

# Analyzing the causes and impact of essential medicines and supplies shortages in the supply chain of the Ministry of health in Saudi Arabia: A quantitative survey study

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## ABSTRACT

**Background:** Investigating the causes and impact of essential medicines and supplies shortages in the supply chain of the MOH in Saudi Arabia could be the initial step in setting innovative strategies for mitigating this issue. This study aimed to identify the key factors contributing to essential medicines and supplies shortages in the supply chain of the MOH in Saudi Arabia and assess their impact on healthcare delivery.

**Methods:** A structured questionnaire was designed to collect relevant data on the causes and impact of essential medicines and supplies shortages. A representative sample of healthcare professionals, from various healthcare MOH facilities in Saudi Arabia. The Statistical Package for the Social Sciences (SPSS) software version 26 was used for the data analysis.

**Results:** A total of 379 respondents participated in the study, 73.7% were males, 51.2% were aged 36–45 years, 23.5% were supply chain professionals, and 32.9% reported an experience of >15 years. 90.0% of the participants reported that they personally have experienced shortages of essential medicines and supplies in the MOH supply chain in KSA. Inadequate planning, forecasting, and procurement were identified as the most significant contributing factors for shortages by about half (48.5%). At least two-thirds of the participants agreed with all strategies adopted for mitigating the issue of shortages.

**Conclusions:** The impact of shortages on patients and healthcare professionals was found to be substantial. The study also identified several key strategies to reduce shortages that received strong support from the participants.

## 1. Introduction

The persistent issue of medicine shortages presents a significant challenge to healthcare systems globally [1]. Throughout history, drug shortages have been a recurring concern, with the early 1920s witnessing the first recorded instance of insulin shortage. Since then, a growing prevalence of medicine shortages across various pharmacological classes, including antibiotics, antiretrovirals, anti-protozoal drugs, antineoplastics, cardiovascular agents, and analgesics, has been documented [2]. The impact of these shortages varies across countries and regions, influenced by factors such as health infrastructure and economic conditions [3].

Root causes of drug shortages are multifaceted, encompassing manufacturing challenges, financial constraints, inadequate raw materials, and just-in-time inventory practices. Developed nations like Saudi

Arabia, the United States, and European Union countries, as well as developing countries like Fiji and Pakistan, grapple with these challenges [4–9].

While acknowledging the global significance of the COVID-19 pandemic and its profound influence on the pharmaceutical industry [10], this study focuses on the broader context of drug shortages in Saudi Arabia. The pandemic strained medical supply chains, especially those heavily reliant on importing active pharmaceutical ingredients (APIs) from major suppliers like China and India [11]. This disruption affected pharmaceutical companies worldwide, with India and China collectively supplying approximately 80% of the APIs needed by U.S. pharmaceutical firms [12]. The subsequent three-month lockdown, triggered by the pandemic's initial impact on China, further disrupted the global medical supply chain, leaving enduring effects on the API market [11].

In Saudi Arabia, reports of medicine shortages, particularly during

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the COVID-19 pandemic, have intensified over the past decade. Critical medications, including antineoplastics, antibiotics, immunosuppressants, gastrointestinal, emergency, respiratory, anesthetic, ophthalmic, psychotropic, and cardiovascular drugs, faced scarcity during this period [13,14].

Recognizing the limited qualitative data on healthcare professionals' concerns about resource shortages, particularly medical supplies, this study aims to delve into the causes and impact of essential medicines and supplies shortages within the Ministry of Health (MOH) supply chain in Saudi Arabia. Through a quantitative approach involving the administration of questionnaires and subsequent data analysis, the study seeks to uncover insights that could pave the way for innovative strategies to address this pressing issue.

## 2. Methods

### 2.1. Study design

This research adopted a cross-sectional, quantitative methodology employing an online questionnaire to comprehensively analyze the causes and impact of essential medicines and supplies shortages within the Ministry of Health (MOH) supply chain in Saudi Arabia.

### 2.2. Study setting

Conducted at the University of Business and Technology in Saudi Arabia, the study sought to gather insights from professionals within the academic community.

### 2.3. Study population

The study targeted a specific group, including supply chain professionals, health practitioners, and healthcare administrators currently employed at various MOH facilities in Saudi Arabia. Individuals who were no longer part of the MOH facilities were excluded to ensure relevance and current insights.

