Perception of Pharmacists about Pharmacy Infection Control in Saudi Arabia

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ABSTRACT

Objectives: In this study, we aimed to explore the perception of pharmacists about pharmacy infection control in the Kingdom of Saudi Arabia. **Methods:** In this cross-sectional study, we aimed to explore the perception of pharmacists about pharmacy infection control in Saudi Arabia. We used a self-reported electronic questionnaire and distributed it to pharmacists from interns to consultants and specialists in Saudi Arabia. The survey collected demographic information of the responders and their perception of pharmacy infection control. In addition, we analyzed the barriers that prevent the implementation of pharmacy infection control in pharmacy practice. We used a 5-point Likert response scale system with close-ended questions to obtain responses. The data were collected through the Survey Monkey system and analyzed with the use of Statistical Package of Social Sciences (SPSS), Jeffery's Amazing Statistics Program (JASP), and Microsoft Excel (version 16) software. **Results:** A total of 435 pharmacists responded to the questionnaire. Of them, 212 (48.96%) were female, and 221 (51.04%) were male responders, and there was no statistically significant difference between them (p=0.665). Most of the responders were in the age group of 24–30 years (151 (34.87%)) and 36–40 years (101 (23.33%)), with statistically significant differences between all age groups (p=0.000). The majority of responders held Bachelor in Pharmacy degree (281 (64.75%)) and Master in Pharmacy degree (94 (21.66%)), and Diploma in Pharmacy (90 (20.74%)). The average score of physician perceptions of pharmacy infection control was 3.47. Furthermore, high scores were obtained for the element "the system in my healthcare institution including policies and procedures related to pharmacy infection control is good at minimizing the occurrence of infection-related problems inside or outside pharmacy" (3.96) and "the pharmacy infection control implementation has led to positive changes for patients and healthcare institution" (3.83). The average score for the element "perceptions of barriers that prevent you from implementing pharmacy infection control" was 3.39. In addition, high scores were obtained for the elements "Level of clinical knowledge of pharmacy infection control" (4.10) and "Uncertain association between the pharmacy infection control and the drug-related infection" (3.65). The scores for single-test reliability analysis for McDonald's ω was 0.838, Cronbach's α was0.837, Gutmann's λ2 was 0.849, Gutmann's λ6 was 0.910, and Greater Lower Bound was 0.960. **Conclusion:** The perception of pharmacy infection control in the Kingdom of Saudi Arabia was found to be satisfactory. Therefore, we need to implement and provide periodic education and training in pharmacy infection control in Saudi Arabia to improve the perception.
Key words: Perception, Pharmacy, Infection, Control, Saudi Arabia.

INTRODUCTION

Over the past few years, several policies with regard to practices and administration in pharmacy have been established in Saudi Arabia.[1,2] In addition, new initiatives and clinical pharmacy services have been started that are comparable with New Saudi Vision 2030 and strategic pharmacy plan.[3] Some of the previous studies have discussed the perception of pharmacists about pharmacy practice programs, which showed a positive attitude of pharmacists in establishing the services.[4-6] Moreover, most pharmacists agree that the various challenges prevent the implementation of pharmacy practice programs.[4] Infection control plays an active role in pharmacy practice, emphasizing intravenous admixture services.[7] Moreover, infection control skills are essential during a pandemic and public emergencies.[8-10] Therefore, the new initiative program's unique infection control for pharmacy services was suggested to be implemented locally.[11,12] The perception of pharmacy infection control is required to declare the pharmacist's perception to stimulate and encourage the pharmacist to implement the new guidelines. To the best of our knowledge, there are no studies conducted to discuss the perception of pharmacists about the perception of infection control practice. Most of the investigations did not zoom on the current topic.[13-16] Therefore, in this study, we aimed to explore the perception of pharmacists about pharmacy infection control in Saudi Arabia.

