Improving Workflow

Electronic Medical Record Customization and the Impact Upon Chart Completion Rates

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Objective: *The study's objctive was to determine if alterations to the utility of an existing electronic medical record (EMR) application resulted in an improvement in clinical operations.* Methods: *We altered several templates within an existing EMR application to improve ease of documentation of clinical encounters. These changes were disease specific, brought documentation into central locations, and altered the input method to facilitate point of care documentation. We examined the length of time (in days) from the creation of a chart entry to the final signing of that chart entry. These charts were delimited to faculty providers who had an active clinical practice during the entire study period.* Results: *We discovered that the template changes resulted in an increase in the number of charts completed within 30 days by nearly 5%, resulting in a substantial number of billable clinical encounters.* Conclusions: *This improvement is important, as compliance policies prohibit the billing of encounters if the chart is not completed within 30 days. We conclude that simple, inexpensive changes in existing technology may be adequate to have a significant impact upon an organization.*

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Electronic medical records (EMRs) are often touted as a way for health care providers to improve the quality of care provided to their patients. Recent evidence of this impact, however, has been mixed. A 2006 systematic review of the literature on the relationship between quality of care and EMR utilization showed promising results.[1] This review found that institutions that had fully implemented EMR systems saw improved care delivery, reduced medication error rates, improved disease surveillance and maintenance, and decreased laboratory and radiology services. These improvements, however, were found among institutions that had substantial resources to alter, customize, and fully implement an EMR system capable of decision support, reminders, and other complex tasks.

Other studies have shown that the link between EMRs and improving the quality of care is tenuous at best. A large nationally representative analysis found that for many measures of ambulatory care quality, EMRs did not improve quality (and actually decreased quality in one measure).[2] The data utilized for this analysis did not, however, collect data regarding the capability of the EMR systems in question. Others have found similar results, showing that practices without an EMR actually performed better on diabetes quality of care measures than practices with an EMR.[3] This result is not surprising, given the author's note that the characteristics of an EMR that carry quality of care benefits—such as decision support, clinical reminders, and registry functionality—was less prevalent among EMR practices compared to non-EMR practices. Even the Healthcare Information and Management Systems Society (HIMSS) will define an EMR as functional (in an ambulatory setting) if the system functions minimally as an electronic storage of medical information.[4]

Thus, the evidence so far indicates that it is not the use of an EMR or other technology but rather the utility of the technology. Others have recognized that attempting to implement burdensome EMR applications that do not fit a provider's workflow or needs will not be successful.[5,6] Different care delivery sites can react differently to identical applications, depending upon the characteristics of the providers in the practice, and can lead to non-adoption.[7,8] Given these difficulties, a method to better utilize an existing EMR installation is

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to align the provider preferences with the utility of the application. The Information Technology Acceptance Model suggests several factors that lead to the eventual adoption and use of any technology.[9] The ITAM model suggests that the sophistication of the technology, combined with its capabilities, lead to a congruence or "fit" within an organization. It is this congruence that leads to users within an organization perceiving the technology as useful or easy to use, both of which are important factors in the technology's eventual adoption.

The purpose of this analysis is to describe changes made to an existing EMR implementation that were intended to improve adoption and utilization of the EMR by improving the utility of the application. The impact of these changes upon utilization of the EMR application was assessed by measuring the time to chart completion, a measure with both clinical and operational implications.

Methods

Our setting has utilized the current EMR since 2004 and has a history of using an EMR since 2000. We analyzed our EMR implementation according to the Healthcare Information and Management Systems Society (HIMSS) EMR Adoption model for Physician Clinics.[4] This framework defines various stages of EMR system implementation, ranging from Stage 0 (the use of paper charts for all clinical documentation) to stage 5 (the use of electronic information systems that allow for proactive management, decision support, and information sharing across providers and the continuum of care). To meet our quality care goals, we identified a need to move beyond our current Stage 3 implementation, which indicates electronic storage of information, laboratory results, messaging, and some basic decision support. We do not, however, have an ideal EMR implementation. The system itself is owned not by our affiliated university but rather by the affiliated hospital system. Thus, we do not have the authority (since we are employees not of the hospital but the university) to fully implement the EMR product.

We also noticed a large number of charts not being completed within a reasonable amount of time. Specifically, the compliance regulations require charts to be signed by the provider within 30 days, or the visit cannot be billed. Therefore, we chose to make alterations to existing modules within the EMR, based upon Dixon's ITAM model.[9] Specifically, the template used for a majority of our office visits was altered along several of Dixon's factors (sophistication, capabilities, fit, perceived ease of use, and perceived usefulness) with the goal of improving the end point of adoption and utilization. Ultimately, these alterations would enhance the portions of the EMR that we could alter, with the goal of improving documentation to allow for more complete billing. The following analysis examines the outcomes of these changes by measuring the length of time it takes a provider to complete and sign the electronic chart.