### 2.4. Data collection

A meticulously structured questionnaire was developed, drawing inspiration from identified themes in previously published studies [15–17]. Leveraging the user-friendly Google Forms tool, the questionnaire was made available in both English and Arabic languages. Dissemination involved reaching out to the target population through mobile messaging applications. The process began with an initial message, providing a concise explanation of the survey's purpose, followed by another message containing the link to the questionnaire. The questionnaire was thoughtfully designed with six sections, covering 1) demographic information, 2) participants' experience and awareness of medicine and supplies shortages, 3) knowledge about potential causes of shortages, 4) understanding the impact of shortages on patients, 5) awareness of the impact on healthcare practitioners, and 6) participants' opinions on recommended strategies to mitigate shortages. External validity and reliability of the study tool was assured before commencing the data collection.

### 2.5. Statistical analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software version 26. The methodology involved employing descriptive statistics, including frequency and percentages, for effective data presentation. To analyze categorical variables related to patient data, the chi-square test was chosen, with a predefined significance level of  $p < 0.05$ .

## 2.6. Ethical considerations

Stringent ethical considerations were observed throughout the study. Personal identifiers, such as names or addresses, were deliberately excluded to ensure participant confidentiality. Ethical approval was secured from the central institutional review board of the Saudi MOH. Prior to participation, participants were provided with comprehensive information regarding the study's purpose, the anticipated time required for questionnaire completion, and the voluntary nature of their involvement. Participants were explicitly informed of their right to withdraw from the study at any point, without the need to provide a reason, emphasizing the importance of informed and voluntary participation (see Fig. 1).

## 3. Results

### 3.1. The demographic characteristics

As shown in Table 1, a total of 379 participants were involved in the study, 73.7% were males, and 51.2% were aged 36–45 years. 56.7% of the participants were healthcare practitioners, and 32.9% reported an experience of >15 years (Fig. 2).

### 3.2. The association between demographic characteristics and ranks for the significance of shortages

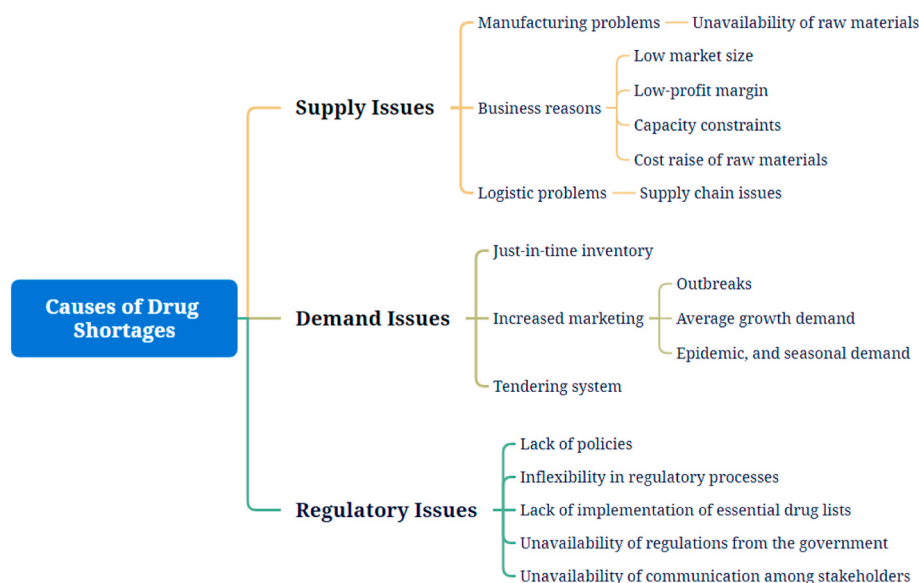
Table 2 illustrates the association between demographic characteristics and ranks for the significance of shortages. Inadequate planning, forecasting and procurement demonstrated a statistically significant correlation ( $p < 0.001$ ) with only the experience years among all demographic characteristics. Financial constraints demonstrated a statistically significant correlation ( $p = 0.03$ ) with only gender. External factors (e.g., global supply chain disruptions) confirmed a statistically significant correlation ( $p < 0.001$ ) with only the experience years. On the other hand, no statistically significant correlation was found between gender and inadequate planning, forecasting and procurement ( $p = 0.08$ ), supply chain inefficiencies ( $p = 0.07$ ), regulatory issues and delays in processes ( $p = 0.17$ ), and external factors such as global supply chain disruptions ( $p = 0.06$ ).

