EVALUATING HOSPITAL PHARMACY PRACTICE: MEDICATION PRESCRIBING, TRANSCRIBING, AND ADMINISTRATION IN TABUK REGION, SAUDI ARABIA

Mostafa A. S. Ali[1,2*], Majed M. Alenazi[3], Abdulrahman M. Asiri[3], Ali M. Ghabban[3], Abdulmohsen A. Ashamrani[3] and Palanisamy Amirthalingam[1]

[1]*Department of Pharmacy Practice, Faculty of Pharmacy, University of Tabuk, Saudi Arabia*
[2]*Department of Clinical Pharmacy, Faculty of Pharmacy, Assiut University, Egypt.*
[3]*Pharmacy graduates, Faculty of Pharmacy, University of Tabuk, Saudi Arabia*

This study aimed to outline the scope of pharmacy practice activities in managing medication use in hospital settings in Tabuk region, Saudi Arabia. The study used a modified American Society of Health-System Pharmacists (ASHP) national survey related to Saudi Arabia hospitals. The pharmacy directors of the Ministry of Health hospitals in Tabuk region were contacted by email. They received a soft copy of the survey questionnaire and a link to the survey formulated using the online survey platform "Google forms". The survey comprised checklist items inquiring about the nature of professional pharmacy services offered in hospital pharmacies. The responses of the pharmacy directors were received, exported to an Excel sheet, and then to statistical software for analysis.

Ten hospitals participated in the survey. The nature of pharmacists' services was mostly distributive pharmacists in six (60%) hospitals. Four hospitals (40%) reported a regular evaluation of physician adherence to medication-use policies. Five hospitals (50%) reviewed compliance with clinical practice guidelines. Seven hospitals (70%) had computerized prescriber order entry (CPOE) systems with clinical decision support systems (CDSSs) to handle the medication orders. Automation was not much implemented in medication distribution, where three hospitals (30%) used automated dispensing cabinets, and three hospitals (30%) routinely utilized machine-readable coding to verify doses before dispensing. Six of the approached hospitals (60%) had an IV admixture preparation area.

Pharmacists were not much engaged in clinical services. More efforts are needed to implement electronic technologies to improve the safety and efficiency of medication prescribing, transcribing, and administration. Pharmacists should expand their role in medication use review, compounding sterile preparations, optimizing medication administration records (MAR), and participation in patient care units.

Keywords: *Automation, medication administration, pharmacy practice, prescribing, transcribing*

INTRODUCTION

Over the past few decades, pharmacy practice services in hospitals and pharmacist interventions have evolved toward improving patient therapeutic outcomes[1].

Pharmacists' roles have expanded beyond conventional drug preparation and dispensing services to involve more patient-centered services such as medication use review, medication monitoring, detection and prevention of medication errors, and promoting health and preventing diseases[1]. The development of pharmacy education, the evolution of evidence-based pharmacy practice, standards and recommendations shared by the pharmacy organizations such as the International Pharmaceutical Federation (FIP), the American Society of Health-System Pharmacists (ASHP), and the American

College of Clinical Pharmacy (ACCP) served to develop advances in hospital pharmacy practice within healthcare systems[2].

Healthcare systems have developed their pharmacy services in ambulatory and inpatient care settings with various approaches to ensure safe and effective medication use in hospitalized patients, such as the implementation of computerized prescriber order entry (CPOE) systems[3], barcode electronic medication administration record (eMAR)[4], medication reconciliation[5], pharmacist transition of care programs[6], and clinical pharmacist interventions[7].

The ASHP conducted a series of three national surveys in the United States to evaluate the pharmacy practice in hospital settings since 1998[8]. The aim was to evaluate practices, technologies, and pharmacists' role in medication management during six major processes: prescribing, transcribing, dispensing, administration, monitoring, and patient education and improvement[9]. Two components are studied each year. In Saudi Arabia, Alsultan et al., in collaboration with the King Saud University College of Pharmacy, the Saudi Pharmaceutical Society (SPS), and the ASHP, utilized and modified the ASHP national survey to describe and evaluate the state of hospital pharmacy practice in Riyadh region in 2012 and 2013[10-12]. Altyar et al., utilized the revised survey to evaluate the pharmacy practice in Jeddah city[13]. These studies concluded that hospital pharmacists were increasingly using electronic technologies to improve the medication-use process. However, more involvement of pharmacists' activities is yet needed.

