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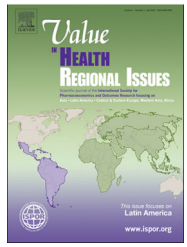

Comparison on Human Resource Requirement between Manual and Automated Dispensing Systems

Prapaporn Noparatayaporn, BSc (Pharm)[1,2], *Rungpetch Sakulbumrungsil, PhD*[1,*], *Tanita Thaweethamcharoen, PhD*[2], *Wunwisa Sangseenil, BSc (Pharm)*[2]

[1]*Social and Administrative Pharmacy International Graduate Program, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, Thailand;* [2]*Department of Pharmacy, Siriraj Hospital, Mahidol University, Bangkok, Thailand*

ABSTRACT

Objective: This study was conducted to compare human resource requirement among manual, automated, and modified automated dispensing systems. **Methods:** Data were collected from the pharmacy department at the 2100-bed university hospital (Siriraj Hospital, Bangkok, Thailand). Data regarding the duration of the medication distribution process were collected by using self-reported forms for 1 month. The data on the automated dispensing machine (ADM) system were obtained from 1 piloted inpatient ward, whereas those on the manual system were the average of other wards. Data on dispensing, returned unused medication, and stock management processes under the traditional manual system and the ADM system were from actual activities, whereas the modified ADM system was modeled. The full-time equivalent (FTE) of each model was estimated for comparison. **Results:** The result showed that the manual system required 46.84 FTEs of pharmacists and 132.66 FTEs of pharmacy technicians. By adding pharmacist roles on screening and verification under the ADM system, the ADM system required 117.61 FTEs of pharmacists. Replacing counting and filling medication functions by ADM has decreased the number of pharmacy technicians to 55.38 FTEs. After the modified ADM system canceled the return unused medication process, FTEs requirement for pharmacists and pharmacy technicians decreased to 69.78 and 51.90 FTEs, respectively. **Conclusions:** The ADM system decreased the workload of pharmacy technicians, whereas it required more time from pharmacists. However, the increased workload of pharmacists was associated with more comprehensive patient care functions, which resulted from the redesigned work process.

Keywords: automated dispensing machine, automated dispensing system, ADM, dispensing system, full-time equivalent, human resource management, medication distribution system, returned medication system, stock management, workload.

Drug distribution is the major responsibility of the pharmacy service and an essential part of the patient care process and has a significant impact on treatment outcomes. The work process of medication distribution in the pharmacy unit is composed of multiple steps and involves a large number of personnel, and this increases the risk of medication errors and adverse events. Automated dispensing machines (ADMs) are widely used in many countries, such as the United States and Canada, and in some private hospitals in Thailand [1–3]. The expected benefits of implementation of ADMs in the dispensing process include more efficient use of human resources and improvement in the quality of the medication distribution process [4].

Previous studies have revealed that ADMs reduced the dispensing time of pharmacists [5–7]. With less time spent in dispensing, pharmacists would have more time to provide more cognitive services, such as patient care–related activities. However, Klein et al. found that the working time of pharmacists was not affected significantly whether or not ADMs were used [8]. Alvarez et al. reported that the workload in the pharmacy department increased after the ADM system was implemented [9]. The reduced time may not be the only interesting factor in implementing the ADM system, but the quality of pharmacy services should also be taken into account.

At the 2100-bed university hospital (Siriraj Hospital, Bangkok, Thailand), a pharmacy-based (centralized) ADM (Yuyama YS-TR-406FDS-II) was implemented in the pharmacy department. An ADM contains 406 medication cassettes and a designated tray for more specialized medications. Each cassette is calibrated for each medication to optimize dispensing accuracy. Radiofrequency identification (RFID) chips and the barcode system are used to recognize the cassette position in the ADM. Medications are removed from manufacturers' original packaging before being placed in the cassette. The unit dose–dispensed pack contains all prescribed medications accompanied by information for each

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* *Address Correspondence to:* Sakulbumrungsil Rungpetch, Social and Administrative Pharmacy International Graduate Program, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok, Thailand.

