Developing patient registration and medical records management system in Ethiopia

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Abstract

Quality problem. In low-income countries, medical record management is often lacking. We sought to evaluate the impact of an inexpensive business process re-engineering project on the accessibility and completeness of patient information and on physician satisfaction.


Setting. A rural hospital in Ethiopia.

Participants. Medical record personnel, hospital administrators, clinical staff.

Implementation. We implemented a hospital-wide patient registration and medical records re-engineering process, which included a simple, custom-made computer database to manage patient information, standardized medical records forms and processes and enhanced human resource management efforts.

Main Outcome Measure(s). We measured medical records accessibility and completeness, and physician satisfaction.

Evaluation. Medical record accessibility and completeness and physician satisfaction improved significantly (P < 0.05) based on pre- and post-intervention comparisons. The success rate of retrieving the proper medical record number for returning patients improved from 14 to 87% (P < 0.01); time to locate medical records decreased from 31.2 sec per record to 15.7 sec per record (P < 0.01); the percentage of complete medical records increased from 6.5 to 45.7% (P < 0.01). Physician satisfaction with the medical records system was significantly higher after the intervention (P = 0.02).

Lessons Learned. Our findings indicate that a well-organized medical record management system can be effective in improving patient information accessibility and completeness in hospitals in low-income countries despite the lack of resources. Longer follow-up is required to assess the sustainability of the hospital improvements accomplished.

Keywords: medical records, patient registration, quality improvement, business process re-engineering, Ethiopia, Africa

Introduction

The medical record is a multifunctional document that is used to communicate and document critical information about patients’ medical care among health care professionals [1–4]. Comprehensive medical records are a cornerstone in the quality and efficiency of patient care during the hospitalization and in subsequent follow-up visits, as they can provide a complete and accurate chronology of treatments, patient results and future plans for care [5, 6]. Despite the importance of medical records to high quality and efficient care, management of medical records, particularly in developing countries, has not been a priority. Whereas in many high-income countries the medical records function is supported by extensive use of information technology [5–9], medical records in developing countries are generally inadequately supported and poorly managed. Although there are some exceptions with new open-source medical records systems becoming available [10, 11], these are yet not widely used.

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In this study, we report on a re-engineering process to improve medical records management in a rural hospital in Ethiopia. While electronic medical records management systems can improve completeness and availability of medical record information, Ethiopia lacks the needed infrastructure and resources for widespread use of electronic medical records. Therefore, we developed a paper-based registration and medical records management system with a simple computer database program to assist patient information search. We used a quality improvement approach, which involved local hospital management, physicians and medical records staff and evaluated the impact of the new system on medical record accessibility and completeness, as well as changes in physician’s satisfaction with the medical records and patient registration processes at the hospital. Results from this study can be used to further assess the potential of quality improvement in strengthening medical records management, a foundational aspect of health systems in low-income countries.

Method

Setting

Our study was completed at a 50-year old rural hospital founded by missionaries as a leprosarium and now used as a general community hospital in Ethiopia. The hospital has 165 beds and serves a catchment area of 1.7 million people. The hospital has a total of 140 employees, 9 of whom are physicians.

Study design and sample

We used a pre–post intervention study to examine the accessibility and completeness of medical records before and after the intervention, as well as changes in physicians’ satisfaction with the medical record management system. Baseline data were collected in October 2006; follow-up data in June 2007, after 2 months of implementation. For the assessment of both medical record accessibility and time required to retrieve the medical record, we sampled from two mornings, two afternoons and two evenings over a 1-week period both before and after the intervention. We sampled in this way due to the potential impact of differing patient volumes at different times of day. For the assessment of accessibility, we randomly selected 29 patients before the intervention and 30 patients after the intervention. For the assessment of time required to retrieve a medical record, we randomly selected 30 patients before the intervention and 25 patients after the intervention. These samples reflected about 75% of the returning patient population visiting the health facility during the study periods. Medical record completeness was assessed using an audit of 31 randomly selected medical records of currently discharged before the intervention and 35 randomly selected medical records of recently discharged patients after the intervention. These samples reflected about 40% of all discharged during those weeks. We rated a medical record complete if it included the following items: medical record number on each page, patient information in the record, physician note, nursing note for inpatient, medication record if ordered, lab result if ordered and radiology result if ordered.

