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ORIGINAL ARTICLE

Hospital pharmacy practice in Saudi Arabia: Drug monitoring and patient education in the Riyadh region

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KEYWORDS

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Abstract *Background:* The purpose of this national survey is to evaluate hospital pharmacy practice in the Riyadh region of Saudi Arabia. The results of the survey pertaining to the monitoring and patient education of the medication use process were presented.

Methods: We have invited pharmacy directors from all 48 hospitals in the Riyadh region to participate in a modified-American Society of Health-System Pharmacists (ASHP) survey questionnaire. The survey was conducted using similar methods to those of the ASHP surveys.

Results: The response rate was 60.4% (29/48). Most hospitals (23, 79%) had pharmacists regularly monitor medication therapy for patients. Of these hospitals, 61% had pharmacists monitoring medication therapy daily for less than 26% of patients, 17% monitored 26–50% of patients and 22% monitored more than half of patients daily. In 41% of hospitals, pharmacists routinely monitored serum medication concentrations or their surrogate markers; 27% gave pharmacists the authority to order initial serum medication concentrations, and 40% allowed pharmacists to adjust dosages. Pharmacists routinely documented their medication therapy monitoring activities in 52% of hospitals. Overall, 74% of hospitals had an adverse drug event (ADE) reporting system, 59% had a multidisciplinary committee responsible for reviewing ADEs, and 63% had a medication safety

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committee. Complete electronic medical record (EMR) systems were available in 15% of hospitals and 81% had a partial EMR system. The primary responsibility for performing patient medication education lays with nursing (37%), pharmacy (37%), or was a shared responsibility (26%). In 44% of hospitals, pharmacists provided medication education to half or more inpatients and in a third of hospitals, pharmacists gave medication education to 26% or more of patients at discharge.

Conclusion: Hospital pharmacists in the Riyadh region are actively engaged in monitoring medication therapy and providing patient medication education, although there is considerable opportunity for further involvement.

1. Introduction

The role of the hospital pharmacist is to ensure the safe, effective, and economic use of medicines. This can be accomplished through various measures including monitoring drug therapy and educating patients on their medication use. Studies have shown that the participation of pharmacists in drug therapy management facilitates patient adherence to therapy, improves outcomes of drug therapy and increases the cost-effectiveness of treatment (Borenstein et al., 2003; Bozovich et al., 2000; Yanchick, 2000). Providing patient education and counseling improves patient compliance, therapeutic outcomes and quality of life as well as increasing their understanding about medication and lifestyle modifications in chronic illness (Malathy et al., 2011; Mehos et al., 2000; Padiyara et al., 2011).

In Saudi Arabia, published studies assessing hospital pharmacy practice are very limited. Hence, in 2010, we designed a project in collaboration with the King Saud University College of Pharmacy, the Saudi Pharmaceutical Society (SPS) and the American Society of Health-System Pharmacists (ASHP) to survey the current state of hospital pharmacy practice in the country. We used a modified survey based on the published ASHP survey, which focuses on assessing the role of pharmacists in managing and improving the medication-use system. The survey has been conducted in hospitals of the Riyadh region and is organized according to the six steps in the medication-use system: prescribing, transcribing, dispensing, administration, monitoring, and patient education. The results for the first four steps have already been published (Alsultan et al., 2012; European Association of Hospital Pharmacists, 2005).

The third part in the series focuses on the monitoring and patient education steps of the medication use process in hospitals of the Riyadh region. To the best of our knowledge, this is the first attempt to assess the role of hospital pharmacists in patient monitoring and education. In assessing the role of pharmacists in patient monitoring and education, the present study seeks to describe and characterize the trends in pharmacist's monitoring of medication therapy, and describe the monitoring activities of pharmacists. This study also describes the methods used to monitor adverse drug events (ADEs), characterizes internal and external ADE reporting, and identifies patient education and counseling activities. In addition, this study describes the working hours of pharmacy operation, staff training, and the readiness of pharmacy graduates for practice in a hospital pharmacy setting.

Findings from this survey will provide an overview of the current practices in drug monitoring and patient education, and should act as a benchmark at local and national levels. The results will also help to track progress over time and will help to identify opportunities for strategic initiatives and policies at a national level to improve practice.

2. Methods

2.1. Survey

A survey questionnaire as pertinent to hospital pharmacy in Saudi Arabia was prepared by modification, addition and subtraction from ASHP survey questions in consultation with ASHP survey members. The survey details were also discussed with some of the hospital pharmacy directors in Riyadh prior to finalizing the survey. For this report, the major domains of the medication use process studied were monitoring and patient education. The survey was conducted using methods similar to those of the ASHP surveys (Pedersen et al., 2008, 2009, 2010, 2011). Some questions were constructed to allow multiple options to be given as responses.