Unfortunately, there is no study evaluating the current hospital pharmacy practice in Tabuk region. Therefore, this study was conducted in Tabuk region and utilized the modified ASHP survey questionnaire to describe and characterize the pharmacy practice services in four components: the prescribing, transcribing, dispensing, and administration processes. The significance of conducting this study was to provide insight into the extent and range of hospital pharmacy services and implemented technologies in hospitals, particularly in the areas of medication prescribing and transcribing. This may be later considered by the local healthcare authority in Tabuk region for optimizing the timeliness, and efficiency of medication-use system and improving patient experience at hospitals. Therefore, the primary objective of this study was to evaluate the current practices of medication prescribing by physicians and medication transcribing or reviewing by pharmacists.

The secondary objective was to describe the medication distribution system, the methods for medication preparation and dispensing, the state of using emerging technology in medication distribution, compounding of sterile preparations, and handling of high-alert/risk drugs.

METHODS

This study was a cross-sectional survey of hospital pharmacy services in hospital settings belonging to the Ministry of Health at Tabuk region, Saudi Arabia. The local Institutional Review Board of Health Affairs at Tabuk officially approved this study (IRB number, TU-077/020/067). Verbal informed consent was obtained from the participants in the study (the pharmacy directors). There were no applied interventions or patients' participation.

Data collection and analysis

This study adopted a customized survey questionnaire directed to the hospital pharmacies in Tabuk region. This survey was developed by Alsultan et al., 2012[11] in Riyadh by the modification, addition and subtraction from the original ASHP survey questions. New questions relevant to the research topics were constructed in Riyadh's survey. We emailed the corresponding author of the Riyadh study[11] to obtain the modified version of the questionnaire, and he sent and approved its use in our research.

Tabuk region comprised twelve government hospitals related to the Ministry of Health hospitals. The pharmacy directors of all twelve were contacted by email and telephone numbers to participate in the survey. A hard copy of the survey and a soft copy using the online survey platform ''Google Forms'', were distributed to pharmacy directors or their representatives between December 2020 and March 2021. To increase the response rate to the survey questionnaire, more than one

attempt reminder was required within the four months duration.

The data were collected upon completion on Google Forms and were exported to Microsoft Excel for cleaning. The data were analyzed using SPSS statistical software (version 22, IBM, SPSS, Chicago, IL, USA). Because of the descriptive nature of the study, only the frequency and proportions of hospitals implementing the surveyed pharmacy practice services were summarized.

RESULTS AND DISCUSSION

Results

General characteristics of hospitals

The pharmacy directors at ten hospitals responded to the survey, yielding a response rate of 83%. The characteristics of respondent hospitals are presented in Table 1. All ten hospitals were governmental hospitals with an average number of 100-199 beds, but one hospital with 300 – 399 beds capacity. The average length of hospital stay was 5-10 days in 60% of hospitals.

Table 1: Size, ownership and accreditation of the participated hospitals.

Characteristic	Hospitals n=10	%
Staffed beds		
< 50	0	0%
50 – 99	1	10%
100 – 199	5	50%
200 – 299	3	30%
300 – 399	1	10%
400 – 599	0	0%
> 600	0	0%
Occupied beds		
< 50	2	20%
50 – 99	3	30%
100 – 199	3	30%
200 – 299	2	20%
300 – 399	0	0%
400 – 599	0	0%
> 600	0	0%
Ownership		
Government hospital	10	100%
Private hospital	0	0%
Type of hospital		
General hospital	6	60%
Specialized hospital	3	30%
Tertiary care hospital	1	10%
Accreditation		
Accredited (CBAHI)	7	70%
Average length of stay		
1-5 days	3	30%
5-10 days	6	60%
10 – 15 days	1	10%