METHODS

It was a descriptive cross-sectional investigation aimed to assess the perception of pharmacists

about pharmacy infection control in Saudi Arabia. We used a self-reported electronic survey questionnaire and distributed it to pharmacists, including physicians from consultants to interns and pharmacy specialists in Saudi Arabia. All non pharmacists, students, and incomplete questionnaires were excluded from this study. The survey collected demographic information of pharmacists and their perception of pharmacy infection control. In addition, we collected data on the perception of barriers that prevent pharmacists from implementing pharmacy infection control in pharmacy practice. We used 5-point Likert response scale system with close-ended questions to obtain responses. According to the previous literature with unlimited population size, the sample for this cross-sectional study. It was calculated with the following parameters; population percentage of 50%, the confidence level of 95% with a *z* score of 1.96, margin of error of 5–6.5%, and a drop-out rate of 10%. Based on these criteria, the sample size was 418 with a power of study of 80%.[17-19] The response rate required for the calculated sample size was at least 60–70%.[19,20] The survey was distributed through social media such as Telegram and via personal communication. In addition, a reminder message has been sent once a week. Expert reviewers and pilot testing validated the survey data. Moreover, the data were analyzed through reliability tests such as Cronbach's α, McDonald's ω, Gutmann's λ2, and Gutmann's λ6. The data were collected through the Survey Monkey system and analyzed using the Statistical Package of Social Sciences (SPSS), Jeffery's Amazing Statistics Program (JASP), and Microsoft Excel (version 16) software. We performed descriptive and frequency analysis, the goodness of fit analysis, correlation analysis, and inferential analysis of factors affecting the perception of pharmacy infection control. The STROBE (Strengthening the reporting of observational studies in epidemiology statement: Guidelines for reporting observational studies) guided the reporting of the results of this study.[21-23]

RESULTS

A total of 435 pharmacists responded to the questionnaire. Of them, one-quarter of the responders were from the central region (97 (22.35%)) and northern region (92 (21.2%)), and there were no statistically significant differences between the regions (p=0.637). Most of the responders belonged to the community pharmacy (81 (18.62%)), Ministry of Health (MOH) hospitals (69 (15.86%)), and military hospitals (49 (11.26%)), with statistically significant differences between working sites (p=0.000). Of the total responders, 212 (48.96%) were female, and 221 (51.04%) were male, and there were no statistically significant differences between the gender (p=0.665). Most of the responders were in the age group of 24–30 years (151 (34.87%)) and 36–40 years (101 (23.33%)), with statistically significant differences between all age groups (p=0.000). Most of the pharmacists were pharmacy staff (192 (44.55%)) and pharmacy supervisors (104 (24.13%)), with statistically significant differences between all positions held (p=0.000). The majority of responders had Bachelor in Pharmacy degree (281 (64.75%)), Master in Pharmacy degree (94 (21.66%)), Diploma in Pharmacy (90 (20.74%)). Most of the pharmacists had work experience of 7–9 years (117 (27.08%)) and 4–6 years (116 (26.85%)), with statistically significant differences between all experience levels (p=0.000). Almost one-fifth of the pharmacists practiced in a clinical pharmacy unit (62 (18.08%)), outpatient pharmacy unit (61 (17.78%)), and inpatient pharmacy unit (555 (16.03%)), with statistically significant differences between all worksites of pharmacy practice (p=0.000). There was a strong positive correlation between age (years) and years of experience at the pharmacy center based on Kendall's tau_b (0.576) or Spearman's rho (0.701) correlation coefficient, with a statistically significant difference between them (p<0.001) (Tables 1 and 2).

