Practice of Cardiopulmonary Resuscitation Services by Pharmacists in Saudi Arabia

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

Samah Mukhlef Alzaid, Bsc.Pharm, Clin.Pharm,
Clinical Pharmacy Services, Gurayat General Hospital, Ministry of Health, Gurayat, SAUDI ARABIA.

Wafa Hussain Alshehre, Pharm.D, BCSP,
Drug information clinical pharmacy specialist Pharmacy Department, Aliman Hospital, Ministry of Health, Riyadh, SAUDI ARABIA.

Rola AL Kenani, BSc. Pharm, SSC-PhP,
Nephrology Pharmacotherapy Specialist Riyadh, SAUDI ARABIA.

Khawlah Ibrahim Alshahrani,
Pharm D,
College of Pharmacy, Taif university, Taif, SAUDI ARABIA.

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

Phone no: +966 504417712
E-mail: yalomi@gmail.com

Received: 18-01-200;

Accepted: 01-05-2022;

Access this article online

www.ijpcs.net

DOI: 10.5530/ijpcs.2022.11.20

ABSTRACT

Objectives: To explore the pharmacist practice of CPR services in Saudi Arabia. **Materials and Methods:** The study analyzed a cross-sectional survey that discussed the Pharmacist practice of Cardiopulmonary Resuscitation (CPR) in Saudi Arabia. The survey consisted of respondents' demographic information about pharmacists, The availabilities of CPR teams, and pharmacist participation in the teams. The hospital's specialties had pharmacy personnel participate with the CPR code. Besides activities the pharmacist provides during CPR code, medications are mainly used for CPR code and *pharmacy CPR services implementations*. 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 carried out with the study. The data analysis of the Pharmacist practice of Cardiopulmonary Resuscitation (CPR) 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 were implemented. **Results:** A total number of 439 pharmacists responded to the questionnaire. Of them, more than one-third responded from the Central region (122 (31.69%)), one Quarter responded from the Eastern part (91 (23.64%)), and one-fifth responded from the southern region (79 (20.52%)). Males responded more than females (203 (53.14%)) versus 179 (46.86%)), with statistically non-significant differences between all levels (p=0.219). Most of the responders were in the age group of 36-45 years (152 (39.48%)) and 46-55 years (134 (34.81%)), with statistically significant differences between all age groups (p=0.000). The majority of pharmacists had training courses in Basic Life Support (BLS) (293 ((77.11%)), Advance Cardiac Life Support (ACLS) (289 ((76.05%)), Pediatric Cardiac Life Support (PCLS) (287((75.53%)), and Neonatal Cardiac Life Support (NCLS) (203 ((53.42%)), with statistically significant differences between all levels (p=0.000). Most pharmacists participated with CPR code with Adults CPR team 317 (81.07%), Neonates CPR team 236 (59.75%), and Pediatric CPR team 230 (58.08%). Most hospital specialties had pharmacy personnel and participated with CPR code: Emergency 339 (86.26%) and Medical (76.59%). The activities provided during the CPR code by pharmacists mostly were the Administration of medications 314 (71.69%), Preparation and dispensing of medications 278 (63.47%), and Providing drug information 267 (60.96%). During ACLS, the most used medicines were Amiodarone 326 (77.99%), Dobutamine 323 (74.94%), and Procainamide 304 (74.33%). The average score of implemented items for CPR services was (4.09). The "Mission of CPR" element obtained the highest score (4.23). The aspect "The vision of CPR including the (ACLS-PCLS-NCLS)" was (4.18). In contrast, the lowest score was obtained for the element "Policy and procedure of CPR" (3.94). The score for the component "The strategic plan of CPR" was (4.02), with a statistically significant difference between the responses (p<0.009). **Conclusion:** The pharmacist's full practice in CPR services is insufficient at most healthcare organizations. Pharmacist participation in the CPR code with whole provides distributive and clinical services that are highly demanded to prevent drug misadventures and improve patient clinical outcomes in the kingdom of Saudi Arabia.

Keywords: Practice, Cardiopulmonary Resuscitation, Services, Pharmacists, Saudi Arabia.

INTRODUCTION

The pharmacist plays a vital role in patient outcomes and the healthcare system locally or internationally.[1-9] The pharmacist prevents drug-related problems and avoids unnecessary economic burdens on healthcare services.[1-9] Those various services validated the pharmacist role, including but not limited to providing drug information, offering poisoning and control services, drug investigational research, and drug utilization and evaluation procedures.[2,3] One of the good services that can save a life is participating in the CPR code system at healthcare organizations.[2,3] The pharmacist can provide medication and drug information. Moreover, adjusting dosing requirements and preventing drug-related problems.[1,10-13] The pharmacist monitors all CPR medications at nursing facilities in various medical and surgical care. The pharmacist might participate through neonatal, pediatric, and adult CPR codes.[1,10-14]

The pattern practice of pharmacists within the CPR code at the local level and in the gulf and Arabic countries is not adequately documented.[14] Exploring the pharmacist's performance during an emergency is required to improve the pharmacist's role in CPR services and provide the best pharmaceutical care. The objective of the current cross-sectional assessment is to explore the pharmacist practice in CPR practice in Saudi Arabia.

