Perception of Nurses about Pharmacokinetics Services in Saudi Arabia

Yousef Ahmed Alomi*, BSc. Pharm, MSc. Clin Pharm, BCPS, BCNSP, DiBA, CDE
Critical Care Clinical Nurses, TPN Clinical Pharmacist, Freelancer Business Planner, Content Editor, and Data Analyst, Riyadh, SAUDI ARABIA.

Mohamed Soliman Imam, B.Sc. Pharm, MSc. Clin Pharm, Department of Clinical Pharmacy, College of Pharmacy, Shaqra University, Shaqra, SAUDI ARABIA.
Department of Clinical Pharmacy, National Cancer Institute, Cairo University, Fom El Khalig Square, Kasr Al-Aini Street, Cairo 11796, EGYPT.

Abeer Atawai, Ph D
Faculty of Nursing, University of Tabuk, Tabuk, SAUDI ARABIA.

Maram Ati Almohammdi, MD
Family Medicine Consultant, Ministry of Health Branch, Tabuk, SAUDI ARABIA.

Abeer Hussain Almasoudi, Bsc. Pharm, BCPS
Investment Planning Department, Ministry of Health Branch Tabuk, SAUDI ARABIA.

Abdullah Matar Almutairi, Pharm D, Department of Pharmacy, Security Forces Hospital, Riyadh, SAUDI ARABIA.

Fares Yahya Alhasani, Pharm D, Department of Pharmacy, Security Forces Hospital, Riyadh, SAUDI ARABIA.

Faris Saud Alyousef, Bsc. Pharm, Department of Pharmacy, Security Forces Hospital, Riyadh, SAUDI ARABIA.

Naif Fahad Mashaan Alshaibani, Pharm D, College of Pharmacy, Shaqra University, Shaqra, SAUDI ARABIA.

Correspondence:
Dr. Yousef Ahmed Alomi, BSc. Pharm, MSc. Clin Pharm, BCPS, BCNSP, DiBA, CDE, Critical Care Clinical Nurses, TPN Clinical Pharmacist, Freelancer Business Planner, Content Editor, and Data Analyst, P.O.BOX 100, Riyadh 11392, SAUDI ARABIA.

E-mail: yalomi@gmail.com

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ABSTRACT

Objectives: To demonstrate the Perception of Nurses about Pharmacokinetics Services in Saudi Arabia. **Materials and Methods:** It analyzes a cross-sectional survey discussing Nurses' Perceptions of pharmacokinetics services in Saudi Arabia. The survey consisted of respondents' demographic information about nurses, nurses, perceptions of nurses about Pharmacokinetics, and barriers, which factors may discourage you from implementing Pharmacokinetics and medications' pharmacokinetics responsibility. The 5-point Likert response scale system was used with closed-ended questions. The survey was validated through the revision of expert reviewers and pilot testing. Besides, various tests of the reliability of McDonald's ω, Cronbach alpha, Gutmann's λ2, and Gutmann's λ6 were done with the study. Furthermore, the data analysis was done using the Survey Monkey system. Besides, the Statistical Package of Social Sciences (SPSS), Jeffery's Amazing Statistics Program (JASP), and Microsoft Excel sheet version 16. **Results:** A total number of 408 nurses responded to the questionnaire. Of them, almost two-thirds responded from the central region (140 (34.31%)) and southern areas (119 (29.17%)), with statistically significant differences between the provinces (p=0.000). Most of the responders were from Ministry of Health (MOH) hospitals (267 (65.44%)), with a statistically significant difference between working sites (p=0.000). Males responded more than females (210 (52.24%)) versus 192 (47.76%)), with statistically significant differences between all levels (p=0.000). Most of the responders were in the age group of 36-45 years (227 (55.91%)) and 46-55 years (99 (24.38%)), with statistically significant differences between all age groups (p=0.000). The average score of reasons perceived by Nurses about Pharmacokinetics demand and need to request drug levels was (4.12). The element "to measure the incidence of adverse drug reactions or toxicity." obtained the highest score (4.47). The aspect "To enable safe drugs to be identified" was (4.17), and the element "improve patient quality of life" was (4.17). In contrast, the lowest score was obtained for the component "identify previously unrecognized adverse drug reactions or toxicity " (4.00). The score for the element "Identify factors that might predispose to an adverse drug reaction or toxicity" was (4.02), and the statement "To provide cost-effective drug levels" was (4.02) with a statistically significant difference between the responses (p<0.000). The most staff responsible for Pharmacokinetics services or therapeutic drug monitoring were clinical pharmacists (4.80), followed by Doctors (4.74) and pharmacists (4.64), more than nurses (3.90) or pharmacy technicians (3.36) and lab technicians (2.77), with a statistically significant difference between the responses (p<0.001). **Conclusion:**

Keywords: Nurses, Perception, Pharmacokinetics, Drug level, Saudi Arabia.

INTRODUCTION

The knowledge of pharmaceutical science is expanding and growing daily; one of the old knowledge is Pharmacokinetics. That is investigating the steps of Pharmacokinetics, such as absorption, drug distribution, metabolism, and execrations. That is, drug behavior leads to drug adjustment of dosing with pediatric or elderly. Pharmacokinetics services are used for drug levels to monitor drug therapy and adjust the dosing of some medications. Besides, it used assessment for the success of drug therapy or discovery of drug-related problems such as adverse drug effects. The pharmacokinetics or drug levels and guidelines are well documented. However, some practitioners, such as physicians, pharmacists, or nursing staff, must be made aware of the Pharmacokinetics of medication or drug levels required for certain medications or diseases, or sometimes there are no sampling times or types of sample serum or blood.[1] Besides, factors requiring the drug level or Pharmacokinetics could encourage or discourage it. The previous literature showed that poor knowledge of physicians leads to not practicing full service of pharmacokinetic services despite a good perception of the implementation of pharmacokinetic services. Nursing is playing the cornerstone of pharmacokinetic services implementation. Some literature shows that nurses need better knowledge or practice of pharmacokinetic services. They are assessing the nursing perception of pharmaceutics.[2-9] The author was unfamiliar with publications in Saudi Arabia or Gulf and Arabic countries about nursing perceptions of pharmacokinetic services. The current research aims to define nursing perception in Saudi Arabia.

