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Original article

## Local causes of essential medicines shortages from the perspective of supply chain professionals in Saudi Arabia

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## ABSTRACT

**Background:** The global supply chains of essential medicines faced frequent disruptions over the past five years, particularly during the COVID-19 pandemic. Different causes of prescription drug supply interruptions have been identified in Saudi Arabia. However, studies have yet to explore the views of pharmaceutical supply chain personnel regarding the causes of these interruptions. Therefore, this study aimed to survey individuals working in the pharmaceutical supply chains about their views on the observed interruptions in the supply of some essential drugs.

**Methods:** This was a questionnaire-based cross-sectional study. The 10-item questionnaire was created based on the findings of previously published research that investigated the root causes of essential drug shortages and the impact of COVID-19 pandemic on the supply chains of essential drugs in Saudi Arabia. Purposive sampling was used to identify individuals with at least one year of experience in the area of the pharmaceutical supply chain, and the data collection occurred between April 19th, 2022 and October 23rd, 2022. In addition, descriptive statistics (e.g., frequencies and percentages) were conducted to present the views of the respondents.

**Results:** Seventy-nine pharmaceutical supply chain specialists accepted the invitation and completed the questionnaire. About two-thirds (69.62%) of the respondents reported that centralized pharmaceutical procurement negatively affected the supply chain of essential drugs. Procurement of unregistered medications by the Saudi Food and Drug Authority (SFDA), as well as generic drugs with a history of recalls, and failure to supply requested quantities were the three most commonly reported reasons behind the observed interruptions in the supply of some essential drugs according to those respondents with a negative view of the centralized procurement. Furthermore, failure of pharmaceutical companies to inform SFDA of potential drug shortages, manufacturing issues, poor demand forecasting, unpredictable increase in demand, and low prices of essential drugs were also believed to be behind the observed interruptions in the supply of some essential medicines.

**Conclusion:** The majority of surveyed pharmaceutical supply chain professionals held negative views about the role of centralized pharmaceutical procurement in exacerbating the issues with essential medicines supply chain. Future research should examine different strategies to improve purchasing and procurement practices in Saudi Arabia.

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## 1. Introduction

The availability and accessibility of prescription medicines are of crucial importance to the success of any healthcare system (Shukar et al., 2021). Therefore, the World Health Organization (WHO) has defined essential medications as “satisfying the population’s priority health care needs”. However, many health care systems around the world are struggling to mitigate the impact of frequent shortages of essential life-saving medicines (Organization 2016). Although medicine shortages are not new, their incidence rates increased over the past decade (Ventola 2011, McLaughlin et al., 2013, Fox et al., 2014, Organization 2016). The shortages of essential medicines can result in innumerable adverse clinical outcomes, such as high mortality rates, undertreatment, and higher rates of medication errors, as demonstrated by multiple research studies (McLaughlin et al., 2013, Phuong et al., 2019, Postma et al., 2022). Unfortunately, medicine shortages became a more significant global problem during the coronavirus disease 2019 (COVID-19) pandemic, resulting in numerous adverse clinical and economic outcomes (Aljadeed et al., 2021, Badreldin and Atallah 2021, Sen-Crowe et al., 2021). Multiple factors have contributed to past and current medicine shortages (Shukar et al., 2021). These factors can be related to unexpected demand changes, such as the increased demand for certain medicines during the COVID-19 pandemic or insufficient buffer stock in case of just-in-time inventory control (Abu Zwaida et al., 2021, Aljadeed et al., 2021, Badreldin and Atallah 2021, Sen-Crowe et al., 2021). Moreover, there has been an increase in demand for many essential medicines from low- and middle-income countries (Organization 2016). In addition, we have seen a substantial increase in the mergers and acquisitions of many generic manufacturers which reduced the market supply of essential medicines especially those with low profit margins (Organization 2016, Gagnon and Volesky 2017).

