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Original Article

Evaluating the Awareness of Hospital Pharmacists towards Hospital Pharmacy Services during Pandemic Readiness: A Cross-Sectional Study

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ABSTRACT

Background: Hospital pharmacists play an essential role in maintaining continuity of care, ensuring medication safety, and managing the medicine supply chain, particularly during public health emergencies. The COVID-19 pandemic highlighted the importance of preparedness and the inclusion of pharmacists within hospital emergency response frameworks. Therefore, this study aimed to examine the level of awareness and preparedness of hospital pharmacists working in Saudi Arabia in the context of the COVID-19 pandemic and to explore the association between awareness levels and selected socio-demographic factors. **Objectives:** The primary objective of the present study is to examine the level of awareness and preparedness of hospital pharmacists working in Saudi Arabia, particularly in the context of the COVID-19 pandemic, and to explore the association between the level of awareness and some socio-demographic factors. **Materials and Methods:** A descriptive cross-sectional study was carried out on 202 pharmacists in different hospitals in Saudi Arabia. A self-administered, pre-validated questionnaire with four domains was used. **Results:** Most respondents had high awareness in integration with institutional planning, at 69.3%, followed by public and professional education and training, at 54.5%, and departmental leadership, at 53.5%. Lower awareness was expressed in the medications and supplies domain, at 45.5%. Strong positive correlations were found among all questionnaire domains. Multivariable analysis disclosed that work location, years of experience, age, and qualification were significant predictors for awareness. **Conclusion:** In general, awareness of pandemic preparedness among hospital pharmacists in Saudi Arabia during the COVID-19 pandemic was good. However, certain areas need more attention, including medication and supply preparedness, which must be effectively carried out by policies even in non-central hospitals.

Keywords: COVID-19, Hospital pharmacists, Pandemic readiness, Pharmacy services, Preparedness, Saudi Arabia.

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INTRODUCTION

The pandemic caused by Coronavirus Disease-2019 (COVID-19) proved crucial in emphasizing the importance of preparedness in hospitals and the role of pharmacy service in hospitals in the management of public health emergencies, as it affects not only the general public but also healthcare personnel (Alsharyah *et al*., 2024). Hospital-level preparedness requires coordinated plans for surge capacity, infection prevention and control, and uninterrupted access to essential medicines components, in which the pharmacy department plays a pivotal operational and clinical role (Singh *et al*., 2025).

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The pharmacists working in the hospitals played a role through a varying range of activities and tasks, and this included provision of medication distribution chain compliance, provision of therapeutic stewardship, reliable medication policies, and provision involving high-risk medications disposition, and pharmacists working in critical areas, telepharmacy and education delivery (Chiu *et al*., 2022; Ibrahim *et al*., 2022). All this showed there was a new demand on pharmacists' clinical decision-making capacity and logistics and interprofessional delivery, and this demanded a new arrangement of tasks and jobs among pharmacists.

Despite recognition of these roles, there was heterogeneity in how hospital pharmacists perceived their preparedness and how services were actually delivered during the pandemic. Cross-sectional surveys and descriptive reports from various health systems documented variable levels of knowledge, access to protocols, availability of PPE, engagement in clinical decision-making, and the capacity to deliver remote or continuity services-lacuna that may have directly impacted patient safety,

medication adherence, and system resilience (Salve *et al*., 2023; Singh, 2025). It is thus important to assess actual practice rather than attitude only to identify operational bottlenecks, training needs, and policy changes that need attention to strengthen future pandemic readiness.

Until date, there is a scarcity of studies that critically examine hospital pharmacists' practices in relation to pandemic readiness using a scientific research methodology. Hence, the purpose of this current research was to assess the practice of hospital pharmacists in relation to providing hospital pharmacy practice services during pandemic readiness by adopting a process of assessing a practice domain.

MATERIALS AND METHODS

Study Design and Setting

The descriptive cross-sectional study design was utilized in evaluating the practice of hospital pharmacist services in preparing for a pandemic in Saudi Arabia and assessing their preparedness regarding the challenges faced in the COVID-19.

