 35-40 percent. As a result, the clinic was able to avoid increases to FTE chart room staffing, even as the patient load rose significantly.

To estimate the savings in chart-related personnel costs due to implementation of the EMR, we assessed a projected patient load increase of 10 percent annually for the next five years. That figure is fairly conservative, con-

| AREA | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | TOTAL |
|---|------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Savings Due to Lower Space Requirements | \$248,000 | - | - | - | - | \$248,000 |
| Cost Avoidance Due to No Increase in Chart Room FTEs while Patient Volume has Doubled | \$61,692 | \$67,861 | \$74,647 | \$82,112 | \$90,323 | \$376,634 |
| Savings via Chart Room FTEs Reduction Through Attrition | - | \$63,679 | \$63,679 | \$63,679 | \$63,679 | \$254,717 |
| Savings Due to Eliminating Development of Charts for New Patients | \$160,000 | \$176,000 | \$193,600 | \$212,960 | \$234,256 | \$976,816 |
| Increased Revenue Due to Improved E/M Coding | \$103,059 | \$283,413 | \$415,673 | \$457,240 | \$502,964 | \$1,762,349 |
| Savings Due to Lower Transcription Expenses | \$380,000 | \$660,000 | \$1,028,500 | \$1,197,900 | \$1,317,690 | \$4,584,090 |
| TOTAL | \$952,751 | \$1,250,953 | \$1,776,099 | \$2,013,891 | \$2,208,912 | \$8,202,606 |

“During the study period, the number of chart requests to the records room fell by 35-40 percent.”

sidering CUMC's physician staff increased from 26 to 52 during the one-year study period. Based on this increase in providers, we project that CUMC would have needed to increase chart-related staff by approximately 30 percent, or three FTEs, to handle the associated increase in demand, assuming the EMR had not been implemented. Since the EMR allowed a zero net increase in chart-related FTEs, this represents a savings of \$61,692 in the first year of implementation and close to \$376,634 over the next five years (see table 1).

Additionally, as CUMC transitions to a

completely paperless environment in July 2003, we anticipate an additional 30 percent reduction in chart room FTEs as a result of attrition (two FTEs have already been eliminated), as traditional chart-related activities are replaced with tasks such as electronically scanning documents. This

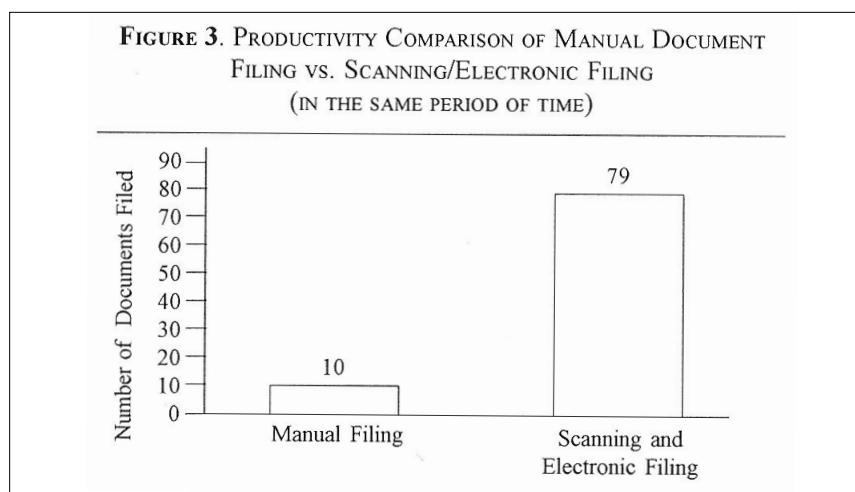
amounts to an additional savings of \$254,717 over five years, for a total savings of \$631,351 in chart-related personnel costs.

One of the key components of the system that enabled CUMC to transition to a completely paperless environment was document imaging, the conversion of paper documents to electronic images. The EMR allows CUMC staff to electronically scan into the computer system existing paper charts and other non-automated documents, such as written correspondence. Scanned documents are available to physicians via the EMR instantly – a significant improvement over the old system, which often required up to three weeks for paper documents to make it into a patient's chart.

In addition to simplifying access to information, scanning has proven to be more efficient from a resource perspective. We conducted a study to validate the effectiveness of scanning versus manual filing and found that CUMC staff were able to file 79 scanned documents

in the same amount of time required to file 10 documents manually – a nearly 800 percent increase in productivity (see figure 3).

Further savings can be expected from a reduction of labor and supply costs associated with the creation of paper charts for new patients. We have assessed the average cost of developing a new chart, both in terms

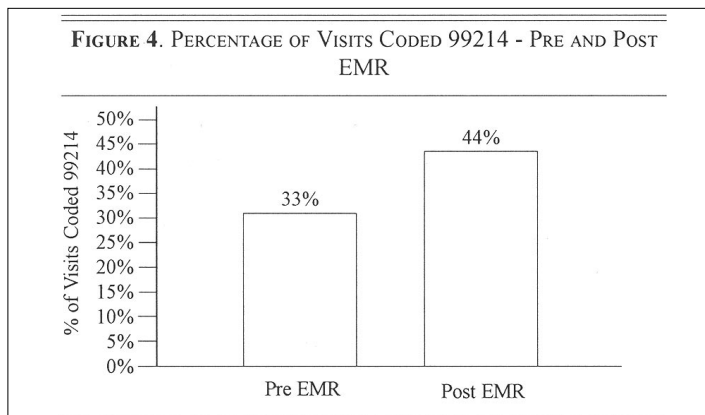


of the labor involved and the supplies, to be \$8 per chart. Based on an estimated annual increase in patient load of 20,000, this amounts to \$160,000 per year saved by the EMR's elimination of new paper charts. Over five years, this savings amounts to \$976,816 (see table 1).

