National Survey of the Pharmacokinetics Services at Ministry of Health Hospitals in Saudi Arabia: Pharmacy Management Practice

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Abstract

Objectives: To explore the pharmacokinetics services at Ministry of Health (MOH) hospitals in Saudi Arabia with an emphasis on pharmacy management practice. **Methods:** This is a 2-month cross-sectional national survey related to the pharmacokinetics services with a focus on pharmacy management and resources at MOH hospitals in Saudi Arabia. The study consisted of two parts: the first part gathers demographic information and the second part contained 43 questions divided into four domains that were derived from the guidelines of the American Society of Health-System Pharmacists and from the literature. We used the 5-point Likert response scale system to obtain the responses of the participants, which consisted of closed-ended questions. An electronic questionnaire was distributed to the coordinators of all the clinical pharmacy services or drug information centers at MOH hospitals; it captures the data regarding education and training through a Survey Monkey system. **Results:** There were 43 total responders from hospital pharmacies; the response rate was found to be 86%. The majority of pharmacokinetics services were provided to the adult patients (37 (86.05%)) followed by the pediatric and geriatric patients (19 (44.19%) and 13 (30.23%) respectively, with most of the hospitals covering less than 20 beds (23 (53.5%)). Most of the pharmacokinetics services were provided through inpatient pharmacy (27 (62.79%)), outpatient pharmacy and through discharge (9 (20.93%)). Most of the administration and management sections of the pharmacokinetics services were with the mission of pharmacokinetics services (68.8%) followed by the total quality management (67.6%) and policy and procedures (64.8%), whereas the least of the administration of pharmacokinetics services was found in the annual pharmacokinetics plan (60%), the pharmacokinetics strategic plan and pharmacokinetics technician competency (62.6%). **Conclusion:** Although there is a daily demand for the pharmacokinetics services, only one-third of the hospitals had pharmacokinetics services to offer. Implementing the MOH pharmacokinetics services strategy is required at all MOH hospitals in Saudi Arabia.

Key words: Pharmacokinetics, Management, Pharmacy resources, Ministry of Health, Saudi Arabia.

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INTRODUCTION

Clinical Pharmacokinetic Services (CPKs) and Therapeutic Drug Monitoring (TDM) services are essential competencies for the pharmacists, which is important to ensure the safe use of drugs. CPKs have been developed to meet the safe and effective dosage regimens for specific patients by the process of

applying pharmacokinetic principles and based on the determination of drug-serum concentrations.¹⁻² The American Society of Hospital Pharmacists (ASHP) believes that clinical pharmacokinetic monitoring is essential to achieve positive outcomes for patients across the continuum of care and in all practice settings of healthcare systems. Examples of such outcomes include decreased mortality, decreased length of treatment,

decreased length of hospital stay, decreased morbidity (either improved symptoms of the disease or improved recuperation), and decreased adverse effects from drug therapy.²

TDM is generally defined as the clinical laboratory measurement of a chemical parameter that, with appropriate medical interpretation, will directly influence the drug-prescribing procedures. In other words, it refers to the patient's individualization of a drug regimen for the maintenance of the drug concentrations in the plasma or blood within a targeted therapeutic window. It allows for the assessment of the efficacy and safety of medications in different clinical settings. The goal of TDM is to individualize therapeutic regimens for the optimal patient benefit. It is a useful clinical tool in drug therapy.^{1,2} Nationwide surveys of TDM services in both internationally developed and those developed in the Far Eastern countries have been reported to determine the current practice of the hospitals by identifying the availability of clinical and analytical components of the service.³⁻⁷ Furthermore, several studies have been conducted in the Gulf countries and inside the Kingdom of Saudi Arabia (KSA) with regard to the pharmacokinetic practice.⁸⁻¹³ However, the national survey of CPKs with an emphasis on the current pharmacokinetic practice has not been reported yet. Therefore, the objectives of this study were to explore the CPKs at the Ministry of Health (MOH) hospitals in the KSA with an emphasis on pharmacy management and resources.