In the fall of 2007, the Family Medical Center (FMC) introduced new EMR templates designed to improve the documentation of clinical visits. These templates were designed by a faculty provider, who had training on template design and implementation. Previously the documentation templates were somewhat generalized and required a substantial amount of free text typing and movement between tabs or windows to complete an adequate history of present illness, review of systems, and physical exam. The newly designed templates improved the process by first grouping disease-specific observations in one place to eliminate the need to change windows or insert additional forms. These revisions resulted in more disease-specific templates with structured data fields regarding the individual diseases that not only focused the provider's line of questioning but also simplified the documentation method by utilizing check boxes and drop-down lists with limited choices. For example, the diabetic chronic disease template was altered to include check boxes that indicated if a patient had an active prescription for an ACE inhibitor, statin, or aspirin. While this information was available on the medication list, the check boxes allowed the clinical staff to more quickly assess the patient's needs and compliance with recommendations.

The main goal of the new templates was to facilitate point of care documentation, with minimal typing and interaction with the application itself, so that the provider's patient encounter workflow could be maintained. Not only would this point of care documentation lead to better clinical documentation but would, theoretically, reduce the amount of time until final completion of the chart. Training was provided to all clinical staff on the use of the new templates during a center-wide education session. Provider satisfaction with the EMR template changes was initially unchanged. However, once providers had more experience using the revised templates they quickly realized the added benefit to documenting a more detailed visit and time savings created by the revisions in documentation style. At this point, verbalized satisfaction from providers became fairly common.

To assess the impact of these template changes, we abstracted office visit documentation information from the EMR system. These visits were conducted in the Family Medicine Center (FMC), the clinical arm of the Department of Family and Preventive Medicine within the University of South Carolina School of Medicine. The FMC employs 48 part-time providers (14 faculty and 34 resident physicians), for a total of 13 full time equivalents. Data were abstracted from the Electronic Medical Record (GE Centricity™) data server using an oracle data connection and was imported into and analyzed with SAS 9.1.

Data obtained from the EMR included a unique identifier of the provider, the date the document was created, and the date the document was signed. The analysis was delimited to just office visits (excluding injections, nurse visits, and procedures) managed by faculty providers who had patient visits during the entire study period. No actual patient information was abstracted, just information about the documentation of the visit, specifically the date and time of documentation creation, the date and time of final signing of the document, and the unique identifier of the provider of record. The data included office visits from January 1, 2006, through December 31, 2008.

The analysis was subdivided into 6-month intervals, beginning in January of 2006. The first three intervals (January to June 2006, July to December 2006, and January to June 2007) were set as the baseline period for the analysis. Since the new forms were introduced in the fall of 2007, the fourth period (July to December 2007) was categorized as a transition period between old and new templates. The following two periods (January to June 2008 and July to December 2008) were used as follow-up study periods.

The main variable of interest was the number of days between the creation of the office visit document (in the EMR) and the final electronic signing of that document. Since the distribution of days to completion was not normally distributed, the median per time period was used as a measure of central tendency. Initial bivariate analysis examined the proportion of visits per time period, by provider. We then displayed median number of charts completed by several categories: less than 1 day, in 7 days or less, in 30 days or less, or greater than 30 days. All differences were tested using Wald Chi Square tests of differences. The analysis was approved by the University of South Carolina Institutional Review Board, as well as the Palmetto Health Alliance Institutional Review Board.

Observations

This study examined 7,446 visits performed by 11 faculty providers. We chose to focus on these providers for several reasons. First, these providers were employed by the FMC, and had an active clinical practice, during the entire study period. These providers also had ample experience with and time learning the EMR system, having used it a minimum of 1 year prior to the study period. Also, these providers had relatively stable patient panels; these providers had closed patient panels and did not, in general, accept new patients. The other providers in the FMC either joined at some point during the study or were resident physicians completing their residency. These providers were excluded due to the learning curve inherent in not only learning to document in an EMR context, but in the case of the residents, learning how to conduct clinical encounters.

Table 1 displays the median time difference, in days, between the document creation date and the final sign date. During the baseline period, the median time to completion varied from 1.11 to 0.97 for the three periods (1.06 for the entire period). The transition period saw an increase in the median time to completion (1.28, $P<.05$) from the baseline. The follow-up period saw a decrease in the median days to completion, from 1.01 to 1.04 (1.03 for the entire period, $P<.05$).