Study Population

The population for this study was hospital pharmacists practicing in hospitals providing secondary and tertiary care across the State of Saudi Arabia.

Questionnaire Development

The study instrument adopted was a structured questionnaire devised after an in-depth perusal of the literature in addition to relevant guidelines on the preparedness and pandemic response of hospital pharmacy globally (Ahmad Suleiman *et al*., 2022; Alkhudaydi *et al*., 2024; Isleem *et al*., 2023; Schumacher *et al*., 2022). Among other elements, the study questionnaire comprised four domains, each aimed at comprehensively assessing pharmacists' practice and preparedness in pandemic response. Among them included being integrated in institution planning (Part 1), being integrated in departmental leadership (Part 2), public and professional educational interventions (Part 3), as well as medications and supplies management (Part 4) in pandemic response. Mostly, it adopted closed-ended questions in addition to Likert scales.

Content Validation and reliability

The content validity of the instrument was confirmed through expert review by senior hospital pharmacists with experience in hospital pharmacy practice and by expert researchers in public health readiness planning. A review of the instrument for clarity, appropriateness, and completeness was conducted, with the required changes made according to the recommendations provided by the expert team that reviewed it.

Data Analysis

The analysis was carried out using R software, version 3.5.2. Descriptive analysis was performed for percentages. Inferential statistics was used to check the associations between variables.

RESULTS

Sociodemographic of the participants

The sample consisted of 202 hospital pharmacists. Most respondents were male (77.7%) and aged 25-34 years (49.0%), followed by 35-44 years (39.1%). Most respondents were Saudi nationals (94.1%). Qualification-wise, 39.1% had a bachelor's degree, 39.1% had a diploma, while 19.9% had postgraduate qualifications. Most participants in this study were non-managers (71.8%). The largest professional groups were the hospital pharmacists with 43.1% and pharmacy technicians with 40.6%. Participants were mostly working in governmental hospitals (91.1%), mainly in public or central hospitals at 40.1% and 34.2%, respectively. The results are explained in Table 1.

Inter-domain Correlations of Hospital Pharmacy Practice and Pandemic Readiness Scores

In Figure 1, Spearman's correlation analysis indicated that all domains were strongly positively correlated. Integration with institutional planning, domain Part 1, correlated strongly with domain Part 2 (departmental leadership), Part 3 (public and professional education and training), and Part 4 (medications and supplies).

Awareness Levels of Hospital Pharmacists across Pandemic Readiness Domains

Likewise, in assessing the level of awareness of each domain, it was established that most of the hospital pharmacists recorded high in integration with institutional planning (69.3%), then in public and professional education and training (54.5%), with departmental leadership ranking next with 53.5%. Conversely, less than half of respondents reported high in medications and supplies, with an interesting 45.5%. On another note, significant variation in awareness levels within the four domains was established with a significance of $p<0.001$. The results are explained in Table 2.

Factors Associated with Awareness of Pandemic Readiness Among Hospital Pharmacists (Univariate logistic regression)

Results for these tests are shown in Table 3. In the univariate regression analysis, pharmacists with a doctoral degree compared with those with a bachelor's degree had a lower awareness level concerning readiness for pandemics, where OR was 0.20, 95%/CI 0.04, 0.85, *p*-value 0.028. In addition, pharmacists from primary care centers, when compared with those from central hospitals, had lower odds for being aware of readiness, where OR was 0.12,

95%/CI 0.04, 0.35, *p*-value <0.001. Furthermore, pharmacists from secondary hospitals compared with those from central hospitals showed lower odds for being aware of readiness for pandemics, where OR was 0.05, 95%/CI 0.00, 0.43, *p*-value 0.013. The results are explained in Table 3.