MATERIALS AND METHODS

It analyzes a cross-sectional survey discussing Nurses' perception of pharmacokinetics services in Saudi Arabia. It self-reported an electronic survey of the pharmacists, including nurses from internship to consultant, nurses' specialties,

and Saudi Arabia. Non-pharmacists or students and non-completed, non-qualified surveys will be excluded from the study. The survey consisted of respondents' demographic information about nurses and perception nurses about Pharmacokinetics, and barriers, which factors may Discourage you from implementing Pharmacokinetics, and recommendations/suggestions for facilitating the implementation of Pharmacokinetics, and medications pharmacokinetics responsibility.[2-9] The 5-point Likert response scale system was used with closed-ended questions. According to the previous literature with unlimited population size, the sample was calculated as a cross-sectional study, with a confidence level of 95% with a z score of 1.96 and a margin of error of 5%, a population percentage of 50%, and a dropout rate of 10%. As a result, the sample size will equal 380-420 with a power of study of 80%.[10-12] The response rate required for the calculated sample size is at least 60-70% and above.[13] The survey was distributed through social media, including applications and telegram groups of nurses. The reminder message had been sent every 1-2 weeks. The survey was validated through the revision of expert reviewers and pilot testing. Besides, various tests of the reliability of McDonald's ω, Cronbach alpha, Gutmann's λ2, and Gutmann's λ6 were done with the study. The data analysis of nurses' perceptions of Pharmacokinetics was done using the Survey Monkey system. Besides, the Statistical Package of Social Sciences (SPSS), Jeffery's Amazing Statistics Program (JASP), and Microsoft Excel sheet version 16. It included a description and frequency analysis, good of fitness analysis, and correlation analysis. Besides, inferential analysis of factors affecting the perception of nurses about health insurance and barriers, which factors may Discourage you from implementing Pharmacokinetics and medications health insurance responsibility with linear regression. The STROBE (Strengthening the reporting of observational studies in epidemiology statement: guidelines for reporting observational studies) guided the reporting of the current study.[14]

RESULTS

A total number of 408 nurses responded to the questionnaire. Of them, almost two-thirds responded from the central region (140 (34.31%)) and southern regions (119 (29.17%)), with statistically significant differences between the provinces (p=0.000). Most of the responders were from Ministry of Health (MOH) hospitals (267 (65.44%)), with a statistically significant difference between working sites (p=0.000). Males responded more than females (210 (52.24%)) versus 192 (47.76%)), with statistically significant differences between all levels (p=0.000). Most of the responders were in the age group of 36-45 years (227 (55.91%)) and 46-55 years (99 (24.38%)), with statistically significant differences between all age groups (p=0.000). Most of the nurses had a bachelor's degree (372 (91.63%)), with statistically significant differences between all levels (p=0.000). Most of the responders worked as nursing staff (342 (84.44%)), with a statistically significant difference between positions (p=0.000). Most nurses had a work experience of 4-6 years (194 (47.67%)) and 6-9 years (126 (30.96%)), with a statistically significant difference between years of experience (p=0.000). Most of nurse's specialties was emergency (58 ((14.46%)), critical care (58 ((14.46%)), family medicine (49 ((12.22%)), and Anesthesia (48 ((11.97%)) with statistically significant differences between all specialties (p=0.000). The majority of responders, 372 (91.85%), worked at an organization that had drug levels form with most of them, 378 (93.33%) had ever requested Pharmacokinetics services or drug levels with statistically significant differences between all answers (p=0.000). The majority of nurses (382 (95.02%) agreed that reporting pharmacokinetics services or drug levels monitoring is essential, with statistically significant differences between all answers (p=0.000). There are non-statistically significant correlations between all demographic variables (p>0.05) (Tables 1 and 2).

Table 1: Demographic, social information.

Nationality	Response Count	Response Percent	*p*-value (X2)
Central area	140	34.31%	0.000
North area	86	21.08%	
South area	119	29.17%	
East area	48	11.76%	
West area	15	3.68%	
Answered question	408		
Skipped question	0		
Site of work	**Response Count**	**Response Percent**	***p*-value (X2)**
MOH Hospitals	267	65.44%	0.000
Military Hospitals	30	7.35%	
National Gaurd Hospital	46	11.27%	
Security Forces Hospitals	26	6.37%	
University Hospital	3	0.74%	
MOH Primary Care Centers	1	0.25%	
Private Hospitals	23	5.64%	
Private Ambulatory Care Clinics	9	2.21%	
Private Primary Healthcare Center	3	0.74%	
Answered question	408		
Skipped question	0		
Gender	**Response Count**	**Response Percent**	
Male	210	52.24%	0.000
Female	192	47.76%	
Answered question	402		
Skipped question	6		
Age	**Response Count**	**Response Percent**	
24-35	76	18.72%	0.000
36-45	227	55.91%	
46-55	99	24.38%	
>55	4	0.99%	
Answered question	406		
Skipped question	2		

The average score of reasons perceived by Nurses about Pharmacokinetics demand and need to request drug levels was (4.12). The element "to measure the incidence of adverse drug reactions or toxicity." obtained the highest score (4.47). The aspect "To enable safe drugs to be identified" was (4.17), and the element "improve patient quality of life" was (4.17). In contrast, the lowest score was obtained for the element "identify previously unrecognized adverse drug reactions or toxicity " (4.00). The score for the element "Identify factors that might predispose to an adverse drug reaction or toxicity" was (4.02), and the statement "To provide cost-effective drug levels" was (4.02) with a statistically significant difference between the responses (p<0.000) (Table 3). The average score

Table 2: Demographic, social information.

