Practice of High-Risk/Alert Medications by Pharmacists in Saudi Arabia

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ABSTRACT

Objectives: To illustrate the pharmacist practice of High-Risk/Alertmedications in Saudi Arabia. **Methods:** It analyzes a cross-sectional survey that discussed the Pharmacist practice of High-Risk/Alert medications in Saudi Arabia. The survey consisted of respondents' demographic information about pharmacists and practices, Basic and advanced High-Risk/Alertmedications practice implementation, the High-Risk/Alertdrugs implemented in the following medication stages, and medications considered high alert or high risk at your institution. 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 reliability, McDonald's ω, Cronbach alpha, Gutmann's λ2, and Gutmann's λ6 been done with the study. Furthermore, the data analysis of the Pharmacist practice of High-Risk/Alert medications is done through 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 442 pharmacists responded to the questionnaire. Of them, more than one-third responded from the Central region (183 (40.40%)), and one Quarter responded from the Western part (119 (26.92%)), with statistically significant differences between the provinces (p=0.000). Males responded more than females (264 (59.59%)) versus 179 (40.41%)), with statistically significant differences between all levels (p=0.000). Most of the responders were in the age group of 24-30 years (266 (59.91%)) and 31-35 years (78 (17.57%)), with statistically significant differences between all age groups (p=0.000). Most of the pharmacists were staff pharmacists (323 (72.75%)) and pharmacy supervisors (56 (12.61%)), with statistically significant differences between all levels (p=0.000). The average score of the practice of pharmacists' basic of High-Risk/Alertmedications was (3.81). The element "The risk medications is a part of medications safety vision" obtained the highest score (4.18), and the element "Policy and procedure of High-Risk/Alertmedications " was (4.18). Followed the "The High-Risk/Alertmedications is a part of medications safety Mission" (4.12). The average advanced High-Risk/Alertmedications practice implementation score was (3.62). The element "The pharmacist share in medications safety committee for High-Risk/Alertmedications discussion" (4.12) and the element "There is documentation of potential impact and outcomes with High-Risk/Alertmedications " was (3.85). The average score of High-Risk/Alertmedications implemented in the medications stages was (3.99). The dispensing stage obtained the highest score (4.21), and the administration stage (4.12). Most drugs considered high alert or high risk at the institutions were antithrombotic agents 332 (77.39%) and adrenergic agonists 330 (76.92%). They were followed by insulin 285 (66.43%) and inotropic medications 284 (65.97%). **Conclusion:** The pharmacist's practice of High-Risk/Alertmedication is sufficient in Saudi Arabia. However, more expanded training in anesthesia and operation rooms has been successfully implemented. That leads to many preventive drug-related problems and avoids unnecessary economic burdens on the healthcare system.

Keywords: Pharmacist, Practice, High-risk, Alert, Medications, Drugs.

INTRODUCTION

Over the past years, medication errors have been considered a significant issue at healthcare institutions at local or international levels.[1-3] It implicated patient burden problems and increased the healthcare system's unnecessary cost.[4-8] Various types of medication errors might have occurred, either potential or straightforward. Besides, there is a wide range of medications.[9-16] They were starting from dangerous or High-Risk/Alertdrugs or wide safety margin medicines.[11,12,17] One of the suitable tools for preventing medication errors is to assess the current situation at healthcare facilities. The Institution of Safe Medication Practice (ISMP) releases updated information about the self-assessment of medications at healthcare institutions and emphasizes the self-assessment of high risks medications.[18-21] The assessment consisted of various tools to evaluate the healthcare practice of dealing with High-Risk/Alertmedications.[21] The ordering stages included the procurement, storage, preparation, distribution, and monitoring of medicine.[21] The assessments help all healthcare providers was expected errors before occurred.[22,23] Few investigations have been conducted about the practice of High-Risk/Alertmedications.[24-26]

Most studies discussed all healthcare providers without emphasizing specialties such as pharmacy staff. Thus, the current cross-sectional study to evaluate the practice of High-Risk/Alertmedications by pharmacists in the kingdom of Saudi Arabia.

METHODS

It analyzes a cross-sectional survey that discussed the Pharmacist practice of High-Risk/Alert Medications in Saudi Arabia. It self-reported an electronic survey of the pharmacist, including pharmacists from internship to consultant, pharmacist specialties, and Saudi Arabia. All non-pharmacist or students, non-completed, non-qualified surveys will be excluded from the study. The survey consisted of respondents' demographic information about pharmacists and practices, Basic and advanced High-Risk/Alert medications practice implementation, the High-Risk/Alert medications implemented in the following medication stages, and medications considered high alert or high risk at your institution. The 5-point Likert response scale system was used with closed-ended questions. According to the previous litterateur with an 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 drop-out rate 10%. As a result, the sample size will equal 380-420 with a power of study of 80%.[27-29] The response rate required for the calculated sample size is at least 60-70 % and above.[29,30] The survey was the survey had been sent to social media of what's applications and telegram groups of pharmacists. 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 the Pharmacist practice of High-Risk/Alert Medications is done through 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 the correlation analysis. Besides, the inferential analysis of factors affecting Basic and advanced High-Risk/Alert medications practice implementation, the High-Risk/Alert medications implemented in the following medications stages, and 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.[31,32]