The pharmacy directors of 48 hospitals in the Riyadh region according to Ministry of Health (MOH) records (Saudi Ministry of Health Portal, 2011) were contacted to participate in the survey. The survey questionnaires were collected upon completion. To increase the response rate, three attempted follow-ups were made within three months and respondents were offered a complimentary copy of the 2010 Saudi National Formulary (SNF) to encourage their participation. Any hospital pharmacy that did not respond during the study period was considered a non-responder. Each booklet of the survey questionnaire was assigned a serial number.

2.2. Statistics

Data were entered into Predictive Analytics Software (PASW) Advanced Statistics version 18 (formerly called SPSS Advance Statistics, SPSS Inc., Chicago, Illinois) licensed for King Saud University. The data are summarized using descriptive statistics, categorized by hospital size as small (less than 100 beds), medium (100–299 beds) or large (300 or more beds).

3. Results

Twenty-nine of the 48 hospital pharmacies in the Riyadh region responded to the survey giving a response rate of 60.4%. The characteristics of respondent hospitals are shown in Table 1.

3.1. Medication therapy monitoring

For the purposes of this survey, medication therapy monitoring occurs after a patient has received a medication. Medication therapy monitoring activities include monitoring therapeutic drug levels, monitoring patient outcomes, monitoring patient laboratory results, adverse drug event monitoring, adjustments in medication regimens, etc.

Table 1 Size, ownership and accreditation of respondent's hospital.

Characteristics	Hospitals (n = 29)	
	N	(%)
Hospital size (Number of staffed beds)		
Small		
< 50	2	(6.9)
50–99	4	(13.8)
Total	6	(20.7)
Medium		
100–199	7	(24.1)
200–299	3	(10.3)
Total	10	(34.4)
Large		
300–399	3	(10.3)
400–599	4	(13.8)
⩾600	4	(13.8)
Total	11	(37.9)
Missing-No Response	2	(6.9)
Occupied beds		
< 50	4	(13.8)
50–99	4	(13.8)
100–199	6	(20.7)
200–299	3	(10.3)
300–399	1	(3.4)
400–599	3	(10.3)
⩾600	3	(10.3)
Missing-No Response	5	(17.3)
Ownership		
Government hospital	14	(48.3)
Private hospital	15	(51.7)
Accreditation		
Accredited	16	(55.1)

Overall, 79.3% (n = 23) of the pharmacy directors reported that pharmacists regularly monitored medication therapy for patients. The survey asked respondents to report the percentage of patients monitored by pharmacists in their hospital on a daily basis. About 61% of respondents indicated that pharmacists monitored ⩽25% of all patients each day. An additional 17.4% indicated that pharmacists monitored 26–50% of patients each day (Table 2).

In those hospitals where monitoring regularly occurred, the service was performed by clinical pharmacists 36% of the time, distributive pharmacists 24%, pharmacy residents in 16% and integrated distributive-clinical pharmacists in 12% (Table 2).

3.1.1. Methods to identify patients in need of monitoring

There are various ways to identify which patients are most likely to benefit from the medication therapy-monitoring activities of a pharmacist.

This survey showed that 39% of hospitals identified patients for monitoring by using one or more of the following methods: a formalized list of specific medications, specific medical or surgical services, disease state, and abnormal laboratory values that prompt dosage adjustments (Table 3). Furthermore, 22% of hospitals identified patients for monitoring by high cost medications and 17% used other methods.

3.1.2. Activities implemented to improve monitoring

Several of our surveyed hospitals had implemented a variety of activities within the past three years to promote medication therapy monitoring by pharmacists. The commonly reported activities were implementation of clinical pharmacy services (40%), computerized prescriber order entry (28%), increased hiring of clinical pharmacy staff (28%), increased access to patient-specific data to pharmacists (28%), implemented satellite pharmacies (24%), expanded pharmacy technician responsibilities (20%), and implemented automated dispensing systems (16%). Activities implemented less frequently included re-deployed pharmacists to patient care units and decentralized pharmacist order entries (Table 3).

Table 2 Number (%) of hospitals with groups who regularly perform medication therapy monitoring and percentage of patients monitored by pharmacists.

