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RESEARCH ARTICLE OPEN ACCESS

# The Role of Pharmacists in Disaster Management: A Qualitative Study Exploring the Experience of Saudi Pharmacists during the COVID-19 Pandemic

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**Abstract:**

***Introduction:*** Saudi Arabia is prone to various public health emergencies, necessitating that all healthcare personnel, including pharmacists, be prepared to contribute to disaster management. Although pharmacists are vital in such scenarios, their role in Saudi Arabia remains unexplored. This study aimed to examine the role of Saudi pharmacists across the four phases of public health emergency management: prevention, preparedness, response, and recovery (PPRR).

***Methods:*** A qualitative exploratory design was employed. Purposive sampling was used to recruit nine pharmacists for semi-structured interviews. All interviews were recorded, transcribed verbatim, and analyzed using thematic analysis.

***Results:*** Four major themes corresponding to the PPRR phases, along with 20 sub-themes (five per phase), were identified. Participants generally perceived that pharmacists had a limited role, particularly in the preparedness and response phases.

***Discussion:*** Pharmacists possess key competencies for disaster management, particularly in logistics, counseling, and support for chronic diseases. However, administrative, cultural, and systemic barriers often hinder their active involvement. There is an urgent need to redefine pharmacists' roles and integrate them meaningfully into national disaster preparedness frameworks.

***Conclusion:*** Pharmacists in Saudi Arabia are both capable and willing to assume expanded roles in disaster management, particularly during the response and recovery phases. Policymakers should formally incorporate pharmacists into disaster planning, provide targeted training, and address limiting perceptions. Enhancing the pharmacist's role will strengthen the resilience of health systems during public health emergencies.

**Keywords:** COVID-19, Disaster, Public health emergency, Saudi pharmacists.



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## 1. INTRODUCTION

Between 2012 and 2017, the World Health Organization (WHO) documented over 1,200 outbreaks across 168 countries, encompassing both emerging and re-emerging infectious diseases [1]. In 2018 alone, an additional 352 infectious disease outbreaks were reported, including those caused by the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) and Ebola virus disease [1]. The recent global crisis caused by Coronavirus disease 2019 (COVID-19), which was declared a pandemic in early March 2020, significantly increased global awareness of disaster and crisis management.

Disasters pose complex challenges to healthcare systems [3]. In Saudi Arabia, these challenges are exacerbated by the country's religious significance, particularly during Hajj and Ramadan, when millions of pilgrims converge on Makkah and Medina [4, 5]. The large number of visitors in the confined areas during these periods presents a substantial burden on healthcare services.

Pharmacists, traditionally recognized for dispensing medications and managing logistics, are expected to expand their roles during emergencies. Their accessibility, presence in the community, and rapid return to service after disasters uniquely position them to support public health continuity [6-9]. However, the profession's involvement in disaster response was not prominently acknowledged until the events of September 11, 2001, and has gained greater global recognition since, particularly during the COVID-19 pandemic [10].

In Europe and the United States, pharmacists expanded their legal roles during the COVID-19 pandemic, offering services such as home delivery, virtual prescription handling, enforcing social distancing in pharmacies, and actively educating the public about infection prevention measures [11-13].

Conversely, in Saudi Arabia, despite added complexity from religious pilgrimages, the roles of pharmacists in public health emergencies remain undefined and underutilized. Research on this topic is scarce, particularly within the framework of the four phases of emergency management: PPRR [14-16]. Thus, the COVID-19 pandemic presents a unique opportunity to explore the engagement of Saudi pharmacists in disaster response. This study aims to assess their roles across the four PPRR phases, drawing on experiences from the COVID-19 crisis [17, 18].

## 2. METHOD

### 2.1. Study Design

This study aimed to explore and gain insight into the roles of pharmacists during disasters, particularly from the perspective of experienced practitioners. Given the limited existing knowledge on this topic, a qualitative exploratory methodology was deemed most appropriate. This approach allowed an in-depth understanding of pharmacists' perceptions of their roles in disaster management. An interview guide (Appendix) was developed based on the Prevention, Preparedness, Response, and Recovery (PPRR) model [6, 19], with each section addressing key concepts that align with the study objectives.

### 2.2. Study Period and Participants

Data collection took place between November 10, 2022, and February 16, 2023, following approval from the relevant ethics committee. Participants were experienced practicing pharmacists, selected under the assumption that they were likely to have encountered a public health emergency or disaster during their careers. The inclusion criteria included Saudi nationality, active registration to practice in Saudi Arabia, and current or prior employment in either public or private healthcare institutions during the COVID-19 pandemic.

