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National Survey of the Pharmacokinetics Services at the Ministry of Health Hospitals in Saudi Arabia: Drug Therapy Monitoring and Healthcare Professional Education

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Abstract

Objectives: A clinical pharmacist offers vital support in the expansion of a final prescription with improved patient management and enhanced safety. The aim of the current study to explore the Pharmacokinetics services at Ministry of Health (MOH) hospitals in Saudi Arabia with an emphasis on drug therapy monitoring and patient's education. **Methods:** This is a 2-months cross-sectional national survey related to the Pharmacokinetics services with a focus on drug therapy monitoring and education of pharmacist at MOH hospitals in Saudi Arabia. The study consisted of two parts; the first part captures demographic information and the second part contained 43 questions designed by the authors. It was derived from American Society of Health-System Pharmacists (ASHP) guidelines and from the literature. We used the 5-point Likert response scale system to obtain responses of the participants; there were close-ended questions. The electronic questionnaire was distributed to all the coordinators of the clinical pharmacy services or to the drug information centers at MOH hospitals. All analysis was done through survey monkey system. **Results:** A total of 43 hospital pharmacies returned the survey, for a response rate of 86%. The most clinical pharmacokinetics services documented were drug quality reporting 34 (87.18%), drug information inquiries 35 (83.33%), adverse drug reaction 35 (81.40%) and medication error 35 (81.40%). Highest clinical impact and cost avoidance of clinical Pharmacokinetics services were drug information inquiries 25 (60.98%), the drug quality reporting system 21 (53.85%) and pharmacist intervention 21 (52.5%). Analysis of monthly workload for clinical Pharmacokinetics services were a number of drug information inquiries 28 (70%) and the number of prescriptions needs 25 (64.1%). The clinical Pharmacokinetics services education and training for pharmacists were found at average 7.8 (20.89%) hospitals with high percentages type of educations was short education course 1-5 days [15 (39.47%)] and long training course 4-5 weeks [8 (21.05%)]. While Pharmacokinetics services education and training for healthcare provider were found at main 6 (15.66%) hospitals only with high percentages type of educations was short education course 1-5 days [8 (20.00%)] and Pharmacokinetics competencies 7 (18.92%). **Conclusion:** Pharmacokinetics services on drug therapy monitoring was not competent at half MOH hospital, while only few of the hospitals had pharmacokinetics education and training to offer. Implementing the MOH pharmacokinetics services strategy with an emphasis on the drug therapy monitoring with education and training is required at all MOH hospitals in Saudi Arabia.

Key words: Pharmacokinetics Services, Monitoring, Therapy, Healthcare, Education, Ministry of Health, Saudi Arabia.

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INTRODUCTION

Clinical Pharmacokinetic (PK) calculations are a key competencies for the pharmacists, which is important to ensure the safe use of drugs.[1] Clinical pharmacists with specialized education, training or experience play an essential role in the improvement of the clinical outcome of the patient and to approve responsibilities such as designing and conducting research to increase clinical pharmacokinetic information. Evaluation and expansion of clinical pharmacokinetic monitoring was an integral part of pharmaceutical care. In addition to developing and applying computer programs and point-of-care information systems to enhance the accuracy and sophistication of pharmacokinetic modeling, applications to pharmaceutical care and serving as an expert consultant to pharmacists with a general background in clinical pharmacokinetic monitoring.[2]

Few studies investigated the pharmacokinetics services survey over hospitals. It included general pharmacokinetic practice, medication monitored, cost avoidance and perception toward of the services.[3-7] Monitoring of drug therapy including workload analysis of pharmacokinetics and documentation does not occur in most of the literature. Also, the pharmacokinetics education and training were not included in most of the published survey in the worldwide and Gulf or Middle East countries. The objective of this study is to explore the Pharmacokinetics services at Ministry of Health (MOH) hospitals in Saudi Arabia with an emphasis on pharmacokinetics workload, documentation, healthcare provider education and training.

METHODS

This is a 2-months cross-sectional national survey related to the Pharmacokinetics services with a focus on drug therapy monitoring and education of pharmacist and healthcare providers at MOH hospitals in Saudi Arabia. This study consists of two parts: the first part captures demographic information and the second part is a questionnaire with 43 questions divided into four domains that are derived from the guidelines of the of the American Society of Health-System Pharmacists (ASHP) and from the literature.[3-6] The domains were belonging to the pharmacy management and resources, medication prescribing and dispensing, drug monitoring and healthcare education and perceptions and barrier of services implementations. The 5-point Likert response scale system was used with closed and ended questions. An electronic questionnaire was distributed to the coordinator of all the clinical pharmacy services or drug information centers at MOH hospitals. All analysis is done through survey monkey system with emphasis on drug monitoring and healthcare education.