Characteristics	Hospitals engaged in activity			
	Small < 100 n (%)	Medium (100–299) n (%)	Large ⩾ 300 n (%)	Total n (%)
Patients monitored by pharmacists each day (n = 23)*				
< 26%	2 (8.7)	6 (26.1)	6 (26.1)	14 (60.9)
26 to 50%	0 (0.0)	2 (8.7)	2 (8.7)	4 (17.4)
51 to 75%	2 (8.7)	0 (0.0)	1 (4.3)	3 (13.0)
75%	1 (4.3)	1 (4.3)	0 (0.0)	2 (8.6)
Groups regularly perform medication therapy monitoring (n = 25)[a]				
Distributive pharmacists	3 (12.0)	1 (4.0)	2 (8.0)	6 (24.0)
Clinical pharmacists	1 (4.0)	1 (4.0)	7 (28.0)	9 (36.0)
Integrated distributive/clinical pharmacists	0 (0.0)	2 (8.0)	1 (4.0)	3 (12.0)
Pharmacy residents	1 (4.0)	1 (4.0)	2 (8.0)	4 (16.0)
Pharmacy students	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
No pharmacists regularly perform patient monitoring services	1 (4.0)	7 (28.0)	2 (8.0)	10 (40.0)

Percentages based on number of hospital respondents

[a] Multiple options could be selected.

Table 3 Number (%) of hospitals using methods to identify patients in need of monitoring and activities implemented to promote medication therapy monitoring by pharmacists.

Characteristics	Hospitals engaged in activity			
	Small <100 *n* (%)	Medium (100–299) *n* (%)	Large $\geqslant 300$ *n* (%)	Total *n* (%)
Methods to identify patients in need of monitoring ($n = 23$)[a]				
Formalized list of medications (e.g., high-risk medication)	3 (13.0)	3 (13.0)	3 (13.0)	9 (39.1)
Specific medical or surgical services	2 (8.7)	2 (8.7)	5 (21.7)	9 (39.1)
Disease state	2 (8.7)	4 (17.4)	3 (13.0)	9 (39.1)
Abnormal lab value changes requiring dosage adjustment	1 (4.3)	2 (8.7)	6 (26.1)	9 (39.1)
High cost medications (e.g., IVIG, Factor VII)	1 (4.3)	1 (4.3)	3 (13.0)	5 (21.6)
Informal process (e.g., individual pharmacist selection)	2 (8.7)	2 (8.7)	5 (21.7)	9 (39.1)
Other	1(4.3)	1(4.3)	2 (8.7)	4 (17.4)
Activities Implemented to Promote Medication Therapy Monitoring($n = 25$)[a]				
Increased hiring of clinical pharmacy staff	0	2 (8.0)	5 (20.0)	7 (28.0)
Implemented satellite pharmacies	1 (4.0)	1 (4.0)	4 (16.0)	6 (24.0)
Implemented computerized prescriber order entry	3 (12.0)	1(4.0)	3 (12.0)	7 (28.0)
Implemented an automated dispensing system	1 (4.0)	1 (4.0)	2 (8.0)	4 (16.0)
Re-deployed pharmacists to patient care units	0 (0.0)	0 (0.0)	2 (8.0)	2 (8.0)
Decentralized pharmacist order entry	0 (0.0)	1 (4.0)	1 (4.0)	2 (8.0)
Expanded pharmacy technician responsibilities	1 (4.0)	3 (12.0)	1 (4.0)	5 (20.0)
Increased access to patient-specific data	1 (4.0)	3 (12.0)	3 (12.0)	7 (28.0)
Promoted value of clinical pharmacy services	1 (4.0)	1 (4.0)	8 (32.0)	10 (40.0)
Other	0 (0.0)	0 (0.0)	1(4.0)	1 (4.0)

Percentages based on number of hospital respondents

[a] Multiple options could be selected.

3.1.3. Therapeutic drug monitoring

In 41% of all surveyed hospitals, pharmacists routinely monitored serum medication concentrations or their surrogate markers such as vancomycin, aminoglycoside levels, international normalization ratio (INR) etc. (Table 4). In 27% of hospitals, pharmacists had the authority, by protocol, to order an initial measurement of serum medication concentrations, and 40% allowed pharmacists to adjust a dosage for a monitored medication. Additionally, 46% of hospitals ensured that pharmacists accurately recorded and evaluated allergies prior to administration of medication.

3.1.4. Documentation and location of medication therapy monitoring activities

For the purposes of this survey, routine patient–profile monitoring is defined as the review of patient profiles (e.g., medication administration records, medical record, and pharmacy medication profile) after the medication order has been processed and the treatment initiated. This definition does not include the monitoring that occurs upon initial processing of the medication order.

The survey showed that pharmacists routinely documented their medication therapy monitoring activities in 52% of hospitals.

Allowing for multiple locations of documentation, pharmacists most frequently documented these activities in patient medical records (36%), pharmacy patient profiles (32%), and medication administration records (27%) (Table 4).