Table 2 displays the percentage of charts completed, by time period. Overall, the percentage of charts completed on the same day did not change significantly, but the percentage completed within 7 days and within 30 days increased in the follow-up study period. The percentage of charts completed within 7 days increased from 75.3% during the baseline period to 78.7% in the follow-up period ($P<.05$). A similar increase was found among charts completed within 30 days, which increased from 94.0% to 97.3% ($P<.05$). These differences resulted in more than 97% of charts completed within 30 days by the final follow-up study period, compared to 94% in the baseline period ($P<.05$).

Discussion

We described an attempt to improve the utility of an existing EMR installation by customizing the template used to record patient medical information generated during a visit. The results indicate that this change resulted in a positive improvement in time to chart completion. This outcome is encouraging for provid-

Table 1

Median Days to Chart Completion, by Study Period

	*Median Days to Completion**
Baseline	**1.06**
January–June 2006	1.11
July–December 2006	1.04
January–June 2007	0.97
Transition (July–December 2007)	**1.28**
Follow-up	**1.03**
January–June 2008	1.01
July–December 2008	1.04

* Difference between baseline and follow-up periods significantly different, $P<.05$

ers with an existing EMR application who do not have the resources to upgrade their functionality. As an alternative, improving the utility of the existing product, either though customization or improved training, has the potential for a significant impact upon clinical practice.

This analysis is important for several reasons. First, by using experienced, stable faculty providers who saw patients during the entire study period, we eliminated a potential confounder of those who may be new to the EMR and its recording requirements. This is validated by the consistent chart completion rates seen during the baseline period, across providers (data not shown). The fact that chart completion rates increased after the introduction of the new templates, in the absence of any other measurable changes (such as changes in patient case mix or experiment with the EMR system itself), lends credence to the causality of the template changes. We did, however, provide a training session to introduce the new forms at the beginning of the transition period; theoretically, this training, in and of itself, could have improved documentation rates. However, if this were the case, then the completion rates would have increased during this transition period and not some time afterward. This 3-month lag from introduction to improvement due to the template changes validates the template change as the probable cause of improvement.

Table 2

Percentage of Charts Completed, by Completion Time and Study Period

	Completed the Same Day	*Completed Within 7 Days**	*Completed Within 30 Days**	*Completed in 30 Days or More**
Baseline	**49.1**	**75.3**	**94.0**	**6.0**
January–June 2006	47.1	76.0	94.0	6.0
July–December 2006	48.9	74.6	94.2	5.8
January–June 2007	50.9	75.3	93.8	6.2
Transition (July–Dec 2007)	**45.9**	**73.2**	**91.7**	**8.4**
Follow-up	**49.2**	**78.7**	**97.3**	**2.7**
January–June 2008	49.6	79.8	96.0	4.0
July–December 2008	48.9	77.7	98.4	1.7

* Difference between baseline and follow-up periods significantly different, $P<.05$

Second, the transition period saw a significant decrease in the chart completion rates, with only 92% completed within 30 days. This illustrates the time it takes to learn new documentation interfaces and to alter methods for recording the necessary data for each patient. This effect lingered into the follow-up period, where the first 6-month period had a 30-day completion rate of 96%, which increased to 98.4% by the second 6-month follow-up period.

The 30-day mark was chosen due to the potential impact upon clinical operations. Our compliance regulations require that charts must be completed within 30 days or else that visit cannot be billed. The improved completion rate (94.0% to 98.4%) during this study period increased the number of billable visits, a result that has significant financial implications. Specifically, given the sample of nearly 7,500 visits in this study alone, a 4.4% increase in billable visits results in 330 more billable encounters than before the changes were implemented. If similar results can be extrapolated to all patient visits seen by the FMC, a 4.4% increase in billable visits would result in more than 1,300 additional billable encounters. At our current collection rate of $72.01 per encounter, the result is a potential increase in revenue of more than $93,000.

This analysis is limited by several factors. With the delimited set of providers, we made the assumption that comfort with the EMR, and computer technology in general, was established before the transition period. Also, intangible effects may exist that may have affected provider chart completion behavior. While the practice did not engage in any specific intervention related to documentation, billing, or the like, it is possible that unknown external forces influence this behavior. It is also possible that the introduction of new faculty providers, or even the incoming resident physician classes, may have affected the existing providers' documentation behavior. This, however, seems unlikely given the relatively stable chart completion rates seen during the baseline period.

With the increasing emphasis upon health information technology and EMR implementation in clinical practices, these results can serve as an important lesson. Namely, even with basic EMR installations, their use, utility, and overall impact upon the clinical practice can be improved with few resources.

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