Factors Associated with Awareness of Pandemic Readiness Among Hospital Pharmacists (Multivariate logistic regression)

In the multiple regression analysis, it was found that pharmacists aged between 45 and 55 had significantly lower odds of showing high levels of awareness compared with those below the age of 25 (AOR=0.00, 95% CI=0.00-0.20; *p*=0.007). Also, those with a doctoral degree qualification had significantly lower levels of awareness (AOR=0.02, 95% CI=0.00-0.29; *p*=0.006). Pharmacist work locations in primary care centers had independent associations with lower levels of knowledge awareness compared with those in central hospitals (AOR=0.02, 95% CI=0.00-0.10; *p*<0.001). Other socio-demographic variables, including gender, nationality, job title, hospital type, and region, were not significantly associated with awareness levels after adjustment. The results are explained in Table 4.

DISCUSSION

This is the first comprehensive study that assesses the awareness and preparedness of Saudi Arabian hospital pharmacists for pandemic readiness and points out important variations based on institutional, professional, and experiential factors. On the whole, the results reflect a generally good state of awareness, especially in domains concerning integration with institutional planning and departmental leadership. Nevertheless, significant deficiencies were observed in areas related to medications and supplies as well as public and professional education.

One of this research's important findings is that there is a strong positive correlation between all the different questions' domains. This would all be congruent with a systems-level preparedness perspective that recognizes that a strong response to pandemics requires good governance, strong leadership, trained personnel, and a strong supply chain, but does so in a more comprehensive manner than would be evident through single-factor-based interventions (Gautier *et al*., 2023; Villacis *et al*., 2025).

The awareness test revealed considerable variance between domains. Where almost 70% of pharmacists had shown a high level of performance in terms of integration with institutional planning, less than half had shown similar performance in medications and supplies management. Such differences are of particular concern, especially because medication availability, alleviation of medication shortages, and inventory management are key aspects of the services provided by healthcare institutions during a health emergency situation. In a matter of fact, the same phenomenon was observed by various studies conducted across

Table 1: Basic socio-demographic characteristics of study population.

Variables	N (%)
Gender	
Female	4 (20.3)
male	157 (77.7)
Age (years)	
< 25 years	13 (6.4)
25 - 34 years	99 (49.0)
35 - 44 years	79 (39.1)
45 - 55 years	7 (3.5)
Nationality	
Non-Saudi	8 (5.9)
Saudi	190 (94.1)
Qualification	
Bachelor	79 (39.1)
Diploma	79 (39.1)
Master	30 (14.9)
Doctorate	10 (5.0)
Managers/supervisor	
No	145 (71.8)
Yes	53 (26.2)
Job title	
Clinical Pharmacist	29 (14.4)
Hospital Pharmacist	87 (43.1)
Pharmacy Technician	82 (40.6)
Work location	
Central Hospital	69 (34.2)
Primary Health Care Center	29 (14.4)
Public Hospital	81 (40.1)
Secondary Hospital	4 (2.0)
Tertiary Specialist Hospital	15 (7.4)
Type of hospital	
Governmental	184 (91.1)
Private	14 (6.9)
Region	
Central Area	88 (43.6)
Eastern Area	58 (28.7)
Northern Area	22 (10.9)
Southern Area	3 (1.5)
Western Area	27 (13.4)
Years of experience	
0 - 3 years	47 (23.3)
3 -6 years	40 (19.8)
6 -10 years	49 (24.3)
10 years or more	62 (30.7)

Table 2: Assessment of awareness of the hospital pharmacists towards pandemic readiness.

Scores	Integration with institutional planning	Departmental leadership	Public and professional education and training	Medications and supplies	*p*-value
High score	140 (69.3%)	108 (53.5%)	110 (54.5%)	92 (45.5%)	<0.001
Moderate score	22 (10.9%)	36 (17.8%)	27 (13.4%)	45 (22.3%)	
Low score	40 (19.8%)	58 (28.7%)	65 (32.2%)	65 (32.2%)	