Methods

It analyzes a cross-sectional survey that discussed the Pharmacist practice of Cardiopulmonary Resuscitation (CPR) 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, The availabilities of CPR teams, and pharmacist participation in the teams. The hospital's specialties had pharmacy personnel participate with the CPR code. Besides, activities the pharmacist provides during CPR code, medications mainly used for CPR code, and *pharmacy CPR services implementations*.[10-19] 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%.[20-22] The response rate required for the calculated sample size is at least 60-70 % and above.[22,23] The survey was distributed through social media such as whatsapp 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 carried out with the study. The data analysis of the Pharmacist practice of Cardiopulmonary Resuscitation (CPR) 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 correlation analysis. Beside, inferential analysis of factors affecting *pharmacy CPR services implementations* 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.[24,25]

RESULTS

A total number of 439 pharmacists responded to the questionnaire. Of them, more than one-third responded from the Central region (122 (31.69%)) one Quarter responded from the Eastern region (91 (23.64%)), and one-fifth responded from the southern region (79 (20.52%)), with statistically significant differences between the provinces (p=0.000). Most of the responders were from University hospitals (91 (20.92%)), National Guard Hospitals (80 (18.39%)), and Private ambulatory care clinics (68 (15.63%)), with a statistically significant difference between working sites (p=0.000). Males responded more than females (203 (53.14%)) versus 179 (46.86%)), with statistically non-significant differences between all levels (p=0.219). Most of the responders were in the age group of 36-45 years (152 (39.48%)) and 46-55 years (134 (34.81%)), with statistically significant differences between all age groups (p=0.000). Most of the responders held Doctor of Philosophy (130 (34.21%)), Pharm D (89 (23.42%)), Bachelor Pharmacy (73 (19.21%)), Postgraduate year three PGY-3 (66 (17.37%)), and Doctor of Philosophy in Pharmacy (65 (14.01%)). Most pharmacists had a work experience of 1-3 years (82 (21.41%)), 4-6 years (80 (20.89%)), and less than one year (74 (19.32%%)), with a statistically non-significant difference between years of experience (p=0.364). Most of pharmacists works at outpatient pharmacy (248 ((65.26%)), Inpatient Pharmacy (237 ((62.37%)), Satellite Pharmacy (224 ((58.95%)), and Narcotics (204 ((53.68%)). The majority of pharmacists had training courses in Basic Life Support (BLS) (293 ((77.11%)), Advance Cardiac Life Support (ACLS) (289 ((76.05%)), Pediatric Cardiac Life Support (PCLS) (287 ((75.53%)), and Neonatal Cardiac Life Support (NCLS) (203 ((53.42%)), with statistically significant differences between all levels (p=0.000). There was a medium positive correlation between age (years) and academic qualifications based on Kendall's tau_b (0.426) and Spearman's rho (0.511) correlation coefficients, with a statistically significant difference between the two factors (p<0.000). There was a medium positive correlation between site of work and academic qualifications based on Kendall's tau_b (0.524) and Spearman's rho (0.553), with a statistically significant difference between the two factors (p<0.000) (Tables 1 and 2).

Almost half of the responder's pharmacist organizations had CPR Adults CPR team 212 (51.83%), Neonates CPR team 188 (47.47%), and Pediatric CPR team 188 (46.70%). Most pharmacists participated with CPR code with Adults CPR team 317 (81.07%), Neonates CPR team 236 (59.75%), and Pediatric CPR team 230 (58.08%) (Table 3). Most hospital specialties had pharmacy personnel and participated with CPR code: Emergency 339 (86.26%) and Medical (76.59%). They were followed by critical care 257 (65.39%) and Surgical department 245 (62.34%). In contrast, the minor department with pharmacy personnel who participated in the CPR code was inpatient pharmacy 34 (8.65%) and Anesthesia section 88 (21.37%) (Table 4). The most activities provided during the CPR code by the pharmacist were the Administration of medications 314 (71.69%), Preparation and dispensing of medications 278 (63.47%), and Providing drug information 267 (60.96%) (Table 5). During ACLS, the most used medicines were Amiodarone 326 (77.99%), Dobutamine 323 (74.94%), and Procainamide 304 (74.33%). During PCLS, the most used medicines were Vasopressin 279 (51.57%), Dextrose 50% 281(50.63%), and Calcium chloride 10 % 156 (36.88%). During NCLS, the most used medication was Isoproterenol 60 (14.93%), Procainamide 60 (14.67%), and Sodium Nitroprusside 48 (11.62%) (Table 6). The average score of implemented items for CPR services was (4.09). The "Mission of CPR" element obtained the highest score (4.23). The aspect "The vision of CPR including the (ACLS-PCLS-NCLS)" was (4.18). In contrast, the lowest score was obtained for the element "Policy and procedure of CPR" (3.94). The score for the component "The strategic plan of CPR" was (4.02), with a statistically significant difference between the responses (p<0.009). All aspects of the practice of pharmacists about implemented items for CPR services were statistically significant between responses (p<0.000) (Table 7). The score for single-test reliability analysis of McDonald's ω was 0.967, Cronbach's α was 0.968, Gutmann's was λ2, 0.968, Gutmann's λ6 was 0.972, and Greater Lower Bound was 0.983 with statistically significant (p<0.05).

Factors affecting the pharmacy CPR services implementations

Factors affecting the practice were analyzed. We adjusted the significant values using the independent samples Kruskal–Wallis test and the Bonferroni correction for multiple tests. Pharmacy CPR services implementations include location, worksite, age, gender, Academic qualifications, years of experience, present of adults, pediatrics, and neonate CPR teams at an institution. Besides, Participations in the Adult, Pediatrics, and Neonates CPR

Table 1: Demographic, social information.

