ポスター

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[P-22] The Impact of Electronic Medical Record on Efficiency of Inpatient Care: An Interrupted Time Series Study

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The Impact of Electronic Medical Record on Efficiency of Inpatient Care: An Interrupted Time Series Study

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Abstract: To enhance quality of services, health facilities have been adopting technologies such as electronic medical records. In Japan the adoption rate of the technologies is high but there is little evidence on their impacts on healthcare services. Therefore, we evaluated the impact of EMR on efficiency of inpatient cares by examining the effect of EMR on inpatient length of stay (LOS) at a general hospital by comparing the monthly average length of inpatient stays using interrupted time series method. The estimates showed the level of average LOS was reduced by 1.74 (95% CI: [-2.09, -1.39]) days and the trend in ALOS was also changed by -0. 08 (95% CI: [-0.09, -0.06]) per month following incorporation of EMR into existing health information technologies.

Keywords: electronic medical record, length of stay, inpatient department, impact

1. Introduction

To improve quality of healthcare delivery, efficiency and patient safety, healthcare providers have been adopting health information technologies (HITs), such as computerized physician order entry (CPOE) system and electronic medical records (EMR) for decades [1–3].

In Japan, adoption rate of HITs by hospitals is higher (75% of major hospitals (with beds > 399) and 51% of medium (hospitals with beds 200 to 399) hospitals as of 2017 [4]) compared to that of other countries, yet there is little evidence documenting the impacts of the technologies on healthcare services. To contribute for generation of evidence on the effects of the technologies on efficiency of healthcare delivery, we evaluated the impact of EMR on inpatient length of stay (LOS) at a general hospital in western Japan.

2. Method

The study was conducted in Kochi Medical School Hospital. The hospital has been progressively implementing EMR, called Integrated Medical Information System (IMIS), since its establishment in 1981. Until 2007, the IMIS was considered basic (similar to standard EMR of JAMI classification) [5]. In 2007, the IMIS of the hospital was expanded and almost all EMR functions were incorporated.

In this study, the differences in monthly average length of stay (ALOS) before and after incorporation of EMR into the existing system to determine its effect on the efficiency of healthcare delivery. An interrupted time series analysis using longitudinal data of de-identified data from January 2005 to December 2006 (2 years before the incorporation of EMR) and January 2007 to December 2009 (3 years after) was employed.

The data were aggregated into monthly average length of stay to create series of 60 months' time period. The series were divided into three: pre-EMR period (the first 24 months: January 2005-December 2006), phase-in period (the first three months of post-EMR series: January 2007 to March 2007) and post-EMR period (33 months' series: April 2007-December 2009). It is believed that changes are not realized soon following interventions. Therefore, to deal with delays to

changes, the phase-in periods have been removed from the model.

Various measures were taken to minimize the confounding effects by other interventions. Secular trends were controlled by modelling time series before and after EMR incorporation. Nurses to bed ratio was also included in the model to control change in nursing system. Inpatients who were selected for clinical pathway were excluded. The hospital implemented Diagnosis Procedure Combination (DPC) in 2003 and therefore, it cannot affect the outcome in this study.

3. Results

The LOS of each inpatient was calculated by subtracting the admission date from discharge date. After removing inpatients' data with LOS of ≥ 90 days, and those who were selected for clinical path system services, the data analyzed was from information of 40615 inpatients' (15,261 pre-EMR and 25,354 post-EMR). Based on these data, the monthly ALOS pre-EMR and post-EMR periods were 19.56 and 17.132 respectively, which was significantly different. The plot of monthly ALOS has been shown in figure 1

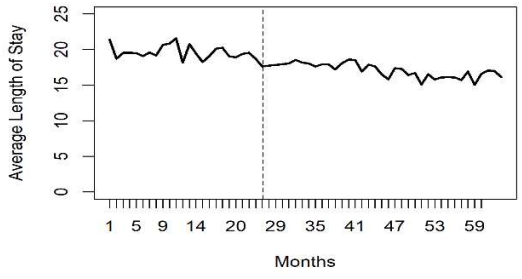

Figure 1: The monthly ALOS in the hospital before and after EMR incorporation

The differences in effect on quarterly ALOS before and after EMR were determined by the equation: monthly ALOS= $\beta_0 + \beta_1 * time_t + \beta_2 * EMR_t + \beta_3 * trend_t + \beta_3 *$ nurses to bed ratio$_t + e_t$.

Adjustments were made for serial correlation observed in the distribution of the data and generalized least square regression was used to generate the estimates.

Table 1: the estimates to determine the effect of EMR on ALOS at the hospital in the study

Model: AIC= 147, BIC=204, Loglik= -45; ARMA(11,11)				
	Coefficients [95% CI]	Std.Error	t-value	p-value
Intercept	19.08 [16.69,21.48]	1.22	15.64	0.000
EMR	-1.74[-2.09, -1.39]	0.18	-9.68	0.000
Time	0.014 [-0.003, 0.03]	1.60	-175.8	0.11
Trend	-0.08 [-0.09, -0.06]	0.006	-12.22	0.000
Nurse to bed ratio	0.41 [-3.89, 4.71]	2.19	0.19	0.85

In the, estimates of the model, following the incorporation of EMR into the existing IMIS in the hospital, the level of monthly ALOS was reduced by 1.74 (95% CI: [-2.09, -1.39]) days and the trend was also changed by -0.08 days per month ([-0.09, -0.06]). The contribution of nurses to bed ratio was not statistically significant (table 1). The plot of the fitted model (figure 2) shows the change in level and trend.

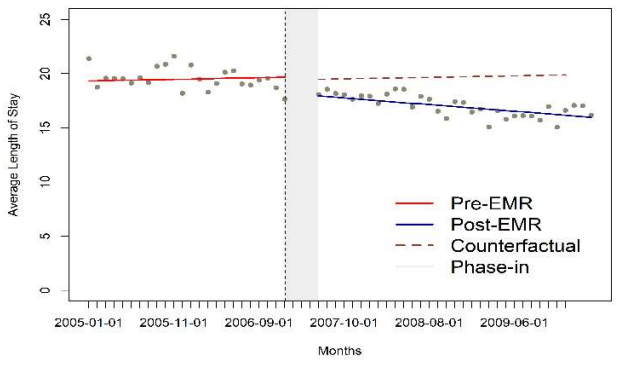

Figure 2: Change in level and trend of ALOS pre-EMR and post-EMR in the hospital

4. Discussion

The study shows that the monthly ALOS and its trend showed significant reduction following the incorporation of EMR into existing system in the

hospital. These finding are in line with similar studies in other settings [6–8]. This finding suggests that one of the purposes of adoption of EMR, that is; improving productive efficiency, has been met. However, we should carefully check whether the reduction of LOS in the hospital had compromised other components of quality of care such as readmission rates.

5. Conclusion

The findings show that the incorporation of EMR into the existing health information technologies in the hospital might have contributed to improve efficiency of Kochi Medical School Hospital.

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