Physician Qualifications	Response Count	Response Percent	*p*-value (X2)
Diploma	10	2.46%	0.000
Bachelor nursing	372	91.63%	
Master	20	4.93%	
Ph D	4	0.99%	
Answered question	406		
Skipped question	2		
Position Held	**Response Count**	**Response Percent**	
Director of the Nursing Department	18	4.44%	0.000
Assistant director of nursing department	25	6.17%	
Supervisor	20	4.94%	
Nursing staff	342	84.44%	
Answered question	405		
Skipped question	3		
Years of experience in a nursing career	**Response Count**	**Response Percent**	
<1	15	3.69%	0.000
1-3	38	9.34%	
4-6	194	47.67%	
6-9	126	30.96%	
>9	34	8.35%	
Answered question	407		
Skipped question	1		
The practice area	**Response Count**	**Response Percent**	
Medical	41	10.22%	0.000
Surgical	45	11.22%	
Pediatrics	39	9.73%	
Critical care	58	14.46%	
Emergency	58	14.46%	
Anesthesia	48	11.97%	
Obstetric and Gynecology	18	4.49%	
Psychiatry	18	4.49%	
Family medicine	49	12.22%	
Ambulatory care clinic	7	1.75%	
Nephrology	11	2.74%	
Cardiology	6	1.50%	
Hematology/Oncology	1	0.25%	
Administration	1	0.25%	
Education/ Training	1	0.25%	
Answered question	401		
Skipped question	7		
The availabilities of Drug Levels at the institution	**Response Count**	**Response Percent**	***p*-value (X2)**
Yes	372	91.85%	0.000
No	21	5.19%	
I do not know	12	2.96%	
Answered question	405		
Skipped question	3		
Have you ever requested any Pharmacokinetics services or drug level?	**Response Count**	**Response Percent**	
Yes	378	93.33%	0.000
No	22	5.43%	
I do not know	5	1.23%	
Answered question	405		
Skipped question	3		
Is the reporting of pharmacokinetics services or drug-level monitoring essential?	**Response Count**	**Response Percent**	
Yes	382	95.02%	0.000
No	14	3.48%	
I do not know	6	1.49%	
Answered question	402		
Skipped question	6		

for the element perception "factors may encourage you from reporting drug levels" was (4.16). The score for the component "The adverse drug reaction or toxicity is serious" was (4.38). The score for the element "The adverse drug reaction related to drug level or toxicity is unusual" was (4.37), and the element "The availability of pharmacokinetics pharmacists" was (4.19) or the statement "Pharmacokinetics was taught in the medical school" was (4.19). In contrast, low scores were obtained for the elements "It should be optional and paid" (3.96). The elements "Reaction not reported before for a particular Drug" (4.06) and the statement "The adverse drug reaction or toxicity is to a new product t" was (4.08) with a statistically significant difference between the responses (p<0.001). All responses about aspects of perception encouraging you from implementing Pharmacokinetics or drug level at pharmacy practice were statistically significant (p<0.000) (Table 4). The average score for the element "factors may discourage you from reporting drug levels" was (4.08). The score for the component "Uncertain association between the drug and the blood levels" was (4.36). The score for the element "The health insurance not coveted most Pharmacokinetics services t" was (4.14), and the element "Lack of Periodic training of nursing staff about Pharmacokinetics services" was (4.12). In contrast, low scores were obtained for the elements "The drug levels are too trivial to report" (3.96). The elements "Concern that a report will generate extra work" (4.00) and the statement "Lack of time to fill in a report" were (4.01) with a statistically significant difference between the responses (p<0.001). All responses about aspects of perception Discourage you from implementing Pharmacokinetics or drug level at pharmacy practice were statistically significant (p<0.000) (Table 5). The most staff responsible for Pharmacokinetics services or therapeutic drug monitoring were clinical pharmacists (4.80), followed by Doctors (4.74) and pharmacists (4.64), more than nurses (3.90) or pharmacy technicians (3.36) and lab technicians (2.77), with a statistically significant difference between the responses (p<0.001). All responses about aspects of perception of responsibility for medications and health insurance were statistically significant (p<0.000) (Table 6). The score for single-test reliability analysis of McDonald's ω was 0.901, Cronbach's α was 0.900, Gutmann's was λ2, 0.905, Gutmann's λ6 was 0.930, and Greater Lower Bound was 0.953 with statistically significant (p<0.05).

Table 3: Why do you think we need to request drug levels.

No	Item	Strongly agree		Agree		Uncertain		Disagree		Strongly disagree		Total	Weighted Average	*p*-value (X2)
1	To enable safe drugs to be identified.	25.87%	104	67.16%	270	5.97%	24	0.25%	1	0.75%	3	402	4.17	0.000
2	To measure the incidence of adverse drug reactions or toxicity.	55.39%	226	36.27%	148	8.09%	33	0.25%	1	0.00%	0	408	4.47	0.000
3	Identify factors that might predispose to an adverse drug reaction or toxicity.	17.49%	71	69.21%	281	11.82%	48	1.23%	5	0.25%	1	406	4.02	0.000
4	To identify previously unrecognized adverse drug reactions or toxicity.	23.40%	95	55.91%	227	17.98%	73	2.22%	9	0.49%	2	406	4.00	0.000
5	To monitor therapeutic efficacy.	25.93%	105	56.30%	228	16.79%	68	0.74%	3	0.25%	1	405	4.07	0.000
6	To compare adverse drug reactions or toxicity of the same drug from Different drug companies.	27.90%	113	59.26%	240	11.36%	46	1.48%	6	0.00%	0	405	4.14	0.000
7	To identify the new, unknown, rare adverse drug reaction or toxicity	28.33%	115	55.91%	227	11.82%	48	3.20%	13	0.74%	3	406	4.08	0.000
8	To provide cost-effective drug levels	24.20%	98	60.25%	244	10.37%	42	4.20%	17	0.99%	4	405	4.02	0.000
9	To improve patient quality of life	27.90%	113	61.98%	251	8.40%	34	1.23%	5	0.49%	2	405	4.16	0.000
	Answered											408		
	Skipped											1		

Table 4: From the following factors, which factors may (Encourage) request drug levels

No	Item	Strongly agree		Agree		Uncertain		Disagree		Strongly disagree		Total	Weighted Average	*p*-value (X2)
1	The adverse drug reaction or toxicity is severe.	43.38%	177	52.21%	213	3.68%	15	0.74%	3	0.00%	0	408	4.38	0.000
2	The adverse drug reaction related to drug level or toxicity is unusual	46.93%	191	45.21%	184	6.39%	26	0.98%	4	0.49%	2	407	4.37	0.000
3	The adverse drug reaction or toxicity is to a new product.	25.12%	102	59.85%	243	12.56%	51	2.46%	10	0.00%	0	406	4.08	0.000
4	Reaction not reported before for a particular Drug.	25.98%	106	57.60%	235	12.99%	53	2.94%	12	0.49%	2	408	4.06	0.000
5	There is an available drug-level request form.	26.91%	109	57.53%	233	13.33%	54	1.73%	7	0.49%	2	405	4.09	0.000
6	Ease of reporting	33.59%	133	52.53%	208	12.37%	49	1.52%	6	0.00%	0	396	4.18	0.000
7	It should be mandatory for selected medications	29.46%	119	58.42%	236	8.66%	35	2.97%	12	0.50%	2	404	4.13	0.000
8	It should be optional and paid	23.82%	96	56.82%	229	13.65%	55	4.96%	20	0.74%	3	403	3.98	0.000
9	Periodic training of medical staff about pharmacokinetics services or drug-level monitoring	29.14%	118	55.56%	225	13.83%	56	1.48%	6	0.00%	0	405	4.12	0.000
10	The availability of pharmacokinetics pharmacists	31.94%	130	57.49%	234	8.60%	35	1.47%	6	0.49%	2	407	4.19	0.000
11	Pharmacokinetics was taught in the medical school	31.11%	126	59.01%	239	8.15%	33	1.23%	5	0.49%	2	405	4.19	0.000
12	Computerized drug level re-question	31.19%	126	58.91%	238	6.93%	28	2.48%	10	0.50%	2	404	4.18	0.000
	Answered											408		
	Skipped											1		

