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The effect of medication therapy management service combined with a national PharmaCloud system for polypharmacy patients

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ABSTRACT

Background: This study evaluated a medication therapy management service using the Taiwan National Health Insurance Administration's PharmaCloud system in a medical center in Taiwan. The new PharmaCloud System, launched in 2013, links a complete list of prescribed and dispensed medication from different hospitals, clinics, and pharmacies for all insured patients.

Method: The study included patients with polypharmacy (≥ 5 drugs) at a medication therapy management service from March 2013 to March 2014. A structured questionnaire was designed to collect patients' baseline data and record patients' knowledge, attitudes, and practice scores before and after the service intervention. Phone follow-ups for practice and adherence scores on medication use were performed after 3 months.

Results: There were 152 patients recruited in the study. Scores for medication use attitudes and practice significantly increased after the service (attitudes: 40.06 ± 0.26 to 43.07 ± 0.19 , $p < 0.001$; practice: 33.42 ± 0.30 to 40.37 ± 0.30 , $p < 0.001$). The scores for medication adherence also increased from 3.02 ± 0.07 to 3.92 ± 0.02 ($p < 0.001$).

Conclusions: The PharmaCloud system facilitates accurate and efficient medication reconciliation for pharmacists in the medication therapy management service. The model improved patients' attitudes and practice of the rational use of medications and adherence with medications. Further studies are warranted to evaluate human resources, executing costs, and the cost-benefit ratio of this medication therapy management service with the PharmaCloud system.

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Chang-Ming Chen and Li-Na Kuo contributed equally to this study.

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1. Introduction

Polypharmacy over-burdens medical finances, increases inappropriate prescriptions, reduces patient medication adherence, and increases drug interactions [1–5]. It is especially common in elderly patients, where the prevalence rate ranges 5%–78% depending on variations in countries, races, and study design [2,6,7]. The rates of taking more than 5 and 10 medications among Taiwanese elderly are 81% and 38%, respectively [8]. According to Taiwan's National Health Insurance Administration (NHIA) statistics, the medical expenditures for duplicate medications have exceeded US\$1.2 million [9]. Resolving polypharmacy is a very important issue globally.

A medication therapy management (MTM) service is an effective method to reduce polypharmacy through the process of medication reconciliation [10–12]. However, collecting and consolidating a patient's comprehensive medication file from different medical institutions is very challenging due to the lack of a universal medical care informative system [11]. Cloud storage of inter-institutional patient medication records can simplify the MTM process and provide a prospective solution to manage polypharmacy. Our work aims to test the value of a cloud-based medication record system to facilitate MTM service in Taiwan.

1.1. Related work

Cloud-based medication record has the advantages of good accessibility, capacity and timely data exchange. Theoretically, it can be utilized as a platform for health care providers to identify medication related problems that were prescribed in different hospitals. In Western Kenya, for maternal and children health, a cloud-based electronic medical record (EMR) is used to improve data integrity and reduce missing data. Moreover, the data are shared across multiple sites in real-time with the cloud-based EMR to increase the accessibility at different level of care [13]. A cloud-based system in Taiwan allows physicians to upload pancreaticoduodenectomy related clinical data in a cloud for sharing information with other physicians. This cloud system capacity was further expended to data collection and storage for facilitating more efficient clinical collaborations [14]. In order to assist medical staff in the convenient gathering and processing of patient clinical information, an ideal cloud database should include both user subsystems for uploading and cloud subsystem for computing [15].

Many countries have begun the development of cloud medical systems for reconciling medications [16–18]. However, most cloud-based medical systems are currently utilized only in limited areas or patients. These systems also can only provide patient original prescription data with no further computation processing. Third-party companies in the U.S. have established a close-system cloud medical system that allows authorized hospitals or clinics to upload and share electronic medical records for conducting MTM [19]. The e-Medikation system has been developed in three regions of Austria for providing timely data exchange in medication lists and automatic central checks for health care providers with the medication safety alert system [20]. In order to strengthen the computing

capacity of the cloud database, the integration of the database with the medical institution Computerized Physician Order Entry (CPOE) system may be the most appropriate.

1.2. Problem statement and contribution

How pharmacists can use the cloud based data effectively at MTM service is a practical issue that is yet to be resolved. The existing cloud based medication informatics system contains all prescriptions from different institutions. However, evaluating the medication list for identifying drug-related problems takes time, and without built-in decision support, it is inefficient for physicians or pharmacists to initiate the review while the patients are being seen. Therefore, there is a need to create of a cloud-based system with decision support incorporating prescription data and potential discrepancy in medication use, preventing physicians from prescribing duplicated medication, and allowing pharmacists to reconcile medications more conveniently for all patients.

Taiwan National Health Insurance (NHI) is a nationwide insurance system that includes 23 million beneficiaries and which had enrolled 99% of Taiwan's population by 2005. Its PharmaCloud system, established by the Taiwan NHIA in July 2013, allows physicians and pharmacists to access the real-time medication history of a patient among all hospitals and clinics in the country in the preceding 3 months. With the coverage of inpatient care, ambulatory care, and prescription medications, the NHI PharmaCloud system is advantageous for strengthening MTM and ensuring patient medication safety.

In this present study, NHI PharmaCloud data were connected to a hospital's CPOE system for facilitating outpatient medication reconciliation by MTM service. This new model was applied at a pharmacist ambulatory clinic for polypharmacy patients with hypertension, hyperlipidemia, or diabetes, by retrieving patients' medication histories from the computed results from NHI PharmaCloud database. The null hypothesis is this new model can influence the humanistic outcomes for those patients undergoing this MTM service. Therefore, the purpose of this study was to evaluate those patient's knowledge, attitudes, practices, and medication adherence before and after the intervention.

2. Methods

The current study employed a prospective, cross-sectional design. To evaluate the effectiveness of the new MTM service, humanistic outcomes of the participated patients before and after this new intervention were compared. The MTM service was established to interview patients with polypharmacy through the aid of PharmaCloud system connected with the CPOE system in the hospital. A structured questionnaire was used to gather the information about patients' knowledge, attitude, and practice toward polypharmacy. The study began after obtaining the patients' informed consent. The research proposal was approved by the Taipei Medical University Joint Institutional Review Board (TMU-JIRB no. 201402028).

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