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Clinical Documentation Improvement for Outpatients by Implementing Electronic Medical Records

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Abstract. This observational study was conducted before and after implementing an electronic medical record (EMR) system to evaluate the change in outpatient workflow by implementation of EMR and the effectiveness of clinical documentation improvement (CDI). The number of hours for patient care increased by 89.2% ($p<.05$) and the hours for writing medical records after consulting decreased after implementation of EMR by27.3% ($p<.01$). Implementation of EMR reduced nurses' workload to handle medical records by 78.8 ($p<.05$) but not changed for physicians. The necessary change in the information management process occurred after using the CDI indicator. We recommend that the "working hours of health professionals" and "handling hours for information resources" should be used widely as CDI indicators to improve workflow when implementing EMR.

Keywords. Electrical Medical Records (EMR), Clinical Documentation Improvement (CDI), Staff Workloads

Introduction

The necessity for clinical documentation improvement (CDI) is rapidly increasing because secondary uses of clinical data in an electronic medical record (EMR) system have increased [1]. CDI is the consistent improvement not only in the "document" but also in the information processing and management processes in a clinical situation. CDI programs require physicians, nurses, pharmacists, and health information specialists to work together because CDI includes various care processes such as medical procedures, nursing care, laboratory work, and rehabilitation. However, CDI programs are not popular in Japan, and two problems have prevented CDI from occurring in Japan.

The first problem concerns standardization and missing values. The Japanese government released the "Doko-Demo My Byoin (Hospital Everywhere)" project in

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2010, which aimed to build regional electronic health records (EHR). Regional EHR is different from EMR in each hospital. Thus, clinical data standardization becomes important to build regional EHR. One of the objectives of "Doko-Demo My Byoin" is to improve chronic disease management, including diabetes, high blood pressure, and hyperlipidemia. Chronic data management requires collecting long-term clinical data of blood pressure, blood sugar, medication, and laboratory data, and managing these data in electronic records is effective for improving clinical performance [2]. However, our previous research indicated that long-term clinical data occasionally lack completeness because of missing values and unstandardized data in EMR.

The second problem concerns clinicians' workload. The workload of physicians and nurses has substantially increased in the past 10 years. Our previous research indicated that physicians spend 3 h or more on clerical work per day, whereas nurses spend 4 h or more. The job-to-applicant ratio continues to increase because physicians and nurses leave their jobs because of overwork. Nevertheless, completing medical records is a very important job for physicians and nurses. In contrast, the number of working hours required to complete medical and nursing records is too long, and the workload for clinical documentation should be shortened. Although the Japanese government hopes that EMR will decrease clinicians' workload based on the "Grand-Design for Computerization in Healthcare" in 2001, a 2005 governmental research suggests that many more physicians feel that EMR increases their workload compared with those who feel that EMR decreases their workload. Therefore, CDI should reduce not increase clinicians' workload.

In 2009, the Japanese government released an "Evaluation of Computerization in Hospitals," which showed 16 perspectives (e.g., improvements in patient safety, reduced workload). However, the perspectives do not consider detailed indicators. An evaluation indicator should be objective not subjective. Thus, CDI programs should be developed to evaluate objective evidence-based indicators.

1. Aim

The purpose of this study was to evaluate the change in outpatient workflow by implementation of EMR and the effectiveness of CDI.

2. Methods

2.1. Data Collection

This study was designed as an observational study and was performed at a private 80-bed hospital in Fukuoka Prefecture, Japan. An observational survey was conducted before and after implementing EMR, and each research period comprised 2 days. The objective consisted of two parts. (1) Human resources: A researcher traced workflow of all medical staff [physicians, nurses, and medical office assistants (MOAs)]. (2) Information resources: A researcher also traced the flow of all informational materials (medical records, charts, slips, and films). Three surveyors were staffed at the outpatient consulting rooms and aisles**,** and recorded both work of each staff and kind of information resources that each staff was handled (Figure 1).

In this survey, 192 patients were observed but their name and indication number were not recorded for the aspect of privacy. This observation survey was approved by the institutional review board of Tokyo Healthcare University.

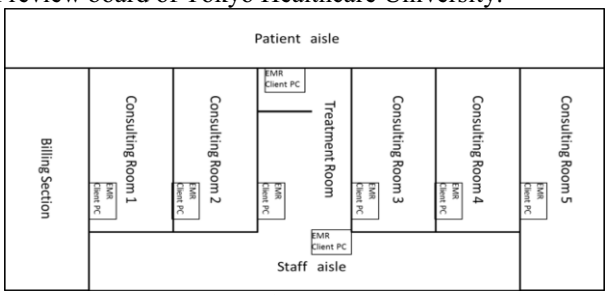

Figure 1. *Field of Observation Survey*

2.2. Data Analysis

2.2.1. Human resources

The average number of working hours (minutes) for reading medical records, writing medical records, medical procedures, and contact with other staff was determined.

2.2.2. Information resources

The type of medical document (progress notes, prescription, laboratory order slips, summary, and reference letters) handled and how long (minutes) they were handled were determined.

3. Results

3.1. Human resources

The amount of time for patient care (consulting and medical procedure) spent by physicians 44.5 min/day before implementing EMR and 84.2 min/day after implementing EMR. Thus, working hours for patient care significantly increased by 89.2% (p=0.046). Working time for patient care increased by 33.0%, however the comparison showed no significant differences (Table 1).