RESULTS

A total of 43 hospital pharmacies returned the survey, for a response rate of 86%. Most of the hospitals responded were with 200-299 beds [14 (32.6%)] and with 100-199 beds [10 (23.3%)]. Most of the hospitals had accreditation from the Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI) [17 (39.53%)] and from the Joint Commotion USA [11 (25.59%)]; however, 8 (16.6%) hospitals did not have any accreditations (Table 1). The highest level of education of the responders was 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 pharmacokinetics services [9 (20.9%)]. None of the responders had Board of Pharmaceutical Specialties (Table 2).

The most clinical Pharmacokinetics services were drug quality reporting 34 (87.18%), drug information inquiries 35 (83.33%), adverse drug reaction

Table 1: Demographic hospital information.

Number of beds	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**
CBAHI	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%
B.Sc. 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	

35 (81.40%) and medication error 35 (81.40%). Electronic documentation for clinical Pharmacokinetics services were drug quality reporting 7.8 (20.00%), drug information inquiries 6 (14.29%), adverse drug reaction 5.38 (12.50%) and medication error 5.38 (12.50%). Highest clinical impact and cost avoidance documented of clinical Pharmacokinetics services were drug information inquiries 25 (60.98%), the drug quality reporting system 21 (53.85%) and pharmacist intervention 21 (52.5%) (Table 3 and 4).

Analysis of monthly workload for clinical Pharmacokinetics services were a number of drug information inquiries 28 (70%), the number of prescriptions needs 25 (64.1%), the number of patients required 25 (62.5%) and a number of adverse drug reaction 24 (58.54%) and medication errors 25 (58.14%) (Table 5). The clinical Pharmacokinetics services education and training for pharmacists were found at average 7.8 (20.89%) hospitals with high percentages type of educations was short education course 1-5 days [15 (39.47%)] and long training course 4-5 weeks [8 (21.05%)]. While Pharmacokinetics services education and training for healthcare provider were found at main 6 (15.66 %) hospitals only with high percentages type of educations was short education course 1-5 days [8 (20.00%)] and Pharmacokinetics competencies 7 (18.92%) (Table 6).

DISCUSSION

According to results, the response rate was found to be decent in different geographical areas of KSA. In KSA, we found a significant influence of the pharmacist on

Table 3: Clinical Pharmacokinetics services in the pharmacy.

Answer Options	Yes manually	Yes electronically	No.	No. of existed manually	Percent of existed manually	No. of existed electronically	Percent of existed manually	Response Count
Medication errors	29	7	8	35	81.40%	5.38	12.50%	43
Adverse drug reactions	30	8	8	35	81.40%	5.38	12.50%	43
Drug quality reporting	29	10	5	34	87.18%	7.80	20.00%	39
Patient counseling	25	5	14	27	65.85%	2.93	7.14%	41
Pharmacist intervention	24	8	11	32	74.42%	3.91	9.09%	43
Drug information inquiries	27	13	7	35	83.33%	6.00	14.29%	42
Poisoning information inquiries	22	5	16	25	60.98%	2.56	6.25%	41
Answered Question								43
Skipped Question								0

Table 4: Clinical impact and cost avoidance of clinical Pharmacokinetics services.

Answer Options	Adults	Pediatrics	Neonates	We do not have it	No. of existed	Percent of existed	Response Count
Medication errors	19	10	7	23	20	46.51%	43
Adverse drug reactions	21	14	10	20	22	52.38%	42
Drug quality reporting	20	9	5	18	21	53.85%	39
Patient counseling	18	7	5	21	19	47.50%	40
Pharmacist intervention	20	12	11	19	21	52.50%	40
Drug information inquiries	23	15	8	16	25	60.98%	41
Poisoning information inquiries	19	10	6	20	19	48.72%	39
Answered Question							43
Skipped Question							0

Table 5: Monthly workload analysis of clinical Pharmacokinetics services.