METHODS

This is a 2-month cross-sectional national survey of CPKs with a focus on pharmacy management and resources at MOH hospitals in the KSA. The study consisted of two parts: the first part gathers demographic information and the second part contains 43 questions divided into three domains that are derived from the ASHP guidelines and from literature.^{3,7,13,14} The parts were pharmacy management and resources, medication prescribing and dispensing, drug monitoring and pharmacy education, and perceptions and barriers of service implementations. We used a 5-point Likert response scale system with close-ended questions. An electronic questionnaire was distributed to the coordinator of all the clinical pharmacy services or drug information centers at MOH hospitals. The questions were focused on the pharmacy management and resources section through the Survey Monkey system.

RESULTS

A total of 43 hospital pharmacies responded to the questionnaire; the response rate was found to be 86%. Most hospitals responded were with 200–299 beds 14 (32.6%) and 100–199 beds 10 (23.3%). Most of the hospitals had an accreditation from Saudi *Central Board for Accreditation of Healthcare Institutions* (CBAHI) 17 (39.53%) and Joint Commotion USA 11 (25.59%), whereas 8 (16.6%) hospitals had no accreditation (Table 1). The highest level of education of the responders was

Table 1: Demographic hospital information.

Number of beds at your hospital	Response Count	Response Percent
< 50	3	7.0%
50-99	6	14.0%
100-199	10	23.3%
200-299	14	32.6%
300-399	6	14.0%
400-499	4	9.3%
500-599	0	0.0%
= or > 600	0	0.0%
Medical City	3	7.0%
Answered question	43	
Skipped question	0	
The hospital accreditation	Response Count	Response Percent
CIBAHI	17	39.53%
Joint Commotion USA	11	25.58%
Canada	0	0.00%
Saudi commission of health accreditation	7	16.28%
Non	8	18.60%
Answered question	43	
Skipped question	0	

Table 2: Demographic responder qualifications information.		
Academic Qualification (s):	Response Count	Response Percent
Diploma. Pharmacy	4	9.30%
Bsc. Pharmacy	22	51.16%
Master of Science	12	27.91%
Doctor of Pharmacy	11	25.58%
Two years Residency (R1)	1	2.33%
Three years Residency (R2)	0	0.00%
Ph. D	1	2.33%
M.B.A.	1	2.33%
Answered question	43	
Skipped question	0	
Board of Pharmaceutical Specialty	Response Count	Response Percent
Board Certified Ambulatory Care Pharmacist (BCACP)	0	0.0%
Board Certified Critical Care Pharmacist (BCCCP)	0	0.0%
Board Certified Nuclear Pharmacist (BCNP)	0	0.0%
Board Certified Nutrition Support Pharmacist (BCNSP)	0	0.0%
Board Certified Oncology Pharmacist (BCOP)	0	0.0%
Board Certified Pediatric Pharmacy Specialist (BCPPS)	0	0.0%
Board Certified Pharmacotherapy Specialists (BCPS)	0	0.0%
Board Certified Psychiatric Pharmacist (BCPP)	0	0.0%
Non	38	100.0%
Other (please specify)	0	0.0%
Answered question	38	
Skipped question	5	
Total years of Experiences in Pharmacokinetic services	Response Count	Response Percent
< 1 year	4	9.3%
1 – 3 years.	9	20.9%
4-6 years.	7	16.3%
= or > 6 years.	9	20.9%
No experiences	11	25.6%
Other (please specify)	3	7.0%
Answered question	43	
Skipped question	0	

found to be Bachelor of Pharmacy 22 (51.2%), Master of Science 12 (27.91%), and Doctor of Pharmacy 11 (25.58%). Most of the responders were with greater than or equal to 6 and 1–3 years of experience in the field of CPKs 9 (20.9%). None of the responders had Board of Pharmaceutical Specialties (Table 2). The majority of CPKs were provided to the adult patients 37 (86.05%) followed by the pediatric and geriatrics patients 19 (44.19%) and 13 (30.23%), respectively) with most of the hospitals having less than 20 beds 23 (53.5%). Most of the CPKs were provided through the inpatient pharmacy 27 (62.79%) and outpatient pharmacy and discharge 9 (20.93%). Most of the hospital pharmacies 33 (76.7%) received less than 100 prescriptions per day for CPKs (Table 3). Most of the CPKs were provided for 8 h/day followed by 24 h and 16 h/day. The majority of the CPKs were provided during the morning of weekdays 17 (53.12%), the morning of weekends 7 (23.33%), and