### 3.3. The impact of shortages on patients and healthcare professionals

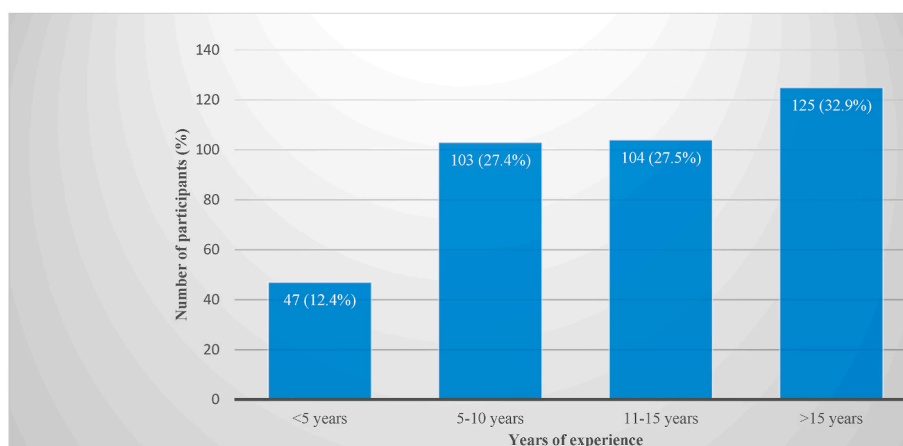
Table 3 represents the participants' views on the impact of shortages on patients and healthcare professionals. 43.8% of the participants reported that patients "frequently" experience the detrimental consequence of shortages by stopping their medication or not having access to necessary medical items. Another crucial finding is that 46.4% of the

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

Characteristics	Response	No.	%
Gender	Male	279	73.7
	Female	100	26.3
Age (years)	18–25	3	1.0
	26–35	129	34.1
	36–45	194	51.2
	46–55	46	12.2
	≥56	7	1.9
Occupation	Healthcare Practitioner	215	56.8
	Supply Chain Professional	89	23.5
	Administrator	33	8.7
	Researcher/Academic	3	1.0
	Others	39	10.3
Experience (years)	<5 years	47	12.4
	5–10 years	103	27.4
	11–15 years	104	27.5
	>15 years	125	32.9



**Fig. 1.** The root causes of drug shortages. 3 root causes of drug shortages including supply issues (e.g., manufacturing issues, unavailability of raw materials, business issues, and logistics issues), demand issues (e.g., just-in-time, increase marketing, and tendering system), and regulatory issues (e.g., lack of policies, inflexibility in regulatory processes, lack of implementation of essential drug lists, unavailability of regulations from the government, and unavailability of communication among stakeholders).



**Fig. 2.** Frequency of years of experience among study participants. About one-third (32.9%) of the participants reported >15 years of experience in the field of supply chains, about one-fourth (27.5%) reported 11–15 years of experience, nearly the same proportion (27.4%) reported 5–10 years of experience, and a minority (12.4%) reported <5 years of experience.

participants reported that patients' adherence to treatment regimens is "frequently" affected by shortages. Furthermore, it is noteworthy that 41.4% of the respondents expressed concerns that shortages have led to patients "frequently" losing their trust in drugs and health professionals. Additionally, 44.3% of the participants reported that they "frequently" experience stress, confusion, anger, and frustration as consequences of essential medicines and medical supplies shortages.

44.3% of the participants reported that these shortages "frequently" lead to disruptions in the continuity of care. 40.3% of the participants reported that these shortages are "frequently" associated with an increased work burden. Similarly, 41.7% of the participants reported that these shortages "frequently" result in interference with practice freedom.

### 3.4. The recommended strategies to mitigate the shortages

Table 4 represents the participants' responses to various strategies that may help reduce essential medicines and medical supplies

shortages. 33.3% of the participants agreed with speaking with the Saudi FDA about shortage problems. 40.1% of the participants agreed with informing key hospitals or health system executives of shortage problems. 39.2% agreed that applying pharmacoeconomics has a role in minimizing the shortage of essential medication and medical items.