Physician satisfaction was measured with a self-administered survey completed by all physicians who were present at the hospital in October 2006 before the intervention and in June 2007 after the intervention. We developed the survey, which was translated into Amharic and pre-tested with Ethiopian clinicians. As part of pre-testing, we performed cognitive interviews to ensure that they understood the items as they were intended. We examined the average satisfaction ratings across all physicians in the hospital at both pre- and post-intervention periods. This comprised nine physicians at each survey period, although they were not the same physicians due to turnover. The physician survey included six items, each rated on a four-point scale of strongly agree, agree, disagree and strongly disagree. The items were: (1) I often repeat my clinical examination due to loss of patient history; (2) it is difficult to look for the lab test result in the current medical records; (3) other patient’s information often mixed in my patient’s medical record; (4) it is difficult to find out the vital signs of your patients; (5) it is difficult to find out the medication administration detail of your patients and (6) my written orders in medical records frequently have not been followed.

Patient registration and medical records intervention

We worked in a collaborative team of six staff members to apply problem solving and quality improvement techniques [12] to define the problem, understand its root cases, set objectives, consider alternative strategies to address the problem and fulfil the objective, select a strategy, implement a set of planned tasks and evaluate the impact of the intervention. We defined the problem as frequent missing or incomplete medical records. To identify root causes and scope of the problem, we conducted a pre-implementation assessment in the fall of 2006. The pre-intervention assessment revealed that the hospital had four distinct points of patient registration, each with an independent registration and medical record number assignment system. Each registration point recorded patient information in a log book. A numerical medical record number was generated sequentially, and there was no master patient index system at the hospital. Therefore, at any given time, four different patients could have the same medical record number. Furthermore, if a returning patient’s medical record could not be found, the patient was assigned a new medical record number. In addition, there were no standardized forms or filing processes. Most clinical information was written on scraps of paper. Some medical records were kept in the clinics or physicians’ offices with few returned to the medical records department.

The intervention included the following components: (1) a single point of entry for patient registration, (2) a custom-
made MS Access-based computerized system for the master patient index and registration process, adapted to the unique needs of Ethiopia’s language, culture, and limited computer skills, (3) standardization of medical records forms, (4) implementation of standardized procedures for medical record handling and filing, and (5) enhanced human resource training and supervision. The database captured several patient-specific data elements including a computer-generated unique medical record number, patient’s name, age (we could not use date of birth as most Ethiopians do not know their date of birth, and the program automatically adjusts age for returning patients), address if known), phone number, and dates of registration. These elements assist in future searches for patients’ medical record numbers. The computer system used click buttons, drop-down menus and Amharic words to accommodate limited keyboard skills and to minimize date input errors. Medical records forms in folders were assigned to each patient, were filed by medical record number and kept in a single central location when the patient was not in the hospital. Only hospital employees were allowed to handle medical records. Due to the complexity of the project, the implementation did not include medical records tracking system. However, all clinicians were encouraged to return the medical records back to medical records department for filing at the end of each business day. The new system computerized the master patient index. Other parts of the new patient registration and medical records system remained paper-based including the registration book, clinical documentation forms, folders for holding medical records and the medical record filing system. The preparation and training phase of the intervention lasted from November 2006 through April 2007. The new patient registration and medical records intervention was implemented on 9 April 2009.

**Measures and data collection**

We measured the percentage of medical record numbers that could be found in cases when the returning patient could not provide their numbers. Time from registration clerks receiving the medical record number to retrieving medical record was recorded. Completeness of the medical record was determined by the percentage of medical records, which had completed all seven essential items through chart audit. Physician satisfaction was measured by a total satisfaction rating; the total satisfaction score was calculated as the four-point Likert scale responses summed across the six items on the questionnaire. Therefore, the possible range of the overall score was 6–24.

**Data analysis**

We used *t*-tests to examine the statistical significance of pre- and post-intervention differences in the percentage of medical record numbers found, time required to find a medical record and the percentage of medical records that were complete. Due to the same physician sample size, we used the Mann–Whitney test to evaluate the statistical significance of pre- and post-intervention differences in the overall physician satisfaction score as well as in individual items on the physician survey.