E-mail: rungpetch.c@chula.ac.th; rungpetch.c@gmail.com

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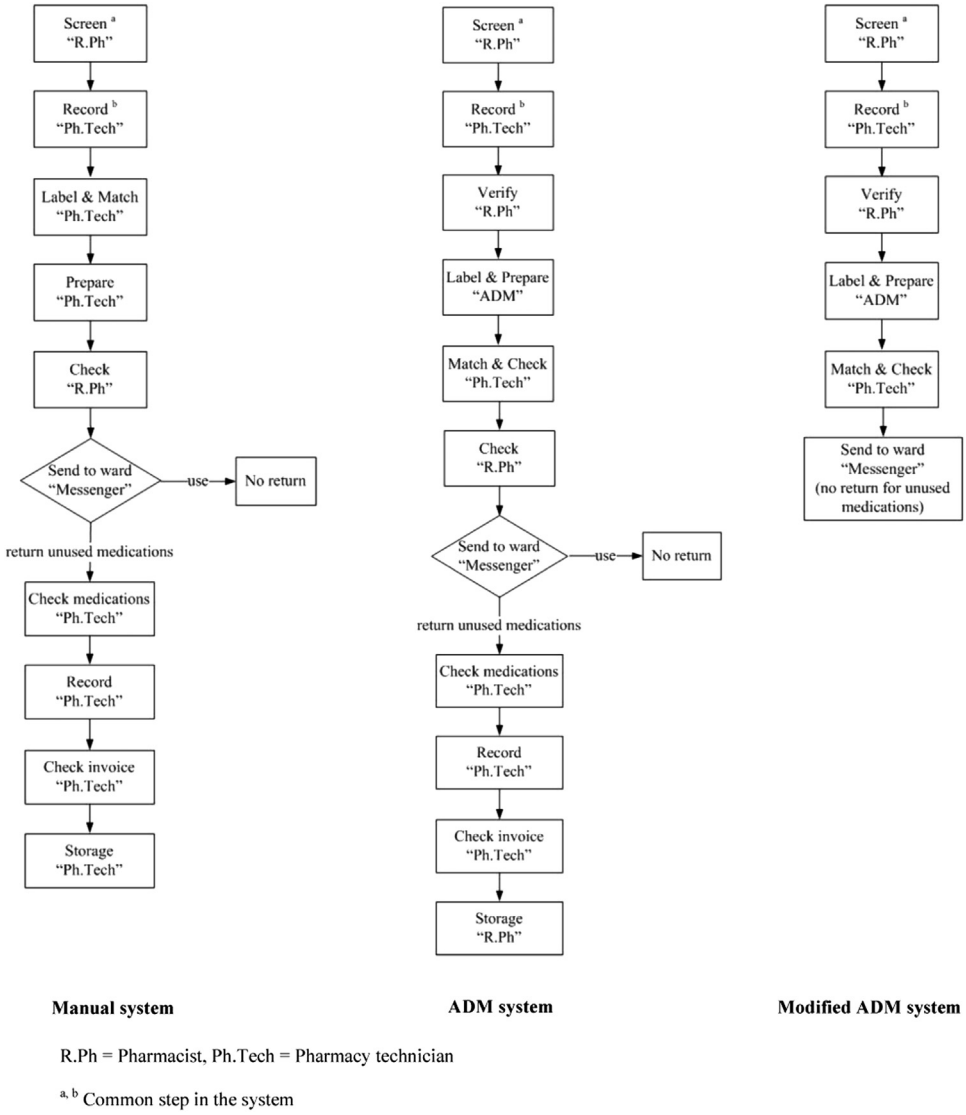

Fig. 1 – Work process in the manual, automated dispensing machine (ADM), and modified ADM systems. [a,b]Common steps in the system. R.Ph, Pharmacist; Ph.Tech, pharmacy technician.

administration. The ADM fills the medications in unit dose packs at the rate of up to 1 pack per second. To reduce contamination, the ADM is cleaned every day, and cleaning of the whole machine is scheduled to occur every 3 months.

The ADM system was implemented and piloted in February 2012 for dispensing medications to 1 inpatient medical ward. The work process and the roles of pharmacists and pharmacy technicians were modified and adjusted after implementation of the ADM system. With the use of ADMs, the dispensing process required additional tasks that increased the involvement of pharmacists. The ADM system is planned to be implement in all 110 wards. However, the number and model of ADMs needs to be considered for full implementation. Thus, this study aims to compare human resource requirements among manual, automated, and modified automated dispensing systems.

Methods

We performed the research at the 2,100-bed university hospital. Data were collected from the pharmacy department. Data on the duration of the medication distribution process for both the manual and the ADM systems were collected during the month of October 2012, 8 months after implementation. The data on the ADM system were obtained from 1 piloted inpatient ward, whereas those on the manual system were the average of other wards. The duration for each work process was self-reported by pharmacists (R.Ph) and pharmacy technicians (Ph.Tech) using recording forms. Expert opinion was obtained in some processes for which data were not available. The dispensing and returned unused medication processes in the manual, ADM, and modified ADM systems are shown in Figure 1. $\frac{\text{Total time spent (hr/year)}}{\text{Working time per FTE (hr/man/year)}}$

Full-time equivalents (FTE) of both pharmacists and pharmacy technicians were estimated for comparison. "FTE" was defined as the number of personnel required for each work process. The human resource requirement of all systems was extrapolated to cover all 110 hospital wards for the purpose of comparison. The FTE of the hospital was calculated by using a formula based on 7 hours per day and 230 days per year. One FTE was equal to 30.96 hours per week.