CBAHI: Central Board of Accreditation for Healthcare Institutions**.**

Pharmacy general characteristics and facilities

A 24-hour pharmacy service was provided from Saturday through Thursday in eight hospitals. The current inpatient pharmacy distribution system was centralized in 70% of hospitals, where the pharmacy directors would like to shift it to a decentralized distribution system. The nature pharmacists' services were mostly distributive pharmacists with limited clinical services in six (60%) hospitals. The frequently reported barriers facing the pharmacy department to change the practice model of deployment of pharmacists were the lack of well-trained pharmacist staff (60%), lack of automation to support change (50%), and resistance to change from current pharmacy staff (40%). Seven hospitals (70%) confirmed that they have a formal quality assurance program that covers drug dispensing and distribution systems.

Prescribing and transcribing services

Table 2 shows that seven (70%) of the responded hospitals handle the medication orders from the physician to the pharmacy electronically through CPOE. Another common practice was the original handwritten order which was utilized in four hospitals (40%). Six hospitals (60%) reported they have a medication-use evaluation (MUE) program designed to improve medication prescribing.

Formulary system management

Pharmacy directors described the extent of various formulary system management techniques that were used in their hospitals (Table 2). Minimal duplication of multisource drug products, such as limiting purchasing of a drug from different suppliers and prescribing generic-name drugs along with pharmacists' interventions for regular check of prescriber adherence to medication-use policies and prior approval of the use of non-formulary drugs are carried out in four (40%) hospitals. Moreover, few hospitals (20%) implemented steps to minimize duplication of therapeutically equivalent products and established policies to review new therapeutic agents.

Table 2: Type (%) of medication order forms and formulary system management techniques.

Characteristics	Hospitals n=10	%
Medication order form		
Copy of original handwritten order	3	30%
Original handwritten order	4	40%
Electronically through CPOE	7	70%
Fax or digital image capture	1	10%
Formulary system management techniques		
Minimal duplication of multisource products	4	40%
Pharmacist interventions designed to help monitor prescriber compliance with established medication-use policies (MUP)	4	40%
Education of prescribers regarding medication costs	2	20%
Minimal duplication of therapeutically equivalent product	2	20%
Therapeutic interchange policy	3	30%
Substitution of therapeutically similar drug	2	20%
Regular review of new therapeutic agents	1	10%
Regular review of therapeutic classes	2	20%
Regular review of non-formulary drugs	2	20%
Regular evaluation of physician adherence to medication-use policies	4	40%
Prior approval required for non-formulary product	4	40%

COPE: Computerized Prescriber Order Entry**.**

Accurate transcription of medication orders

Table 3 illustrates actions taken by hospitals for accurate and safe transcription of medication orders. The approached hospitals regularly perform one or more of these actions; five hospitals (50%) utilized standard physician order forms and MAR; five hospitals (50%) verified the order regarding spelling the drug name, dose, dosage form, and name of patient; adoption of special transcribing procedures for high-risk drugs (40%); utilization of eMAR and the prescribers are required to countersign all verbal orders (40%).

Medication dispensing
Unit dose preparation and dispensing

For medical and surgical wards, four hospitals (40%) dispensed ≥75% of oral medications in unit dose form (i.e., ready to administer to a patient without further dosage calculation or modification), and 40% dispensed 50-74% as unit dose form (Table 3). The hospital pharmacy directors were asked about the methods used to check the dispensed unit doses. The response showed that many hospitals (70%) had technicians prepared and pharmacists checked unit doses, and technicians prepared and other technicians checked (tech-check-tech) in two hospitals (20%).

Two hospitals (20%) used a robotic drug distribution system that automates dispensing unit dose medications. Three hospitals (30%) routinely utilized machine-readable coding in the inpatient pharmacy to verify doses before dispensing.

Table 3: Number (%) of hospitals undertaking actions to ensure accurate transcription of medication orders and unit dose dispensing.