Participants were contacted by email or telephone and provided with a brief study summary and a copy of the letter of ethical approval. Interviews were conducted in person at the participants' workplaces or by telephone, depending on their availability and safety considerations. In all instances, privacy and infection control precautions were observed.

### 2.3. The Research Sample

A purposive, non-probability snowball sampling method was used. The sample size was determined by thematic saturation, defined as the point at which no new themes emerged. The initial participants were asked to suggest other suitable individuals, resulting in a referral-based sample. Emphasis was placed on the richness and depth of the data rather than generalizability. Saturation was considered reached when additional interviews produced redundant responses and no new insights.

### 2.4. Data Collection

The interviews were conducted in Arabic by three final-year pharmacy students (RAA, ZDD, and ZWA).

The primary interview question focused on pharmacists' perceptions of their roles in disaster management, particularly on whether their current responsibilities during public health emergencies reflect the full extent of their potential contributions.

Interview durations ranged from 30 to 70 minutes, with an average of 50 minutes.

### 2.5. Data Analysis

Audio recordings were transcribed verbatim in Arabic, translated into English, and then back-translated into Arabic to ensure accuracy and consistency. Inductive content analysis was used. Coding was performed manually by AAA and reviewed by RAA, ZDD, and ZWA. An agreement on codes and themes was reached prior to interpretation.

Thematic content analysis involved an initial read-through of transcripts followed by detailed coding to identify recurring patterns. These guided the organization of themes and sub-themes. Each theme was supported by participant quotations that best illustrated the core findings.

### 2.6. Ethical Consideration

The study received ethical approval from the Committee of Research Ethics, Deanship of Scientific Research, Qassim University (Approval No.: 23-27-11). Participants were informed of the study objectives and provided written consent to participate, including permission to record the interviews and anonymously publish their responses.

## 3. RESULTS

### 3.1. Participant Demographics

Nine pharmacists participated in the study. The majority were hospital pharmacists with 15 to 19 years of experience. All were actively engaged in the service during the COVID-19 pandemic. Table **1** provides a demographic summary of the participants.

**Table 1. Demographic characteristics of the participants.**

| Variable | Number | Percentage |
|---|---|---|
| **Location** | | |
| Community Pharmacy (CP) | 2 | 22.2% |
| Hospital Pharmacist (Senior) (HP) | 4 | 44.4% |
| Other (O) | 3 | 33.3% |
| **Years of Experience** | | |
| 10 > | 1 | 11.1% |
| 10 – 14 | 3 | 33.3% |
| 15 – 19 | 4 | 44.4% |
| > 19 | 1 | 11.1% |

### 3.2. Thematic Content Analysis

The themes enable the findings to be presented in an organized way, providing an explanatory framework. These themes provided a structured framework for presenting pharmacists' perceived roles in disaster and public health emergency management. Selected participant quotations are included to illustrate key perspectives. When multiple participants expressed similar views, a representative quote was used, accompanied by identifiers (*e.g.*, CP3) to indicate the respondent type and supporting sources.

#### *3.2.1. Theme 1: Prevention*

This phase emphasizes minimizing the impact of disasters and public health emergencies by reducing exposure and mitigating associated risks. It includes strategic planning and training to enhance pharmacists' contributions to community resilience.

##### *3.2.1.1. Sub-theme: Optimizing Medication Supplies for Chronic Disease Management*

Participants, particularly community pharmacists, highlighted the importance of ensuring continuity of care for patients with chronic conditions. They emphasized the need to educate patients on maintaining a buffer supply of medications by stating as follows:

*"I always try to educate my patients with chronic diseases to keep stock of their medicines, because if for example they kept a stock at home for one month and in addition to that they used to have another month of buffer, if emergency like COVID-19 happened, it will affect them much less because they are not running out of their medications and their chronic disease is under control." (CP3)*

##### *3.2.1.2. Sub-theme: Administering Vaccinations*

Pharmacists noted their capacity to support vaccination efforts, particularly during crises when healthcare systems are strained.