Additionally, 40.6% of the respondents agreed with developing or modifying policies of MOH regarding essential medication and medical items availability. Similarly, 42.2% of respondents agreed with providing in-service education for medical staff on alternatives for essential medication and medical items in short supply. 39.5% of the participants agreed with implementing information and communication technology (ICT) such as electronic medical records and integrated enterprise resource planning (ERP) systems to keep up and meet the actual demand. 39.2% of the participants strongly agreed with establishing contracts with suppliers to secure backup sources of essential drugs and medical items.

36.1% of the participants agreed, and 35.6% strongly agreed, that the Pharmacy and Therapeutic Committee (P&TC) has a role in the

**Table 2**  
The association between demographic characteristics and ranks for the significance of shortages.

Demographics	Causes of shortages	p-value <sup>a</sup>
Gender	Inadequate planning, forecasting and procurement	0.08
	Supply chain inefficiencies	0.07
	Regulatory issues (FDA Approval) and delays in processes	0.17
	Financial constraints	0.03 <sup>¶</sup>
	External factors (e.g., global supply chain disruptions)	0.06
Age	Inadequate planning, forecasting and procurement	0.35
	Supply chain inefficiencies	0.07
	Regulatory issues (FDA Approval) and delays in processes	0.09
	Financial constraints	0.06
	External factors (e.g., global supply chain disruptions)	0.08
Occupation	Inadequate planning, forecasting and procurement	0.15
	Supply chain inefficiencies	0.07
	Regulatory issues (FDA Approval) and delays in processes	0.47
	Financial constraints	0.36
	External factors (e.g., global supply chain disruptions)	0.08
Experience years	Inadequate planning, forecasting and procurement	<0.001 <sup>¶</sup>
	Supply chain inefficiencies	0.05
	Regulatory issues (FDA Approval) and delays in processes	0.06
	Financial constraints	0.42
	External factors (e.g., global supply chain disruptions)	<0.001 <sup>¶</sup>

FDA; Food and Drug Administration.

¶ Statistically significant.

<sup>a</sup> Calculated using Chi-square test.

management of essential drugs and medical items in short supply by utilizing alternatives and employing the MOH guidelines effectively. 43.0% of the respondents agreed, and 36.4% strongly agreed, with regularly informing the staff of essential drugs and medical items in short supply. Additionally, 39.2% of the respondents agreed, and 36.4% strongly agreed, with adding backup inventory for critically important medical items and drug categories. In the same context, 33.5% of the respondents agreed, and 45.9% strongly agreed, with generating an approved list of critical and lifesaving items to be provided within 24–48 h 42.5% of the respondents agreed, and 32.2% strongly agreed, with the implementation of restrictions (control) for essential medical items and drug use on shortage supply. Finally, 37.5% of the participants agreed with close tracking inventory and moving stock.

4. Discussion

Saudi Arabia is now experiencing a significant overhaul of its healthcare system with the implementation of the National Transformation Program (NPT) as part of the new Economic Vision 2030, which was introduced in 2016 [18]. The continuing improvements in the healthcare system are intended to rejuvenate the present healthcare system and enhance public health, while also assuring sustainable development and cost-effectiveness in healthcare [19]. Public spending on pharmaceuticals is increasing at a faster rate than inflation due to several factors. These include the high occurrence rates of chronic diseases like diabetes, dyslipidemia, and hypertension, the reluctance of certain health organizations to adopt generic medications, and the introduction of new and costly therapies to the market [16]. Previous studies indicate that the increasing rates of shortages in essential medicines over the past seven years can be attributed to centralized pharmaceutical procurement practices. Many employees in pharmaceutical planning and purchasing departments of certain public health sectors have identified this as the cause. The user’s text is enclosed in tags.