The average score for the element "perceptions of pharmacy infection control" was 3.47. The scores for the elements "the system in my healthcare institutions including policy and procedure of pharmacy infection control is good at minimizing the occurrence of infection-related problems inside or outside pharmacy" was 3.96 and "the pharmacy infection control implementation has led to positive changes for patients and healthcare institution" was 3.83. In contrast, the lowest score was obtained for the element "pharmacy infection control should be mandatory" (3.14), followed by The element "I have the opportunity to discuss and receive feedback about my infection control work performance with other staff" (3.21) and "the pharmacy infection control should be optional and paid" (3.21), with statistically significant differences between the responses (p=0.000) (Table 3). The average score for the element "perception of barriers that prevent you from implementing pharmacy infection control" was 3.39. The highest score was obtained for the element "level of clinical knowledge of pharmacy infection control" (4.10), followed by an "uncertain association between the pharmacy infection control and the drug-related infection" (3.65).

In comparison, the lowest scores were obtained for the elements "lack of confidence in discussing pharmacy infection control with the physician" (2.93) and "the pharmacist stated the infection control is too trivial to work" (3.04) with statistically significant difference between the responses (p<0.05). All aspects of physicians' perception of barriers that prevent them from implementing pharmacy infection control showed statistically significant differences between responses (p=0.0000) (Table 4). Most of the recommendations were obtained for the element "facilitating pharmacy infection control implementation was setting up the therapeutic protocol or guidelines for the infection control" (286 (66.20%)) and "implementing medication safety tools of pharmacy infection control" (258 (59.72%)) followed by the element "increase number of pharmacist infection control staff" (254 (58.80%)), and standardized policies and procedures for pharmacy infection control (247 (57.18%)) (Table 5). The scores for single-test reliability analysis of McDonald's ω was 0.838, Cronbach's α was0.837, Gutmann's λ2 was 0.849, Gutmann's λ6 was 0.910, and Greater Lower Bound was 0.960.

Factors affecting the perception of pharmacists about pharmacy infection control and the barriers that prevent implementing pharmacy infection control

Factors affecting the perception of pharmacists about pharmacy infection control were analyzed. We adjusted the significance values using the independent samples Kruskal–Wallis test and the Bonferroni correction for multiple tests. The factors that affect pharmacists' perception about pharmacy infection control include location, worksite, gender, age, practice area, current position held, and years of experience. Two of these factors (gender and position held) did not affect the knowledge of storage, and there was no statistically significant difference between them (p>0.05). The location of the pharmacist might affect the perception of pharmacy infection control. The southern region showed the lowest scores (3.2135), with a statistically significant difference between all regions (p=0.000). The working site might affect the perception of pharmacy infection control with the lowest score (2.9400) obtained for the private primary healthcare centers, with statistically significant difference between the worksites (p=0.000). Age affected the perception of pharmacy infection control, with the lowest score (3.0964) obtained for those in the age group of 41–45 years, with statistically significant difference between them (p=0.000). Practice areas affected the perception of

Table 1: Demographic, social information.

Locations	Response Count	Response Percent	*p*-value (X2)
Central area	97	22.35%	0.637
North area	92	21.20%	
South area	83	19.12%	
East area	79	18.20%	
West area	83	19.12%	
Answered question	**434**		
Skipped question	**1**		
Site of work	**Response Count**	**Response Percent**	***p*-value (X2)**
MOH Hospitals	69	15.86%	0.000
Military hospitals	49	11.26%	
National Gaurd Hospital	25	5.75%	
Security forces hospitals	41	9.43%	
KFSH&RC	2	0.46%	
University hospital	24	5.52%	
MOH primary care centers	23	5.29%	
Private hospitals	25	5.75%	
Private ambulatory care clinics	26	5.98%	
Private primary healthcare center	26	5.98%	
Community pharmacy	81	18.62%	
Pharmaceutical companies	38	8.74%	
Non-employment	3	0.69%	
Intern	3	0.69%	
Answered question	**435**		
Skipped question	**0**		
Gender	**Response Count**	**Response Percent**	
Male	221	51.04%	0.665
Female	212	48.96%	
Answered question	**433**		
Skipped question	**2**		
Age	**Response Count**	**Response Percent**	
24-30	151	34.87%	0.000
31-35	89	20.55%	
36-40	101	23.33%	
41-45	60	13.86%	
46-50	30	6.93%	
> 50	2	0.46%	
Answered question	**433**		
Skipped question	**2**		

Table 2: Demographic, social information.