Nationality	Response Count	Response Percent	*p*-value (X2)
Central area	122	31.69%	0.000
North area	64	16.62%	
South area	79	20.52%	
East area	91	23.64%	
West area	29	7.53%	
Answered question	**385**		
Skipped question	**54**		
Site of work	**Response Count**	**Response Percent**	***p*-value (X2)**
MOH Hospitals	44	10.11%	0.000
Military hospitals	13	2.99%	
National Gaurd Hospital	80	18.39%	
Security forces hospitals	19	4.37%	
University Hospital	91	20.92%	
MOH primary care centers	65	14.94%	
Private hospitals	25	5.75%	
Private ambulatory care clinics	68	15.63%	
Private primary healthcare center	3	0.69%	
Community pharmacy	19	4.37%	
Pharmaceutical company	6	1.38%	
University	2	0.46%	
Answered question	**435**		
Skipped question	**4**		
Gender	**Response Count**	**Response Percent**	
Male	203	53.14%	0.219
Female	179	46.86%	
Answered question	**382**		
Skipped question	**57**		
Age	**Response Count**	**Response Percent**	
24–35	94	24.42%	0.000
36–45	152	39.48%	
46–55	134	34.81%	
> 55	5	1.30%	
Answered question	**385**		
Skipped question	**54**		

Table 2: Demographic, social information.

The last academic qualifications	Response Count	Response Percent	*p*-value (X2)
Bachelor Pharm	73	19.21%	0.000
Pharm D	89	23.42%	
Master	18	4.74%	
Ph D	130	34.21%	
Residency R1	2	0.53%	
Residency R2	2	0.53%	
Residency R3	66	17.37%	
Fellowship	0	0.00%	
Answered question	**380**		
Skipped question	**59**		
Years of experiencing a pharmacy career	**Response Count**	**Response Percent**	
< 1	74	19.32%	0.364
1 – 3	82	21.41%	
4 – 6	80	20.89%	
7 - 9	62	16.19%	
> 9	85	22.19%	
Answered question	**383**		
Skipped question	**56**		
The practice area	**Response Count**	**Response Percent**	
Inpatient Pharmacy	237	62.37%	
Outpatient Pharmacy	248	65.26%	
Satellite Pharmacy	224	58.95%	
Narcotics	204	53.68%	
IV admixture	137	36.05%	
Extemporaneous Preparation	72	18.95%	
Clinical Pharmacy	90	23.68%	
Inventory Control	75	19.74%	
Drug Information	13	3.42%	
Emergency pharmacy	5	1.32%	
Medication safety	5	1.32%	
Repacking	4	1.05%	
Pharmacy Education and Training	134	35.26%	
Pharmacy Research	121	31.84%	
Primary care pharmacy	56	14.74%	
Community pharmacy	64	16.84%	
Answered question	**380**		
Skipped question	**59**		
Did you take any of the following training courses	**Response Count**	**Response Percent**	
Basic Life Support (BLS)	293	77.11%	0.000
Advance Cardiac Life Support (ACLS)	289	76.05%	
Pediatric Cardiac Life Support (PCLS)	287	75.53%	
Neonatal Cardiac Life Support (NCLS)	203	53.42%	
Nothing	6	1.58%	
Answered question	**380**		
Skipped question	**59**		

Table 3: Do you have CPR teams at your institution.									
	Yes		No		I do not know		Total	Weighted Average	*p*-value (X2)
Adults CPR team	51.83%	212	42.05%	172	6.11%	25	409	2.46	0.000
Pediatric CPR team	45.97%	188	46.70%	191	7.33%	30	409	2.39	0.000
Neonates CPR team	47.47%	188	43.94%	174	8.59%	34	396	2.39	0.000
Answered							**415**		
Skipped							**24**		
Have you ever participated in any CPR code									
	Yes		No		I do not know		Total	Weighted Average	*p*-value (X2)
Adults CPR team	81.07%	317	13.04%	51	5.88%	23	391	2.75	0.000
Pediatric CPR team	58.08%	230	37.88%	150	4.04%	16	396	2.54	0.000
Neonates CPR team	59.75%	236	20.00%	79	20.25%	80	395	2.40	0.000
Answered							**407**		
Skipped							**32**		

Table 4: The type of hospital's specialties the pharmacist participates with CPR code.			
No		Responses	
1.	Critical Care	257	65.39%
2.	Emergency	339	86.26%
3.	Medical	301	76.59%
4.	Surgical	245	62.34%
5.	Pediatrics	148	37.66%
6.	Anesthesia	84	21.37%
7.	Psychiatry	144	36.64%
8.	Obstetrics and Gynecology	153	38.93%
9.	Family medicine	91	23.16%
10.	Ambulatory care	146	37.15%
11.	Outpatient pharmacy	88	22.39%
12.	Inpatient pharmacy	34	8.65%
	Answered	**393**	
	Skipped	**46**	