**Results**

**Accessibility and completeness of the medical record**

The likelihood of finding medical record numbers for returning patients increased significantly from before the intervention to after the intervention (14% pre-intervention and 87% post-intervention, *P* < 0.01) (Table 1). The time required to retrieve medical records also improved significantly from before to after the intervention (31.2 sec per medical record pre-intervention and 15.7 sec per medical record post-intervention, *P* < 0.01). In addition, the percent of medical records that were complete increased significantly (6.5% pre-intervention and 45.7% post-intervention, *P* < 0.01).

**Physician satisfaction**

The overall physician satisfaction score improved significantly (mean satisfaction score 11.3 pre-intervention and 15.2 post-intervention, *P* = 0.02). In analysis of individual survey items, we found physicians were less likely (*P* < 0.05) to agree with each of the following statements in the post-versus pre-intervention period: ‘It is difficult to look for the lab test result in the current medical records’, ‘It is difficult to find out the vital signs of your patients’ and ‘It is difficult to find out the medication administration detail of your patients’.

**Discussion**

We found that a simple set of interventions could be accomplished to significantly improve the accessibility and completeness of medical records in a resource-limited setting. The simplicity and inexpensiveness of this project produced results that demonstrate that a well-planned business process re-engineering intervention can improve management and system operations that can facilitate better patient medical information and improve physician satisfaction in rural setting despite that there are limited resources to support their clinical work. In addition, the intervention resulted in increased training and performance by important but often overlooked human resources at hospitals, the medical record room staff. Critical to the system design was the merging of patient registration and medical record number assignment into one process, the design of a computerized master patient index, standardization of medical record handling and filing procedures and adequate training and human resource development efforts for involved staff. An automated tracking system for medical records checked out of the medical record room for patient care is also possible to implement, although this may be viewed as a second step after first establishing more fundamental medical records number...
### Table 1: Pre- and post-intervention changes in medical record accessibility, completeness and physician satisfaction

<table>
<thead>
<tr>
<th></th>
<th>Pre-intervention</th>
<th>Post-intervention</th>
<th>P-value</th>
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<tbody>
<tr>
<td><strong>Medical record accessibility</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of medical record numbers found</td>
<td>14% (4 records/29 records)</td>
<td>87% (26 records/30 records)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Mean time to find medical record (SD)</td>
<td>31.2 sec (8.0 sec)</td>
<td>15.7 sec (12.8 sec)</td>
<td>&lt;0.01</td>
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<tr>
<td><strong>Medical record completeness</strong></td>
<td></td>
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<tr>
<td>Percent of medical record numbers complete</td>
<td>6.5% (2 records/31 records)</td>
<td>45.7% (16 records/35 records)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td><strong>Physician satisfaction</strong></td>
<td></td>
<td></td>
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<tr>
<td>Mean score % (number of responses out of 9)</td>
<td></td>
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<tr>
<td>Overall mean score</td>
<td>11.3</td>
<td>15.2</td>
<td>0.02&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Percentage of agree and strongly agree for the following items</td>
<td></td>
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<tr>
<td>1. I often repeat my clinical examination due to loss of patient history.</td>
<td>2.2 66 (6/9)</td>
<td>2.4 42 (4/9)</td>
<td>0.63</td>
</tr>
<tr>
<td>2. It is difficult to look for the lab test results in the current medical records.</td>
<td>1.9 78 (7/9)</td>
<td>2.9 33 (3/9)</td>
<td>0.04&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>3. Other patient's information often mixed in my patient's medical records.</td>
<td>2.0 78 (7/9)</td>
<td>2.3 42 (4/9)</td>
<td>0.51</td>
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<tr>
<td>4. It is difficult to find out the vital signs of your patients.</td>
<td>1.6 89 (8/9)</td>
<td>2.7 33 (3/9)</td>
<td>0.03&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>5. It is difficult to find out the medication administration detail of your patients</td>
<td>1.9 89 (8/9)</td>
<td>2.8 33 (3/9)</td>
<td>0.04&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>6. My written orders in medical records frequently have not been followed.</td>
<td>1.8 89 (8/9)</td>
<td>2.2 66 (6/9)</td>
<td>0.34</td>
</tr>
</tbody>
</table>

<sup>a</sup>P-value < 0.05.
assignment and medical record filing and completion processes.