RESULTS

A total number of 442 pharmacists responded to the questionnaire. Of them, more than one-third responded from the Central region (183 (40.40%)), and one Quarter responded from the Western part (119 (26.92%)), with statistically significant differences between the provinces (p=0.000). Most of the responders were from MOH Hospitals (157 (35.36%)), with a statistically significant difference between working sites (p=0.000). Males responded more than females (264 (59.59%)) versus 179 (40.41%)), with statistically significant differences between all levels (p=0.000). Most of the responders were in the age group of 24-30 years (266 (59.91%)) and 31-35 years (78 (17.57%)), with statistically significant differences between all age groups (p=0.000). Most of the pharmacists were staff pharmacists (323 (72.75%)) and pharmacy supervisors (56 (12.61%)), with statistically significant differences between all levels (p=0.000). Most of the responders held Bachelor in pharmacy (1214 (48.20%)) and Pharm D (193 (43.47%)). Most pharmacists had a work experience of 1-3 years (125 (28.28%%)) and >1 year (99 (22.40%)), with a statistically significant difference between years of experience (p=0.000). Most pharmacists works at inpatient pharmacy (110 ((26.76%)) and outpatient (88 ((21.41%)) with statistically significant differences between all levels (p=0.000). There was a strong positive correlation between age (years) and years of experience based on Kendall's tau_b (0.744) and Spearman's rho (0.827) correlation coefficients, with a statistically significant difference between the two factors (p<0.000). There was a medium negative correlation between age (years) and current positions based on Kendall's tau_b (0.429) and Spearman's rho (0.474) correlation coefficients, with a statistically significant difference between them (p<0.000). There was a medium positive correlation between the site of work and current practice area based on Kendall's tau_b (0.322) and Spearman's rho (0.404), with a statistically significant difference between the two factors (p<0.000). There was a medium negative correlation between the site of work and years of experience based on Kendall's tau_b (0.323) and Spearman's rho (0.407), with a statistically significant difference between the two factors (p<0.000) (Tables 1 and 2).

The average score of the practice of pharmacists' basic of High-Risk/Alert medications was (3.81). The element "The risk medications is a part of medications safety vision" obtained the highest score (4.18), and the element "Policy and procedure of High-Risk/Alert medications "was (4.18). Followed the "The High-Risk/Alert medications is a part of medications safety Mission" (4.12). In contrast, the lowest score was obtained for the element "The High-Risk/Alert medications and research" (2.95). The score for the element "The High-Risk/Alert medications and off-labeled or unapproved indications" was (3.30), and for the element "The High-Risk/Alert medications and drug utilization evaluation" was (3.41), with a statistically significant difference between the responses (p<0.000). All aspects of the practice of pharmacist's basic High-Risk/Alert medications were statistically significant between responses (p<0.05) (Table 3). The average implementation of advanced High-Risk/Alert medications practice score was (3.62). The element "The pharmacist share in medications safety committee for High-Risk/Alert medications discussion" (4.12) and the element "There is documentation of potential impact and outcomes with High-Risk/Alert medications" was (3.85). In contrast, the lowest score was obtained for "the pharmacists attended several courses or workshops about High-Risk/Alert medications" (3.32). The score for the element "There are standardized smart infusion pumps used for High-Risk/Alert medications at our organization" was (3.44), with a statistically significant difference between the responses (p<0.000). All aspects of the advanced High-Risk/Alert medications practice implementation were statistically significant between responses (p<0.000) (Table 4). The average score of High-Risk/Alert medications implemented in the medications stages was (3.99). The dispensing stage obtained the highest score (4.21), and the administration stage (4.12). In contrast, the lowest score was obtained from the procurement stage (3.48) and the monitoring stage (3.94), with a statistically significant difference between the responses (p<0.000). All aspects of the advanced High-Risk/Alert medications implemented in the medications stages were statistically significant between responses (p<0.000) (Table 5). Most drugs considered high alert or high risk at the institutions were antithrombotic agents 332 (77.39%) and adrenergic agonists 330 (76.92%). They were followed by insulin 285 (66.43%) and inotropic medications 284 (65.97%) (Table 6). The score for single-test reliability analysis of McDonald's ω was 0.926, Cronbach's α was 0.928, Gutmann's was λ2, 0.936, Gutmann's λ6 was 0.962, and Greater Lower Bound was 0.980 with statistically significant (p<0.05).

Table 1: Demographic, social information.