3.1.5. Access to electronic information

Computer access to laboratory data was readily available to pharmacists to monitor medication therapy in 56% of hospitals (Table 4).

3.1.6. Medical record system and organizational program

Only 15% of hospitals, classified as large hospitals, had a complete electronic medical record (EMR) system with no paper records whereas 81% of hospitals had a partial EMR with some components still using paper charts (Table 4).

An organizational program with appropriate pharmacy involvement in order to achieve significant annual documented improvement in the safety of all steps in medication use was present in 44% of hospitals.

3.2. Adverse drug events (ADEs) monitoring and reporting

Since operational definitions of ADEs vary, hospital pharmacy directors were provided with the following definition of ADEs: "An adverse drug event is an injury resulting from the use of, or not using, a needed medication. For the purpose of this survey, consider both adverse drug reactions and medication errors that result in adverse clinical outcomes together as adverse drug events."

3.2.1. Review of ADEs

Overall, 74% of hospitals had an ADE reporting system and 59% had a multidisciplinary committee (including physicians, pharmacists, and nurses) that was responsible for the review, analysis, education, policy formation and corrective action related to adverse drug events. In addition, 63% of hospitals had a medication safety committee (Table 5).

3.2.2. Methods to identify ADEs

Recipients of the survey were asked to identify which methods pharmacists use to routinely monitor patients for ADEs (Table 5). The most commonly used methods were an ADE

Table 4 Number (%) of hospitals with pharmacists involved in therapeutic drug monitoring, documenting their monitoring, location of documentation and having electronic access to patient information.

Characteristics	Hospitals engaged in activity			
	Small < 100 *n* (%)	Medium (100–299) *n* (%)	Large ⩾ 300 *n* (%)	Total *n* (%)
Therapeutic drug monitoring				
Monitor medication levels ($n = 27$)	2 (7.4)	4 (14.8)	5 (18.5)	11 (40.7)
Authorized to order serum medication level measurement ($n = 26$)	1 (3.8)	2 (7.7)	4 (15.4)	7 (26.9)
Authorized to dosage adjustment for a routinely monitored medication ($n = 25$)	2 (8.0)	3 (12.0)	5 (20.0)	10 (40.0)
Allergies are accurately recorded and evaluated prior to medicine administration ($n = 26$)	2 (7.7)	4 (15.4)	6 (23.1)	12 (46.2)
Medication therapy monitoring documentation ($n = 27$)				
Documentation of monitoring activities	3 (11.1)	4 (14.8)	7 (25.9)	14 (51.9)
Locations of Medication Therapy Monitoring Documentation ($n = 22$)[a]				
Patient medical record	3 (13.6)	0 (0.0)	5 (22.7)	8 (36.4)
Medication administration record	1 (4.5)	4 (18.2)	1 (4.5)	6 (27.3)
Pharmacy patient profile	1(4.5)	2 (9.1)	4 (18.2)	7 (31.8)
Other	0 (0.0)	2 (9.1)	1(4.5)	3 (13.6)
Electronic access to laboratory data ($n = 27$)				
Electronic access to laboratory data to pharmacists	2 (7.4)	5 (18.5)	8 (29.6)	15 (55.6)
Medical record system ($n = 26$)				
Entire electronic medical record system	0 (0.0)	0 (0.0)	4 (15.4)	4 (15.4)
Some components are electronic	6 (23.1)	9 (34.6)	6 (23.1)	21 (80.8)
Not applicable	0 (0.0)	1(3.8)	0 (0.0)	1 (3.8)

Percentages based on number of hospital respondents
[a] Multiple options could be selected.

Table 5 Number (%) of hospitals using an ADE reporting system.