In Saudi Arabia, medicine shortages have been reported for many essential medicines over the past decade. However, this was exacerbated in the past five years and peaked during the COVID-19 pandemic (AlRuthia et al., 2017, AlRuthia et al., 2018, AlAzmi et al., 2020, Aljadeed et al., 2021). These shortages affected different classes of essential medicines, such as antineoplastic agents, antibiotics, immunosuppressants, gastrointestinal medicines, emergency medicines, respiratory medicines, anesthetics, ophthalmic preparations, psychotropic medicines, and cardiac medications (Al-Aqeel et al., 2010, Al-Ruthia et al., 2017, AlRuthia et al., 2017). The factors that contributed to the interrupted supply of some essential medicines were not always domestic, such as the shortage of numerous prescription medicines during the COVID-19 pandemic due to the disruption of global supply chains and the unexpected spike in demand for various essential medicines, such as some monoclonal antibodies, antibiotics, antiretrovirals, and corticosteroids (Aljadeed et al., 2021, Badreldin and Atallah 2021, Sen-Crowe et al., 2021). However, many believe that the pharmaceutical supply chain in Saudi Arabia has internal issues that make it more susceptible to disruptions resulting in shortages of different essential medicines despite the generous government spending on prescription medicines in the public health sector. These issues were explored in a focus group meeting that involved representatives from different health and regulatory entities in 2018 (AlRuthia et al., 2018). The participants listed different reasons behind medicine shortages that could fall under seven themes:

Failure of pharmaceutical manufacturers to notify the health regulatory bodies, such as the Saudi Food and Drug Authority (SFDA) of any imminent medicine shortage six months in advance;

Poor inventory management and planning;  
Lack of effective disciplinary actions against pharmaceutical manufacturers who fail to supply the market with the needed supplies of prescription medicines;  
SFDA red tape with regard to releasing biological medicinal products from different ports of entry;  
Overreliance on imported prescription medicines;  
The strict pricing policy of essential pharmaceutical products by the SFDA;  
Outdated pharmaceutical procurement policy.

Although some of these issues were largely resolved, there are still issues that were not explored fully, such as the national centralized procurement of medicines. Centralized procurement or pooled procurement can be defined as a collaboration initiative of buyers that consolidates their purchases (Baldi and Vannoni 2017). Previous studies have improved spending efficiency and access to essential medicines in some countries (Baldi and Vannoni 2017, Wang et al., 2021, Zhang et al., 2022). As part of Vision 2030, Saudi Arabia has implemented significant pharmaceutical and procurement policy reforms. One of these policies is consolidating the procurement and demand planning responsibilities at the national procurement agent, National Unified Procurement Company (NUPCO). Since 2009, NUPCO has been reinforcing its position as the national procurement agent. As a result, NUPCO is responsible for procuring, warehousing, and distributing all medicines in the public sector. Nonetheless, centralized procurement has also been associated with potentially limiting supply-side competition and medicine shortages, according to recent studies (Vogler et al., 2022). Therefore, we aimed to explore whether the national centralized pharmaceutical procurement has contributed to medicine shortages in Saudi Arabia since it became mandatory for all public health entities to secure their needs of all pharmaceutical and medical supplies through a single national procurer (Alamoudi et al., 2022). Moreover, we tried to identify different factors that may have contributed to medicine shortages from the perspective of individuals working in the local pharmaceutical supply chain in Saudi Arabia.

## 2. Methods

### 2.1. Study design and population

In order to explore the causes of pharmaceutical supply chain disruptions (e.g., raw material shortages, incorrect lead time, regulatory compliance issues, equipment failures, transportation issues) that led to shortages of some essential medicines over the past five years among individuals working in planning, procurement, purchasing, and inventory management in Saudi Arabia, a questionnaire was developed based on the identified themes in previously published studies (AlRuthia et al., 2018). The 10-item questionnaire inquired about the sociodemographic characteristics of the participants (e.g., age, gender, educational level, whether the participant earned a graduate degree related to supply chain management, current position, years of experience in the pharmaceutical supply chain, and health sector the participant is affiliated with), whether the national centralized pharmaceutical procurement has positively or negatively impacted the supply chain of essential medicines in Saudi Arabia, and if they believed that the impact was negative what factors do they think have contributed to that negative impact. Additionally, the other reasons they believe have contributed to the disruption in the supply of essential medicines. The respondents were able to tick one or more boxes from a provided checklist or write their views in a separate