Nationality	Response Count	Response Percent	*p*-value (X2)
Central area	183	41.40%	0.000
North area	31	7.01%	
South area	45	10.18%	
East area	64	14.48%	
West area	119	26.92%	
Answered question	**442**		
Skipped question	**2**		
Site of work	**Response Count**	**Response Percent**	***p*-value (X2)**
MOH Hospitals	157	35.36%	0.000
Military hospitals	34	7.66%	
National Guard Hospital	33	7.43%	
Security forces hospitals	5	1.13%	
University Hospital	22	4.95%	
MOH primary care centers	11	2.48%	
Private hospitals	50	11.26%	
Private ambulatory care clinics	5	1.13%	
Private primary healthcare center	2	0.45%	
Community pharmacy	81	18.24%	
Pharmaceutical company	19	4.28%	
Academia	3	0.68%	
King Faisal Specialist Hospital and Research Center	5	1.13%	
SFDA	5	1.13%	
Royal Commission	1	0.23%	
Non employed	1	0.23%	
Intern	10	2.25%	
Answered question	**444**		
Skipped question	**0**		
Gender	**Response Count**	**Response Percent**	
Male	179	40.41%	0.000
Female	264	59.59%	
Answered question	**443**		
Skipped question	**1**		
Age	**Response Count**	**Response Percent**	
24-30	266	59.91%	0.000
31-35	78	17.57%	
36-40	46	10.36%	
41-45	28	6.31%	
46-50	16	3.60%	
> 50	10	2.25%	
Answered question	**444**		
Skipped question	**0**		

Table 2: Demographic, social information.

Pharmacist Qualifications	Response Count	Response Percent	*p*-value (X2)
Diploma in Pharmacy	2	0.45%	
Bachelor in Pharmacy	214	48.20%	
Master	63	14.19%	
Pharm D	193	43.47%	
Ph. D	8	1.80%	
PGY 1	16	3.60%	
PGY 2	10	2.25%	
PGY 3	3	0.68%	
Fellowship	3	0.68%	
Answered question	**444**		
Skipped question	**0**		
Position Held	**Response Count**	**Response Percent**	
Director of Pharmacy	44	9.91%	0.000
Assistant Director of Pharmacy	12	2.70%	
Supervisor	56	12.61%	
Pharmacy staff	323	72.75%	
Pharmacy intern	9	2.03%	
Answered question	**444**		
Skipped question	**0**		
Years of experience in a pharmacy career	**Response Count**	**Response Percent**	
Less than one year	99	22.40%	0.000
1-3	125	28.28%	
4-6	76	17.19%	
7-9	46	10.41%	
10-12	25	5.66%	
>12	71	16.06%	
Answered question	**442**		
Skipped question	**2**		
The practice area	**Response Count**	**Response Percent**	
Inpatient Pharmacy	110	26.76%	0.000
Outpatient Pharmacy	88	21.41%	
Satellite Pharmacy	2	0.49%	
Narcotics and Controlled	5	1.22%	
Extemporaneous Preparation	2	0.49%	
Clinical Pharmacy	59	14.36%	
Inventory Control	9	2.19%	
Drug Information	19	4.62%	
IV admixture	11	2.68%	
Community pharmacy	66	16.06%	
Pharmacy administrations	6	1.46%	
Pharmaceutical company	18	4.38%	
Drug Regulation administration	6	1.46%	
Medication safety	3	0.73%	
Pharmacy intern	1	0.24%	
All hospital pharmacy area	5	1.22%	
Academia activities	1	0.24%	
Answered question	**411**		
Skipped question	**33**		

Table 3: Basic High-Risk/Alertmedications practice implementation.