*"I believe pharmacists have a role in public vaccination even at times when there is no public health emergency. So, certainly, if there is a public health emergency like COVID-19, pharmacists should have a role in vaccinating individuals." (O6)*

Another pharmacist working in a community pharmacy mentioned that

*"Yes, I think it is a role that pharmacists can do. We are trained and we can vaccinate, we can administer a vaccination, the only thing we need is support from top management." (CP6)*

##### *3.2.1.3. Sub-theme: Educate the Public on Reducing the Spread of Communicable Diseases/infections*

Some participants were enthusiastic about the role of pharmacists in community education, leveraging their accessibility.

*"Yes, pharmacists could do that. I have some colleagues doing those educational roles. I think as pharmacists are widely spread among the community and easily accessible, they are the most suitable health professionals to play this educational role". (CP3)*

Others expressed skepticism, noting cultural barriers and limited engagement.

*"To be frank, I am not expecting much. Theoretically, pharmacists can do this, but it is not the practice. It may be a culture, but what we used to see is a pharmacist standing behind the counter in the pharmacy with little or almost no conversation with patients". (HP1)*

##### *3.2.1.4. Sub-theme: Raising Awareness of Increased Risk for Vulnerable Populations*

Pharmacists recognized their role in informing high-risk individuals and their families about the elevated risks associated with health crises.

*"Since this pandemic was announced, we have been constantly spreading awareness about the increased risk for patients with chronic diseases and older people. We are continuously advising healthy and young family members to take care of their relevant and try not to let them come to the pharmacy because of the increased risk due to their diseases." (CP6)*

##### *3.2.1.5. Sub-theme: Tailored 'point of Care' Messaging to Chronic Disease Patients*

The general opinion of the participants is that the role of pharmacists concerning 'point of care' messaging is quite passive and restricted mainly to dissemination.

*"Yes, many messages were disseminated through pharmacies, but I never heard about a pharmacist who has shown initiative like creating videos or organizing social media campaigns to spread awareness." (CP5)*

### 3.3. Theme 2: Preparedness

This phase emphasizes the importance of planning to minimize the cost and chaos associated with reacting to disasters. A senior hospital pharmacist reflected this view:

*"For every riyal you spend in prevention and preparedness, you save ten times the amount that would be otherwise spent in response." (HP2)*

Many participants felt that pharmacists are underutilized during this stage and advocated for more structured involvement and training. This view was outlined in a remark made by a hospital pharmacist.

*"I think for a more effective response, pharmacists need to be involved in the preparedness phase. Because if they did not plan for it, their response will not be appropriate, because they will not have enough knowledge to provide the needed services in such situations" (HP6)*

Several participants commented:

*"I think that training for disaster management should be part of every pharmacist's training. Without appropriate training, it is very difficult to be ready to tackle disasters with all the information and skills needed to do this role." (CP5)*

#### *3.3.1. Sub-theme: Ensuring Uninterrupted Supply of Essential Medications*

Participants noted that modern inventory practices, such as just-in-time stock systems, make pharmacies vulnerable to supply chain disruptions. This point was highlighted by some of the participants, as a community pharmacist and a hospital pharmacist commented:

*"For the sake of not freezing money, now the pharmacy operates according to the philosophy of just-in-time inventory fashion. Therefore, there will be no adequate stock of drugs to face even a short interruption in drug supply. Then, even with a small-scale disaster, you will not be able to deliver services that your community most needs. I think pharmacists should have a role here advocating for their patients." (CP5)*

#### *3.3.2. Sub-theme: Maintaining Cold Chain Integrity*

Maintaining the efficacy of medications during disasters is crucial, particularly for temperature-sensitive drugs. Participants identified simple, practical solutions.

A hospital pharmacist participant commented:

*"I think you have to have ice bags ready all the time. Yes, simple but efficient for keeping drugs that should be stored at low temperature for as long as possible. I think this is one of the easiest and most efficient strategies in disasters" (HP6)*

#### *3.3.3. Sub-theme: Participating in Local Disaster Management Teams*

Pharmacists expressed frustration over their lack of formal inclusion in disaster planning and response teams.

A senior manager complained:

*"I do not see a lot of engagement in disaster management teams. Pharmacists are not engaged with these teams. Actually, they are not considered in disaster planning from the point of view of engaging them in plan development or review. They cannot see them out of hospitals and/or community pharmacies." (HP6)*

#### *3.3.4. Sub-theme: Accessing National Stockpiles*

A widespread lack of knowledge about accessing national stockpiles was evident.