Activity	Hospitals n=10	%
Standard physician order forms are used	5	50%
Verbal orders must be countersigned	4	40%
All verbal orders must be read back, including spelling the drug name, dose, dosage form, and name of patient	5	50%
If CPOE not available, physicians must print/ type all medication orders	2	20%
Any illegible order is clarified before transcription/entry onto MARs	2	20%
MARs and pharmacy patient profiles are reconciled at least daily	3	30%
Have electronic MAR	4	40%
Pharmacy sends label to be placed on MAR	0	0%
Second nurse double checks written changes to MAR	0	0%
Special transcribing procedures are used for high-risk drugs	4	40%
Have CPOE with interface to pharmacy computer system	3	30%
Methods to check unit dose dispensing		
Proportion of unit dose dispensing		
1-24%	1	10%
25-49%	1	10%
50-74%	4	40%
75% or more	4	40%
Primary method to check unit dose dispensing		
Pharmacist fills/no check	1	10%
Technician fills/pharmacist checks	7	70%
Technician fills/technician checks (tech-check-tech)	2	20%

COPE: Computerized Prescriber Order Entry; MAR: Medication Administration Records.

IV admixture preparation and total parenteral nutrition (TPN)

Six approached hospitals (60%) had an IV admixture preparation area. Nurses were required to prepare ≥ 60% of IV admixture solutions in four hospitals (40%) and 20% of IV admixture solutions in the remaining six hospitals (Table 4). Three hospitals (30%) purchased intravenous commercially available small-volume parenteral products, while 70% of hospitals predominately prepared and dispensed small-volume parenteral doses from the pharmacy. Many hospitals (80%) had approved policies and effectively implemented standardized drug concentrations for IV infusions to promote patient safety. There was no use of automated devices for compounding flushes or syringe-based small volume parenterals. The pharmacy in four hospitals (40%) prepared TPN solutions.

Seven hospitals (70%) required a double check before dispensing medication to high-risk patient populations (e.g., pediatric patients), and 80% of hospitals required two pharmacists to check high-risk/alert medications such as chemotherapy before dispensing.

Four (40%) of respondent hospitals currently use smart infusion pumps.

Documentation of medication administration practices

Regarding the use of technology for safe medication administration, three (30%) of respondent hospitals used handwritten MARs, and five (50%) adopted eMAR, with two hospitals (20%) using computer-generated paper MARs. Three (30%) of the respondent hospitals are currently using Barcode-assisted medication administration (BCMA) for accurate verification of the identity of patient and the medication administration at the point of care. Apart from the hospitals that had BCMA, 20% of hospitals planned to implement a BCMA system within the next three years, and 50% of hospitals had no current plan to implement a BCMA system.

Table 4: IV admixture and total parenteral nutrition (TPN) preparation.

Activity	Hospitals n=10	%
Pharmacy has an IV admixture preparation area	6	60%
Purchase of intravenous commercially available products		
Small volume parenterals	3	30%
Large volume parenterals	2	20%
Policies approved to promote the use of standardized drug concentrations for IV infusions	8	80%
Preparation and dispensing of small volume parenterals		
Mini-bag	2	20%
Syringe for infusion pump	2	20%
Syringe for volume control chamber, or IV push	1	10%
Vial to be prepared by nurse	4	40%
Robotic compounding device (e.g., IV station)	1	10%
Pharmacy prepares TPN	4	40%
Automation used to support TPN preparation	2	20%

Discussion

The general purpose of this study was to outline the current hospital pharmacy practices in Tabuk region, focusing on practices and technologies for managing and improving the medication-use system in hospitals. The hypothesis was that besides the traditional role of pharmacists in the entire medication-use process such as purchase, storage, preparation, and distribution of medications, they are expected to play an essential role in developing drug policies and adopting emerging technologies that promote effective, safe, and economic use of medications.

This study adds to the current literature and expands the knowledge about the extent and range of hospital pharmacy practice in one of the major regions in Saudi Arabia in an attempt to guide healthcare policies toward improving the health system and overall patient outcomes.