Factors affecting nurses' perception Pharmacokinetics Services

Factors affecting nurses' practice were analyzed. We adjusted the significant values using the independent samples Kruskal-Wallis test and the Bonferroni correction for multiple tests. Various factors might affect the nursing perception of pharmacokinetics services, including location, site of work, age (years), nurse gender, and nurse qualification. nurses practice area, years of experience, position held, drug levels of pharmacokinetics services at the institution, requesting any drug levels before, number of drug levels requisition, number of patients needed for drug levels services, perception of drug levels services. Three factors only (locations, nurses' practice area, perceptions of drug levels services) out of thirteen were statically significant and released ($p<0.05$). The nursing perception of drug-level services showed the highest scores (4.2099) in the central region, with statistically significant differences

Table 5: Which factors may discourage reporting drug levels?

No	Item	Strongly agree		Agree		Uncertain		Disagree		Strongly disagree		Total	Weighted Average	*p*-value (X2)
1	The level of clinical knowledge makes it difficult to decide whether or not drug levels or the Pharmacokinetics of medications have occurred.	17.91%	72	76.12%	306	4.48%	18	1.00%	4	0.50%	2	402	4.10	0.000
2	Uncertain association between the drug and the blood levels	55.20%	223	29.21%	118	12.62%	51	2.48%	10	0.50%	2	404	4.36	0.000
3	The drug levels are too trivial to report	12.22%	49	76.06%	305	7.48%	30	3.74%	15	0.50%	2	401	3.96	0.000
4	Concern that a report will generate extra work.	20.20%	81	63.59%	255	12.72%	51	2.74%	11	0.75%	3	401	4.00	0.000
5	Pharmacokinetics or drug requesting form is not available when needed.	25.62%	103	57.47%	231	14.18%	57	1.99%	8	0.75%	3	402	4.05	0.000
6	Lack of confidence in discussing the drug levels with the prescriber.	28.54%	115	55.33%	223	12.65%	51	2.73%	11	0.74%	3	403	4.08	0.000
7	Not enough information from the patient	25.50%	103	57.92%	234	11.38%	46	4.46%	18	0.74%	3	404	4.03	0.000
8	Need more time to fill in a report.	24.19%	97	59.10%	237	11.72%	47	3.99%	16	1.00%	4	401	4.01	0.000
9	Unaware of the existence of pharmacokinetics services.	27.75%	111	57.50%	230	12.00%	48	1.75%	7	1.00%	4	400	4.09	0.000
10	Fear of legal liability.	27.86%	112	55.23%	222	12.94%	52	3.48%	14	0.50%	2	402	4.06	
11	Unaware of the need to request drug levels.	25.69%	103	60.35%	242	10.48%	42	3.24%	13	0.25%	1	401	4.08	
12	Pharmacokinetics services are optional and not paid.	28.22%	114	53.72%	217	14.85%	60	2.73%	11	0.50%	2	404	4.06	
13	Do not feel the need to request drug levels well-recognized reactions for a specific drug	28.57%	114	55.14%	220	14.79%	59	1.25%	5	0.25%	1	399	4.11	
14	Consider it the physician's responsibility	27.25%	109	57.75%	231	13.00%	52	2.00%	8	0.00%	0	400	4.10	
15	The negative consequences associated with Pharmacokinetics services	22.56%	88	66.15%	258	10.26%	40	1.03%	4	0.00%	0	390	4.10	
16	Lack of Periodic training of nursing staff about Pharmacokinetics services	27.99%	110	57.76%	227	12.98%	51	1.02%	4	0.25%	1	393	4.12	
17	The Pharmacokinetics services were Not taught properly in nursing Schools	26.72%	105	60.31%	237	10.43%	41	2.04%	8	0.51%	2	393	4.11	
18	The health insurance not coveted most Pharmacokinetics services	24.23%	95	66.84%	262	7.65%	30	0.77%	3	0.51%	2	392	4.14	
	Answered											408		
	Skipped											1		

Table 6: Pharmacokinetics services or therapeutic drug monitoring is the responsibility of (please select your level of agreement with each option).

	Strongly agree		Agree		Uncertain		Disagree		Strongly disagree		Total	Weighted Average	*p*-value (X2)
Doctors	77.40%	315	19.90%	81	1.72%	7	0.98%	4	0.00%	0	407	4.74	0.000
Clinical pharmacist	84.62%	341	11.66%	47	2.73%	11	0.99%	4	0.00%	0	403	4.80	0.000
Pharmacist	67.16%	272	30.12%	122	2.22%	9	0.49%	2	0.00%	0	405	4.64	0.000
Nurses	7.64%	31	79.56%	323	9.11%	37	2.46%	10	1.23%	5	406	3.90	0.000
Pharmacy technicians	6.40%	26	29.80%	121	57.88%	235	5.67%	23	0.25%	1	406	3.36	0.000
Lab technician	7.65%	31	20.49%	83	16.54%	67	52.10%	211	3.21%	13	405	2.77	0.000
Answered											408		
Skipped											1		

between regions (p=0.000). The nursing practice area might affect the nursing perception of pharmacokinetics services, with the highest scores (4.3223) at pediatrics services and statistically significant differences between other practice areas (p=0.000). The agreed perception of pharmacokinetics services was essential and showed the highest score (4.1461) with statistically significant differences between other answers (p=0.000) (Table 7).