NO	Items	No activity had been implemented		It was formally discussed and considered, but it was not implemented		It is partially implemented in hospitals for some or all areas, patients, drugs, staff		It is fully implemented in the hospital for some areas, patients, drugs, and staff		It is fully implemented throughout the hospital for all patients, drugs, and staff		Total	Weighted Average	*p*-value (X2)
1.	The risk medications are a part of medications safety vision	6.62%	29	2.05%	9	16.89%	74	15.98%	70	58.45%	256	438	4.18	0.000
2.	High-Risk/Alertmedication is a part of the medications safety Mission	6.25%	27	3.24%	14	16.67%	72	19.68%	85	54.17%	234	432	4.12	0.000
3.	High-Risk/Alertmedication is a part of the medication's safety strategic plan	6.90%	30	4.37%	19	14.71%	64	20.00%	87	54.02%	235	435	4.10	0.000
4.	The annual plan for High-Risk/Alertmedications	11.49%	50	3.91%	17	14.71%	64	19.31%	84	50.57%	220	435	3.94	0.000
5.	Policy and procedure of High-Risk/Alertmedications	7.27%	32	2.73%	12	14.55%	64	15.91%	70	59.55%	262	440	4.18	0.000
6.	The High-Risk/Alertmedications competency	9.15%	40	3.43%	15	18.99%	83	22.43%	98	46.00%	201	437	3.93	0.000
7.	The High-Risk/Alertmedications and quality management	9.45%	41	5.07%	22	12.44%	54	20.28%	88	52.76%	229	434	4.02	0.000
8.	The High-Risk/Alertmedications and education and training program	15.33%	67	4.58%	20	19.22%	84	22.88%	100	37.99%	166	437	3.64	0.000
9.	The High-Risk/Alertmedications and medications errors system	11.42%	50	5.02%	22	17.58%	77	18.72%	82	47.26%	207	438	3.85	0.000
10.	The High-Risk/Alertmedications and adverse drug reactions	15.40%	67	5.52%	24	17.47%	76	19.31%	84	42.30%	184	435	3.68	0.000
11.	The High-Risk/Alertmedications and drug quality reporting system	14.91%	65	5.50%	24	15.14%	66	19.95%	87	44.50%	194	436	3.74	0.000
12.	The High-Risk/Alertmedications and potential drug-drug interaction	14.61%	64	6.85%	30	16.21%	71	18.04%	79	44.29%	194	438	3.71	0.000
13.	The High-Risk/Alertmedications and prohibited abbreviations	10.93%	48	4.10%	18	13.67%	60	15.95%	70	55.35%	243	439	4.01	0.000
14.	The High-Risk/Alertmedications and medications reconciliation ال	14.42%	63	6.18%	27	16.48%	72	18.08%	79	44.85%	196	437	3.73	0.000
15.	The High-Risk/Alertmedications and research	33.26%	146	7.52%	33	17.31%	76	15.26%	67	26.65%	117	439	2.95	0.000
16.	The High-Risk/Alertmedications and off-labeled or unapproved indications	24.20%	106	5.94%	26	18.04%	79	19.18%	84	32.65%	143	438	3.30	0.000
17.	The High-Risk/Alertmedications and Computerized physician Oder entry	16.48%	72	5.49%	24	13.04%	57	13.96%	61	51.03%	223	437	3.78	0.000
18.	The High-Risk/Alertmedications and drug utilization evaluation	23.62%	103	5.96%	26	14.91%	65	16.97%	74	38.53%	168	436	3.41	0.000
19.	The High-Risk/Alertmedications looks and sound like a system	12.59%	55	2.97%	13	12.36%	54	16.02%	70	56.06%	245	437	4.00	0.000
20.	The High-Risk/Alertmedications and prohibited abbreviations	12.76%	56	4.33%	19	12.98%	57	14.35%	63	55.58%	244	439	3.96	0.000
	Answered											**441**		
	Skipped											**3**		

Table 4: Advance High-Risk/Alertmedications practice implementation.

No	Items	Strongly disagree		Disagree		Uncertain		Agree		Strongly agree		Total	Weighted Average	*p*-value (X2)
1	The pharmacist is always an active member of the mortality committee at the healthcare institutions for High-Risk/Alertmedications cause mortality	8.16%	36	10.20%	45	31.07%	137	26.98%	119	23.58%	104	441	3.48	0.000
2	The pharmacist share in the medications safety committee for High-Risk/ Alertmedications discussion	2.74%	12	3.65%	16	13.24%	58	39.73%	174	40.64%	178	438	4.12	0.000
3	There is documentation of the potential impact and outcomes of High-Risk/ Alertmedications	5.50%	24	5.73%	25	19.72%	86	36.24%	158	32.80%	143	436	3.85	0.000
4	I attended several courses or workshops about High-Risk/Alertmedications	10.78%	47	15.60%	68	22.94%	100	32.57%	142	18.12%	79	436	3.32	0.000
5	In our institution, there is double check system for all stages of preparation, prescribing, dispensing, and administration of High-Risk/Alertmedications	8.66%	38	8.66%	38	22.55%	99	34.62%	152	25.51%	112	439	3.60	0.000
6	Pharmacists work onsite in patient care areas for at least 8 hr each day performing clinical activities(e.g., reviewing medication orders, verifying medications, attending interdisciplinary rounds, providing input into the selection and administration of medicines, educating patients) where high-alert medications are ordered and administered	8.72%	38	7.80%	34	24.31%	106	31.42%	137	27.75%	121	436	3.62	0.000
7	There are standardized smart infusion pumps used for High-Risk/ Alertmedications at our organization	8.43%	37	10.25%	45	30.30%	133	30.07%	132	20.96%	92	439	3.45	0.000
8	In reality, A rapid response team is available 24 hr a day, 7 days a week (or whenever the facility is open), and consistently responds to patient, family, and staff concerns about increasing instability and/or clinical deterioration of the patient of High-Risk/Alertmedications	8.22%	36	9.36%	41	29.68%	130	32.65%	143	20.09%	88	438	3.47	0.000
9	There is a standardized concentration of High-Risk/Alertmedications	5.75%	25	7.59%	33	22.53%	98	38.62%	168	25.52%	111	435	3.71	0.000
10	There is clinical therapy for High-Risk/Alertmedications	5.52%	24	7.59%	33	24.60%	107	40.00%	174	22.30%	97	435	3.66	0.000
	Answered											441		
	Skipped											3		

Table 5: The High-Risk/Alert medications had been implemented in the following medications stages.