box. See Appendix I for the questionnaire. This questionnaire was face and content validated by six researchers and experts in pharmaceutical supply chain management. Moreover, the questionnaire was discussed in the annual meeting of the Saudi chapter of the Professional Society for Health Economics and Outcomes Research (ISPOR) to ensure that its content fits the context of the pharmaceutical supply chains in Saudi Arabia. The discussion involved five participants from different sectors (academia, media, public healthcare payer, procurement, and regulatory) where the themes of the newly constructed questionnaire, such as the impact of centralized procurement, demand forecasting, inventory management, and pricing and regulations on the supply chain of essential drugs, were brought up in the discussion and the participants agreed that each of the included theme played a role in the observed shortages of some essential drugs. Purposive sampling was utilized to identify individuals who work in the pharmaceutical supply chain through the “Saudi group for medical supply chains management” within the *Saudi pharmaceutical society*. Only individuals who have been certified by the Saudi group for medical supply chains management as working in the pharmaceutical supply chain in public or private sectors were invited to participate. Individuals no longer working in the pharmaceutical chain in Saudi Arabia were excluded.

## 2.2. Data collection and statistical analysis

The link to the online questionnaire, which was created using Microsoft® Forms, was sent to the individuals who met the inclusion criteria by Saudi group for medical supply chain management. Data collection occurred between April 19th, 2022 and October 23rd, 2022. Frequencies and percentages of the responses were used to describe the participants' responses. Chi-square and Fisher's exact tests were conducted as appropriate to examine whether the respondents' views of the impact of centralized pharmaceutical procurement on pharmaceutical supply chain of essential drugs vary based on their characteristics. SAS version 9.2 (Cary, NC, SAS institute) was used for all statistical analyses.

## 2.3. Ethical considerations

No personal identifiers, such as name or address, were collected. The research proposal was reviewed and approved by the central institutional review board of the Saudi Ministry of Health (IRB approval number: 20–152 E). Also, the institutional review board has waived the requirement for a consent form. Participants were informed that their participation is voluntary and they can withdraw from the study anytime without giving any reason. The study adhered to the ethical principles of the Helsinki declaration for medical research involving human beings ([Association 2014](#)).

## 3. Results

Out of 115 individuals who received the link to the online questionnaire, 79 (68.69%) have responded and filled out the questionnaire after three reminders. Most of the respondents were males (75.95%), and between 35 and 55 years of age (65.82%). Additionally, the majority (88.61%) had a bachelor's degree or higher with at least five years of experience in the field of pharmaceutical supply chains (69.62%), and 45.57% received some postgraduate training or education in supply chain management. About 56% of the respondents held leadership positions in the supply pharmaceutical supply chains, such as supply chain specialist, pharmaceutical planning specialist, supply chain director, and planning manager. More than two-thirds (86.1%) of the respondents worked in public

**Table 1**  
Participants' characteristics.

Characteristic	N (%)
<b>Gender</b>	
Male	60(75.95)
Female	19(24.05)
<b>Age</b>	
25–35 yrs.	25(31.65)
35–45 yrs.	33(41.77)
45–55 yrs.	19(24.05)
55–65 yrs.	2(2.53)
<b>Educational level</b>	
High school diploma	3(3.79)
Associate degree	6(7.59)
Bachelor's degree	38(48.10)
Professional degree (e.g., PharmD, MD, etc...)	6(7.59)
Graduate degrees (e.g., Master of Science or Doctor of Philosophy).	26(32.91)
<b>Years of experience in pharmaceutical supply chain</b>	
< 1 yr.	6(7.59)
1–5 yrs.	18(22.78)
5–10 yrs.	16(20.25)
> 10 yrs.	39(49.37)
<b>What is your current position in the organization that you work in?</b>	
Pharmacist	17(21.52)
Senior or Chief Pharmacist	18(22.78)
Supply Chain Specialist	11(13.92)
Planning Specialist	10(12.66)
Others (e.g., Planning manager, supply chain director, director of pharmacy, etc...)	23(29.11)
<b>Have you earned any postgraduate degree or certificate in supply chain management?</b>	
Yes	36(45.57)
No	43(54.43)
<b>Which sector your organization is affiliated with?</b>	
Ministry of Health	39(49.37)
Military Healthcare affairs (e.g., National Guards, Ministry of Defense, Ministry of Security Forces, etc...)	29(36.71)
Pharmaceutical Industry	9(10.39)
Private Healthcare Institutions	1(1.27)
King Faisal Specialist Hospital and Research Center (KFSH&RC)	1(1.27)

healthcare institutions affiliated with either the Ministry of Health or military-affiliated healthcare organizations, as shown in [Table 1](#).

