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# Role of Automated dispensing machines: An emerging and efficient technology in Saudi Arabia

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## Abstract

**Background**: Recently, pharmacies are progressively transforming in the direction of automation to increase dispensing procedures for medication. Such dispensing technologies have penetrated the health care system in Saudi Arabia during the last few years; however, there is no strong evidence regarding the use of automated drug dispensing systems (ADDSs) in Saudi Arabia. Therefore, we carried out a rapid review of published studies regarding ADDSs in Saudi Arabia over the last ten years.

**Methods**: We carried out an electronic and systematic search on the effectiveness and usefulness of the automated drug dispensing systems concerning different parameters. All studies that were carried out between 2010 and 2020 were included and reviewed in this rapid review. Since there is a shortage of literature on the topic, mainly in Saudi Arabia, we included all studies that had assessed the usefulness of automated drug dispensing systems from various aspects.

**Results**: The included studies' findings suggested that ADDSs have been found useful in reducing the errors related to medication dispensing and workflow. It also resulted in the improved efficiency at which medicines will regulate, expands the precision of drug profiling for clients, reduces unsuitable supply and delivery of medicines, and offers efficient usage of the health workforce in the hospitals. These systems are found to substitute a few regular, time-consuming filling practices by increasing precision, enhancing productivity, and reducing medication errors.

**Conclusion**: ADDSs appear to increase drug regulation effectiveness, improve the accuracy of drug profiling of patients, reduce the inadequate administration and administration of drugs, and allow for more efficient use of human resources in pharmacies and hospitals. However, further studies are required to evaluate the effectiveness of automated drug distribution systems in a representative sample of hospitals in Saudi Arabia.

**Keywords:** Automated drug dispensing system; Effectiveness; Saudi Arabia; Rapid review.

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## 1. Introduction

Recently, pharmacies in hospitals are progressively transforming in the direction of automation to increase dispensing procedures for medication. Automated drug dispensing systems (ADDSs) have been utilized in various pharmacies over the last ten years[1]. For instance, this new technology has been on the upswing, with 97% of hospital pharmacies in the United States using ADDSs in various hospital pharmacies [2].

Automated pharmacy services are substituting a few of the regular, time-consuming filling practices by increasing precision, enhancing productivity and causing fewer medication errors. This rise tends to imply the advantages of ADDSs such as increased safety and productivity via decreased dispensing hours, improved storage volume and stock control, more suitable allotment of the workforce to responsibilities with minimum period waste, and decreased dispensing inaccuracies [3]. Recurrent drug stock-outs and expiry attributable to inadequate quantification and management procedures may also manage using the ADDSs [4]. One of the most important reasons for improving automated dispensing is to enhance pharmacies and maintain pharmaceutical care evolution.[5]. Additionally, the ADDSs are proposing as emerging technologies that help improve hospital pharmacies' efficacy and possibly decrease the likelihood of adverse drug effects [6, 7].

Despite the above findings from the literature, there are a shortage and scarcity of valid studies to assess the validity evidence base's usefulness and efficacy verifying these apparent benefits have not been determined. Although studies on the worth of ADDSs are restricted, numerous studies have revealed the advantages of ADDSs in the United States and European countries in curtailing adverse effects related to medications, plummeting unsuitable fees, gaining a precise record of medication, and authorizing better and effective use of health professionals mainly pharmacists and nurses [8-11].

A part of western countries, the ADDSs was established in Saudi Arabia during the last few years; however, its wider usage in this territory remains restricted due to the absence of proper systems, sills, knowledge, and experience. In addition, there is no strong evidence regarding the use of ADDSs in Saudi Arabia. Although very few studies have been carried out in Saudi Arabia indicating that this technology is gradually penetrating in Saudi Arabia, the findings of such studies are not synthesized and reviewed critically to understand how the ADDSs play a role in improving efficacy and efficiency concerning the distribution of medicines.

Therefore, we carried out a rapid review of published studies regarding ADDSs in Saudi Arabia over the last ten years.

## 2. Materials and Methods

We searched articles from databases such as Google Scholar and PubMed. We conducted text-word and vocabulary searches in Google Scholar and PubMed. Published articles on automated drug distribution systems have been researched to gather evidence to support the authors' opinion. We searched all the articles by using search terms such as ‘efficacy of automated drug dispensing systems in Saudi Arabia’, ‘effectiveness of automated drug dispensing systems in Saudi Arabia, ‘usefulness of automated drug dispensing systems in Saudi Arabia’, and ‘automated drug dispensing systems as an emerging technology in Saudi Arabia’. We only included articles that were published in the English language. We examined all articles pertinent to our objective while writing this review to achieve our purpose based on the available premise.

Our search determines between 2010 and 2020; we applied a filter on the time duration while searching the databases' articles. All eligible articles were identified in the chosen databases using a snowball sampling technique consisting of backward and forward reference searching of articles. Besides, all suitable articles are referenced and reviewed to avoid missing any article appropriate to the objective. After searching for different databases and following the above criteria, we reviewed full-text articles of the studies that focused on assessing the efficacy or effectiveness of automated drug dispensing systems in Saudi Arabia. We took a review of fifteen full-text articles that were either case reports, case series, or any other study in the hierarchy of study designs.