	Strongly disagree		Disagree		Uncertain		Agree		Strongly agree		Total	Weighted Average	*p*-value (X2)
Procurement	4.31%	19	8.16%	36	39.23%	173	32.20%	142	16.10%	71	441	3.48	0.000
Storage medications	2.51%	11	3.42%	15	16.44%	72	43.38%	190	34.25%	150	438	4.03	0.000
Prescribing	2.05%	9	4.10%	18	14.81%	65	41.91%	184	37.13%	163	439	4.08	0.000
Preparation	1.59%	7	3.41%	15	15.91%	70	40.91%	180	38.18%	168	440	4.11	0.000
Dispensing	1.14%	5	2.73%	12	11.62%	51	43.28%	190	41.23%	181	439	4.21	0.000
Administration	0.91%	4	3.18%	14	15.91%	70	43.18%	190	36.82%	162	440	4.12	0.000
Monitoring	2.52%	11	6.18%	27	18.54%	81	40.05%	175	32.72%	143	437	3.94	0.000
Answered											**441**		
Skipped											**3**		

Table 6: The medications considered as high alert or high risk at healthcare institutions.

No.	Items	Responses	
1.	Adrenergic agonists, IV (e.g., EPINEPHrine, phenylephrine, norepinephrine)	330	76.92%
2.	Adrenergic antagonists, IV (e.g., propranolol, metoprolol, labetalol)	160	37.30%
3.	Anesthetic agents, general, inhaled, and IV (e.g., propofol, ketamine)	259	60.37%
4.	Antiarrhythmics, IV (e.g., lidocaine, amiodarone)	259	60.37%
5.	Antithrombotic agents, including anticoagulants (e.g., warfarin, low molecular weight heparin, unfractionated heparin)	332	77.39%
6.	Direct oral anticoagulants and factor Xa inhibitors (e.g., dabigatran, rivaroxaban, apixaban, edoxaban, betrixaban, fondaparinux)	268	62.47%
7.	Direct thrombin inhibitors (e.g., argatroban, bivalirudin, dabigatran)	193	44.99%
8.	Glycoprotein IIb/IIIa inhibitors (e.g., eptifibatide)	114	26.57%
9.	Thrombolytics (e.g., alteplase, reteplase, tenecteplase)	232	54.08%
10.	Cardioplegic solutions	121	28.21%
11.	Chemotherapeutic agents, parenteral and oral	247	57.58%
12.	Dextrose, hypertonic, 20% or greater	263	61.31%
13.	Dialysis solutions, peritoneal and hemodialysis	101	23.54%
14.	Epidural and intrathecal medications	162	37.76%
15.	Inotropic medications, IV (e.g., digoxin, milrinone)	283	65.97%
16.	Insulin, subcutaneous, and IV	285	66.43%
17.	Liposomal forms of drugs (e.g., liposomal amphotericin B) and conventional counterparts (e.g., amphotericin B desoxycholate)	146	34.03%
18.	Moderate sedation agents, IV (e.g., dexmedetomidine, midazolam, LORazepam)	242	56.41%
19.	Moderate and minimal sedation agents, oral, for children (e.g., chloral hydrate, midazolam, ketamine [using the parenteral form])	208	48.48%
20.	Opioids, including IV, oral (including liquid concentrates, immediate- and sustained-release formulations), transdermal	259	60.37%
21.	Neuromuscular blocking agents (e.g., succinylcholine, rocuronium, vecuronium)	232	54.08%
22.	Parenteral nutrition preparations	181	42.19%
23.	Sodium chloride for injection, hypertonic, greater than 0.9% concentration	219	51.05%
24.	Sterile water for injection, inhalation, and irrigation (excluding pour bottles) in containers of 100 mL or more	95	22.14%
25.	Sulfonylurea hypoglycemics, oral (e.g., chlorproPAMIDE, glimepiride, glyBURIDE, glipiZIDE, TOLBUTamide)	162	37.76%
	There is NOT any consideration	27	6.29%
	Answered	**429**	
	Skipped	**15**	

Factors affecting the implementation of the essential High-Risk/Alert medications practice

Factors affecting *the basic High-Risk/Alert medications practice implementation* were analyzed. We adjusted the significant values using the independent samples Kruskal–Wallis test and the Bonferroni correction for multiple tests. *Basic High-Risk/Alert medications practice implementation includes* location, worksite, age (years), gender, years of experience, position held, and practice area in a pharmacy career. Five of the seven factors (locations, gender, age, experiences, and position) did not affect the High-Risk/Alert medications practice implementation with a non-statistically significant difference between working sites ($p<0.05$). Seventeen worksites affected pharmacists' knowledge about High-Risk/Alert medication, with a statistically significant difference between working sites ($p=0.038$). However, there is a non-statistically significant difference between working sites ($p>0.05$). The practice areas affected the *basic High-Risk/Alert medications practice implementation* with a statistically significant difference between working sites ($p=0.011$). However, there is a non-statistically significant difference between practice areas ($p>0.05$).

The relationship between the practice of pharmacist's *basic* High-Risk/Alert medications and factors such as location, worksite, age (years), gender, years of experience, position held, and practice area in a pharmacy career. The multiple regression analysis considered perception as the dependent variable and factors affecting it as an expletory variable. There was a weak relationship (R=0.163 with $p=0.153$) between the practice of pharmacist's specific items of High-Risk/Alert medications and its factors. Six out of seven were non-significant differences ($p>0.05$). However, multiple regression analysis confirmed that one factor (i.e., practice area) explained 12.6 % of the negative relationship to the variation in the pharmacist's *basic* practice of the High-Risk/Alert medications, with a statistically significant difference ($p=0.024$). The bootstrap model was also confirmed. Furthermore, the relationship was verified by the non-existence of multicollinearity with a variance inflation factor (VIF) of 1.262, less than three or five as an adequate number of VIF (Table 7).[33-35]

Table 7: Multiple regression of Factors with the Basic High-Risk/Alertmedications implementations Model.