**Table 3**  
Participants’ view about impact of shortages on the patients and healthcare providers.

The impacts of essential medicines & medical supplies shortages	Response	No.	%
<b>On the patients</b>			
Patients have stopped taking the medications and/or medical items	Never	38	10.1
	Rarely	118	31.1
	Frequently	166	43.8
	Always	41	10.8
	Not applicable	16	4.2
Patients adherence has been affected	Never	29	7.7
	Rarely	89	23.5
	Frequently	176	46.4
	Always	76	20.0
	Not applicable	9	2.4
Patient lost trust in drugs and health professionals	Never	43	11.3
	Rarely	98	25.9
	Frequently	157	41.4
	Always	74	19.5
	Not applicable	7	1.9
Patient is stressed, confused, angry and frustrated	Never	27	7.1
	Rarely	60	15.8
	Frequently	168	44.3
	Always	122	32.2
	Not applicable	2	0.5
<b>On the healthcare providers</b>			
Disruption in the continuity of care	Never	25	6.6
	Rarely	96	25.4
	Frequently	168	44.3
	Always	85	22.4
	Not applicable	5	1.3
Increase work burden	Never	24	6.4
	Rarely	60	15.8
	Frequently	153	40.3
	Always	138	36.4
	Not applicable	4	1.1
Interference with practice freedom	Never	32	8.4
	Rarely	87	22.9
	Frequently	158	41.7
	Always	85	22.4
	Not applicable	17	4.6

MOH; Ministry of Health.

The present research aims to examine the repercussions of shortages on the healthcare system in Saudi Arabia and to find possible methods to alleviate these shortages. The current research found that a large majority (90.0%) of the participants had personal experiences of shortages of vital medications and supplies within the Ministry of Health supply chain in KSA. Approximately half (50.1%) of the individuals who reported this occurrence encountered it on more than five occasions (50.1%). Conversely, 26.4% of individuals encountered this issue 3–5 times, but only 15.1% of people seldom faced this scarcity.

The implementation of centralized pharmaceutical procurement, serving as an exemplification of inadequate planning, detrimentally affects the availability of vital medications and medical resources. The negative impact of the procurement process can be attributed to several factors, one of which is the acquisition of unregistered medications by the Saudi Food and Drug Authority (SFDA). This led to the withdrawal of certain generic medications after reports of therapeutic failure by public health institutions [16]. Several factors, such as the absence of a nearby producer or supplier for certain necessary prescription drugs, the inability of local suppliers to meet the demand, a scarcity of active pharmaceutical ingredients, and the failure to make timely payments to suppliers, may have led to the acquisition of prescription medicines from unregistered suppliers or manufacturers not approved by the SFDA [20].

**Table 4**  
Participants' responses to strategies that may reduce shortages, n = 379.

Recommended Strategy	Response	No.	%
Speaking with Saudi FDA about shortage problems	Strongly disagree	28	7.4
	Disagree	35	9.2
	Neutral	102	26.9
	Agree	126	33.3
	Strongly agree	88	23.2
Informing key hospitals or health system executives of shortage problems	Strongly disagree	19	5.0
	Disagree	17	4.6
	Neutral	63	16.6
	Agree	152	40.1
	Strongly agree	128	33.7
Applying Pharmacoeconomics have a role in minimizing shortage of essential medication and medical items	Strongly disagree	17	4.6
	Disagree	24	6.4
	Neutral	92	24.3
	Agree	149	39.2
	Strongly agree	97	25.5
Developing or modifying policies of MOH regarding essential medication and medical items availability	Strongly disagree	15	4.0
	Disagree	20	5.3
	Neutral	63	16.6
	Agree	154	40.6
	Strongly agree	127	33.5
Providing in-service education for medical staff on alternatives for essential medication and medical items in short supply	Strongly disagree	13	3.4
	Disagree	20	5.3
	Neutral	62	16.4
	Agree	160	42.2
	Strongly agree	124	32.7
Implementing ICT such as electronic medical records and integrated ERP systems to keep up and meet the actual demand	Strongly disagree	17	4.6
	Disagree	11	2.9
	Neutral	71	18.7
	Agree	150	39.5
	Strongly agree	130	34.3
Establish contracts with suppliers to secure back-up sources of essential drugs and medical items	Strongly disagree	10	2.6
	Disagree	17	5.6
	Neutral	56	14.8
	Agree	147	38.8
	Strongly agree	149	39.2
P&TC has a role in the management of essential drugs and medical items in short supply by utilizing alternatives and employing the MOH guidelines effectively	Strongly disagree	17	4.6
	Disagree	19	5.0
	Neutral	71	18.7
	Agree	137	36.1
	Strongly agree	135	35.6
Regularly inform staff of essential drugs and medical items in short supply	Strongly disagree	17	5.6
	Disagree	11	2.9
	Neutral	50	13.1
	Agree	163	43.0
	Strongly agree	138	36.4
Adding back-up inventory for critically important medical items and drugs categories	Strongly disagree	11	2.9
	Disagree	13	3.4
	Neutral	68	18.0
	Agree	149	39.2
	Strongly agree	138	36.4
Generate an approved list of critical and lifesaving items to be provided within 24–48 h	Strongly disagree	11	2.9
	Disagree	15	4.0
	Neutral	52	13.7