Pharmacist's Qualifications	Response Count	Response Percent	*p*-value (X2)
Diploma in Pharmacy	1	0.23%	
Bachelor in pharmacy	281	64.75%	
Master	94	21.66%	
Pharm D	90	20.74%	
Ph. D	12	2.76%	
PGY 1	9	2.07%	
PGY 2	15	3.46%	
PGY 3	7	1.61%	
Fellowship	4	0.92%	
Other (please specify)	2	0.46%	
Answered question	**434**		
Skipped question	**1**		
Position Held	**Response Count**	**Response Percent**	
Director of Pharmacy	46	10.67%	0.000
Assistant Director of Pharmacy	51	11.83%	
Supervisor	104	24.13%	
Pharmacy staff	192	44.55%	
Intern	38	8.82%	
Answered question	**431**		
Skipped question	**4**		
Years of experience at Dentists career	**Response Count**	**Response Percent**	
Less than one year	69	15.97%	0.000
1-3	83	19.21%	
4-6	116	26.85%	
7-9	117	27.08%	
10-12	25	5.79%	
>12	22	5.09%	
Answered question	**432**		
Skipped question	**3**		
Pharmacy practice	**Response Count**	**Response Percent**	
Pharmacy administration	1	0.29%	0.000
Inpatient Pharmacy	55	16.03%	
Outpatient Pharmacy	61	17.78%	
Satellite Pharmacy	17	4.96%	
Narcotics and Controlled	22	6.41%	
Extemporaneous Preparation	8	2.33%	
Clinical Pharmacy	62	18.08%	
Inventory Control	26	7.58%	
Drug Information	17	4.96%	
IV admixture	19	5.54%	
Community pharmacy	33	9.62%	
Pharmaceutical companies	22	6.41%	
Answered question	343		
Skipped question	92		

Table 3: The Perception of pharmacy infection control?

	Strongly Disagree		Disagree		Uncertain		Agree		Strongly agree		Total	Weighted Average	*p*-value
The system in my healthcare institutions, including policy and procedure of pharmacy infection control is good at minimizing the occurrence of infection-related problems inside or outside pharmacy	9.49%	41	9.03%	39	11.11%	48	16.90%	73	53.47%	231	432	3.96	0.000
The pharmacy infection control implementation has led to positive changes for patients and healthcare institution	2.78%	12	4.87%	21	20.19%	87	50.58%	218	21.58%	93	431	3.83	0.000
I think there is under-working in pharmacy infection control at the healthcare institutions	1.65%	7	10.85%	46	29.95%	127	34.91%	148	22.64%	96	424	3.66	0.000
The infection control physicians or nurses feel comfortable to ask for help or support from infection control pharmacist colleagues to patients infection control	8.12%	35	19.95%	86	22.74%	98	31.32%	135	17.87%	77	431	3.31	0.000
I have the opportunity to discuss and receive feedback about my infection control work performance with other staff	13.99%	60	19.11%	82	17.72%	76	30.54%	131	18.65%	80	429	3.21	0.000
The pharmacy infection control should be mandatory	14.88%	64	22.33%	96	12.09%	52	35.58%	153	15.12%	65	430	3.14	0.000
The pharmacy infection control Should be optional and paid	10.90%	46	18.01%	76	27.73%	117	26.30%	111	17.06%	72	422	3.21	0.000
Answered											**432**		
Skipped											3		