Table 5: The pharmacist provides most activities during the CPR code.			
NO		Responses	
1.	Providing drug information	267	60.96%
2.	Preparation and dispensing of medications	278	63.47%
3.	Administration of medications	314	71.69%
4.	Record administration of medications	169	38.58%
5.	Chest compressions	141	32.19%
6.	measure intervals during drug administration	98	22.37%
7.	check the heart rhythm	71	16.21%
8.	Calculate the dose and IV drip rate	235	53.65%
9.	Setting infusion pump	161	36.76%
10.	Provide extra stock for CPR medications	37	8.45%
11.	Provide mini bags for the CPR team	23	5.25%
	Answered	**438**	
	Skipped	**1**	

teams at an institution, and Participations in the Neonates CPR team. The north region showed the lowest scores (1.1469), with statistically significant differences between regions (p=0.000). Twelve worksites affected the pharmacy CPR services implementations. The working site affected the factors of pharmacy CPR services implementations. The lowest scores (1.5377) and (1.5472) were obtained from University hospitals and National Guard Hospitals, respectively, with statically significant differences among all sites (p=0.0.00). The gender female (2.5060) was more affected by pharmacy CPR services implementations than males (1.6570), with statistically significant differences between them (p=0.000). The age of the responders affected the pharmacy CPR services implementations. Pharmacists aged 46-55 showed the lowest score (1.1240), with a statistically significant difference between all age groups (p=0.000). Eight levels of the last academic qualifications affected the pharmacy CPR services implementations, with the lowest score (1.1310) obtained for the Ph.D. with a statistically significant difference between all levels (p=0.000). Five levels of work experience did not affect the pharmacy CPR services implementations with non-statically significant differences among all levels (p=176). The pharmacist does not know about the presence of Adults CPR team at the institution (4.0903) or the presence of Adults CPR team at the institution (2.2662) affected pharmacy CPR services implementations with a statistically significant difference between all answers (p=0.000). The pharmacist does not know about the presence of a pediatrics CPR team at an institution (4.5952) affected pharmacy CPR services implementations with a statistically significant difference between all answers (p=0.000). The pharmacist does not know about the presence of the neonatal CPR team at the institution (4.4499), or the presence of the neonatal CPR team at the institution (2.0040) affected pharmacy CPR services implementations with a statistically significant difference between all answers (p=0.000). The pharmacist who participated in the Adults CPR code with the lowest score (1.6133) affected pharmacy CPR services implementations with a statistically significant difference between all answers (p=0.000). The pharmacist who participated in the pediatrics CPR code with the lowest score (1.1469) affected pharmacy CPR

Table 6: The medications are primarily used for CPR code.

NO		ACLS		PCLS		NCLS		I do not know		None of them		Total	Weighted Average
1.	Epinephrine 1:10,000	341	72.71%	40	8.53%	47	10.02%	36	7.68%	5	1.07%	469	4.44
2.	Lidocaine 2%	333	72.23%	42	9.11%	32	6.94%	40	8.68%	14	3.04%	461	4.39
3.	Amiodarone	326	77.99%	28	6.70%	18	4.31%	41	9.81%	5	1.20%	418	4.50
4.	Dopamine	325	73.36%	40	9.03%	43	9.71%	29	6.55%	6	1.35%	443	4.47
5.	Dobutamine	323	74.94%	39	9.05%	24	5.57%	34	7.89%	11	2.55%	431	4.46
6.	Procainamide	304	74.33%	23	5.62%	11	2.69%	60	14.67%	11	2.69%	409	4.34
7.	Isoproterenol	248	61.69%	77	19.15%	9	2.24%	60	14.93%	8	1.99%	402	4.24
8.	Epinephrine 1:1000	253	61.56%	94	22.87%	22	5.35%	41	9.98%	1	0.24%	411	4.36
9.	Atropine sulfate	206	49.28%	148	35.41%	27	6.46%	34	8.13%	3	0.72%	418	4.24
10.	Calcium chloride 10 %	203	47.99%	156	36.88%	24	5.67%	35	8.27%	5	1.18%	423	4.22
11.	Vasopressin	206	38.08%	279	51.57%	15	2.77%	38	7.02%	3	0.55%	541	4.20
12.	Dextrose 50%	207	37.30%	281	50.63%	38	6.85%	25	4.50%	4	0.72%	555	4.19
13.	Magnesium Sulfate 10%	206	49.52%	146	35.10%	34	8.17%	28	6.73%	2	0.48%	416	4.26
14.	Norepinephrine	211	49.30%	146	34.11%	25	5.84%	37	8.64%	9	2.10%	428	4.20
15.	Glucagon	256	62.14%	86	20.87%	26	6.31%	36	8.74%	8	1.94%	412	4.33
16.	Sodium Bicarbonate 1 meq/ml	259	62.41%	90	21.69%	27	6.51%	32	7.71%	7	1.69%	415	4.35
17.	Adenosine	255	63.12%	91	22.52%	16	3.96%	39	9.65%	3	0.74%	404	4.38
18.	Dextrose 10%	249	58.18%	51	11.92%	91	21.26%	34	7.94%	3	0.70%	428	4.19
19.	Milrinone	242	60.80%	27	6.78%	85	21.36%	37	9.30%	7	1.76%	398	4.16
20.	Sodium Nitroprusside	251	60.77%	21	5.08%	90	21.79%	48	11.62%	3	0.73%	413	4.14
21.	Sodium chloride 0.9% 10 ml	254	59.76%	43	10.12%	95	22.35%	30	7.06%	3	0.71%	425	4.21
	Answered											**429**	
	Skipped											**10**	

Table 7: Do you have the following implemented items for CPR services.