The intervention did require standardization of forms. While such standardization may not be easily accepted by clinicians because it can add to documentation and time requirements, such documentation is critical for communication among the care team.Clinicians can find laboratory results, vital signs and medication administration records more easily and hence be more proactive in their care for patients and likely improve the quality of care. Furthermore, as nurses enhance their skill levels, it is important that they are aware of the patient information that can be documented in the medical record and that they follow-up on such information anticipating potential problems and communicating as more informed and empowered members of the care team. Last, such medical record documentation forms the basis for proper epidemiologic evaluation of various patterns of disease as well as more accurate monitoring of quality of care delivered in the hospital. Ideally, patient information documented comprehensive medical records at the facility level can contribute to a national system for epidemiologic surveillance and reporting, which can help with future health system planning and evaluation.

We learned several key lessons during the implementation process. First, full co-operation from the hospital staff (physicians, nurses and other staff) takes time to attain and is paramount to success. Our implementation required 6 months of preparation; much of this time involved gaining support from front-line staff who would promote the new ways. Initially hospital employees were resistant to the changes. Staff had been using the previously poorly designed medical records system for so long that it was very difficult to transition the system without causing confusion. Some clinical staff refused to participate in the new process before seeing any benefits. Support from the hospital senior management and involvement of all staff in substantial education were crucial to success. Second, although the system was implemented with few resources, it nonetheless required an investment at the beginning of the process for what was a promise of benefit. Particularly when there were other pressing matters, such as cholera epidemics and power shortages, it was difficult to create a sense of urgency to address medical records issues. It was important to articulating the link between accessible and complete medical records and quality of care and demonstrate that the investment saved time and resources in the long-run. Our cost analysis indicated that apart from the initial investment in folders and a computer program, the annual maintenance cost was similar to the cost of the previous medical records management system. The intervention was relatively inexpensive, with the first year investment and operating expenses being about 2% of the hospital budget, and about 1% of the hospital’s overall annual budget in subsequent years. Initial set-up cost could be further reduced if the hospital purchased a used computer or requested the item be donated. Finally, maintenance of the system requires some information technology support as well as continuous monitoring and retraining if necessary. As with any change in job tasks, performance evaluation and corrective action if needed must be used to ensure sustainability of the system.

Despite the difficulties and challenge, our findings support that a well-planned medical records management system can be effective in enhancing the accessibility and completeness of patient information to support clinical practice. The time to retrieve medical records was reduced almost to half. Before the intervention, the hospital did not have a reliable filing system; medical records were haphazardly left in different locations without recognizable medical record numbers on the records. Organizing the files, clearly labelling the shelves and using better folders improved efficiency and reduced time to retrieve the medical records. In addition, the intervention eliminated all duplicated medical record numbers, making it easier to file medical record reliably.

The findings of the study should be interpreted in light of its limitations. First, the sample size was modest, which limits the statistical power to detect significant differences in the pre- and post-intervention data, particularly among the physician satisfaction measures. Nevertheless, we did have adequate power to detect significant differences in the medical record accessibility, time for retrieval and medical record completeness measures as shown by our results, and we included all available physicians for the physician satisfaction study. Therefore, we believe that the sample sizes were appropriate for the purposes of the study. Second, we cannot eliminate the possibility of a Hawthorne effect, when staff members act differently when they are being observed. However, we used the same observation methods in the pre- and post-intervention periods; therefore, we do not think this potential bias substantially affected our conclusions. Finally, the study was conducted in a single rural hospital in Ethiopia; results may differ in other settings.

Our findings indicate that applying problem solving and quality improvement techniques to re-engineer the medical record management system can be effective in improving patient information management in hospitals in low-income countries despite the lack of resources. The approach was simple and inexpensive, and the results indicate significant improvement in accessibility, completeness and physician satisfaction in the medical records system despite the small sample size. The full support from hospital leadership and staff is the key to success. Extensive training on human resources is crucial to implementation. Longer follow-up would be required to assess the sustainability of the hospital improvements accomplished.

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