pharmacy control infection, with the lowest score (2.8083) obtained for the IV admixture area, with a statistically significant difference between them (p=0.000). Years of experience also affected the perception of pharmacists about infection control, with the lowest score (3.1425) obtained for those with an experience of 7–9 years, with statistically significant difference between them (p=0.000). The relationship between perception of pharmacy infection control and factors affecting it include location, worksite, age (years), gender, area, years of experience, and current position held. Using multiple regression models, we assumed that perception of pharmacy infection control as the dependent variable and factors affecting it as the expletory variable. The results showed a weak relationship (R=0.269 p=0.001) between the perception of pharmacy infection control and factors. All factors showed no significant differences between them (p>0.05). However, in multiple regression, one factor (practice area) explained an 18.9% negative relationship to the variation, with a statistically significant difference (p=0.001), which the Bootstrap model confirmed. The relationship was verified by the non-existence of multi-collinearity between the years of experience with variance inflation factor (VIF) of 1.240, which was less than three or five[24-26] (Table 6).

On the contrary, the factors were affecting the barriers to prevent the pharmacy infection control implementation. The adjusted significant values were calculated using independent samples Kruskal–Wallis test and the Bonferroni correction for multiple tests. Various factors might act as barriers and prevent the implementation of pharmacy infection control protocols, including location, worksite, gender, age, practice area, current position held, and experience level. Three factors (gender, age, and experience level) did not affect the implementation of pharmacy infection control protocols, with a non-statistically significant difference between them (p>0.05). Five locations affected the implementation of pharmacy infection control. East region showed the lowest scores (3.1385), with a statistically significant difference between all regions (p=0.000). Fourteen worksites also affected the implementation of pharmacy infection control protocols, with the lowest scores obtained for community pharmacy (3.2062), with a statistically significant difference between all worksites (p=0.000). Twelve practice areas affected the barriers that prevent the implementation of pharmacy infection control, with the lowest score obtained for satellite pharmacy (3.0415) and clinical pharmacy units (3.0674). Five positions affected the implementation of pharmacy infection control, with the lowest score (3.0077) obtained for the position of pharmacy director, and the differences were statistically significant (p=0.000). The relationship between barriers and discourage implementing pharmacy infection control and factors including location, worksite, age (years), pharmacist gender, practice area, years of experience, and current position held. It was revealed through a multiple regression model, which measured the barriers and discouraged implementing pharmacy infection control as the dependent variable and factors measured as the expletory variable. There was a weak relationship (R=0.294 with p=0.000) between barriers preventing implementing pharmacy infection control and its factors. All factors did not show any significant differences (p>0.05). However, three factors, including the responder's age, explained 24.7% negative relationship, current position held illustrated 19.7% positive relationship. Years of experience explained a 17% positive relationship to the variation in the perception of pharmacy infection control, with statistically significant (p=0.002, 0.002, and 0.029, respectively) differences obtained via multiple regression model and confirmed by Bootstrap model. The relationship was verified by the non-existence of multi-collinearity with the years of experience factor with variance inflation factor

Table 4: From the following barriers, which factors may Discourage you to implement pharmacy infection control.