NO		76-100 % implemented		51-75 %		25-50 %		< 25 %		We do not have any of it		I do not know		Total	Weighted Average	*p*-value (X2)
1.	The vision of CPR, including the (ACLS-PCLS-NCLS)	67.90%	294	4.16%	18	5.31%	23	9.01%	39	6.00%	26	7.62%	33	433	4.18	0.000
2.	Mission of CPR	55.56%	240	19.68%	85	6.94%	30	8.56%	37	3.70%	16	5.56%	24	432	4.23	0.000
3.	The strategic plan of CPR	55.76%	237	5.88%	25	21.18%	90	5.41%	23	4.94%	21	6.82%	29	425	4.02	0.000
4.	The annual plan of CPR	56.46%	236	3.83%	16	6.70%	28	21.05%	88	3.35%	14	8.61%	36	418	4.15	0.000
5.	Policy and procedure of CPR	56.69%	233	5.11%	21	19.71%	81	4.38%	18	7.54%	31	6.57%	27	411	3.94	0.000
6.	CPR pharmacist competency	56.76%	231	3.93%	16	19.41%	79	8.35%	34	4.67%	19	6.88%	28	407	4.05	0.000
7.	CPR pharmacy quality management	58.12%	229	5.08%	20	21.83%	86	4.31%	17	3.55%	14	7.11%	28	394	4.08	0.000
	Answered													**441**		
	Skipped													**3**		

services implementations with a statistically significant difference between all answers (p=0.000). The pharmacist who participated in the neonatal CPR code with the lowest score (1.1957) affected pharmacy CPR services implementations with a statistically significant difference between all answers (p=0.000).[26-28]

The relationship between the implemented items for CPR services and factors such as location, worksite, age (years), gender, academic qualifications, years of experience in a pharmacy career, present of adults, pediatrics, and neonate CPR teams at an institution. Besides, Participations in the Adult, Pediatrics, and Neonates CPR teams at an institution. The multiple regression analysis considered perception as the dependent variable and factors affecting it as an expletory variable. There was a medium relationship (R=0.870 with p=0.000) between the basic knowledge of the Cardiopulmonary Resuscitation (CPR) medications and its factors. Eight out of twelve were non-significant differences (p>0.05). However, multiple regression analysis confirmed that one factor (i.e., age) explained 29.7 % of the negative relationship to the variation in perception, with a statistically significant difference (p=0.000). Therefore, the bootstrap model was also confirmed. Furthermore, the relationship was verified by the non-existence of multicollinearity with a variance inflation factor (VIF) of 2.540, less than three or five as a sufficient number of VIF.[26-28] Besides, three factors (i.e., work site, Participate of Adults CPR team at an institution, and Participate of pediatrics CPR team at the institution) explained 24.4%, 17.2%, and 27.3%, respectively, of the positive relationship to the variation in knowledge, with a statistically significant difference (p=0.000), (p=0.000), and (p=0.000). Therefore, the bootstrap model was also. Furthermore, the non-existence of multicollinearity verified the relationship with a variance inflation factor (VIF) of 1.825 and 2.442, respectively less than three or five as an adequate number of VIF. Except, Participate of the Pediatrics CPR team at the institution had an existence of multicollinearity with a variance inflation factor (VIF) of 5.384 (Table 8).[26-28]

DISCUSSION

The Cardiopulmonary Resuscitation team usually consisted of physicians, nurses, pharmacists, and respiratory therapists.[29,30] Each member had a specific role inside the team during the call of CPR code, also known as, code blue.[29,30] The CPR code should cover all hospital departments, sections, and overall patients during admission or when visiting the healthcare institutions at emergency and ambulatory care clinics.[29,30] The pharmacist roles vary from one Healthcare organization to another. For example, the pharmacist might be responsible for CPR supply only at some institutions and might be involved in participating during the code and preparation of the medications and provide any inquiries about drug information.[10-13] The current study explored the pharmacist's performance with CPR medication and healthcare organizations' coverage of adult, pediatric, and neonatal patients. The study was a cross-sectional survey distributed to all pharmacists covering all various demographic parameters inside pharmacy society, similar to previous studies.[10-13] Besides, it had reliability results better than the earlier studies,[10-13] appropriately calculated sample size better than previous studies and lower than one published report.[10-13]

The finding showed that only 50% of respondents had CPR teams, and the majority participated with Adults CPR code better than previously published locally and internationally[10,12,14] which might mean there is an improvement in the services which was similar findings of another study.[13] In contrast, two-thirds of responders participated in pediatrics and neonatal CPR codes. That means some hospitals did not implement CPR teams, or the doctor responded to the CPR code with an organized official team. Most pharmacists had trained in ACLS, PCLS, and NCLS better than previous findings.[11,12] Both studies were old-dated, while the same results were in recent publications.[10] Besides, they had experiences sharing an adult CPR team which good pharmacy services. However, less participation in pediatrics or neonatal CPR team due to the hospital not providing pediatric services or the pharmacy not covering them, or no expert pharmacist is sharing the teams, similar to a previous local study.[14] The pharmacist participated with the CPR team in common occurrences the CPR cases such as emergency, critical care, medical and surgical departments. In contrast, the pharmacist less frequently participated with the CPR team in the anesthesia section, which is related to the absence of pharmacy services provided to that department. The activities provided during the CPR code by the pharmacist were medication administration, preparation and dispensing of drugs, provision of drug information, and dose and IV drip rate calculations similar to previous findings in the earlier studies,[10-13] which was the prominent role of pharmacist during CPR code. In contrast, the documentation of pharmacist's activities, such as medication administration records or measuring the interval during administration, was less frequently done during CPR, similar to past studies.[10]