**Table 4 (continued)**

Recommended Strategy	Response	No.	%
Implementation of restrictions (control) for essential medical items and drugs use on shortage supply	Agree	127	33.5
	Strongly agree	174	45.9
	Strongly disagree	12	3.2
	Disagree	19	5.0
	Neutral	65	17.1
Closely tracking inventory and moving stock	Agree	161	42.5
	Strongly agree	122	32.2
	Strongly disagree	50	13.1
	Disagree	16	4.2
	Neutral	61	16.1
	Agree	142	37.5
	Strongly agree	110	29.1

**ERP**; enterprise resource planning, **FDA**; Food and Drug Administration, **ICT**; information and communication technology, **MOH**; Ministry of Health, **P&TC**; Pharmacy and Therapeutic Committee.

A notable discovery from the present investigation is that a substantial percentage (43.8%) of participants said that patients often face adverse outcomes due to shortages, such as discontinuing their prescription or lacking access to essential medical supplies. This discovery aligns with a research done in Jordan, where participants indicated that patients may endure significant distress due to shortages, primarily impacting their health results and convenience [17]. Similar to earlier research [17,21], the findings of the present study indicate that, according to the participants, patients encounter interruptions, their health outcomes are negatively affected, and their treatment is postponed.

The frequent changes in medication lead to shortages, which in turn cause patients to experience heightened stress and feelings of confusion and anger. Consequently, patients are compelled to seek out other options, leading to a loss of confidence in both the medications and their healthcare providers. As a result, patients are experiencing a decline in their confidence in the public healthcare system, leading to a detrimental effect on their compliance with medicine. This underscores the significant ramifications of shortages on patient well-being and adherence to therapy. Furthermore, it emphasizes the need of maintaining a strong supply chain and implementing contingency plans to prevent any interruptions in patient care. An investigation carried out in North Carolina, South Carolina, Georgia, and Florida revealed that the scarcity of drugs had a significant role in the elevated occurrence of mistakes in prescriptions for patients, resulting in increased load on patients and detrimental effects on their health outcomes. Both the healthcare workers and the patients were exposed to peril due to this situation. Alfuzosin was substituted for Tamsulosin due to its limited availability, despite the fact that Alfuzosin causes prolongation of the QT interval [22,23]. The lack of some drugs and medical supplies might lead to a higher mortality rate. The death rate was substantial as a result of insufficient chemotherapeutic treatments, as well as the absence of other crucial medications such as antibiotics, phytonadione, electrolyte solutions, analgesics, and opioids [24]. Counterfeit product sales have significantly increased in middle-income nations as a result of shortages in medication and medical supplies [25].

Approximately 44.3% of the participants in the present survey said that shortages of necessary medications and medical supplies often result in interruptions in the provision of continuous care. Approximately 40.3% of the participants said that these shortfalls are often linked to an elevated workload. These results emphasize the added burden and stress experienced by healthcare professionals as they attempt to handle scarce resources and accomplish their duties efficiently.

Similarly, 41.7% of the participants said that these shortages



sometimes hinder their practice independence. This implies that shortages might limit the capacity of healthcare workers to make appropriate judgments in patient care, hence impeding treatment efficacy and overall patient contentment. Moreover, a significant percentage (41.1%) of the respondents indicated experiencing regular displeasure with the Ministry of Health (MOH), hospital leadership, or other healthcare personnel as a result of shortages. This highlights the need for efficient communication, cooperation, and assistance among everyone involved in the healthcare system to tackle and alleviate the consequences of shortages. These shortages often lead to doctors experiencing frustration, agitation, tension, irritation, dissatisfaction, loss of patients' confidence, and even threats from them [8]. The situation grows more dire for those who have planned surgeries, those in need of urgent medical assistance, and those diagnosed with cancer [26].