	Strongly Disagree		Disagree		Uncertain		Agree		Strongly agree		Total	Weighted Average	*p*-value
Level of clinical knowledge of pharmacy infection control	4.41%	19	8.35%	36	6.96%	30	33.18%	143	47.10%	203	431	4.10	0.000
Uncertain association between the pharmacy infection control and the drug-related infection	6.50%	28	9.05%	39	17.17%	74	47.33%	204	19.95%	86	431	3.65	0.000
The Pharmacist shred in infection control is too trivial to work	17.02%	73	15.15%	65	24.48%	105	33.57%	144	9.79%	42	429	3.04	0.000
Concern that pharmacy infection control will generate extra work.	2.78%	12	35.73%	154	20.65%	89	32.48%	140	8.35%	36	431	3.08	0.000
An infection control Pharmacist is not available when needed.	12.33%	53	23.26%	100	23.95%	103	26.51%	114	13.95%	60	430	3.07	0.000
Lack of confidence in discussing pharmacy infection control with the physician.	14.42%	62	30.70%	132	13.95%	60	29.30%	126	11.63%	50	430	2.93	0.000
Lack of time to fill the reports of pharmacy infection control.	9.32%	40	15.15%	65	19.81%	85	31.47%	135	24.24%	104	429	3.46	0.000
Unaware of the existence of a national pharmacy infection control system.	8.16%	35	16.55%	71	13.52%	58	38.23%	164	23.54%	101	429	3.52	0.000
I did not know how to practice pharmacy infection control.	12.04%	52	14.58%	63	17.13%	74	31.71%	137	24.54%	106	432	3.42	0.000
Fear of legal liability.	12.53%	54	12.30%	53	20.65%	89	36.19%	156	18.33%	79	431	3.35	0.000
Unaware of the need of pharmacy infection control	13.89%	60	15.97%	69	20.14%	87	26.16%	113	23.84%	103	432	3.30	0.000
Lack of financial reimbursement.	8.10%	35	11.11%	48	26.85%	116	35.88%	155	18.06%	78	432	3.45	0.000
Consider it the doctor's responsibility	7.87%	34	13.43%	58	28.47%	123	35.42%	153	14.81%	64	432	3.36	0.000
The negative consequences associated with pharmacy infection control	7.18%	31	23.61%	102	25.23%	109	31.25%	135	12.73%	55	432	3.19	0.000
Lack of Periodic training of pharmacy staff about forensic pharmacy	5.57%	24	14.85%	64	19.03%	82	35.27%	152	25.29%	109	431	3.60	0.000
The pharmacy infection control is serious and needs accuracy.	5.80%	25	7.42%	32	32.71%	141	30.16%	130	23.90%	103	431	3.59	0.000
The pharmacy infection control was Not taught properly in pharmacy School	9.03%	39	15.05%	65	10.42%	45	41.44%	179	24.07%	104	432	3.56	0.000
Answered												**432**	
Skipped												**3**	

(VIF)=2.330, 1.409, and 2.163, respectively, less than 3 or 5[24-26] (Table 7).

DISCUSSION

Each new pharmacy practice program has positive and negative perceptions before and during implementation.[4-6] Moreover, various barriers and risk factors might prevent or stop the practice of such a program.[4-6] If the pharmacist knows the perception of infection control in the pharmacy practice, it will resolve all the reasons for implementation. In this study, the perception of pharmacists was declared through an electronically validated survey with high reliability and distributed to an equal number of responders in each geographic area. Moreover, the equivalent number of males and females reflected practice in both genders. The survey was distributed by convenient sample methodology, and the calculated sample size was better than the previous study,[16] the representative number of pharmacists in the local country. The responders mainly worked at community or hospital pharmacies, reflecting the difference in pharmacy settings for implementing pharmacy infection control. In this study, the responder had a medium level of work experience with pharmaceutical care career positions, which reflected the perception from the practice and leadership point of view. The average score of pharmacy infection control was positively acceptable. Mostly, they agreed with pharmacy infection control policies and procedures and produced positive outcomes if the program was implemented. While the perception of pharmacists was positive that mandating the pharmacy infection control might be related to the responders not being familiar with the

Table 5: What are your recommendations/suggestions for facilitating the implementation of pharmacy infection control?

Answer Choices	Responses	
Implementation of an electronic pharmacy infection control	144	33.33%
Increase number of pharmacist infection control staff	254	58.80%
Applied the Quality Management standards	156	36.11%
Implement medication safety tools of pharmacy infection control	258	59.72%
Setup up the therapeutic protocol or guidelines for infection control	286	66.20%
Standardized the Pharmacy infection control	189	43.75%
Standardized policy and procedures for pharmacy infection control	247	57.18%
Implement pharmacy infection control at each healthcare institution	234	54.17%
Implement pharmacy infection control residency program	140	32.41%
Other (please specify)	1	0.23%
Answered	**432**	
Skipped	**3**	

program's content. Some responders believed that the program should be optional and paid, showing that they needed more time to work. Besides, the program requires various infection control products and material, and changes in the pharmacy environment might be adequately costly. However, the cost related to infection prevention and dissemination is much higher than the program cost. In this study, we showed that various barriers prevent or delay the implementation of the pharmacy infection control system. The responders agreed that there was a lack of knowledge about pharmacy infection control, which is expected because of a lack of education and training provided during undergraduate or postgraduate courses, as reported in the previous study.[16] Another reason is that most of them do not agree, or there is no clear picture of infection control and drug-related infection. Various parenteral medications preparation might cause infections in patients, and they might die.[27-32] In this study, pharmacists showed a positive attitude toward pharmacy infection control,