The study findings showed that most medications used during the CPR codes depended on the type of code provided to adults, pediatrics, and neonatal patients and expected according to the American Heart Association (AHA) and other international guidelines.[31-34] Moreover, the average score items implemented for the CPR code were good. The most thing that was implemented for CPR services by the pharmacy department was the vision and mission of CPR services. In contrast, the policy and procedures with strategic plans are less frequently applied. That means discrepancies in the pharmacist's role in the CPR code and future vision of pharmacy settings were not discussed in the pharmacy practice. Besides, there is not much improvement in CPR services provided by the pharmacy. Thus, there is no previous investigation to compare with the current findings

Various factors of demographic parameters might affect the item implementations of the CPR code. The location might affect the practice of performances, with the lowest score being from the northern area. That's related to not adequately implementing the items of CPR code services. The working sites that might affect the practice with the lowest scores were university and national guard hospitals. That might be related to some items such as vision, mission, or an annual or strategic plan. Otherwise, the team might have existed, and active pharmacist participation but missed some organization items plan. The female might be involved in the practice more than the male. That might be related to CPR responsibilities by female pharmacists. The age and academic qualifications might affect the implementation practice with the lower score with age-old pharmacists 46-56 years and Ph.D. holders. That's expected because most of those ages are leaders not involved in pharmacy operations, clinical practice, or clinical research. Besides, those ages are utilized for planning administration and study of CPR code services more than providing clinical services. The presence of CPR in all types of teams might be affected by increased practice improvement than not presence. That's expected because the presence of teams might improve the practice through frequent applications of CPR codes and remove all barriers to implementation. The pharmacist participating in all types of the team might negatively affect practice implementations due busy schedules of pharmacists or the CPR teams not being interested in changing, or the pharmacist's role is not sufficient to improve

Table 8: Multiple regression of Factors with the implemented items for pharmacy CPR services.

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)	.870 [b]	.756	92.598	.000[b]	-.204	.283		-.721	.471	-.761	.353		
	Location					.002	.039	.002	.054	.957	-.074	.079	.528	1.895
	Site of work					.138	.020	.244	6.926	.000	.099	.177	.548	1.825
	Age (years)					-.560	.078	-.297	-7.153	.000	-.713	-.406	.394	2.540
	Pharmacist gender					-.156	.098	-.054	-1.597	.111	-.349	.036	.605	1.652
	Academic qualifications					-.036	.041	-.050	-.889	.374	-.117	.044	.214	4.674
	Years of experience in a pharmacy career					.003	.028	.003	.106	.916	-.051	.057	.934	1.071
	Presence of Adults CPR team at the institution					-.300	.127	-.115	-2.352	.019	-.551	-.049	.287	3.483
	Presence of the Pediatrics CPR team at the institution					.242	.178	.099	1.362	.174	-.107	.591	.129	7.733
	Presence of the Neonates CPR team at the institution					.510	.146	.217	3.493	.001	.223	.797	.176	5.674
	Pharmacist's participation in the Adult CPR team at the institution					.496	.118	.172	4.224	.000	.265	.728	.410	2.442
	Pharmacist's participation in the Pediatrics CPR team at the institution					.737	.164	.273	4.509	.000	.416	1.059	.186	5.384
	Pharmacist's participation in the Neonates CPR team at the institution					.398	.133	.221	3.006	.003	.138	.659	.126	7.963

a. Dependent Variable: implemented items for pharmacy CPR services, Predictors: (Constant), Location, Age (years), Pharmacist gender, Position Held, and Years of experience in a pharmacy career, Presence of Adults CPR team at the institution, presence of pediatrics CPR team at the institution, presence of neonatal CPR team at the institution, Pharmacist's participation in the Adult CPR team at the institution, Pharmacist's involvement in the pediatrics CPR team at the institution, and Pharmacist's participation in the neonatal CPR team at the institution presence of Health insurance coverage, Years of Health insurance coverage.

Bootstrap for Coefficients							
Model		B	Bias	Bootstrap[a]			
				Std. Error	Sig. (2-tailed)	95% Confidence Interval	
						Lower	Upper
1	(Constant)	-.204	-.013	.352	.552	-.919	.471
	Location	.002	.009	.075	.980	-.136	.164
	Site of work	.138	-.001	.037	.004	.063	.212
	Age (years)	-.560	.009	.112	.001	-.766	-.328
	Pharmacist gender	-.156	.008	.128	.242	-.397	.098
	Academic qualifications	-.036	-.002	.070	.594	-.181	.089
	Years of experience in a pharmacy career	.003	-.001	.026	.913	-.050	.051
	Presence t of Adults CPR team at the institution	-.300	.001	.180	.088	-.639	.076
	Presence of the Pediatrics CPR team at the institution	.242	-.039	.377	.493	-.646	.889
	Presence of the Neonates CPR team at the institution	.510	.012	.317	.101	-.039	1.269
	Participate of Adults CPR team at the institution	.496	.013	.190	.015	.151	.935
	Participate in the Pediatrics CPR team at the institution	.737	.029	.290	.011	.244	1.365
	Participate in Neonates CPR team at the institution	.398	-.030	.227	.074	-.106	.784

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

the CPR system provided by the pharmacy department. The dependable factors, including working site and pharmacist participation in the CPR team, might correlate positively with item implementations of CPR code services. That's expected because the work site might have highly organized teams and vision, mission, and strategic plan, with education and training which dramatically increases the practice implementation. In contrast, the older generation pharmacy staff will negatively affect improved practice. That's expected; the young generation of pharmacists had more active participation and improvement to the CPR code services in practice. Thus, there is no previous investigation to compare with the current findings.