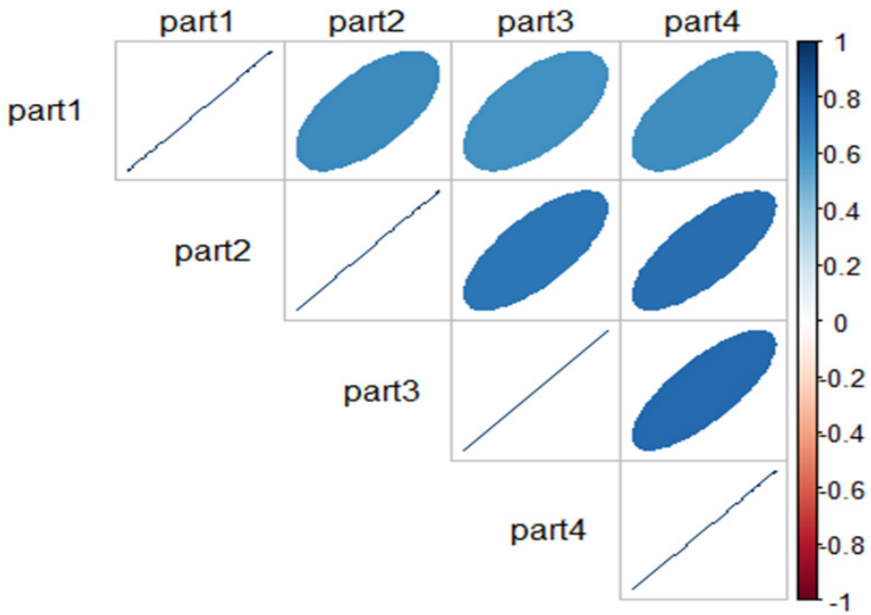

Figure 1: Correlation - Spearman (r) coefficient between questionnaire parts and mean percent scores.

China, and the Middle East on the COVID-19 health emergency, where there was a lack of proper availability of medicines with pharmacists, unprecedented disruptions were experienced by the supply chain, and a lack of efficient strategies to handle the emergency stocks were also observed (Elden *et al*., 2023; Zoubir and Tran, 2022).

On another level, as shown in the foregoing figures, regression analysis also indicated that awareness of pandemic preparedness in China was significantly associated with work settings and professional working experiences (Xu *et al*., 2020). Pharmacists working in primary care centers and secondary hospitals had significantly lower odds of higher awareness of pandemic preparedness compared to those working in central hospitals (Bahlol and Dewey, 2021; Basheti *et al*., 2021). This could probably be ascribed to differences in terms of accessibility of resources, professional development, and direct involvement in working on emergency plans in different working settings, since central hospitals play more central roles in terms of coordination in emergency response compared to others in China.

Years of experience were identified as one of the strongest predictors of awareness. These results coincide with those obtained from previous epidemics such as SARS and MERS; experience was a positive determinant for preparedness, confidence, and decision-making potential among health care practitioners (Haridi *et al*., 2018; Hong *et al*., 2022).

Interestingly, an important side effect of the study was the inverse correlation between doctoral qualifications and the level of awareness. It may have been due to an understanding of their role differences instead of their lack of understanding, as pharmacists holding doctoral qualifications in Saudi Arabian hospitals are less likely to work in hospitals providing front-end pharmacy services due to their other predominant roles in academia, research, and management. Similar observations have also been reported in other studies conducted on pharmacists' preparedness in relation to their frontline work in relation to COVID-19, as described in Visacri *et al*., (2021).

Yet another key factor revealed was age, with pharmacists between 45 and 55 years old being associated with lower adjusted odds for high levels of awareness. The rapid shift towards more and more digitization of services, including telepharmacy and electronic inventory management, because of COVID-19, may have been more impactful for younger or mid-career-aged pharmacists, as also revealed by studies conducted internationally (Poudel and Nissen, 2016).

Table 3: Univariate logistic regression for the association between socio-demographic characteristics of the study population and the awareness level.