## 3. Findings

A conducted study by Al-Sultan et al. (2012) to assess pharmaceutical facilities in hospitals in the Kingdom of Saudi Arabia. The authors surveyed on steps related to prescription and transcription of the medication use method [12]. The authors showed that the ADDSs are utilized by around a quarter of hospitals in the Kingdom. The authors reported that ADDSs are substituting a few regular, time-consuming filling practices by increasing precision, enhancing productivity, and reducing medication errors. The demonstrates that despite the reality that some hospitals in Saudi Arabia do practice international standards emerging technologies such as ADDSs for dispensing drugs in pharmacies of Saudi Arabia are in their infancy phase [12].

Besides, one more study conducted by Dibet al (2006) revealed the effect of ADDSs on medication distribution success. The authors conducted their study in Saudi Aramco Medical Services Organization, one of the first Middle East's first institutions to start ADDDs. The authors generally found that the ADDSs increased medication dispensing efficiency supported cost control, and reduced the frequency of adverse

events related to medications [13]. The study results illustrate that ADDSs in Saudi Arabia is considered an efficient and effective system that can be expanded across the nation. Further, the authors also found that the ADDSs enhanced service delivery to clients by rationalizing the medication delivery plan, permitting improved use of pharmacist and nurse time, helping inappropriate administration of medicine to clients, and delivering reasonable control of medicines can access [13].

Moreover, the study findings revealed that the implementation of the ADDSs resulted in the improved throughput of the health workforce [13]. The authors suggested that these ADDSs can be adapted to extend invoicing solutions for the hospitals. For example, the pharmacists and nurses who were formerly engaged with the medication plan and distribution are now accessible to the patients, leading to improved patient care. Further, the authors highlighted that since the ADDSs has the ability to accumulate a variety of drugs, new drugs for chronic patients or medicines for new patients can be distributed from a place that is nearer to the bedside without waiting for the pharmacist to deliver the medicines from the pharmacy [13].

Likewise, another study conducted by Darwesh et al (2017) found that the frequency of controlled and uncontrolled medications has decreased considerably. After implementing the ADDSs (P-value: 0.004). The authors also noticed a rise in the quantity of IV drug provisions due to reduced workload and increased in nursing staff utilization [14]. The authors observed a high rate of incorrect bin opening post-installation of the automated dispensing system; however, it's decreased slowly after eight weeks. Overall, the authors found that the ADDSs resulted in the improved efficiency at which medicines regulated, expands precision of drug profiling for clients, reduces unsuitable supply and delivery of medicines, and offers efficient usage of the health workforce in the hospitals. However, it highlighted that the process of transferring into a new technology of the ADDSs might pose a myriad of challenges, which can be overcome by training of human resources on this technology [14].

In another study conducted by Al Muallem et al. (2015), the installation of the ADDSs was effective in reducing the errors related to medication dispensing and workflow. Overall, it improved the distribution of the drugs to patients and helped staff divert their attention towards patients that enhanced the quality of care. However, there are some areas of research that were highlighted by authors to evaluate in future studies. For example, the authors suggested assessing the relevant parameters such as medication errors, order interruptions, omitted doses of the medicines, and interaction between medicines, enhancing patients' care [15].

Similarly, there was another study undertook by Elkady et al. (2019) at King Faisal Specialist

Hospital. The study's findings highlighted that the usefulness, ease of usage, apparent efficacy to expand control system, and training of the new technology staff had shown positive effects on enhancing nursing staff's attitudes toward using these newly installed automated machines [16].

## 4. Conclusion and way forward

The ADDSs is a system of automated distributing medicines placed in the hospitals' patient care zones. Such emerging technologies distribute and deliver medicines and document these operations at a pharmacy. Utilizing such techniques has earned a reputation due to the efficiency and comparative safety it bestows in health care organizations. These automated dispensing systems have been widely used in western countries; however, their usage in Saudi Arabia is not up to the mark. It appears that the ADDSs has been gradually penetrating the health care system of Saudi Arabia. Given the findings of this rapid review, it seems that this technology of the ADDSs upsurges the efficacy at which medicines regulated, expands the precision of patient drug profiling, reduces unsuitable administration and delivery of medicines, and provides improved utilization of the health workforce in the pharmacies and hospitals.

However, this process might need better cooperation, coordination between the staff, and the staff's training to overcome the challenges posed by any new technology. Since the existing evidence and findings based on the limited studies, there is a need to conduct more studies with a larger sample size to assess the efficacy and effectiveness of the ADDSs in a representative sample of hospitals in Saudi Arabia. It will help better understand the real benefits as well as challenges associated with the ADDSs before implementing such dispensing systems across the nation or even across the region.

## 5. Declarations

### 5.1 Conflict of Interest Statement

The authors have no conflict of interests to declare.


### 5.2 Funding Disclosure

None.

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