Limitations

The current study explored various performances of pharmacists during CPR codes with high-reliability results that reached the target of the calculated sample size. However, it had multiple limitations that included the sampling techniques used. It is a non-random sampling method that provides for different characteristics of responders and is not representative of the entire pharmacy culture. Besides, the study was criticized for temporary results and could be changed over time. Therefore, future investigation with random sampling techniques is highly suggested and periodically conducted to follow up on improving CPR services in pharmacy practice.

CONCLUSION

One-half of the responders had CPR teams for adults, pediatrics, and neonatal patients. The majority of the pharmacists had participated in adult CPR services. But, they had a lesser extent of participation in pediatric and neonatal CPR services. The medical and surgical departments had fewer CPR services in the anesthesia section. Most pharmacists prepare and administer medication and drug information during the CPR code. The average pharmacist practice implementation of CPR services was appropriate and had a mission and vision of pharmacist CPR services and lesser found of Pharmacy CPR strategies planning. Various factors might affect the pharmacy CPR implementation, such as age, existing of CPR teams, and pharmacist participation in the CPR teams. Therefore, targeting to expand the pharmacy CPR services with much involvement of clinical pharmacy services is highly recommended in healthcare practice in Saudi Arabia.

ACKNOWLEDGEMENT

None.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

None.

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

IV: Intravenous; **ADR:** Adverse Drug Reaction; **MOH:** Ministry of Health; **KSA:** Kingdom of Saudi Arabia; **MOH:** Ministry of Health; **IV:** Intravenous; **ADR:** Adverse Drug Reaction; **CBAHI:** Saudi Central Board for Accreditation of Healthcare Institutions; **BLS:** Basic Life Support; **ACLS:** Advance Cardiac Life Support; **PCLS:** Pediatric Cardiac Life Support; **NCLS:** Neonatal Cardiac Life Support; **CPR:** Cardiopulmonary Resuscitation; **SPSS:** Statistical Package of Social Sciences; **JASP:** Jeffery's Amazing Statistics Program; **STROBE:** Strengthening the reporting of observational studies in epidemiology statement; **VIF:** Variance Inflation Factor; **AHA:** American Heart Association.

ORCID ID

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

REFERENCES

1. Bond CA, Raehl CL. Clinical pharmacy services, pharmacy staffing, and adverse drug reactions in United States hospitals. Pharmacotherapy. 2006;26:735-47.
2. Bond CA, Raehl CL. Clinical pharmacy services, pharmacy staffing, and hospital mortality rates. Pharmacotherapy. 2007;27:481-93.
3. Bond CA, Raehl CL, Franke T. Clinical pharmacy services and hospital mortality rates. Pharmacotherapy. 1999;19(5):556-64.
4. Al-Dhawailie AA. Inpatient prescribing errors and pharmacist intervention at a teaching hospital in Saudi Arabia. Saudi Pharm J [Internet]. 2011;19(3):193-6. Available from: http://dx.doi.org/10.1016/j.jsps.2011.03.001
5. Alomi YA, Alshabaar N, Lubad N, Albusalih FA. Inpatient Medication Errors and Pharmacist Intervention at Ministry of Health Public Hospital, Riyadh, Saudi Arabia. Pharmacol Toxicol Biomed Reports. 2019;5(1):44-8.
6. Alanazi AA, Alomi YA, Almaznai MM, Aldwihi M, Aloraifi IAK, Albusalih FA. Pharmacist's Intervention and Medication Errors Prevention at Pediatrics, Obstetrics and Gynecology Hospital in East Province, Saudi Arabia. Int J Pharmacol Clin Sci. 2019;8(2):122-8.
7. Alomi YA, El-Bahnasawi M, Elemam A, Shaweesh T, Antonio EJ. The Economic Outcomes of Pharmacist Interventions at Critical Care Services of Private Hospital in Riyadh City, Saudi Arabia. Pharmacol Toxicol Biomed Reports. 2019;5(3s):S23-34.
8. Alomi YA, Fallatah AO, Bahadig FA, Qahtani AA AL. The Economic Outcomes of Pharmacist Interventions in Total Parenteral Nutrition Services in Saudi Arabia. Pharmacol Toxicol Biomed Reports. 2019;5(3s):S40-9.
9. Alomi YA, Alghamdi SJ, Alattyh RA, Shorog E, Alshahran A, Alasmary S, Alenazi H, Almutairi A AM. National Survey of Pharmacy Practice At Ministry of Health Hospitals in Saudi Arabia 2016-2017: Prescribing and Medication Management. J Pharm Pr Community Med. 2018;(5):S54-9.
10. Bolt J, Semchuk W, Loewen P, Bell A, Strugari C. A Canadian survey of pharmacist participation during cardiopulmonary resuscitation. Can J Hosp Pharm. 2015;68(4):290-5.
11. Shimp LA, Mason NA, Toedter NM, Atwater CB, Gorenflo DW. Pharmacist participation in cardiopulmonary resuscitation. Am J Heal Pharm [Internet]. 1995;52(9):980-4. Available from: https://academic.oup.com/ajhp/article-abstract/52/9/980/5093638
12. Toma MB, Winstead PS, Smith KM, Lewis DA, Clifford TM. Pharmacy resident participation in cardiopulmonary resuscitation events. American Journal of Health-System Pharmacy. American Society of Health-Systems Pharmacy; 2007;64:747-53.
13. Machado C, Barlows TG, Marsh WA, Coto-DePani Y, Dalin G. Pharmacists on the emergency cardiopulmonary resuscitation team: Their responsibilities, training, and attitudes. Hosp Pharm. 2003;38(1):40-9.
14. Alomi YA, Al-Doughan F, Al-Jarallah SM, Ahmed Ibrahim Y, Alragas AM, Bin Haidarah NO. National Survey of Clinical Pharmacy Practice in Saudi Arabia-2017-2018: Performances and Activities. Pharmacol Toxicol Biomed Reports. 2020;6(2):44-9.
15. Riaz S, Akram S, Shoukat N, Kousar M, Iqbal Z. Assessment of Knowledge of Cardiopulmonary Resuscitation among Pharmacy Students of Mirpur, Azad Jammu and Kashmir. J Adv Pharm Pract. 2019;1(1):24-33.
16. Abolfotouh MA, Alnasser MA, Berhanu AN, Al-Turaif DA, Alfayez AI. Impact of basic life-support training on the attitudes of health-care workers toward cardiopulmonary resuscitation and defibrillation. BMC Health Serv Res. 2017;17(1):1-10.
17. Silverplats J, Strömsöe A, Äang B, Källestedt MLS dersved. Attitudes towards cardiopulmonary resuscitation situations and associations with potential influencing factors-A survey among in-hospital healthcare professionals. PLoS One. 2022;17(7):1-11.
18. Silverplats J, Södersved Källestedt ML, Wagner P, Ravn-Fischer A, Äng B, Strömsöe A. Theoretical knowledge and self-assessed ability to perform cardiopulmonary resuscitation: A survey among 3044 healthcare professionals in Sweden. Eur J Emerg Med. 2020;27(5):368-72.
19. Kaihula WT, Sawe HR, Runyon MS, Murray BL. Assessment of cardiopulmonary resuscitation knowledge and skills among healthcare providers at an urban tertiary referral hospital in Tanzania. BMC Health Serv Res. 2018;18(1):1-8.
20. Charan J, Biswas T. How to calculate sample size for different study designs in medical research? Indian Journal of Psychological Medicine.