An example was the system of receiving medication orders. Our finding showed that 70% of pharmacies primarily received medication orders electronically through CPOE. This was considered a good technology practice to reduce the incidence of medication errors and improve patient safety. The CPOE has been promoted as an essential component of health information technology and electronic medical record (EMR)[14]. A well-designed CPOE system has been proven as an efficient tool to minimize medication errors and improve medication prescribing due to the elimination of handwritten orders and enhanced communications between healthcare providers[14&15]. CPOE was the primary method used to receive medication orders in Jeddah (80.0%) and a lower proportion in Riyadh (41.4%). This showed that awareness about the importance of COPE is improving nationwide since the low proportion in Riyadh region published in 2012, has been improved to 80% and 70% in Jeddah city and Tabuk region, respectively. Almost 100% of hospitals in the US utilize CPOE/HER (electronic health record) systems in the 2020 survey[16].

Another important role that was expected to be managed by pharmacists was the formulary system and selection of medications. Our finding showed that (40%) of hospitals regularly reviewed their adherence to medication use policies and non-formulary medication use policy. This reflects malpractice in more than 50% of the hospitals because adherence to the formulary medication process is the cornerstone of good medication management and rational drug use. However, occasionally, hospitals may encounter some clinical conditions where non-formulary medications are required, such as newly launched drugs in the market, one of patient's own medication before hospital admission, and medications with no therapeutic alternatives in the hospital[17]. The pharmacy practice survey in Riyadh showed that 59.3% of hospitals adhered to their non-formulary medication use policy, and 52% adhered to their medication use policies[11]. The ASHP survey conducted in 2019 showed that more than 70% of US hospitals regularly adhered to such policies[16]. Frequent use of non-formulary medications has the potential to increase the risk of medication errors, impose additional costs, and impact the safety of patients[18]. Pummer and coworkers demonstrated that 28% of all orders entered as non-formulary medications had a prescribing error[19].

Our survey suggested that a few hospitals (< 30%) regularly review the use of new therapeutic agents and therapeutic interchange policy. The survey in Riyadh reported that only 48% of hospitals in Riyadh regularly review the use of new therapeutic agents and therapeutic interchange policy[11]. The nature of the healthcare system and hospitals in Tabuk region located in the Northwestern area is different than Riyadh city. Riyadh is a large capital city with many large-bed (1200-1500) specialized and tertiary care hospitals and medical cities with enormous facilities and efficient automation of medication dispensing. The ASHP survey conducted in 2019 showed that more than 70% of US hospitals regularly used such policy and procedures to minimize duplication of multisource products[16]. Implementing such therapeutic policies may optimize health expenditure and improve the quality of medical care.

Hospitals implemented different actions and special procedures to ensure accurate transcription of medication orders, especially for high-risk medications, such as utilizing EMR and double-check clarification and reading back verbal medication orders. Few hospitals (30%) have CPOE interfaced to

pharmacy computer system compared with (14.8%) in Riyadh and 73.3% in Jeddah[13]. Developing an interface between pharmacy and the patient clinical data and computerized prescription-order entry systems can provide opportunities for improving the prescribing and transcription components.

The lack of skilled clinical pharmacists was likely to be the main reason for the limited clinical and patient-oriented services and the lower level of monitoring services provided by our surveyed hospitals. However, in Riyadh, the percentage of clinical pharmacists providing the monitoring service in hospitals was 36%, and they have fewer integrated distributive-clinical pharmacists (12%) performing the tasks[12].

Our findings demonstrated that using BCMA to verify medication administration was not widely implemented in hospitals where only three hospitals used it. Only 13.3% of hospitals in Jeddah implemented the use of BCMA in the 2019 survey[13], and a lower proportion (7.4%) in Riyadh hospitals in 2012[10]. A higher proportion (87.5%) of hospitals regularly review BCMA, as reported by the 2020 ASHP survey in the United States[9]. The implementation of BCMA scanning has proven effective in improving medication administration accuracy and reducing medication errors by electronic verification of patient identity and correct regimen[20].

We acknowledge this study encountered some limitations. The study was restricted to the governmental hospitals with no invitation and participation from the private sector, which hindered drawing an instructive conclusion about the hospital pharmacy practice in private settings. However, two large tertiary care hospitals responded to the survey, which provided a robust view of the pharmacy practice services. The study design was a cross-sectional description of the pharmacy practice services in hospitals. There was no performed advanced analysis. Despite these limitations, the survey findings suggest areas for the development of strategies toward improving pharmacy practices in the region.