The relationship between the nursing perception of Pharmacokinetics Services and factors include location, Site of work, Age (years), Nurse gender, and nurse qualification. Nurses practice area, Years of experience, Position Held, Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services. The multiple regression analysis considered perceptions as the dependent variable and factors affecting it as an expletory variable. There was a medium relationship (R=0. 423 with p=0.000) between the nursing perception of Pharmacokinetics Services and its factors. Three factors only (Locations, Nurses' practice area, perceptions of drug levels services) out of thirteen were statically significant and released (p<0.05). Three factors only (Locations, Nurses' practice area, and perceptions of drug levels services) out of thirteen were statically significant, releasing (p<0.05) explained 14.7%, 10.8%, and 16.8% of the negative relationship respectively to the variation in nursing perception, with a statistically significant difference (p=0.005), (p=0.026), (p=0.003) respectively and The bootstrap model was also confirmed. Furthermore, the relationship was verified by the non-existence of multicollinearity with the three factors only (Locations, Nurses practice area, Perception of drug levels services) with a Variance Inflation Factor (VIF) of 0.016, 0.006, and 0.072 respectively less than three or five as a sufficient number of VIF (Table 7).

Factors Affecting the Factors nurses' Perception of Responsibilities of Pharmacokinetics Services

Factors affecting nurses' practice were analyzed. We adjusted the significant values using the independent samples Kruskal-Wallis test and the Bonferroni correction for multiple tests. Various factors might affect the nurses' perception of the responsibilities of Pharmacokinetics Services, including Location, Site of work, Age (years), Nurse gender, and nurse qualification. Nurses practice area, Years of experience, Position Held, Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services. Three factors only (Locations, Nurses' experiences, perceptions of drug level services) out of thirteen were statically significant and released (p<0.05). The nurses' perception of the responsibilities of Pharmacokinetics Services showed the central region the highest scores (4.0804), with statistically significant differences between regions (p=0.000). The nursing experiences might affect the nursing perception of pharmacokinetics services with the highest scores (4.2049) with more than nine years of nursing experience, statistically significant differences between other practice areas (p=0.000). The agreed perception of pharmacokinetics services was essential and showed the highest score (4.0585) with statistically significant differences between other answers (p=0.000) (Table 8).

The relationship between the nurses' perceptions of responsibilities of Pharmacokinetics Services and factors such as Location, Site of work, Age (years), Nurse gender, and nurse qualification. Nurses practice area, Years of experience, Position Held, Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services. The multiple regression analysis considered perceptions as the dependent variable and factors affecting it as an expletory variable. There was a medium relationship (R= 0. 400 with p=0.000) between the nurses' perceptions of the responsibilities of Pharmacokinetics Services and its factors. Three factors only (Locations, Nurses' years of experience, perceptions of drug level services) out of thirteen were statically significantly released (p<0.05). Two factors only (Locations and Perception of drug levels services) out of thirteen were statically significant, releasing (p<0.05) explained 12.4% and 19.3% of the negative relationship, respectively to the variation in nurses' perception responsibilities of Pharmacokinetics Services, with a statistically significant difference (p=0.018), and (p=0.001) respectively and The bootstrap model was also confirmed. Furthermore, the relationship was verified by the non-existence of multicollinearity with the two factors only (Locations and Perception of drug levels services) with a variance inflation factor (VIF) of 0.016 and 0.07 respectively less than three or five as a sufficient number of VIF. (19)(20)(21). One factor only (Nursing experiences) out of thirteen were statically significant, releasing (p<0.05) explained 17.2 of the positive relationship respectively to the variation in nurses' perception responsibilities of Pharmacokinetics Services, with a statistically significant difference (p=0.002) and The bootstrap model was also confirmed. Furthermore, the relationship was verified by the non-existence of multicollinearity with only one factor (Nursing experiences) and a variance inflation factor (VIF) of 0.023, less than three or five, as a sufficient number of VIF (Table 8).

Factors affecting the nurses' perceptions may (Encourage) requests for drug levels or Pharmacokinetics Services

Factors affecting nurses' practice were analyzed. We adjusted the significant values using the independent samples Kruskal-Wallis test and the Bonferroni correction for multiple tests. Various Factors that might affect the nurses' perceptions may (Encourage) request drug levels or Pharmacokinetics Services, including Location, Site of work, Age (years), Nurse gender, and nurse qualification. Nurses' practice area, Years of experience, Position Held, Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services. Four factors only (Location, Nursing practice area, Requesting any drug levels before, and Perception of drug levels services) out of thirteen were statically significantly released (p<0.05). Nurses' perceptions of factors that may (Encourage) request drug levels or Pharmacokinetics Services showed the highest scores (4.2626) in the central region, with statistically significant differences between regions (p=0.000). The nursing practice area might affect the nurses' perceptions of factors that may (Encourage) request drug levels or Pharmacokinetics Services with the highest scores (4.2816) with the surgical area with statistically significant differences between other practice areas (p=0.000). The request for a drug level before had the highest score (4.2142), with statistically significant differences between the others (p=0.000). The agreed perception of pharmacokinetics services was essential and showed the highest score (4.2048) with statistically significant differences between other answers (p=0.000) (Table 9). The relationship between the nurses' perceptions of factors may (Encourage) request drug levels or Pharmacokinetics Services and factors such as Location, Site of work, Age (years), Nurse gender, and nurse qualification. Nurses practice area, Years of experience, Position Held, Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services. Four factors only (Location, Nursing practice area, Requesting any drug levels before, and Perception of drug levels services) out of thirteen were statically significantly released (p<0.05). The multiple regression analysis considered perceptions as the dependent variable and factors

affecting it as an expletory variable. There was a medium relationship (R=0. 470 with p=0.000) between the nurses' perceptions of factors that may (Encourage) request drug levels or Pharmacokinetics Services and its factors. The multiple regression analysis confirmed that Four factors only (Location, Nursing practice area, Requesting any drug levels before, and Perception of drug levels services) out of thirteen were statically significant and had to be released (p<0.05). That explained 15.9%, 10.2%, 23.7%, and 21.2% of the negative relationship to the variation in nurses' Perception with a statistically significant difference (p=0.002), (p=0.032), (p=0.000), and (p=0.000) respectively. The bootstrap model was also confirmed. Furthermore, the relationship was verified by the non-existence of multicollinearity with the Four factors only (Location, Nursing practice area, Requesting any drug levels before, and Perception of drug levels services) with a Variance Inflation Factor (VIF) of 0.015, 0.006, 0.069, and 0.067 respectively less than three or five as a sufficient number of VIF (Table 9).