Table 6: Multiple regression of Factors with the Pharmacy infection control perception.[a]

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)	.269 [b]	.072	3.677	.001[b]	3.883	0.262		14.833	0.000	3.368	4.398		
	Location					−0.042	0.024	−0.094	−1.726	0.085	−0.089	0.006	0.952	1.051
	Site of work					0.001	0.011	0.006	0.090	0.929	−0.021	0.022	0.743	1.346
	Age (years)					−0.024	0.040	−0.048	−0.591	0.555	−0.102	0.055	0.429	2.329
	Pharmacist gender					0.095	0.073	0.073	1.296	0.196	−0.049	0.239	0.895	1.117
	Practice area					−0.037	0.012	−0.189	−3.205	0.001	−0.060	−0.014	0.806	1.240
	Current Position					9.434E−05	0.036	0.000	0.003	0.998	−0.071	0.071	0.710	1.409
	Years of experiences					−0.048	0.037	−0.102	−1.307	0.192	−0.121	0.024	0.462	2.164

a. Dependent Variable: Pharmacy infection control perception, Predictors [b]: (Constant), Location, Site of work, Age (years), Pharmacist gender, Practice area, years of experience, and current Position

Bootstrap for Coefficients							
Model		B	Bootstrap[a]				
			Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	3.883	0.015	0.274	0.001	3.387	4.480
	Location	−0.042	−0.001	0.023	0.081	−0.090	0.005
	Site of work	0.001	0.000	0.012	0.932	−0.021	0.024
	Age (years)	−0.024	−0.002	0.049	0.620	−0.127	0.062
	Pharmacist gender	0.095	−0.004	0.073	0.203	−0.055	0.230
	Practice area	−0.037	0.000	0.012	0.003	−0.062	−0.016
	Current Position	9.434E−05	−0.001	0.036	0.997	−0.075	0.068
	Years of experiences	−0.048	0.001	0.044	0.287	−0.133	0.037

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

Table 7: Multiple regression of Factors with Barriers and Discourage to implement pharmacy infection control.[a]

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)	.294 b	.087	4.482	.000b	3.337	0.220		15.155	0.000	2.903	3.770		
	Location					−0.032	0.020	−0.085	−1.577	0.116	−0.072	0.008	0.951	1.051
	Site of work					−0.009	0.009	−0.062	−1.021	0.308	−0.028	0.009	0.740	1.351
	Age (years)					−0.104	0.034	−0.247	−3.079	0.002	−0.170	−0.037	0.429	2.330
	Pharmacist gender					−0.108	0.062	−0.097	−1.747	0.082	−0.229	0.014	0.895	1.117
	Practice area					0.016	0.010	0.093	1.582	0.114	−0.004	0.035	0.802	1.248
	Current Position					0.096	0.030	0.197	3.162	0.002	0.036	0.156	0.710	1.409
	Years of experiences					0.068	0.031	0.170	2.198	0.029	0.007	0.130	0.462	2.163

a. Dependent Variable: Barriers and Discourage to implement pharmacy infection control, Predictors [b]: (Constant), Location, Site of work, Age (years), Pharmacist gender, Practice area, years of experience, and current Position