2013;35:121-6.
21. Pourhoseingholi MA, Vahedi M, Rahimzadeh M. Sample size calculation in medical studies. Gastroenterol Hepatol from Bed to Bench. 2013;6(1):14-7.
22. G Ezhumalai. How big a sample do I need require. Ann SBV. 2017;6(1):39-41.
23. Johnson TP, Wislar JS. Response rates and nonresponse errors in surveys [Internet]. JAMA - Journal of the American Medical Association. 2012;307:1805-6. Available from: http://www.aapor.org/Standard_Definitions2.htm.
24. Erik Von Elm, Douglas G. Altman, Matthias Egger, Stuart J. Pocock, Peter C. Gøtzsche JPV. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: Guidelines for Reporting Observational Studies. PLoS Med [Internet]. 2007;4(10):1623-7. Available from: http://www.epidem.com/
25. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies [Internet]. 2007;370. www.thelancet.com. 2007. Available from: www.plosmedicine.org
26. Liao D, Valliant R. Variance inflation factors in the analysis of complex survey data. Surv Methodol. 2012;38(1):53-62.
27. Akinwande MO, Dikko HG, Samson A. Variance Inflation Factor: As a Condition for the Inclusion of Suppressor Variable(s) in Regression Analysis. Open J Stat. 2015;05(07):754-67.
28. Thompson CG, Kim RS, Aloe AM, Becker BJ. Extracting the Variance Inflation Factor and Other Multicollinearity Diagnostics from Typical Regression Results. Basic Appl Soc Psych. 2017;39(2):81-90.
29. Saudi Center Board for Accreditation for Healthcare Institutions (CBAHI). Medication Management (MM). In: National Hospital Standards. 2nd Editio. Saudi Central Board for Accreditation of Healthcare Institutions. 2016;194-211.
30. Joint Commission International. Joint Commission International Standart Accreditation for Hospitals. 2014;1:296.
31. Link MS, Berkow LC, Kudenchuk PJ, Halperin HR, Hess EP, Moitra VK, *et al.* Part 7: Adult advanced cardiovascular life support: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2015;132(18):S444-64.
32. Soar J, Böttiger BW, Carli P, Couper K, Deakin CD, Djärv T, *et al.* European Resuscitation Council Guidelines 2021: Adult advanced life support. Resuscitation. 2021;161:115-51.
33. Lee MJ, Rho TH, Kim H, Kang GH, Kim JS, Rho SG, *et al.* Part 3. Advanced cardiac life support: 2015 Korean Guidelines for Cardiopulmonary Resuscitation. Clin Exp Emerg Med. 2016;3(S):S17-26.
34. Lundin A, Djärv T, Engdahl J, Hollenberg J, Nordberg P, Ravn-Fischer A, *et al.* Drug therapy in cardiac arrest: A review of the literature. Eur Hear J - Cardiovasc Pharmacother. 2016;2(1):54-75.