Characteristics	Hospitals engaged in activity			
	Small < 100 *n* (%)	Medium (100–299) *n* (%)	Large ⩾ 300 *n* (%)	Total *n* (%)
ADE reporting system and committees (27)				
ADE reporting system	3 (11.1)	7 (25.9)	10 (37.1)	20 (74.1)
Medication safety committee	3 (11.1)	8 (29.7)	6 (22.2)	17 (63.0)
Multidisciplinary committee	1 (3.7)	7 (25.9)	8 (29.7)	16 (59.3)
Methods routinely use to identify ADEs (27)[a]				
Routine review of lab values	2 (7.4)	2 (7.4)	3 (11.1)	7 (25.9)
Therapeutic drug monitoring	3 (11.1)	2 (7.4)	4 (14.8)	9 (33.3)
Pharmacists round with physicians	1 (3.7)	2 (7.4)	5 (18.5)	8 (29.6)
Pharmacists round independent of physicians	0	1 (3.7)	5 (18.5)	6 (22.2)
Adverse drug events hotline	1 (3.7)	0	1 (3.7)	2 (7.4)
Notification from nursing	1 (3.7)	5 (18.5)	6 (22.2)	12 (44.4)
Through patient counseling/interaction	1 (3.7)	2 (7.4)	4 (14.8)	7 (25.9)
ADE incident reporting system	1 (3.7)	6 (22.2)	7 (25.9)	14 (51.8)
None of the above methods used	2 (7.4)	2 (7.4)	0	4 (14.8)
ADE Reporting practice ($n = 26$)[a]				
Report regularly to the medication safety committee and P&T committee	3 (11.5)	6 (23.1)	8 (30.8)	17 (65.4)
Externally to FDA or the international agency	0	1 (3.8)	0	1 (3.8)
Saudi Food and Drug Authority (SFDA)	3 (11.5)	4 (15.4)	7 (26.9)	14 (53.8)
Ministry of Health (MOH)	4 (15.4)	4 (15.4)	3 (11.5)	11 (42.3)
Manufacturers of pharmaceutical products	3 (11.5)	2 (7.7)	3 (11.5)	8 (30.7)
Other	1 (3.8)	0	0	1 (3.8)

Percentages based on number of hospital respondents
[a] Multiple options could be selected.

incident reporting system (52%), notification from nursing (44%), therapeutic drug monitoring (33%), pharmacists round with physicians to assess ADEs (30%), routine review of lab values (26%), and through patient counseling/interaction (26%). Less frequently used methods included pharmacists round independent of physicians (22%), and having an ADE hotline (7%).

Table 6 Number (%) of hospitals performing patient medication education and counseling and the method used to select patient for counseling.

Characteristics	Hospitals engaged in activity			
	Small < 100 *n* (%)	Medium (100–299) *n* (%)	Large ⩾ 300 *n* (%)	Total *n* (%)
Primary responsibility for medication education and counseling ($n = 27$)				
Patient education by nursing	7 (25.9)	2 (7.4)	1 (3.7)	10 (37.0)
Patient education by pharmacy	0	6 (22.2)	4 (14.8)	10 (37.0)
Patient education by nursing and pharmacy	0	2 (7.4)	3 (11.1)	5 (18.5)
None/Other	0	0	2 (7.4)	2 (7.4)
Method to select patient for counseling ($n = 23$)[a]				
All patients are counseled	0	1 (4.3)	3 (13.1)	4 (17.4)
Patients discharged on more medications	3 (13.1)	1 (4.3)	4 (17.4)	8 (34.8)
Patients discharged on highly complex or high-risk medication regimens	3 (13.1)	3 (13.1)	5 (21.7)	11 (47.9)
Upon patient request	1 (4.3)	2 (8.7)	1 (4.3)	4 (17.4)
Upon physician order	0	1 (4.3)	4 (17.4)	5 (21.7)
Upon nurse request	0	1 (4.3)	1 (4.3)	2 (8.7)
History of noncompliance	0	0	0	0
Disease-based focus	0	0	1 (4.3)	1 (4.3)
Drug–drug interactions	0	0	2 (8.7)	2 (8.7)
Newly prescribed medications	1 (4.3)	2 (8.7)	1 (4.3)	4 (17.4)

Percentages based on number of hospital respondents

[a] Multiple options could be selected.

3.2.3. Internal ADE reporting

ADEs were reported internally to the medication safety committee, and pharmacy and therapeutics (P & T) committee in 65% of hospitals (Table 5).

3.2.4. External ADE reporting

Of those hospitals that reported ADEs externally, the Saudi Food and Drug Authority (54%), Ministry of Health (42%), and the manufacturer of pharmaceutical products (31%) were the main recipients. Only one hospital (4%) reported serious ADEs externally to the US-FDA or another international agency (Table 5).

3.3. Patient medication education and counseling

For the purposes of this survey, patient education and counseling are defined as a combination of teaching activities that focus on keeping patients informed about their health condition, treatment plans, medication therapy, and self-care management to facilitate changes in behavior for improvement and maintenance of health. Patient education and counseling may also include incidental, informal, or spontaneous exchanges of information that may be initiated by a specific need, concern, or situation at a given time.

3.3.1. Department responsible for medication education and counseling

The nursing department and the pharmacy department each had equal opportunities to perform patient medication education and counseling (37% each). However, 26% of hospitals reported this task as a shared responsibility between pharmacy and nursing or another department. (Table 6).

3.3.2. Proportion of patients receiving medication education and counseling

Overall, 44% of hospitals reported that at least half of all patients received medication education from a pharmacist during their inpatient hospital stay and a third of hospitals provided patient medication education to 26% or more of patients at discharge.