*"It may be disappointing, but this is the reality, pharmacists do not have enough information about this point. To be frank, I know nothing about this." (O8)*

#### *3.3.5. Sub-theme: Contributing to Disaster Preparedness Meetings*

Participants offered mixed views on pharmacists' involvement in strategic preparedness efforts. Some emphasized their value in logistics, while others cited a lack of training.

*"Yes, at the time of disasters, we are mostly logisticians, but this is crucial for the successful management of public health emergencies. When it comes to logistics, we are the best health professionals handling that." (O3)*

*"This is what I have told you before. Yes, there is no role here because training is lacking in this area. That is why, as pharmacists, we have weak knowledge and no expertise on analyzing and planning what will happen in the following month or years after disasters." (CP2)*

### 3.4. Theme 3: Response

This phase focuses on immediate actions taken to reduce harm and maintain healthcare service delivery during a disaster. Pharmacists were recognized for their vital role, particularly in ensuring access to medication, providing patient counseling, and facilitating logistical coordination.

#### *3.4.1. Sub-theme: Dispensing Medications and Supplies to Affected Community Members*

Participants emphasized the importance of pharmacists in ensuring the availability and delivery of medications during the pandemic. A community pharmacist mentioned:

*"During the pandemic, we introduced delivery services, and some pharmacists had personally worked on delivering medication to their patients' homes without charging for delivery." (CP6)*

A hospital pharmacist commented:

*"In the hospitals, we used to go through patients' profiles, especially for patients with chronic diseases, and make refills for their medications, so they avoid consulting physicians with the anticipated risk of getting an infection." (HP6)*

#### *3.4.2. Sub-theme: Counseling Patients on Medication Use*

Pharmacists stepped up to educate patients on how to take and manage their medications properly. A community pharmacist said:

*"As it is not advised to go to hospitals during the pandemic unless it is absolutely necessary, we were in community pharmacies, very active in counseling our*

*patients about their medications. These services provided by community pharmacists allowed physicians in hospitals to focus on serious cases and cases that require critical care." (CP3)*

### *3.4.3. Sub-theme: Coordinating Logistics for Chronic Disease Medications*

Evacuations and lockdowns disrupted normal routines, underscoring the need for coordinated logistics to maintain medication supply. Several participants highlighted this point. A community pharmacist commented:

*"During the pandemic, we did a refill of medications for chronic conditions, and we did our best to deliver medications to our patients at their homes despite the possible changes in addresses." (CP2)*

### *3.4.4. Sub-theme: Providing One-off Medication Emergency Supply Refills for up to 30 days during the Declared Disaster*

Most participants emphasized the importance of this point.

*"During the pandemic, there was an interruption in the supply. At the same time, most of the patients, especially those with chronic diseases, cannot visit the pharmacy frequently as they used to during normal days. So, yes, it is more helpful and more appropriate to provide those patients a 30-day supply whenever possible." (CP5)*

A community pharmacist commented:

*"As I have good links with other pharmacies, I explain to my patients where they should go if they need emergency supplies of medicines." (CP2)*

### *3.4.5. Sub-theme: Assisting with National Stockpiles Distribution*

Despite their expertise, pharmacists reported being excluded from national stockpile logistics.

*"Although we are the most skillful among all other health professionals in logistics, but still this skill has still never been used with regard to the release and allocation of national stockpiles. It is really disappointing to say this, but unfortunately, this is the reality." (O2)*

## 3.5. Theme Four: Recovery

The recovery phase focuses on restoring healthcare services and ensuring system resilience following a disaster. Pharmacists described both their active involvement and unrealized potential during this phase.

### *3.5.1. Sub-theme: Re-establish Normal Stock Levels and Dispose of Contaminated Stock*

Participants reported strong involvement in managing medication inventories post-disaster, including appropriate disposal of compromised supplies.

*"I think pharmacists have a big role in re-establishing normal stock levels, as well as destroying contaminated stock appropriately. This is because, as pharmacists, we are the sole health professionals working continually to monitor the medical stock. So, we are responsible for ensuring that once the disaster is finished, normal stock levels of medications are resumed. Also, we have the responsibility of destroying the contaminated and expired stock appropriately so no patient is harmed because of the presence of contaminated medications, and at the same time, no pollution is caused due to inappropriate destruction of contaminated stock." (HP6)*

### *3.5.2. Sub-theme: Restocking Emergency and Disaster Kits*

This role was reported to be primarily undertaken by pharmacists working with NGOs and charitable organizations.