Model		R	R Square	F	Sig.	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
						B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.163 [b]	.027	1.537	.153[b]	3.136	.295		10.634	.000	2.556	3.716		
	Location					.013	.024	.028	.546	.585	-.035	.062	.965	1.036
	Site of work					-.003	.011	-.014	-.226	.822	-.025	.020	.663	1.508
	Age (years)					.002	.060	.003	.034	.973	-.116	.120	.300	3.330
	Pharmacist gender					.057	.087	.033	.649	.517	-.115	.228	.929	1.077
	Years of experience in a pharmacy career					.006	.046	.013	.135	.892	-.085	.097	.275	3.639
	Position Held					-.070	.049	-.081	-1.422	.156	-.167	.027	.762	1.312
	Practice area					-.025	.011	-.126	-2.259	.024	-.046	-.003	.792	1.262

a. Dependent Variable: Basic High-Risk/Alert medication implementations, Predictors: (Constant), Location, Age (years), gender, Years of experience in a pharmacy career, Position Held, and practice area.

Bootstrap for Coefficients

Model		B	Bias	Bootstrap[a]			
				Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	3.136	-.005	.296	.001	2.552	3.722
	Location	.013	-7.242E-05	.025	.581	-.035	.065
	Site of work	-.003	-8.671E-05	.012	.831	-.025	.018
	Age (years)	.002	.004	.052	.969	-.096	.111
	Pharmacist gender	.057	-.001	.087	.517	-.126	.216
	Years of experience in a pharmacy career	.006	-.002	.041	.873	-.075	.082
	Position Held	-.070	.002	.050	.145	-.167	.029
	Practice area	-.025	.000	.010	.017	-.045	-.005

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

Factors affecting the Advanced High-Risk/Alert medications practice implementation

Factors affecting the passing factors of the advanced High-Risk/Alert medications practice implementation were analyzed. We adjusted the significant values using the independent samples Kruskal–Wallis test and the Bonferroni correction for multiple tests. The factors affecting advanced High-Risk/Alert medication practice implementation include location, worksite, age (years), gender, experience, position held, and practice area in a pharmacy career. Four of seven factors (locations, gender, positions, and practice area did not affect the High-Risk/Alert medications practice implementation with a statistically significant difference between working sites ($p<0.05$).

Seventeen worksites affected the advanced *High-Risk/Alert medications practice implementation* with a statistically significant difference between working sites ($p=0.008$). However, there is a non-statistically significant difference among working sites ($p>0.05$). The age of the responders affected the advanced *High-Risk/Alert medication practice implementation* with a statistically significant difference between all age groups ($p=0.035$). However, there is a non-statistically significant difference among all age groups ($p>0.05$). Finally, six levels of experience affected the advanced *High-Risk/Alert medication practice implementation with* a statistically significant difference between working sites ($p=0.048$). However, there is a non-statistically significant difference between working sites ($p>0.05$).

The relationship between implementing the High-Risk/Alert medications practices and factors such as location, worksite, age (years), gender, years of experience, position held, and practice area in a pharmacy career. The multiple regression analysis considered perception as the dependent variable and factors affecting it as an expletory variable. There was a weak relationship (R=0.134 with $p=0.407$) between the High-Risk/Alert medications practice implementation and its factors. All seven factors were non-significant differences in the relationship ($p>0.05$). The bootstrap model was also confirmed (Table 8).

Factors affecting the Factors of High-Risk/Alert medications are implemented in the specific drugs ordering stages

Factors affecting the passing factors of *the High-Risk/Alert medications implemented in the specific medication stages* were analyzed. We adjusted the significant values using the independent samples Kruskal–Wallis test and the Bonferroni correction for multiple tests. The factors that might affect *the High-Risk/Alert medications implemented in the specific drug ordering stages* include location, worksite, age (years), gender, years of experience, position held, and practice area in a pharmacy career. Four of seven factors (gender, age, position, and practice area did not affect the High-Risk/Alert medication practice implementation with a statistically non-significant difference between working sites ($p<0.05$). The central region showed the lowest scores (3.6494), with statistically significant differences between regions ($p=0.006$). Seventeen worksites affected by the *High-Risk/Alert medications are implemented in the specific drug ordering stages* with a statistically significant difference ($p=0.029$). The highest score (4.3896) was obtained from a university hospital as a comparison with the community pharmacy score (3.7707), with a statistically significant difference ($p=0.044$). Six levels of work experience affected the High-Risk/ Alert medications implemented in the specific medication ordering stages. The highest score (4.1870) was obtained for those with work experience of >12 years, with a statistically significant difference between all levels ($p=0.030$).