3.3.3. Method to select patient for medication education and counseling

Less than half of the hospitals (46%) used some method to select patients for medication education and counseling by pharmacists. Of those that used a method to select patients, the identification of patients discharged on highly complex or high-risk medication regimens (48%), patients discharged on more medications (35%) and upon physician order (22%) were the most commonly used (Table 6). Less commonly used methods to select patients included newly prescribed medications, upon nurse or patient request, or medications with potential drug–drug interactions.

3.3.4. Follow-up after discharge

Overall, 21% of hospitals had pharmacists follow up high-risk patients about their medications after they were discharged from the hospital.

3.3.5. Required documentation

Twenty-four percent of the pharmacy directors reported that their pharmacists were required to document inpatient medication counseling in the patient's medical record.

3.4. Hours of pharmacy operation

Most hospitals (79%) reported that they provided 24-h pharmacy services.

Table 7 Readiness of pharmacy graduates to practice independently in hospitals.

Characteristics	New pharmacy graduate (non-residency) $n = 25$ n (%)	New pharmacy practice resident ($n = 25$) n (%)
Well prepared, minimal orientation and training required	4 (16.0)	7 (28.0)
Prepared, reasonable orientation and training required	9 (36.0)	13 (52.0)
Unprepared, extensive training and remediation required	6 (24.0)	9 (36.0)
Not applicable	6 (24.0)	17 (68.0)

3.5. Staffing

Over half of the hospitals (56%) reported having an executive level pharmacy position that met the job profile of the chief pharmacy officer, regardless of the actual job title.

3.6. Full time equivalent (FTE) positions

Data on FTE positions were not analyzed due to variable responses. The data indicated that pharmacy directors had some difficulty in calculating FTE positions, possibly due to misunderstanding the definition.

3.7. Staff training

To train newly hired pharmacy technicians, 81.5% of hospitals used on the job training with observation, 18.5% used in-house self-study of books or videos, and 7.4% used in-house didactic training (lecture component with written exam).

Pharmacy directors acknowledged their contribution to the introductory or advanced pharmacy practice experience (IPPE/APPE) for pharmacy students in their pharmacy departments. More than 62% of pharmacy directors believed that pharmacy student training contributes to patient care.

3.8. Readiness of pharmacy graduates

The readiness of new pharmacy graduates to practice independently is shown in Table 7.

4. Discussion

Our study is the first to provide descriptive data on the status of pharmacy practice pertaining to monitoring and patient education in hospitals in the Riyadh region of Saudi Arabia.

We consider our survey response rate of 60.4% as good. Although, the survey sample size is relatively small we believe that it gives a fair representation of hospital pharmacies in the Kingdom of Saudi Arabia as the survey was conducted in the Riyadh region of Saudi Arabia with a population of 6.2 million and where about 40% of the major hospitals in Saudi Arabia are situated (Saudi Ministry of Health Portal, 2011).

Despite the fact that the majority of the surveyed hospitals (79.3%) reported that pharmacists regularly monitored medication therapy for patients, about 60% of hospitals provide monitoring on a daily basis to less than 26% of patients. This indicates that there is a significantly lower level of daily drug monitoring in Saudi Arabia compared with the United States of America (US) as the ASHP survey conducted in 2009 showed only 20% of hospitals providing a drug monitoring service on a daily basis to less than 26% of patients (Pedersen et al., 2010). In addition, although the percentage of clinical pharmacists providing the monitoring service in our hospitals is comparable to the US (36% vs. 44%), we have fewer integrated distributive-clinical pharmacists performing the same task here than in US hospitals (12% vs. 65%).

The lack of skilled clinical pharmacists is likely to be the main reason for the lower level of monitoring service provided by our surveyed hospitals compared to the US. Currently, most employed hospital pharmacists hold a bachelor degree in pharmaceutical science with minimal clinical skills learned during five years of education. However, in 2001, King Abdulaziz University Jeddah, Saudi Arabia, introduced the first doctor of pharmacy (Pharm. D) program. The purpose of the program is to train pharmacists to assume greater responsibility in providing pharmaceutical care service and to promote the role of a pharmacist as a direct patient care provider in various clinical setting. Currently, 15 colleges of pharmacy offer the Pharm. D curriculum across the Kingdom and 4,500 clinical pharmacists (based on the assumption that 30 graduates/college/year) are expected to graduate by 2020. In contrast, in the US, a doctor of pharmacy program has been available since the 1960s, currently all accredited schools and colleges of pharmacy in the US offer the Pharm. D degree as a mandatory entry level for pharmacists. We believe that the introduction of the Pharm. D program will gradually expand pharmaceutical care services in Saudi Arabia. In addition, expansion in postgraduate residency training programs e.g. PGY-1 and PGY-2 will further enhance the quality of pharmaceutical care. In Saudi Arabia, there is an ongoing national residency program and this is considered equivalent to a PGY-1, that only graduates general clinical pharmacists without a focus on a specific specialty (Al-Haidari and Al-Jazairi, 2010; Al-Qadheeb et al., 2012).