Answer Options	Adults	Pediatrics	Neonates	Never	No. of existed	Percent of existed	Response Count
No. of Medication errors	25	13	4	18	25	58.14%	43
No. of Adverse drug reactions	22	15	6	17	24	58.54%	41
No. of Drug quality reporting	18	10	5	19	20	51.28%	39
No. of Patient counseling	15	8	3	22	17	43.59%	39
No. of Pharmacist intervention	19	11	6	18	23	56.10%	41
No. of Drug information inquiries	26	14	10	12	28	70.00%	40
No. of Poisoning information inquiries	16	10	4	18	18	50.00%	36
No. of patients	24	15	11	15	25	62.50%	40
No. of prescriptions	24	13	7	14	25	64.10%	39
Clinical outcomes impact	12	6	5	22	13	37.14%	35
Total No. of drug level	9	9	4	24	12	33.33%	36
Total No. of drug level above of range	11	9	4	25	12	32.43%	37
Total No. of drug level below of range	10	9	4	24	13	35.14%	37
Total No. of sampling time	9	7	3	25	11	30.56%	36
Total No. of wrong sampling time	7	6	2	27	9	25.00%	36
Cost avoidance impact	6	4	0	28	8	22.22%	36
Answered Question							43
Skipped Question							0

Table 6: Education and training for Pharmacokinetics services staff.

Answer Options	Pharmacy technician	Pharmacist	Clinical Pharmacist	Emergency Pharmacy supervisor	We do not have it	No. of existed	Percent of existed	Response Count
Short education course 1-5 days	6	13	6	1	23	15	39.47%	38
Long training course 4-5 weeks	4	6	5	1	30	8	21.05%	38
General Pharmacist residency program	3	6	4	1	30	7	18.92%	37
Specialized pharmacist residency program	1	3	3	0	32	4	11.11%	36
Distance learning pharmacy education	0	3	4	0	31	5	13.89%	36
Answered Question								43
Skipped Question								0
Answer Options	**Nurses**	**Physicians**	**ER technicians**	**Other health care provider**	**We do not have it**	**No. of existed**	**Percent of existed**	**Response Count**
Short education course 1-5 days	8	6	1	1	32	8	20.00%	40
Long training course 4-5 weeks	4	7	4	3	33	6	15.38%	39
Pharmacokinetics competencies	6	6	1	0	30	7	18.92%	37
Distance learning pharmacokinetics education	2	3	0	0	33	3	8.33%	36
Answered Question								43
Skipped Question								0

the clinical pharmacokinetics services. In therapeutic drug monitoring, pharmacist had a significant influence on the patient condition and outcome. Twenty-four hospitals started their service and the number of hospitals offering the service significantly increased. Hospitals that have the TDM service are generally with a variable number of hospital beds (200-299 beds and 100-199 beds). The findings from this study, to some extent, are similar to those reported elsewhere in Malaysia.[4] The documentation of clinical activities system started at the Ministry of Health in the 1990s. The memo random from Minister of Health stated that any pharmacist has right to interpret with any physicians if there is any mistakes or error or UN-appropriates of drug therapy. Several types of pharmacist interventions or clinical Pharmacokinetics activities included general pharmacy intervention, drug information inquiries, medications errors, adverse drug reactions documentation, patient counseling, drug quality reporting and medications reconciliation. The author and his colleague participated in a poster session at the American College of Clinical Pharmacy conference about pharmacist documentation of clinical activities with included all related intervention. The author explored the highest pattern of documentation were pharmacokinetics services, drug therapy monitoring, patient education and training similar to the previous studies.[8,9] The results expected because the four activities established for a long time almost before more than 25 years ago at KSA hospitals[10] Similary, the author found the same results of workload analysis with the same items including pharmacokinetics consultations.[11,12] The remaking system needs awareness to encourage the pharmacist to start to document the activities. The pharmacokinetics education and training were poor finding because the compete Pharmacokinetics services not existed at all Ministry of Health Hospitals. The education and training of pharmacokinetics services should increase for pharmacist and healthcare providers. Other an innovative educational way for clinical pharmacists. As clinical pharmacy has the most excellent history of advancing practice through innovation. These innovations helped to mold clinical pharmacy into a patient-centered discipline recognized for its contributions to improving medication therapy outcomes. The presence of appropriate online pharmacokinetics, education, leadership and support, a shift in current professional extended education and training and a commitment to cultivating future innovators, the academic–practice

partnership can develop new and innovative practice advancements that will improve patient outcomes.[13] Most of the study findings could not compare with other examination because the study may be the first pharmacoepidemiology study in this field related to pharmacokinetics with an emphasis on drug therapy monitoring in addition to the type of patient education and training in pharmacy practice in Saudi Arabia, Gulf or Middle East countries or else world locations.

CONCLUSION

Drug therapy monitoring during Pharmacokinetics services was not competent at MOH hospital. Only few of the hospitals had pharmacokinetics education and training to offer. There is the need to increase the number of clinical pharmacists who are specialized in this field with a focus on 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; **PK:** Clinical Pharmacokinetic; **CPS:** Clinical pharmacokinetics services; **ASHP:** American Society of Health-System Pharmacists; **TDM:** Therapeutic drug monitoring.

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