Factors affecting the Factors nurses' perceptions factors may (Discourage) request drug levels or Pharmacokinetics Services

Factors affecting nurses' practice were analyzed. We adjusted the significant values using the independent samples Kruskal-Wallis test and the Bonferroni correction for multiple tests. Various factors might affect the nurses' perception of factors that may (Discourage) requests for drug levels or Pharmacokinetics Services, including location, site of work age (years), nurse gender, and nurse qualification. Nurses' practice area, Years of experience, Position Held, Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services. All thirteen factors did not affect the nurses' perceptions of factors that may (Discourage) request drug levels or Pharmacokinetics Services with non-statically significant differences (p>0.05) (Table 10).

The relationship between the nurses' perception of factors may (Discourage) request drug levels or Pharmacokinetics Services and factors such as Location, Site of work, Age (years), Nurse gender, and Nurse qualification. Nurses practice area, Years of experience, Position Held, Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services. All factors thirteen did not affect the nurses' perceptions of factors that may (Discourage) request drug levels or Pharmacokinetics Services with non-statically significant differences (p>0.05). The multiple regression analysis considered perceptions as the dependent variable and factors affecting it as an expletory variable. There was a medium relationship (R=0. 415 with p=0.000) between the nurses' perceptions of factors that may (Discourage) request drug levels or Pharmacokinetics Services and its factors. One factor only (Perception of drug levels services) out of thirteen were statically significant had released (p<0.05). The multiple regression analysis and the bootstrap model also confirmed that all thirteen factors did not affect the nurses' perceptions of factors that may (Discourage) request drug levels or Pharmacokinetics Services with non-statically significant differences (p>0.05) (Table 10).

DISCUSSION

Pharmacokinetic services are very potential services that impact the patient clinically or economically.[4] The nursing staff plays an essential role in the practice of the pharmacokinetics team. The perception of Pharmacokinetics is the backbone of knowledge and practice. Assessing nursing perception of pharmacokinetic services is critical and required to improve the knowledge and practice of pharmacokinetic services. Besides related standards. The cross-sectional study calculated and appropriate the number of samples better than previous physician study,[1] and lower than other study.[8] The convenient method of sampling, and the high-reliability validation of the survey, which might give an initial global picture like previous physician study[1] of nursing perceptions of pharmacokinetics services in Saudi Arabia. The survey respondents were from various regions; however, most were from the central and southern areas without apparent reason. Most respondents from MOH hospitals related to the survey distributors have easy access to MOH hospitals. The age distribution is statistically significant but not clinically significant in the practice. The age level was 35-45 years, which was an excellent sample to give the appropriate picture of the pharmacokinetic services. The nursing staff with more than four years of experience has the highest number, which reflects the accuracy perception based on knowledge and practice picture of pharmacokinetic services. The nursing practice was good, with a statistically significant distribution but not clinically significant. Most respondents had drug-level services and had practiced them before, which had a good perception of pharmacokinetics services. The average score for nursing perception of Pharmacokinetics is at the optimal level like previous physician study,[8] reflecting a positive perception of the measure of drug-related problems such as adverse effects and drug toxicity. The nursing staff's perception of pharmacokinetics services is commendable, ranging from drug safety and patient quality of life to monitoring drug therapy and choosing cost-effective treatments. They have an excellent perception of the implementation of pharmacokinetic services and are eager to improve the implementation of these services in entire healthcare facilities. Various factors affect the nursing perception of pharmacokinetic services, such as location, pediatric practice area, and nursing agreement of the availability of pharmacokinetics services essential. These factors, when addressed, can further enhance the positive perception and implementation of pharmacokinetic services.

Various factors might encourage the nurses to report drug levels, such as if they found severe adverse effects or drug levels correlated with drug toxicity. Besides, the availability of pharmacists provides pharmacokinetic services. Those factors will facilitate the development and improvement of pharmacokinetic services.

Various factors might affect the answer factors encourage drug level reporting, such as location, nursing practice area, requesting drug testing before, and perception that essential pharmacokinetics services might have adverse effects related to massive working with drug levels and a high number of patients and previous good perception absent of vision and annual plan of pharmacokinetics services and missing of pharmacokinetics practice standard.

Conversely, some factors can discourage nurses from reporting drug levels. For instance, if there is no correlation between drug level and toxicity or adverse effects, or if the pharmacokinetics services and drug levels are not covered by health insurance, nurses might be less motivated to report. The lack of periodic education and training can also be a deterrent resemble of pharmacy study.[4] These factors can significantly discourage nurses from participating in the drug levels reporting system. Conversely, nurses might not believe in the impact of pharmacokinetics services on their workload or disagree with the lack of available time for reporting drug levels.[4] These factors do not influence the survey responses. The nursing staff's perception of Pharmacokinetics or drug-level responsibility aligns with that of clinical pharmacists resemble of previous physician study[1] and doctors, indicating a harmonious understanding and a shared goal of improving the quantity and quality of pharmacokinetics services.

However, various factors might negatively influence the nursing surveys, such as location and good perception of essential pharmacokinetics services related to a vision and annual plan of pharmacokinetics services and poor impact of the services. At the same time, the nursing experiences had a positive effect on the perception of pharmacokinetics

Table 7: Multiple regression of Factors with the nurses' perceptions of Pharmacokinetics Services

Model						Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
		R	R Square	F	Sig.	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.423[b]	.179	6.044	.000[b]	4.944	.242		20.412	.000	4.468	5.421	4.944	.242
	Location					-.046	.016	-.147	-2.851	.005	-.078	-.014	-.046	.016
	Site of work					-.003	.009	-.018	-.350	.727	-.022	.015	-.003	.009
	Age (years)					-.047	.028	-.087	-1.652	.099	-.102	.009	-.047	.028
	Nurses gender					.040	.036	.055	1.115	.265	-.030	.110	.040	.036
	Nurses qualification					-.041	.057	-.038	-.720	.472	-.154	.072	-.041	.057
	Nurses practice area					-.014	.006	-.108	-2.232	.026	-.026	-.002	-.014	.006
	Years of experience in a medical career					.049	.023	.116	2.098	.037	.003	.094	.049	.023
	Position Held					-.037	.027	-.075	-1.398	.163	-.090	.015	-.037	.027
	The presence of Drug levels of pharmacokinetics services					-.048	.057	-.051	-.853	.394	-.160	.063	-.048	.057
	Requesting any drug levels before					-.198	.074	-.172	-2.681	.008	-.343	-.053	-.198	.074
	Number of drug levels requisition					-.011	.009	-.063	-1.236	.217	-.030	.007	-.011	.009
	Number of patients needed for drug levels of services					-.011	.034	-.017	-.338	.736	-.077	.055	-.011	.034
	Perception of drug levels services					-.214	.072	-.168	-2.976	.003	-.356	-.073	-.214	.072

a. Dependent Variable: Nurses' sectional practice about Pharmacokinetics services, Predictors: (Constant), Location, Site of work, Age (years), Nurses gender, Nurse qualification. Nurses practice area, Years of experience, Position Held, The presence of Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services