The relationship between High-Risk/Alert medications is implemented in the specific medication stages and factors such as location, worksite, age (years), gender, years of experience, position held, and practice area in a pharmacy career. The multiple regression analysis considered perception as the dependent variable and factors affecting it as an expletory variable. There was a weak relationship (R=0.143 with $p=0.318$) between the High-Risk/Alert medications implemented in the specific medication stages and their factors. All seven factors were non-significant differences in the relationship ($p>0.05$). The bootstrap model was also confirmed (Table 9).

DISCUSSION

The current cross-sectional study with an appropriate sample, high-reliability score, and variable characteristics of demographic information that might reflect the whole pharmacy society; explores the practice of essential elements of High-Risk/Alert medication. It was better than the previous sample size and reliability analysis.[24-26] The findings showed the average score of the basic practice of High-Risk/Alert medicine was acceptable. That includes mission, vision, policy, and procedures, which was expected because all those elements were required for quality management of healthcare organizations such as CBAHI and international standards.[36,37] In contrast, some basic practices are not shared by pharmacists, such as research of High-Risk/alert medications, off labeled of High-Risk/Alert medicines, and drug utilization of High-Risk/Alert medications. That's related to pharmaceutical care services plan and level of quality management plan in pharmacy departments.[24,38] Besides, the shortage of pharmacy staff and low education and training in High-Risk/Alert medication within healthcare facilities. Therefore, all pharmacy leaders should revise those vital elements of High-Risk/Alert medicines. Implementing those elements can show the impact and outcome of a High-Risk/Alert medication system entire the healthcare system.[24,25,38]

In the current study, the findings showed that the advanced practice of High-Risk/Alert medications was acceptable, especially in the participated medication safety, discussed the matter of High-Risk/Alert medicines, and documented the potential impact of High-Risk/Alert medications. Medication safety is beneficial to prevent drug misadventures in the future. However, the potential impact and outcome of High-Risk/Alert drugs properly mean the documentation of medication errors, ADR occurrences, and prevention in the future.[11,39] However, the documentation of patient clinical impact and cost avoidance has not existed.[15,16] The pharmacist does not commonly practice standardized High-Risk/Alert medications infusion, as reported in other studies.[40,41] Besides, the pharmacist only sometimes practices education and training in High-Risk/Alert medication. The findings should the pharmacist implement High-Risk/Alert medication stages with a high emphasis on dispensing and administration stages. That's related to documentation of drug-related problems within pharmacy and nursing facilities, which is required from accrediting agency CBAHI.[36] In contrast, the pharmacy does not have a common practice of High-Risk/Alert medication in procurement and monitoring stage medication processes. That's related to the absence of education on High-Risk/Alert medications or a plan to implement those elements. The pharmacy quality management should consider reviewing the High-Risk/Alert medication order stages to ensure all quality management is implemented for High-Risk/Alert medicines.

The findings showed the wide discrepancy regarding the High-Risk/Alert medication available at their health care organization. That's related to the absence of continuous education and training about high risks medications. In addition, some medication facilities, such as dialysis solutions, might not be available within the hospital drug formulary. Although some High-Risk/Alert medications were commonly used in practice, some pharmacists

Table 8: Multiple regression of Factors with the Advance High-Risk/Alertmedications practice implementation.

Model		R	R Square	F	Sig.	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
						B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.134 [b]	.018	1.033	.407[b]	3.484	.299		11.661	.000	2.897	4.072		
	Location					.005	.025	.010	.206	.837	-.044	.054	.965	1.036
	Site of work					-.009	.012	-.047	-.761	.447	-.031	.014	.663	1.508
	Age (years)					.054	.061	.080	.884	.377	-.066	.173	.300	3.330
	Pharmacist gender					.101	.088	.059	1.149	.251	-.072	.275	.929	1.077
	Years of experience in a pharmacy career					.003	.047	.006	.060	.952	-.090	.095	.275	3.639
	Position Held					-.039	.050	-.045	-.790	.430	-.138	.059	.762	1.312
	Practice area					.004	.011	.020	.362	.717	-.018	.026	.792	1.262

a. Dependent Variable: Advance High-Risk/Alert medications practice implementation, Predictors: (Constant), Location, Age (years), gender, Years of experience in a pharmacy career, position Held, and practice area.

Bootstrap for Coefficients

Model		B	Bias	Bootstrap[a]			
				Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	3.484	-.002	.295	.001	2.950	4.107
	Location	.005	7.221E-05	.024	.836	-.041	.051
	Site of work	-.009	.000	.011	.430	-.029	.012
	Age (years)	.054	.004	.066	.402	-.077	.190
	Pharmacist gender	.101	-.003	.091	.271	-.083	.278
	Years of experience in a pharmacy career	.003	-.002	.046	.963	-.094	.090
	Position Held	-.039	.002	.049	.401	-.136	.055
	Practice area	.004	.000	.010	.693	-.017	.024

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

Table 9: Multiple regression of Factors with the High-Risk/Alertmedications are implemented in the specific medications stages.