*"I believe that pharmacists are the only health professionals who have the appropriate knowledge and skills to play this role. However, only pharmacists who work in NGOs and charities are doing this right now." (O3)*

### *3.5.3. Sub-theme: Assessing the Health Needs of the Local Community*

Pharmacists expressed that their community presence positions them to contribute meaningfully to post-disaster needs assessments, though this potential remains underutilized.

*"Yes, pharmacists have a role to play in checking the health needs for the local community, but in my opinion, considering our presence in the heart of the community, we can do a lot more. During this last COVID-19 pandemic, many of the community pharmacies have called for permits to be allowed to open under the curfew, but was that for the sake of satisfying the need of the community, or was it aimed at serving the financial interests of their business?" (CP4)*

### *3.5.3. Sub-theme: Identifying and Prioritizing Vulnerable Community Members*

Participants noted that frequent interaction with vulnerable patients positions pharmacists to play a key role in identifying and prioritizing their care, if better supported by policy.

*"Yes, vulnerable patients are well known to community pharmacists as they frequently visit community pharmacies. However, these potentials are not considered or utilized by health authorities and public health policymakers. Therefore, despite the potentialities, the role of pharmacists in this regard is still limited." (CP5)*

### *3.5.4. Sub-theme: Restoring Patient and Drug Records Post-power Outage*

While pharmacists participated in this activity, they viewed it as a secondary task that was better suited for clerical staff.

*"Yes, we can help, but this is mainly clerk work that can be done by clerks and no need to involve health professionals." (HP2)*

## 4. DISCUSSION

Pharmacists play a crucial role during public health crises, often becoming the first healthcare professionals to resume service after a disaster. Their ability to dispense

emergency medications, provide health counseling, and relieve pressure on emergency rooms underlines their potential to support disaster management efforts.

Despite their value, pharmacists' roles in disaster response are still limited, in part due to the profession's perception. On the one hand, pharmacies are often viewed as commercial enterprises focused on profitability; on the other hand, they are recognized as healthcare services. These conflicting perceptions, as reflected in the literature [20], influence both public and policymakers' views of pharmacists' potential in disaster contexts.

This study found broad support among participants for the inclusion of pharmacists across all four phases of the PPRR. Many expressed the belief that pharmacists could be vital members of disaster management teams, provided their roles are formally recognized and supported.

### 4.1. Prevention Phase

Participants reported that pharmacists' potential was underutilized in prevention due to factors such as time constraints, a lack of management support, and low patient awareness of pharmacists' capabilities. Some also noted that additional training is necessary to engage in public health efforts fully. These challenges have been noted in prior studies [21].

Regarding vaccination, many participants expressed enthusiasm but cited administrative and cultural barriers to participation. However, these barriers are starting to diminish as the Saudi Ministry of Health partners with community pharmacies to deliver vaccines during COVID-19 campaigns [22, 23]. This aligns with practices in several European countries where pharmacists routinely administer vaccines [24].

### 4.2. Preparedness Phase

Most participants reported that pharmacists have limited involvement in disaster preparedness, including poor integration into emergency planning and training. Many were unfamiliar with how to access national stockpiles or participate in formal planning meetings. Similar findings were reported in other studies, where pharmacists cited limited applicable training in emergency preparedness [25, 26].

Conversely, studies from the United States have reported greater levels of preparedness, with hospitals implementing formal protocols and pharmacy departments playing active roles in disaster planning [27]. Pharmacists' contributions to preparedness are more established in high-income countries [28, 29], but this has not yet become the norm in many other settings. Some participants felt that pharmacists are perceived merely as support staff rather than as essential members of healthcare teams—a perspective also documented in Australian research [30]. However, the COVID-19 pandemic has expanded both the legal and practical roles of pharmacists in many parts of the world, underscoring their crucial contributions during public health emergencies [31].

### 4.3. Response Phase

While pharmacists have the skills to contribute across all four disaster phases, many participants noted that their roles remain narrowly focused on logistics and medication supply. Their consistent involvement in maintaining medication access, particularly for patients with chronic illnesses, was universally acknowledged. This finding is consistent with the existing literature, which emphasizes pharmacists' logistical expertise in emergency situations [32, 33].

Participants described providing medication counseling, refilling prescriptions, and delivering medications to patients, particularly those who were unable to visit pharmacies due to curfews or transportation barriers. These roles have also been observed in studies from China and India [12, 34].