Bootstrap for Coefficients							
Model		Bootstrap[a]					
		B	Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	4.944	.030	.280	.001	4.427	5.489
	Location	-.046	-.001	.020	.022	-.087	-.008
	Site of work	-.003	.000	.011	.781	-.025	.019
	Age (years)	-.047	.000	.027	.095	-.100	.010
	Nurses gender	.040	.001	.034	.244	-.026	.111
	Nurses qualification	-.041	-.006	.065	.516	-.180	.081
	Nurses practice area	-.014	.000	.006	.033	-.026	.000
	Years of experience in a medical career	.049	.001	.030	.118	-.011	.109
	Position Held	-.037	-.002	.028	.185	-.096	.017
	The presence of Drug levels of pharmacokinetics services	-.048	.006	.108	.662	-.249	.167
	Requesting any drug levels before	-.198	-.011	.122	.096	-.480	.004
	Number of drug levels requisition	-.011	.001	.010	.252	-.031	.009
	Number of patients needed for drug levels of services	-.011	.003	.039	.776	-.083	.074
	Perception of drug levels services	-.214	-.012	.104	.035	-.462	-.038

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 8: Multiple regression of Factors with the nurses' perception responsibilities of Pharmacokinetics Services

Model						Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
		R	R Square	F	Sig.	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.400[b]	.160	5.281	.000[b]	4.285	.236		18.160	.000	3.821	4.749	4.285	.236
	Location					-.037	.016	-.124	-2.373	.018	-.068	-.006	-.037	.016
	Site of work					-.009	.009	-.050	-.977	.329	-.027	.009	-.009	.009
	Age (years)					-.005	.028	-.009	-.169	.866	-.059	.050	-.005	.028
	Nurses gender					.014	.035	.020	.406	.685	-.054	.083	.014	.035
	Nurses qualification					.021	.056	.020	.371	.711	-.089	.131	.021	.056
	Nurses practice area					.001	.006	.005	.096	.924	-.011	.012	.001	.006
	Years of experience in a medical career					.069	.023	.172	3.064	.002	.025	.113	.069	.023
	Position Held					-.006	.026	-.012	-.223	.823	-.057	.045	-.006	.026
	The presence of Drug levels of pharmacokinetics services					.059	.055	.064	1.064	.288	-.050	.168	.059	.055
	Requesting any drug levels before					-.184	.072	-.166	-2.558	.011	-.326	-.043	-.184	.072
	Number of drug levels requisition					-.007	.009	-.038	-.728	.467	-.024	.011	-.007	.009
	Number of patients needed for drug levels of services					-.009	.033	-.014	-.272	.786	-.073	.055	-.009	.033
	Perception of drug levels services					-.237	.070	-.193	-3.372	.001	-.375	-.099	-.237	.070

a. Dependent Variable: Nurses nurses' perceptions of responsibilities of Pharmacokinetics Services, Predictors: (Constant), Location, Site of work, Age (years), Nurse gender, Nurse qualification. Nurses practice area, Years of experience, Position Held, The presence of Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services

Bootstrap for Coefficients							
Model		Bootstrap[a]					
		B	Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	4.285	.022	.292	.001	3.747	4.910
	Location	-.037	.000	.018	.045	-.072	-.001
	Site of work	-.009	7.055E-05	.011	.429	-.031	.012
	Age (years)	-.005	.000	.027	.859	-.059	.046
	Nurses gender	.014	.001	.034	.684	-.049	.082
	Nurses qualification	.021	-.005	.082	.798	-.161	.175
	Nurses practice area	.001	.000	.006	.929	-.011	.013
	Years of experience in a medical career	.069	-.001	.028	.021	.011	.122
	Position Held	-.006	.000	.024	.800	-.054	.040
	The presence of Drug levels of pharmacokinetics services	.059	-.004	.080	.435	-.103	.219
	Requesting any drug levels before	-.184	.003	.103	.068	-.394	.011
	Number of drug levels requisition	-.007	.000	.011	.568	-.030	.016
	Number of patients needed for drug levels of services	-.009	-.001	.037	.827	-.081	.063
	Perception of drug levels services	-.237	-.012	.095	.014	-.454	-.078

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 9: Multiple regression of Factors with the nurses' perceptions factors may (Encourage) request drug levels or Pharmacokinetics Services

Model						Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
		R	R Square	F	Sig.	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.470[b]	.221	7.862	.000[b]	4.840	.225		21.524	.000	4.398	5.282	4.840	.225
	Location					-.047	.015	-.159	-3.159	.002	-.077	-.018	-.047	.015
	Site of work					-.008	.009	-.043	-.873	.383	-.025	.010	-.008	.009
	Age (years)					.001	.026	.003	.057	.955	-.050	.053	.001	.026
	Nurses gender					.047	.033	.068	1.417	.157	-.018	.112	.047	.033
	Nurses qualification					.025	.053	.024	.461	.645	-.080	.130	.025	.053
	Nurses practice area					-.012	.006	-.102	-2.154	.032	-.023	-.001	-.012	.006
	Years of experience in a medical career					.030	.021	.075	1.397	.163	-.012	.072	.030	.021
	Position Held					-.023	.025	-.049	-.940	.348	-.072	.025	-.023	.025
	The presence of Drug levels of pharmacokinetics services					-.020	.053	-.022	-.377	.706	-.123	.084	-.020	.053
	Requesting any drug levels before					-.261	.069	-.237	-3.801	.000	-.395	-.126	-.261	.069
	Number of drug levels requisition					.011	.009	.065	1.305	.193	-.006	.028	.011	.009
	Number of patients needed for drug levels of services					-.047	.031	-.075	-1.516	.130	-.109	.014	-.047	.031
	Perception of drug levels services					-.257	.067	-.212	-3.842	.000	-.388	-.125	-.257	.067

a. Dependent Variable: Nurses' nurses' perceptions of factors may (Encourage) request drug levels or Pharmacokinetics Services; Predictors: (Constant), Location, Site of work, Age (years), Nurses' gender, and Nurses' qualification. Nurses practice area, Years of experience, Position Held, The presence of Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services