evening of weekdays 6 (20.7%) (Table 4). The highest number of drug level samples was requesting during the morning of weekdays 20 (66.55%), followed by the morning of weekends 9 (33.33%), and evening of weekdays 8 (29.62%) (Table 5). The majority of the CPKs' administration and management sections were with the mission of CPKs (68.8%) followed by the total quality management (67.6%) and policy and procedures (64.8%), whereas the least of the administration of pharmacokinetic services was found to be annual pharmacokinetic plan (60%) and pharmacokinetic strategic plan and pharmacokinetics technician competency (62.6%) (Table 6).

DISCUSSION

The CPKs were started at the MOH's biggest hospital

Table 3: General Information of Pharmacokinetics services.

No. of Beds covers Pharmacokinetic services	Response Count	Response Percent
<20	23	53.5%
20-29	3	7.0%
30-39	0	0.0%
40-49	1	2.3%
50-59	4	9.3%
60-69	3	7.0%
70-79	0	0.0%
80-89	1	2.3%
90-99	3	7.0%
= or > 100	5	11.6%
Answered question	43	
Skipped question	0	
The type of section they are receiving Pharmacokinetics services at the hospital	Response Count	Response Percent
Discharge Patient	9	20.93%
Ambulatory care clinic	5	11.63%
Inpatient pharmacy	27	62.79%
Outpatient pharmacy	9	20.93%
Home care	4	9.30%
Critical Care	1	2.33%
Non	9	20.93%
Answered question	43	
Skipped question	0	
The type of patients you service at Pharmacokinetics services	Response Count	Response Percent
Adults	37	86.05%
Pediatrics	19	44.19%
Geriatric	13	30.23%
Neonates	11	25.58%
Non	6	13.95%
Answered question	43	
Skipped question	0	
The number of prescription needed for pharmacokinetics services	Response Count	Response Percent
<100	33	76.7%
100-199	4	9.3%
200-299	3	7.0%
300-399	0	0.0%
400-499	0	0.0%
500-599	2	4.7%
600-699	0	0.0%
700-799	0	0.0%
800-899	0	0.0%
900-999	0	0.0%
= or > 1000	1	2.3%
Answered question	43	
Skipped question	0	

Table 4: Number of hours/24 provided of CPKs

Answer Options	No services	8 hrs	16 hrs	24 hrs	Response Count
Morning weekdays	10	17	2	3	32
Evening weekdays	21	6	0	2	29
Night weekdays	22	5	0	3	30
Morning weekend	19	7	2	2	30
Evening weekend	22	5	1	2	30
Night weekend	22	4	2	1	29
<i>answered question</i>					32
<i>skipped question</i>					11

Table 5: Number of requested samples/24 for CPKs

Answer Options	0	5	6-10	11-15	16-20	> 20	Total number	Total percent	Response Count
Morning weekdays	10	12	4	0	3	1	20	66.67%	30
Evening weekdays	20	3	2	1	1	0	7	25.93%	27
Night regular day	20	5	1	0	1	0	7	25.93%	27
Morning weekend	18	2	3	2	2	0	9	33.33%	27
Evening weekend	19	2	2	4	0	0	8	29.63%	27
Night weekend	20	2	4	1	0	0	7	25.93%	27
<i>answered question</i>									30
<i>skipped question</i>									13

Table 6: CPKs administration and management

Answer Options	76-100 % completed	51-75 %	25-50 %	< 25 %	We do not have it	Rating Average	Response Count
Vision of CPKs	16	3	7	4	12	3.17	42
Vision of CPKs	17	7	3	5	9	3.44	41
Strategic plan of CPKs	12	7	5	6	10	3.13	40
Annual plan of CPKs	8	10	7	4	11	3.00	40
Policy and procedure of CPKs	17	5	2	7	11	3.24	42
Job satisfaction of CPKs	13	8	5	2	12	3.20	40
CPKs Pharmacist competency	12	8	8	3	10	3.22	41
CPKs Pharmacy technician competency	12	5	10	2	11	3.13	40
CPKs Total Quality of Management	14	9	5	2	10	3.38	40
<i>answered question</i>							43
<i>skipped question</i>							0