Based on the findings of the present research, a minimum of two-thirds of participants expressed agreement with all the suggested solutions that may be used to address or avoid shortages of important medications and medical supplies. This discovery emphasizes the necessity of providing healthcare professionals with knowledge about viable alternatives in times of scarcity. This enables them to make informed choices in order to maintain patient care. It also underscores the significance of establishing robust supply chains and contingency plans to minimize the effects of shortages. Additionally, it is crucial to have a clearly defined list of essential items and ensure their prompt availability during shortages to effectively manage patients.

In order to address the scarcity of medication and medical supplies, several strategies are implemented in most high-income nations and some middle-income countries. The World Health Organization (WHO), the International Pharmaceutical Federation (FIP), the American Society of Health-System Pharmacists (ASHP), and the European Association of Hospital Pharmacists (EAHP) are among the numerous international and national organizations actively engaged in undertaking initiatives, disseminating information, and establishing guidelines to mitigate shortage situations. The United States, European countries, Canada, Australia, China, etc. Concurrently proposed many ideas. However, given this problem persists and is mostly unattended to in low- and middle-income nations, there is an ongoing need for universally applicable, updated approaches to tackle it on a worldwide scale [1].

Hospitals use the following tactics to handle medicine shortages: The actions include: 1) notifying prescribers and suggesting other medications, 2) reaching out to other suppliers for the temporarily unavailable drug, 3) conducting an inquiry into supply restoration and making appropriate plans, 4) replacing the prescription medication with a suitable substitute, and 5) revising the formulary to reflect any changes. Nevertheless, within community pharmacies, community pharmacists and staff effectively address medication shortages by the implementation of certain strategies: 1) effectively managing existing shortages, 2) reaching out to approved suppliers, 3) collaborating with other pharmacies, and 4) proposing alternate treatments to patients [27,28].

## 5. Conclusion

The findings of the current investigation revealed a widespread occurrence of deficiencies in vital medications and medical resources. A significant majority of respondents (90%) reported firsthand encounters with these shortages inside the Ministry of Health's distribution network. The study revealed that shortages had a considerable influence on patients, as a large proportion of participants reported negative consequences on patient care, treatment compliance, confidence in healthcare providers, and emotional welfare. These results emphasize the immediate need to resolve shortages in order to guarantee optimum patient outcomes and enhance the overall quality of healthcare services. Furthermore, the scarcity of resources was shown to have substantial consequences for healthcare practitioners, resulting in interruptions in the provision of consistent treatment, heightened workload, and limitations on professional autonomy. This underscores the need of

providing assistance to healthcare professionals and enacting efficient tactics to alleviate the difficulties they encounter during shortages.

The research further highlighted some crucial techniques to mitigate shortages that garnered substantial approval from the participants. These strategies encompass offering in-service education to medical personnel regarding alternative options for essential medication and medical items, creating an authorized inventory of crucial and life-saving items for prompt distribution, enforcing restrictions on appropriate usage during shortages, closely monitoring inventory and optimizing stock movement, and establishing contractual agreements with suppliers to ensure access to alternative sources of essential drugs and medical items. These techniques have significant potential in efficiently resolving shortages and guaranteeing a healthcare system that is more robust and dependable.

## 5.1. Limitations

Because this study has a number of limitations, the findings should be considered carefully. First, the study design as a cross-sectional study is subject to various forms of bias. Second, although the study involved participants drawn from various healthcare MOH facilities in Saudi Arabia, the study failed to establish a link between the facility's location and type and the impact of shortages on patients' health outcomes, the prevalence of essential medicine and medical supplies shortages, and the effects of these shortages on healthcare providers. Finally, the study did not investigate the measures taken by each institution to address these shortages and what specific regulations and policies might need to be changed to address the issue at work.

## CRedit authorship contribution statement

**Fatin Alshibli:** Writing – review & editing, Writing – original draft, Software, Project administration, Methodology, Data curation, Conceptualization. **Khaled Alqarni:** Conceptualization. **Hasan Balfaqih:** Supervision.

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Fatin Alshibli reports statistical analysis and writing assistance were provided by Medical Supply Chain Management, Aseer General Directorate, Ministry of Health, Aseer 62523, Saudi Arabia. Fatin Alshibli reports a relationship with Medical Supply Chain Management, Aseer General Directorate, Ministry of Health, Aseer 62523, Saudi Arabia that includes: employment. Fatin Alshibli has patent pending to Medical Supply Chain Management, Aseer General Directorate, Ministry of Health, Aseer 62523, Saudi Arabia. None If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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