Socio-demographic data		OR (95%CI)	*p* value
Gender			
	Female	-	
	Male	0.75 (0.28-1.78)	0.535
Age			
	< 25	-	
	25-34	1.01 (0.21-3.67)	0.994
	35-44	1.20 (0.25-4.57)	0.801
	45-55	0.30 (0.03-2.35)	0.251
Nationality			
	Non-Saudi	-	
	Saudi	2.68 (0.51-12.66)	0.211
Qualification			
	Bachelor	-	
	Diploma	0.74 (0.33-1.62)	0.449
	Doctorate	0.20 (0.04-0.85)	0.028
	Master	1.92 (0.56-8.88)	0.341
Manager /Supervisor			
	No	-	
	Yes	0.95 (0.44-2.16)	0.897
Job title			
	Clinical Pharmacist	-	
	Hospital Pharmacist	1.73 (0.58-4.83)	0.304
	Pharmacy Technician	1.28 (0.44-3.50)	0.637
Work location			
	Central Hospital	-	
	Primary Health Care Center	0.12 (0.04-0.35)	<0.001
	Public Hospital	0.64 (0.24-1.63)	0.356
	Secondary Hospital	0.05 (0.00-0.43)	0.013
	Tertiary/Specialist Hospital	0.80 (0.17-5.77)	0.795
Type of hospital			
	Governmental	-	
	Private	0.38 (0.11-1.35)	0.116
Region			
	Central Area	-	
	Eastern Area	0.68 (0.29-1.60)	0.373
	Northern Area	0.43 (0.14-1.41)	0.147
	Southern Area	0.11 (0.00-1.20)	0.077
	Western Area	0.73 (0.24-2.52)	0.596
Years of experience			
	0-3 years	-	
	10 years or more	2.27 (0.92-5.78)	0.078
	3-6 years	3.22 (1.08-11.02)	0.044
	6-10 years	2.16 (0.83-5.86)	0.118

Table 4: Multivariate logistic regression for the association between socio-demographic characteristics of the study population and the awareness level.

Socio-demographic data		AOR (95%CI)	*p* value
Age			
	< 25	-	
	25-34	0.38 (0.04-2.59)	0.347
	35-44	0.30 (0.02-3.68)	0.360
	45-55	0.00 (0.00-0.20)	0.007
Qualification			
	Bachelor	-	
	Diploma	0.66 (0.02-11.78)	0.792
	Doctorate	0.02 (0.00-0.29)	0.006
	Master	2.96 (0.37-40.77)	0.355
Work location			
	Central Hospital	-	
	Primary Health Care Center	0.02 (0.00-0.10)	<0.001
	Public Hospital	0.40 (0.09-1.63)	0.218
	Secondary Hospital	0.01 (0.00-0.14)	0.005
	Tertiary/Specialist Hospital	0.37 (0.02-17.30)	0.536
Years of experience			
	0-3 years	-	
	10 years or more	20.90 (2.63-212.22)	0.006
	3-6 years	7.49 (1.41-58.22)	0.030
	6-10 years	1.80 (0.41-7.91)	0.433

Importantly, gender, nationality, job title, type of hospital, and regions did not independently influence preparedness after adjustment. This implies that preparedness is more influenced by experiential factors than demographic factors. These observations affirm the necessity for equitable training, preparedness protocols, and emergency planning in all hospital types at various levels, as advocated by various international entities (Kreisberg *et al*., 2016; Organization, 2020).

While the integration of pharmacists into planning structures was clear, there were indications of significant challenges with respect to medicine supply preparedness and unequal familiarity with aspects of preparedness across different categories of hospitals.

CONCLUSION

The study revealed that the levels of awareness displayed by hospital pharmacists in Saudi Arabia about pandemic preparedness in general and their integration with different planning processes within the institutions and various forms of leadership in different departments during the COVID-19 pandemic have been satisfactory in nature. The study revealed an overall positive correlation with all the different aspects that have been included in the study in a highly positive manner by highlighting their interconnected nature with all the different aspects within it.

However, gaps with respect to health emergencies in terms of medications and supplies, public education, and professional education, which point to areas that may undermine the effective service delivery in health emergencies, have also been pointed out.

ABBREVIATIONS

AOR: Adjusted Odds Ratio; **CI:** Confidence Interval; **COVID-19:** Coronavirus Disease 2019; **OR:** Odds Ratio; **PPE:** Personal Protective Equipment; **R:** Statistical Software R; **SPSS:** Statistical Package for the Social Sciences; **WHO:** World Health Organization.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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