Bootstrap for Coefficients

Model		Bootstrap[a]					
		B	Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	4.840	.039	.267	.001	4.344	5.415
	Location	-.047	-2.487E-05	.017	.004	-.080	-.014
	Site of work	-.008	.001	.009	.389	-.025	.011
	Age (years)	.001	-.002	.027	.940	-.053	.051
	Nurses gender	.047	-.003	.034	.168	-.023	.110
	Nurses qualification	.025	-.004	.060	.675	-.098	.143
	Nurses practice area	-.012	.001	.005	.021	-.022	-.001
	Years of experience in a medical career	.030	-.001	.026	.251	-.022	.080
	Position Held	-.023	-.003	.026	.402	-.075	.027
	The presence of Drug levels of pharmacokinetics services	-.020	-.004	.072	.765	-.175	.114
	Requesting any drug levels before	-.261	.006	.096	.003	-.445	-.070
	Number of drug levels requisition	.011	-.001	.009	.220	-.008	.029
	Number of patients needed for drug levels of services	-.047	.002	.027	.078	-.097	.010
	Perception of drug levels services	-.257	-.012	.119	.028	-.514	-.026

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Table 10: Multiple regression of Factors with the nurses' perceptions factors may Discourage reporting drug levels

Model						Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Collinearity Statistics	
		R	R Square	F	Sig.	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.415[b]	.172	5.703	.000[b]	.687	.321		2.136	.033	.055	1.319	.687	.321
	Location					.036	.021	.090	1.724	.086	-.005	.078	.036	.021
	Site of work					-.007	.012	-.028	-.552	.581	-.031	.017	-.007	.012
	Age (years)					-.002	.037	-.003	-.065	.948	-.075	.070	-.002	.037
	Nurses gender					.068	.047	.072	1.453	.147	-.024	.159	.068	.047
	Nurses qualification					-.005	.080	-.004	-.066	.947	-.163	.152	-.005	.080
	Nurses practice area					.004	.008	.027	.547	.584	-.011	.020	.004	.008
	Years of experience in a medical career					.071	.031	.130	2.310	.021	.011	.131	.071	.031
	Position Held					.039	.035	.060	1.105	.270	-.030	.107	.039	.035
	The presence of Drug levels of pharmacokinetics services					.247	.074	.202	3.360	.001	.102	.391	.247	.074
	Requesting any drug levels before					.352	.096	.238	3.681	.000	.164	.541	.352	.096
	Number of drug levels requisition					-.007	.012	-.028	-.548	.584	-.030	.017	-.007	.012
	Number of patients needed for drug levels of services					-.004	.044	-.005	-.091	.928	-.090	.082	-.004	.044
	Perception of drug levels services					.070	.093	.043	.746	.456	-.114	.253	.070	.093

a. Dependent Variable: Nurses' perceptions of factors may Discourage reporting drug levels; predictors: (Constant), Location, Site of work, Age (years), Nurses' gender, and Nurses' qualification. Nurses practice area, Years of experience, Position Held, Drug levels of pharmacokinetics services at the institution, Requesting any drug levels before, Number of drug levels requisition, Number of patients needed for drug levels services, Perception of drug levels services.

Bootstrap for Coefficients							
Model		Bootstrap[a]					
		B	Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	.687	.024	.484		-.245	1.702
	Location	.036	.000	.025	.164	-.016	.088
	Site of work	-.007	-.001	.012	.137	-.033	.013
	Age (years)	-.002	.007	.039	.581	-.071	.079
	Nurses gender	.068	-.002	.046	.951	-.020	.155
	Nurses qualification	-.005	-.012	.148	.146	-.321	.273
	Nurses practice area	.004	-9.895E-05	.006	.959	-.008	.017
	Years of experience in a medical career	.071	-.002	.041	.513	-.015	.152
	Position Held	.039	.000	.038	.099	-.045	.109
	The presence of Drug levels of pharmacokinetics services	.247	.005	.132	.305	-.004	.511
	Requesting any drug levels before	.352	-.004	.189	.052	-.031	.688
	Number of drug levels requisition	-.007	.000	.013	.059	-.034	.019
	Number of patients needed for drug levels of services	-.004	-.002	.041	.617	-.099	.068
	Perception of drug levels services	.070	.000	.146	.911	-.255	.355

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

responsibilities, which might the involvement of pharmacists benefit and assistance in the services. This reiteration of the nursing staff's perception and its alignment with other healthcare professionals underscores the importance of their role and valuable contribution to the field of Pharmacokinetics.

Limitation

The current study had informative information about the nursing perception of pharmacokinetics services. Besides, an appropriate sample size should be used with varying geographical locations and different practices in nursing areas. However, it contains various limitations, such as using nonrandom sampling methods and unequal distributions. Repeated future research with appropriate and random sampling techniques will improve the accurate picture of current research.

CONCLUSION

The nursing perception of pharmacokinetic services reached optimal through a cross-sectional study with an appropriately calculated sample size of various nursing specialty disciplines and geographical locations. The nurses agreed to fully implement pharmacokinetics services to prevent drug-related problems, improve future patient safety, and provide cost-effective therapy. Some factors discourage Pharmacokinetics, such as health insurance not covering the pharmacokinetics services, the pharmacist not wholly involved in the services, and the lack of education and training in the kinetics field. Resolving all previous parameters might improve the performance and implementation of pharmacokinetics services.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Informed consent was obtained from all the participants

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https://www.hhs.gov/ohrp/regulations-and-policy/decision-charts-2018/index.html

ABBREVIATIONS

MOH: Ministry of Health; **K.S.A.:** Kingdom of Saudi Arabia; **SPSS:** Statistical Package of Social Sciences; **JASP:** Jeffery's Amazing Statistics Program; **STROBE:** Strengthening the Reporting of Observational studies in Epidemiology statement: guidelines for reporting observational studies; **VIF:** Variance Inflation Factor.

ORCID ID

https://orcid.org/0000-0003-1381-628X

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