Pharmacists were also active in educating patients and enabling physicians to focus on critical cases. Similar services were documented during Hurricane Maria in Puerto Rico, where pharmacists provided medication counseling and guidance on storage and use [35]. However, participants expressed frustration that they were not involved in the release or distribution of national stockpiles, despite having the relevant skills.

### 4.4. Recovery Phase

During the recovery phase, pharmacists actively contributed to restocking medications, safely disposing of expired stock, and restoring service operations. However, their participation in broader recovery tasks, such as community health assessments and vulnerability mapping, was minimal.

While participants recognized their capacity to identify and support vulnerable patients, they noted that health authorities do not formally recognize such roles. Likewise, their role in updating medical records was seen as supplementary rather than essential. Participants emphasized that these tasks are often left to pharmacists in NGOs and charities, suggesting underutilization in public health systems.

### 4.5. Strengths and Limitations

To our knowledge, this is the first qualitative study in Saudi Arabia to examine pharmacists' perspectives on their roles in disaster response using their experiences during COVID-19 as a case reference. The use of the PPRR framework enabled a comprehensive exploration and organization of the findings. However, the study has limitations: most interviews were conducted by phone due to COVID-19 risks, which reduced the depth of interaction. Additionally, the qualitative design limits the generalizability of findings. Future research should consider conducting quantitative surveys to gain broader insights.

### 4.6. Implications for Practice

This study provides actionable insights for policymakers seeking to enhance the integration of pharmacists into disaster management frameworks. Using the PPRR model, the findings clearly outline where pharmacists can be utilized more effectively. The COVID-19 experience provides a

practical reference for designing policies that enable pharmacists to contribute meaningfully during future emergencies.

## CONCLUSION

This study highlighted Saudi pharmacists' perceives of their roles in managing public health emergencies, particularly in light of the COVID-19 pandemic. While participants expressed strong support for the inclusion of pharmacists in all four phases of the disaster management cycle (prevention, preparedness, response, and recovery), they also emphasized that administrative, cultural, and systemic barriers continue to constrain their contributions.

The study found that pharmacists are highly capable and willing to take on broader responsibilities in disaster management. However, their involvement is most evident during the response and recovery phases, while engagement in prevention and preparedness remains limited due to the lack of formal training, professional recognition, and integration into national frameworks. These findings hold strategic significance for the development of health policy in Saudi Arabia. Integrating pharmacists into disaster planning, offering specialized training, and shifting public and institutional perceptions of pharmacists, from dispensers to frontline healthcare providers, can significantly enhance the health system's resilience.

Given the likelihood of future public health crises and the documented shortage of healthcare personnel during such events, this study reinforces the importance of utilizing pharmacists' expertise. Policymakers should urgently consider strategies to formalize and expand the role of pharmacists within disaster management systems.

Declaration of generative AI and AI-assisted technologies in the writing process.

No Generative AI was used in the preparation of this manuscript.

## AUTHORS' CONTRIBUTIONS

The authors confirm contribution to the paper as follows: A.A.A.: Writing – original draft, Visualization, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. R.A.A, Z.D.A, and Z.W.A.: Writing – review & editing, Methodology, Data collection. All authors have read and agreed to the published version of the manuscript.

## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| COVID-19 | = | Coronavirus Disease 2019 |
| MERS-CoV | = | Middle East Respiratory Syndrome Coronavirus |
| PPRR | = | Prevention, Preparedness, Response, and Recovery |
| NGO | = | Non-Governmental Organization |
| CP | = | Community Pharmacist |
| HP | = | Hospital Pharmacist |
| VC | = | Vaccination Center (Pharmacist) |
| WHO | = | World Health Organization |
| SARS | = | Severe Acute Respiratory Syndrome |
| AI | = | Artificial Intelligence (mentioned in metadata, not used in manuscript text) |

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research protocol was approved by the Committee of Research Ethics, Deanship of Scientific Research, Qassim University (No.: 23-27-11).

## HUMAN AND ANIMAL RIGHTS

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or research committee and with the 1975 Declaration of Helsinki, as revised in 2013.

## CONSENT FOR PUBLICATION

Participating pharmacists were first informed of the official approval granted by the relevant authority. Informed consent was then obtained after the study's objectives were explained. This consent included permission to record the interviews and to publish the responses anonymously.

## STANDARDS OF REPORTING

COREQ guidelines were followed.

## AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## FUNDING

None.

## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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