in Riyadh, in 1998, by Alomi YA. The program was started by monitoring the levels of aminoglycoside and vancomycin via individual consultation or during the critical care rounds. The program was organized and expanded by the national drug information center and was headed by Alomi YA in 2008. The program covered all adults' surgical and critical care units. The clinical pharmacist specialized in the CPKs

did daily rounds and followed-up with the patients who were on aminoglycoside and vancomycin, reviewed the physician order and corrected the dose, requested a laboratory assessment of the drug level, did the appropriate calculation, and adjusted the dose accordingly. During this time, Alomi YA *et al*, studied the impact of the pharmacokinetics services and came up with positive clinical and financial

outcomes.^{10,12,15,16} The authors of this study explored the pharmacokinetics services at all MOH hospitals, and they obtained a good response rate from hospitals with less than two-thirds of the hospitals that were not accredited by CBAHI or Joint Commission USA. This is expected because not all the MOH hospitals have accreditation from both aforementioned agencies and most of the MOH hospitals are still under the process of accreditation. Most of the responders had a bachelor's degree because few clinical pharmacists at MOH existed and the pharmacy residency program not implemented at the most of the MOH hospitals. Furthermore, the number of clinical sites in this study was low and most of the hospitals did not participate in the residency program. According to our results, most of the pharmacokinetics services were provided to adult patients. This is expected because it was a newly established service which needed time to cover different types of population. Most of the services were provided by an inpatient pharmacy, which is normal because most easy to request the drug levels for common medications Aminoglycoside. This agrees with the results reported by Ab Rahman ABF *et al.* to some extent and lower percentages in the inpatient or outpatient setting. This may be because of the well-established program in comparison to our study.¹⁷ In this study, we found that most of the services were provided during the morning duties because of the fact that the clinical pharmacists were unavailable during the evenings. The number of daily requested drug levels were few that's may related of the majority of the physicians were not aware of the program or were not aware of the principles TDM parameters. However, the number of samples requested for CPKs were higher than that of Ab Rahman ABF *et al.*'s study. That's may due to the high number of patients who required monitoring of their drug concentrations in blood or misuse overutilization and wrong sampling requesting for medications.¹⁷ The finding showed low to medium percentage of elements related to pharmacokinetics services administration, especially with annual plan, pharmacist competency, and vision of the program. This shows that the pharmacists either did not fully understood the program, the hospital lacked national or local pharmacokinetics services guidelines, or that they had a poor background knowledge of the pharmacokinetics services. Upon reviewing the Pharmacy Practice Model Expansion on Pharmacokinetic Services, we performed an optimization of medication dosing. In addition to improving patient safety, new CPKs were implemented in two phases with institutional pharmacokinetic expansion: Phase 1 included universal monitoring

by pharmacists with recommendations made to prescribers during business hours and phase 2 expanded clinical pharmacists' coverage to 24/7 and provided an optional 24/7 pharmacist-managed pharmacokinetic consultation service. After comparing the medication therapeutic trough attainment, dosing, and clinical and safety outcomes between phases 1 and 2 in adult inpatients receiving therapeutic medication dose, we found that there was a significant increase in patient safety and the outcomes. This shows that implementing the CPKs will have a high impact on the optimization of medication dosing and improvement in patient safety.¹⁸ Despite the demand and benefits of CPKs program, the services need to be reviewed with a clear vision and mission with all the necessary administrative requirements. Other results were difficult to compare due to the missing data. The pharmacy and healthcare staff need education and training with regard to CPKs to improve the implementation of the new CPKs at MOH hospitals in the KSA.

CONCLUSION

The CPKs have not been completed yet at MOH hospitals in KSA. There is the need to increase the number of clinical pharmacists who are specialized in this field with a focus on administration revision of the program and pharmacokinetics education and training at MOH hospitals in KSA.

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None.

CONFLICT OF INTEREST

None.

ABBREVIATIONS

KSA: Kingdom of Saudi Arabia; **MOH:** Ministry of Health; **CPKs:** Clinical pharmacokinetics services; **ASHP:** American Society of Health-System Pharmacists; **TDM:** Therapeutic drug monitoring; **CBAHI:** Saudi Central Board for Accreditation of Healthcare Institutions.

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