Bootstrap for Coefficients							
Model		B	Bootstrap[a]				
			Bias	Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	3.337	−0.007	0.252	0.001	2.814	3.811
	Location	−0.032	0.001	0.022	0.142	−0.073	0.010
	Site of work	−0.009	0.000	0.010	0.331	−0.028	0.010
	Age (years)	−0.104	−0.001	0.031	0.001	−0.167	−0.048
	Pharmacist gender	−0.108	0.002	0.066	0.105	−0.228	0.020
	Practice area	0.016	0.000	0.010	0.115	−0.004	0.036
	Current Position	0.096	0.000	0.026	0.001	0.044	0.147
	Years of experiences	0.068	0.000	0.026	0.014	0.019	0.118

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

an essential program in pharmacy practice. The majority of responders recommended establishing protocol or guidelines about pharmacy infection control which is not widely documented.[33-36] Moreover, they suggested standardized preparation skills and tools prevent infection, set up policies and procedures for pharmacy infection control, and increase the number of pharmacists working in this field. All previous suggestions are very critical for the implementation of pharmacy infection control in Saudi Arabia.

Factors affecting the pharmacist's perception of pharmacy infection control

Various factors might affect the perception of pharmacists about pharmacy infection control. Based on the location of the pharmacist, the southern region showed the lowest perception due to inadequate implementation of pharmacy infection control practices. The worksite of the pharmacists was another factor that affected the perception with statistically significant differences between private primary healthcare centers and hospital pharmacy sections. Older age and work experience of 7–9 years showed the lowest perception of pharmacy infection control, related to insufficient practice or inadequate education and training in pharmacy infection control. The intravenous admixture area had lower perception among other practices areas, which might be associated with inadequate infection control services at healthcare organizations. The regression analysis revealed that the practice area was negatively affected with 18% because they always need help from infection control to guide the policy and procedures and for education and training. However, the department of infection control properly did not provide adequate services to pharmacy departments.

On the contrary, additional factors might affect the perception of barriers that prevent the implementation of pharmacy infection. The location of the pharmacist might affect the perception of obstacles, and there was a lower perception in the eastern region than that of other regions; however, there are not many barriers to preventing the program's foundation. The worksite of the pharmacist was another factor that might influence the perception of obstacles to the implementation of pharmacy infection control. The lowest score of perception of barriers was community pharmacy, related to the acceptable and implemented the pharmacy infection control services without various obstacles. The factors related to the practice area emphasize satellite pharmacy or clinical pharmacy departments, which showed the lowest score because they participate with medical teams. The current position held is another factor that might affect the perception. The director of the pharmacy showed a lower perception, which is expected because most of the existing barriers might resolve through the pharmacy director. Age was found to be a negative dependent factor

with 24% of which the perception of obstacles reduced by increasing the age because they had enough knowledge and experiences lead to an agreement to implement the infection control services in the pharmacy practice. The position held showed a positive correlation with perception of barriers, which increased by higher jobs with 19% because the pharmacy leaders are aware of barriers existing and thus improves the score of perception. Moreover, the experience was a positive dependent factor with 17% increases the perception because they had enough experience to discover and be aware of the pharmacy infection control obstacles.

Limitations

The results of this study provided valuable information and reflected the current practice of pharmacy infection control in Saudi Arabia. Moreover, the study showed high reliability with expert validated revision and acceptable sample size. However, there was unequal study distribution of demographic information such as age, years of experience, current position held, worksite, and practice areas. Moreover, there are few studies to compare with the results of this study. Therefore, we recommend future studies with comparable demographic data.

CONCLUSION

The perception of pharmacists about pharmacy infection control was found to be satisfactory in Saudi Arabia. However, various factors might affect the perception, such as age, years of experience, and practice site. Other factors such as geographic location and worksite varied depending on the implementation of pharmacy infection control. The performance of pharmacy infection control services will change the perception of responders toward the positive side.

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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 is 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; **SPSS:** Statistical package of social sciences; **JASP:** Jeffery's Amazing Statistics Program; **STROBE:** Strengthening the reporting of observational studies in epidemiology; **VIF:** Variance Inflation Factor.

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