Even more savings could be estimated if we were to consider potential savings. For instance, we estimate that the EMR results in a 15 percent reduction (1.2 hours per day) in the amount of time CUMC RNs and medical assistants spend working with and/or searching for patient records. Based on a conservative estimate of an average 8-hour workday, this would amount to an annual savings of at least 312 hours per RN/MA. However, since these are potential and not actual savings, and since CUMC does not project targeting savings by adjusting clinical staffing, we did not include the estimate in our final calculation.

Savings and Revenue Generated from Increased Coding Levels. As noted above, prior to the implementation of the EMR, CUMC physicians were likely to "downcode," choosing the less restrictive (and lower compensated) E/M codes, thereby causing significant monetary losses for their practices. Leveraging the EMR's templates during the course of the study, the clinic's physicians were able to better document the level of care they rendered, enabling an increase in coding levels. The EMR includes an automatic E/M code calculator that recommends the proper code based on the level of care that they have electronically documented.

To evaluate the impact of the EMR on revenue generated by E/M coding, the study compared the percentage of patient visits that were coded 99213 (problems of low to moderate severity) and 99214 (problems of moderate to high severity) in 2000-2001 and during the study period. We found an 11 percent overall increase in the appropriate use of 99214 codes that would previously have been coded 99213 (see figure 4). To ensure the accuracy of this finding,



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the CUMC compliance committee retrospectively audited the use of 99214 codes and found them to have met the proper documentation levels. The resulting reduction in downcoding due to the EMR produced an average billable gain of \$26 per patient during the study period, for a total positive revenue impact of \$103,059. Over a five-year span, we estimate that CUMC will generate \$1,762,349 in revenue gains as a direct result of physicians utilizing the EMR's templates to improve documentation and coding.

Decreased Physical Space Requirements Due to Paperless Record. CUMC is building a new facility next to its main clinic in Provo, Utah. Thanks to the elimination of paper records for new patients, there will be no records room in this new facility, resulting in a projected savings of \$248,000. This figure accounts for space, the cost of a storage rack system, and miscellaneous build-out expenses. Additionally, CUMC has downsized its physical space requirements for record

storage in existing buildings. Several chart storage rooms are slated to become offices or exam rooms in the near future. Our calculations do not include the incremental revenue that will be generated by the transformation of storage space into revenue-generating areas.

Discussion

While the EMR is widely assumed to provide qualitative

benefits to the provision of patient care (easier access to information, greater patient and provider satisfaction, etc.), there is limited data regarding its economic benefits to an institution. Our study suggests that implementation of an electronic medical record can quickly produce a significant economic benefit for a healthcare institution, resulting in substantial savings and increased revenue. This provides the economic justification for the investment in a technology that CUMC believes will have a significant impact on patient outcomes. The ability to receive health maintenance alerts and notification of potential drug interactions, to graph results, to instantly access information anywhere at any time, to improve communication between providers, and to have the assurance of a complete patient record, all will play a major role in improving patient outcomes.

A number of potential limitations should be considered in interpreting these results. The evaluation was carried out at a single organization that was not part of an integrated delivery network. Additionally, larger clinics, such as CUMC, have a greater ability to invest in information technology, considering that the expenses can be spread over a larger number of physicians. Considering these institution factors, the results may not be applicable in all settings. However, it is important to note that CUMC is a large multi-specialty clinic with several locations and a diverse patient population, which may lend credence to the generalizability of the results.

Overall, disappointingly few studies have examined the financial case for EMR. However, some data are available.

In the ambulatory setting, Renner performed a study of a 40-physician ambulatory care medical group and estimated a net present value for the EMR system of \$279,670.² And Wang³ estimated that electronic medical records would save the average primary care provider an estimated \$86,400 over five years, compared to traditional paper-based methods. Benefits cited include reduced drug spending, reductions in radiology, decreased billing errors, and improved charge capture for billing.

There have been additional studies that have focused on savings at a macro level. A recent analysis for the Massachusetts Technology Collaborative⁴ concluded that, assuming a physician adoption rate of 75 percent, the annual net benefit to the state would be \$290.3

million. This research also concluded that EMRs would eliminate 47,000 preventable adverse drug events (ADEs). An additional assessment by the Center for Information Technology Leadership⁵ concluded that ambulatory computerized physician order entry (ACPOE) can save approximately \$44 billion per year in reduced medication, radiology, laboratory, and ADE-related expenses per year. The report also concluded that ACPOE could eliminate more than \$10 in rejected claims per outpatient visit.

Our analysis did not contemplate savings in areas such as drug spending and radiology, as there was not a direct economic benefit to the organization. Depending on the location and environment, these savings might be more applicable.

Taken together, these data confirm our findings that financial benefits will accrue to healthcare institutions from the implementation of an EMR. Moreover, the benefits may accrue more quickly, as in the case of CUMC, than most past studies have projected.

About the Authors

Scott Barlow, MBA, (sbarlow@cumcmds.com) is the chief executive officer for Central Utah Multi-Specialty Clinic.

Jeffrey Johnson, MD, (jjohnson@cumcmds.com) is an internist and the physician lead for EMR implementation at Central Utah Multi-Specialty Clinic.

Jamie Steck, MBA, (jsteck@cumcmds.com) is director of information technology at Central Utah Multi-Specialty Clinic.

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