Table 1. *Physicians' outpatient working hours*

Unit: working hours (min/day[1])

Work	Before implementing EMR	After Implementing EMR	Variance (%)	P value
Patient Care	44.5	84.2	89.2	0.046
Writing/Reading Records[2]	75.5	50.6	-33.0	n.s.
Communication between Staff	18.8	14.7	-21.8	n.s.
Total	**138.8**	**149.5**	**7.7**	**n.s.**

1) Outpatient service is usually provided for half a day.
2) Excluding handling of medical records during consultation

3.2. Information resources

The time spent in handling information resources by physicians did not change significantly before and after EMR was implemented. The handling time required by nurses and MOAs decreased by 78.8-80% (Table 2).

Table 2. Handling time spent by professionals on outpatient information resources

Unit: handled hours (min/day)1

Profession	Before Implementing EMR	After Implementing EMR	Variance (%)	P-value
Physicians	103.8	110.2	6.2	n.s.
Nurses	51.4	10.9	-78.8	0.022
Medical Office Assistants	45.0	9.0	-80.0	n.s.

1) Including handling of medical records during consultation

The time required for carrying medical records, writing medical records after consulting, and writing laboratory order slips decreased significantly after EMR was implemented. At the same time, the time required for writing medical records during consulting significantly increased. Some of these did not change (Table 3).

Table 3. Time spent handling outpatient information resources

Unit: handled hours (min/patient)

Document	Before Implementing EMR	After Implementing EMR	Variance (%)	P-value
[Routine Works for most patients]				
A) Carrying Medical Records	4.5	2.9	-35.6	0.040
B) Reading Medical Records	2.6	2	-23.1	n.s.
C) Writing Medical Records during consulting	2.4	4.0	66.7	<0.001
D) Prescription	3.3	2.2	-33.3	n.s.
E) Writing Medical Records after consulting	3.3	2.4	-27.3	0.006
F) Booking next consultation	2.0	2.0	0.0	n.s.
Total	18.1	15.5	-14.4	n.s.
[Works as clinical necessary]				
G) Laboratory Order Slip	6.2	1.5	-75.8	<0.001
H) Reference Letter	3.25	8	146.2	n.s.

Totally, the time required for handing medical records before implementing EMR was 18.1 min/patient and reduced to 15.5min/patient by 14.4% after implementing EMR, however the comparison showed no significant differences.

4. Discussion

4.1. Health Professionals' Workflow and Clinical Documentation Process

The results from Table 1 indicate that implementing EMR reduced physicians' workload for handling EMR. However, Table 2 indicates that the number of handling hours required by physicians remained unchanged. The difference between the results presented in Tables 1 and 2 is the key point of this study.

The working time for all professionals for writing medical records was 5.7 min before implementing EMR. Approximately 3.3 min (57.9%) of the 5.7 min were used after consulting. This time was indirect care hours and caused delays in outpatient waiting time. Then, after implementing EMR, 2.4 min (37.5%) of 6.4 min were used after consulting. Therefore, the "consulting to after consulting ratio [$= E / C + E$] " changed greatly.

On the other hand, the working time for writing prescription did significantly changed. The working hours for consultation is consisted of "writing records during consultation" and "prescription" because a prescription is usually filled out during consultation to the patient whether it is paper-based or entered into EMR. Therefore the result indicates that EMR slightly clinical documentation process (Figure 2).

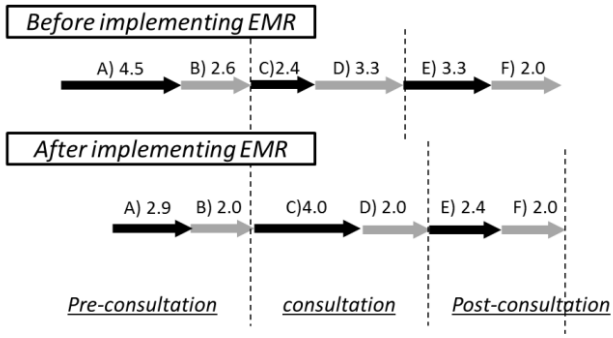

Figure 2. *Change of Clinical Documentation Process*

The results also show that nurses' and MOAs' workloads for handling medical records decreased. In 2010, the Japanese Nursing Association reported on issues of improving professionalism in the outpatient service and noted that outpatient nurses had a high clerical workload. EMR was effective in improving this issue.

4.2. Possibility of CDI

Although our results show that implementing EMR affected the workflow of health professionals, more issues that need improvement became apparent. Time for handling medical records and outpatient service time for each patient decreased. Needless to say, the reduction in nurses' clerical workload was highly appreciated. However, the results require additional improvement because physicians' workload remained unchanged, whereas MOAs' workload decreased.

Physicians' working hours to write medical records during consultation increased after implementing EMR, which could reduce "face to face communication between physicians and patients" because of the use of computers [3]. Therefore, if MOAs could assist in writing medical records, physicians' writing time would be reduced. Additionally, nurses' working hours could be used to assist chronic disease patients or implement other patient care instead of handing medical records [4, 5].

The CDI indicator used in this study was “working hours of health professionals” and “handling hours for information resources.” These indicators are suitable for showing the clinical situation and the possibility of adapting to other cases.

4.3. Limitations and Next Step

This research was a case study at a small private hospital. Thus, the results are limited and cannot be applied to all hospitals because the clinical situations may be different between public and private large and small hospitals. Therefore, this study should be conducted in other hospitals. This study required more research staff because it was observational. However, as a next step, electronic data collection using EMR should be considered to analyze the same CDI indicators more effectively.

5. Conclusion

Implementing EMR reduced nurses’ and MOAs’ workload to handle medical records, although there was little effect on physicians’ workload.

We recommend that “working hours of health professionals” and “handling hours for information resources” should be widely used as CDI indicators to improve workflow after implementing EMR.

Acknowledgment

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