Studies have shown that pharmacist interventions can maximize therapeutic efficacy while minimizing AEs and improving patient outcomes (Chumney and Robinson, 2006; Kaboli et al., 2006). Monitoring high-risk medications and abnormal laboratory value changes that require dosage adjustment can reduce ADEs and improve clinical outcome among hospitalized patients (Szekendi et al., 2006). The present study has shown that only 39% of our hospitals use abnormal laboratory values and high risk patient-specific medical information to identify which patients require daily monitoring compared with 75% of surveyed hospitals in the ASHP surveys (Pedersen et al., 2010). Due to lack of well-trained clinical pharmacists in many of the surveyed hospitals, we suggest that pharmacy directors should consider increasing their use of abnormal laboratory values and high-risk patient-specific medical information by pharmacists to maximize therapeutic drug monitoring outcome.

Our survey also highlights the lack of activities in the hospitals here in promoting therapy monitoring compared to hospitals in the US. This was especially evident in areas such as promoting the value of clinical pharmacy services (40% vs. 56%), increasing access to patient-specific data (28% vs. 44%), implementing an automated dispensing system (16% vs. 30%), and deploying of pharmacists to patient care units (8% vs. 23.5%) (Pedersen et al., 2010).

The benefits of measuring plasma or whole blood medications concentration or biochemical markers to achieve optimized dosage regimens are well-established (Touw et al., 2007). Our survey findings indicated that only 41% of hospitals had pharmacists routinely monitor serum medication concentrations or their surrogate markers to evaluate drug therapy outcome and toxicity. This is considerably lower than the rate reported in the ASHP survey where more than 92% of hospitals engaged in this activity (Pedersen et al., 2010). Our survey also highlights that clinical pharmacists have a less pronounced role regarding initial ordering of drugs level and adjusting the medication dosage that has been monitored than their US counterparts. In US hospitals, 80% of clinical pharmacists were authorized, by protocol, to order an initial drug level compared to only 27% in our surveyed-hospitals and 79% of US hospitals allowed their clinical pharmacists to adjust the dosage of a medication compared to 40% in the Kingdom (Pedersen et al., 2010).

While pharmacists understand the importance of documenting relevant issues pertaining to medication management in medical records, they do not always achieve their goal here. As per Saudi Ministry of Health, all clinical interventions involving changes of patient orders shall be appropriately documented on the patient's medical record using clinical pharmacist intervention form in such a manner to allow others to easily understand and re-trace activities or actions (Saudi Ministry of Health., 2010). We found that pharmacists routinely documented their medication therapy monitoring activities in only 52% of hospitals here compared to 85% in the US (Pedersen et al., 2010). On the other hand, about 63% of hospitals in Ireland and Spain kept a written report on pharmacist intervention for inpatients in the pharmacy (European Association of Hospital Pharmacists, 2005). This indicates that there is the potential for a significant improvement in this domain.

The primary method to improve the efficiency of monitoring is to make laboratory data readily accessible to pharmacists. The new Joint Commission on Accreditation of Healthcare Organizations (JCAHO) Medication Management and Use Standard MM.1.10 (Rich, 2004) requires that "Patient-specific information is readily accessible to those involved in the medication management system." The present study has shown that only 56% of the surveyed hospitals provide pharmacists computer access to laboratory information. This is an unexpectedly low compared with the US where most pharmacists (93%) have access to laboratory data using electronic systems (Pedersen et al., 2010). In a Canadian survey, 43% of respondents reported that their laboratory system is interfaced with the medication order entry system and 54% of respondents reported that they accessed laboratory data through view-only terminals (Hospital Pharmacy in Canada Editorial Board, 2011). Hence, this is another area with considerable opportunity for improvement here.

The broad adoption of EMR systems have shown to reduce medical errors, improve health, and major health care savings (Hillestad et al., 2005). Over 75% of physicians at a teaching hospital in Saudi Arabia have indicated that the use of EMR systems has a positive impact on work and quality of care (Nour El Din, 2007). Our findings indicated that 15% of hospitals had a complete EMR system with no paper records. This compares favorably with the US, as the ASHP survey found that only 8.8% of US hospitals had a complete EMR system with no paper records (Pedersen et al., 2010). This figure seems over-inflated, as respondents of this survey might have considered the presence of CPOE as a complete EMR. A relatively older study in the US (Jha et al., 2009) reported that only 1.5% of US hospitals have a comprehensive EMR system (i.e., present in all clinical units), and an additional 7.6% have a basic system (i.e., present in at least one clinical unit).