Conclusions

Hospital pharmacists were not much engaged in providing patient-centered care and medication therapy management. A few hospital pharmacies in Tabuk region were utilizing new technology and automation to develop pharmacy practices in hospital settings regarding prescribing, transcribing, and administration of medications. Pharmacists need to expand their role in regular review of therapeutic classes, safe handling of high-risk medications, and adjustment of MAR. More implementation of automation in IV/TPN preparation and barcode scanning to verify medication administration is recommended.

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نشرة العلوم الصيدليــــة
جامعة أُسيوط

تقييم خدمات الممارسة الصيدلة بالمستشفيات: وصف الأدوية ونسخها وتناولها في منطقة تبوك ، المملكة العربية السعودية

مصطفى علي[2,1]* – ماجد العنزي[3] – عبد الرحمن عسيري[3] – علي غبان[3] – عبد المحسن الشمراني[3] – بالانيسامي أميرثالينجام[1]

[1] قسم الممارسة الصيدلانية، كلية الصيدلة، جامعة تبوك، المملكة العربية السعودية

[2] قسم الصيدلة الإكلينيكية، كلية الصيدلة، جامعة أسيوط، مصر

[3] خريجو صيدلة، كلية الصيدلة، جامعة تبوك، المملكة العربية السعودية

هدفت هذه الدراسة إلى تحديد مستوى خدمات الممارسة الصيدلة في إدارة استخدام الأدوية في المستشفيات في منطقة تبوك بالمملكة العربية السعودية.

استخدمت الدراسة نسخة معدلة من الاستبيان الوطني للجمعية الأمريكية لصيادلة النظام الصحي بما يتسق مع مستشفيات المملكة العربية السعودية. تم توزيع نسخة إلكترونية من الاستبيان إلى البريد الإلكتروني لمديري أقسام الرعاية الصيدلية بمستفيات منطقة تبوك. اشتمل الاستبيان قائمة مرجعية تستفسرعن طبيعة الخدمات الصيدلة المقدمة للمرضى في صيدليات المستشفيات. تم استقبال الردود عبر الإنترنت باستخدام منصة الاستطلاع عبر الإنترنت "نماذج جوجل" وتم تصديرها الى برنامج احصائي لعرض النتائج.

شارك مديري قسم الرعاية الصيدلية بعشر مستشفيات في الرد على الاستبيان. كانت طبيعة خدمات الصيادلة في الغالب مقتصرة على صرف الأدوية في ست (٦٠٪) مستشفيات. أفادت أربع مستشفيات (٤٠٪) عن اجراء تقييم منتظم لالتزام الطبيب بسياسات استخدام الأدوية. تابعت خمسة مستشفيات (٥٠٪) امتثال الأطباء للأدلة الاسترشادية للممارسة السريرية. سبعة مستشفيات (٧٠ ٪) لديها أنظمة إدخال الكتروني للوصفات العلاجية مع أنظمة دعم القرار السريري للتعامل مع الوصفات الطبية. لم يتم تنفيذ الأتمتة كثيرًا في توزيع الأدوية ، حيث استخدمت ثلاث مستشفيات (٣٠٪) خزائن آلية لصرف وتوزيع الأدوية ، واستخدمت ثلاثة مستشفيات (٣٠٪) بشكل أساسي ترميزًا يمكن قراءته آليًا للتحقق من الجرعات قبل صرفها للمرضى. ستة من المستشفيات المشاركة (٦٠٪) لديها مكان مخصص لتحضير المحاليل الوريدية.

الخلاصة: أن مشاركة الصيادلة قليلة في الخدمات السريرية. هناك حاجة إلى مزيد من الجهود لتطبيق التقنيات الإلكترونية لتحسين سلامة وكفاءة وصف الأدوية وكتابتها وإدارتها. يجب على الصيادلة زيادة دورهم في مراجعة صرف واستخدام الأدوية ، وتركيب المستحضرات الوريدية ، والمشاركة في وحدات رعاية المرضى، وتطوير سجلات المرضى الخاصة بالأدوية.

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