Model		R	R Square	F	Sig.	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
						B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.143 [b]	.020	1.171	.318[b]	3.909	.252		15.541	.000	3.414	4.404		
	Location					-.002	.021	-.005	-.106	.916	-.043	.039	.965	1.036
	Site of work					-.012	.010	-.074	-1.218	.224	-.031	.007	.663	1.508
	Age (years)					.049	.051	.088	.967	.334	-.051	.150	.300	3.330
	Pharmacist gender					.137	.074	.095	1.845	.066	-.009	.283	.929	1.077
	Years of experience in a pharmacy career					-.021	.040	-.051	-.534	.593	-.099	.057	.275	3.639
	Position Held					-.023	.042	-.031	-.543	.587	-.106	.060	.762	1.312
	Practice area					-.004	.009	-.022	-.394	.694	-.022	.015	.792	1.262

a. Dependent Variable: High-Risk/Alertmedications implemented in the specific medications stages; predictors: (Constant), Location, Age (years), gender, Years of experience in a pharmacy career, Position Held, and practice area.

Bootstrap for Coefficients

Model		B	Bias	Bootstrap[a]			
				Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	3.909	.000	.236	.001	3.458	4.384
	Location	-.002	-.001	.020	.921	-.044	.035
	Site of work	-.012	1.802E-05	.009	.210	-.030	.007
	Age (years)	.049	.000	.050	.323	-.043	.151
	Pharmacist gender	.137	.000	.074	.076	-.015	.280
	Years of experience in a pharmacy career	-.021	1.398E-05	.037	.558	-.098	.046
	Position Held	-.023	.001	.040	.561	-.106	.056
	Practice area	-.004	-1.588E-05	.009	.668	-.022	.014

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

did not choose them among High-Risk/Alert medicines. Such as narcotics medication, sulfonylurea hypoglycemic agent, and sterile water for injection, similar to previous studies.[24,25] Unfortunately, some responders did not consider all lists as High-Risk/Alert medications due to the absence of a system at some organizations and low education about High-Risk/Alert medicines.[38]

In the study, the majority of factors such as location, working site, age, experience, and position did affect the answer of the responders about the essential practice of basic High-Risk/Alert medication. However, there are some differences among the working sites and practice areas of practice High-Risk/Alert medicines. That finding was expected because some healthcare organizations fully implemented the High-Risk/Alert medication system, and others did not. Besides, some critical practice areas in pharmacy practice properly should implement the system, such as preparing and distributing parenteral medications and total parenteral nutrition. Most factors did not affect the advanced practice of High-Risk/Alert medicines. However, there are some differences in implementation, such as working site, age level, and experience. That's expected because the older and expert pharmacists had more practice implementing the High-Risk/Alert medication approach during their duties. No dependents factors affect the practice of advanced High-Risk/Alert medication elements. Most factors did not affect the High-Risk/Alert medication implementation stages. However, some differences exist between locations, working sites, and pharmacist experiences. The university hospital had a high score for implementing High-Risk/Alert medication related to quality management tools at the ordering stage. In contrast, the community pharmacy had a low implementation of steps due to the need to fully implement the High-Risk/Alert medication system. No dependent factors affect the High-Risk/Alert medication ordering stages. Thus, there is no previous investigation to compare with the current findings.

Limitations

The current cross-sectional study had various advantages, including an appropriately calculated sample size and a consistent validation and reliability test with high scores. Besides, it provides informative information and analyzes High-Risk/Alert medications in pharmacy practice. However, the study had several limitations, such as non-randomized sampling techniques and no equivalent sample demographic information of the responders. In addition, the study's findings about the current practice might change. Therefore, systematic and further research in the future and avoiding some disadvantages are highly suggested.

CONCLUSION

The pharmacist's basic and advanced practice of High-Risk/Alert medications is appropriate. The most practice elements were High-Risk/Alert medicines' vision, mission, policy, and procedures. Besides, the medication committee and documentation of the outcome of High-Risk/Alert medications. In contrast, the research on High-Risk/Alert medication or labels and drug utilization of High-Risk/Alert medicines obtained the lowest score of practice. Besides, the education and training of standardized infusion pumps of High-Risk/Alert products were inadequate. Most healthcare facilities considered High-Risk/Alert medications were antithrombotic agents and adrenergic agonists. They were followed by insulin and inotropic drugs. Most demographic factors did not affect the basic and advanced practice of High-Risk/Alert medications. Therefore, the pharmacist practice of High-Risk/Alert medicines is essential to improve educational performance and other relevant practice elements in additional research. Therefore, High-Risk/Alert medication utilization is highly recommended in pharmacy practice.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Consent for Publications

Informed consent was obtained from all the participants

Ethical Approval

This research was exempted from research and ethical committee or an institutional review board (IRB) approval.

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

ABBREVIATIONS

MOH: Ministry of Health; **KSA:** Kingdom of Saudi Arabia; **CBAHI:** Saudi Center for Accreditation of healthcare institutions; **ISMP:** The Institution of Safe Medication Practice; **SPSS:** Statistical Package of Social Sciences; **JASP:** Jeffery's Amazing Statistics Program; **STROBE:** Strengthening the reporting of observational studies in epidemiology statement.

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