Adverse drug reaction reporting systems can help minimize harm from medicines at local, regional, national, and international level (Reza and Emmerton, 2005). Our findings show that more than half of the pharmacists are using an ADE incident/ occurrence reporting system to routinely monitor patients for ADEs. Pharmacists in the US are using similar methods but with a higher frequency (Pedersen et al., 2010). Moreover, adverse drug reactions are monitored by pharmacists in 82% of Italian hospitals and in more than 70% of Irish, Spanish and Dutch hospitals (European Association of Hospital Pharmacists, 2005).

The primary purpose of reporting is to document variances, examine system errors and learn from experience. When an adverse event occurs in a hospital, it is reported to multidisciplinary committees, an investigation is carried out to uncover the causes, and changes are made to prevent a recurrence (Vincent et al., 2000; Vincent et al., 1998). Our result shows that significantly lesser (59%) hospitals had a multidisciplinary committee(s), which was/were responsible for the review, analysis, education, policy formation and corrective action related to ADEs compared to most hospitals (89%) in the US (Pedersen et al., 2010).

A good internal reporting system ensures that all responsible parties (healthcare providers and patients) are aware of major hazards including ADEs (Lucian, 2002). The analysis of the reports will highlight the causes and assist in determining the incidence of ADRs. The current results indicate that in only two thirds of hospitals (65%) ADEs were reported internally to the medication safety committee and/or Pharmacy and therapeutics (P & T) committee. Ideally, internal reporting of ADEs in any hospital should be near 100%. The level of reporting of ADEs found in this survey is suboptimal and in need of significant improvement.

Data suggest that counseling patients in general reduces medication discrepancies, errors, and improves adherence (Al-Rashed et al., 2002; Lipton and Bird, 1994; Smith et al., 1997). Our result indicates that the primary departments responsible for patient medication education and counseling were pharmacy and nursing departments (37%) each. The results suggest that pharmacy departments here have a more dominant role in education and counseling patients than in US hospitals. For instance, the most recent ASHP survey reported that the vast majority of hospitals (89.0%) assigned primary responsibility for performing patient medication education and counseling to nurses while pharmacists were responsible for performing these tasks in only 5.9% of institutions (Pedersen et al., 2010). Our findings may provide a benchmark for the proportion of patients receiving medication

education during their inpatient hospital stay and at discharge in Saudi Arabia and it will allow tracking progress over time. Unfortunately, the ASHP survey conducted in 2009 reported that the proportion of patients receiving patient education by pharmacists either during their hospital stay or when they are discharged has not significantly changed over the past nine years (Pedersen et al., 2010).

Comprehensive counseling for every patient is not always feasible and only 17% of the hospitals in this survey counseled all patients. Therefore, focusing interventions for specific patients is often necessary and it may be appropriate to arrange specialized counseling for patients who are prescribed high-risk medications or medications that require special administration skills (Forster et al., 2003; Gandhi et al., 2003). As expected, our results showed that the two groups of patients most commonly selected for medication education and counseling by pharmacists were patients discharged on highly complex or high-risk medication regimens (48%) and those discharged on greater number of medications (35%). Counseling patients taking several medications at a time is particularly important, as studies have reported that patients prescribed more than five medications may not only experience added difficulty, but they are also at greater risk of ADEs (Gandhi et al., 2003; Kripalani et al., 2008).

One fifth of hospitals had pharmacists follow up high-risk patients about their medications after their discharge from hospital in our survey. The post discharge medication review and telephone follow-up by a pharmacist reduce the hospitalization rate, total health care costs, and a lower rate of preventable ADEs 30 days after discharge (Jack et al., 2009; Schnipper et al., 2006). Studies have also shown that better documentation of a patient's medications reduces ADEs during and after hospitalization (Kaboli et al., 2006; Schnipper et al., 2006). Only a quarter of our survey respondents reported that pharmacists were required to document inpatient medication counseling in the patient's medical record. Hence, further improvements are needed in both the documentation and the post discharge follow - up.

5. Conclusion

Hospital pharmacists in the Riyadh region are actively engaged in monitoring medication therapy and providing patient medication education, although there is considerable opportunity for further improvement.

Conflicts of interest and source of funding

The authors declare no conflicts of interest.

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