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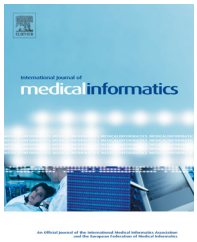

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Electronically implemented clinical indicators based on a data warehouse in a tertiary hospital: Its clinical benefit and effectiveness

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ABSTRACT

Objective: Assessing and monitoring care and service using clinical indicators (CIs) can allow the measurement of and lead to improvements in the quality of care. However, the management and maintenance of CI data has been shown to be difficult because the data are usually collected and provided manually. In this study, for the purpose of efficient managing quality indicators, a data warehouse (DW)-based CI monitoring system was developed. The clinical effectiveness and efficiency of a DW-based CI monitoring was investigated through several case studies of the system's operation at a tertiary hospital.

Methods: This study analyzed the CIs that have been developed over the past 8 years at a 1340-bed tertiary general university hospital in South Korea to improve and monitor the quality of care and patient safety. The hospital was opened as a fully digital hospital in 2003, and the CIs were computerized in 2005 by implementing a DW-based CI monitoring system. We classified the computerized CIs and evaluated the monitoring results for several representative CIs, such as *the optimal prescribing of preventive antibiotics, the average length of stay, the mortality rate, and the rehospitalization rate*.

Results: During the development of the system in 2005, 12 of 19 CIs were computerized, and this number gradually increased until 299 of 335 CIs were computerized by 2012. In addition, among the CIs built computationally through the CI task force team, focal CIs subject to monitoring were selected annually, and the results of this monitoring were shared with all of the staff or the related department and its staff. By providing some examples of our CI monitoring results, we showed the feasibility of improving the quality of care, and maintaining the optimum level of patient care with less labor.

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Conclusions: The results of this study provide evidence regarding the clinical effectiveness and efficiency as well as the systems operation experience of a DW-based CI monitoring system. These findings may aid medical institutions that plan on computerizing CIs with respect to decision and policy making regarding their systems development and operations.

1. Introduction

As interest in healthcare increases in concert with people's desire to be healthier, the demand for quality medical services also increases [1,2]. Accordingly, each country is devoting significant attention to increasing the quantity and the quality of medical services while keeping treatment costs as low as possible [1,2]. A clinical indicator (CI) is an indicator developed for assessment purposes to objectively measure and continually monitor medical quality of care [3,4]. In 2007, four CI assessment categories that were not included in the 2004 Joint Commission's assessment in Korea, including pneumonia, intensive care, maternity and neonatal and surgical infection prevention divisions were added. In 2004, pneumonia was the 6th leading cause of death for elderly patients over the age of 65 in the United States [5]. This condition has a very high cost of treatment due to its high death and hospitalization rates; however, these rates can potentially be lowered through improvements in treatment processes [5,6]. As a result, U.S. institutions such as the Centers for Medicare & Medicaid Services (CMS) and the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) have been trying to improve the quality of pneumonia treatment processes by selecting oxygen saturation measurement, time of blood culture assessment, time of antibiotic administration, and other parameters as the process indicators [7]. In addition, by developing and adjusting indicators of specific diseases, including pneumonia and stroke rehabilitation, several studies exploring the effects of the indicators have been conducted [8–12].

Similarly, implementing CIs in monitoring and evaluating the quality of care and service can lead to better measurement of the quality of care and improvement in performance [13,14]. However, such CIs are usually collected and produced manually, which makes their continual management and maintenance difficult. In other words, through computerized monitoring of specific indicators, the safety of care and patient safety activities may be systematically and continuously monitored [15].

In this study, a data warehouse (DW)-based CI monitoring system was developed to maintain computerized quality indicators. We then evaluated the clinical effectiveness and efficiency of the DW-based CI monitoring system through systems operations at a tertiary hospital. By sharing the operational experiences and knowledge of the systems, the results of this study may aid medical facilities that plan on implementing a DW-based CI monitoring system when making decisions by providing them with sufficient evidence for efficiency.

2. Methods

2.1. Study site

This study was performed at the Seoul National University Bundang Hospital (SNUBH), located in Seongnam-si, Gyeonggi-do, in the Seoul metropolitan area of Korea. SNUBH is a national tertiary hospital founded in May 2003 as a fully digital hospital equipped with a fully paperless comprehensive electronic health record (EHR) system certified with an Electronic Medical Record Adoption Model (EMRAM) Stage 7. The hospital has 1340 beds and has been visited by an average of approximately 5000 outpatients daily as of August 2013. As the hospital had a full electronic medical record (EMR) system, in 2004 it began developing a data warehouse system using the EMR for monitoring performance and clinical indicators as well as to support research.

2.2. Clinical indicator development process

To continuously improve the quality of care, we created two major committees: a medical service innovation committee and a hospital safety control committee. The CIs were developed and monitored by a CI task force team (TFT), which was one of the TFTs under the medical service innovation committee. The CI TFT was composed of 15 members, including 5 doctors, 1 nurse, 2 staff members from the medical information team, 1 staff member from the medical records team, 1 pharmacist, 1 staff member from the health insurance team, and 4 staff members from the quality assurance (QA) team.

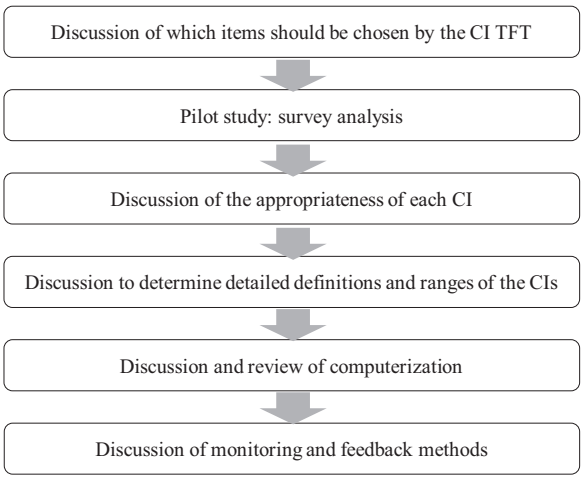

Fig. 1 – Clinical indicator development process.