More than two-thirds of the respondents (69.62%) viewed the impact of centralized pharmaceutical procurement negatively, as shown in [Fig. 1](#). Although no significant difference in participants' views about the impact of centralized procurement on essential medicines supply chain across different age groups, gender, years of experience, employers, and positions, those with longer years of experience in pharmaceutical supply chain management and participants who held leadership positions in supply chain management were leaning toward expressing negative views about the impact of centralized pharmaceutical procurement on essential medicines supply chain as shown in [Table 2](#). For those who viewed the role of the centralized procurement negatively, they attributed that to the procurement of unregistered prescription medicines by the SFDA, long procurement lead time, procurement of generic medicines with frequent history of recalls, failure of the national centralized procurement to supply the healthcare organization with the requested quantity, and poor communication between the requesting health organization and the national centralized procurement, as shown in [Fig. 2](#). The other reasons that contributed to the pharmaceutical supply chain disruptions in Saudi Arabia were failure to inform the SFDA of medicine shortages ahead of time by the manufacturers, manufacturing issues (e.g., shortages of raw materials), poor demand forecasting, unpredictable increase in demand (e.g., COVID-19 pandemic), and low prices of some essential medicines, as shown in [Fig. 3](#).

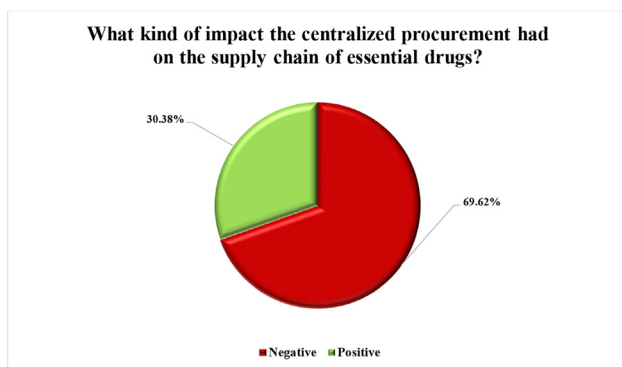


Fig. 1. The impact of centralized procurement on the supply chain of essential medicines.

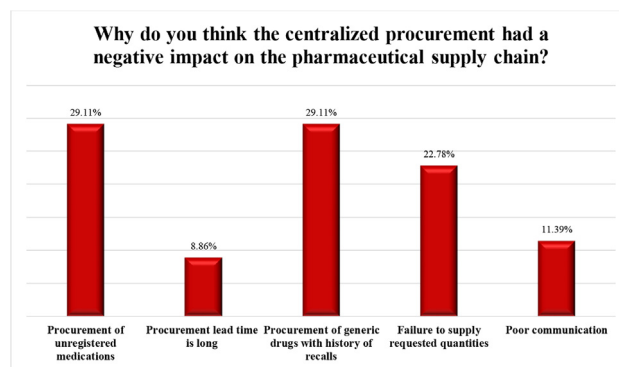


Fig. 2. Respondents' reported reasons behind the negative role of the centralized procurement on the pharmaceutical supply chain.

**Table 2**  
Views of participants about the impact of centralized procurement on essential drugs supply chain based on their characteristics.

Characteristic	Centralized procurement had a negative impact N(%)	Centralized procurement had a positive impact N(%)	p-value
<b>Gender</b>			
Male	37(61.67)	23(38.33)	0.7692
Female	11(57.89)	8(42.11)	
<b>Age</b>			
25–35 yrs.	12(48)	13(52)	0.3110
35–45 yrs.	21(63.64)	12(36.36)	
45–55 yrs.	14(73.68)	5(26.32)	
55–65 yrs.	1(50)	1(50)	
<b>Position</b>			
Pharmacist	9(52.94)	8(47.06)	0.4764
Senior or Chief Pharmacist	12(66.66)	6(33.33)	
Supply Chain Specialist	6(54.55)	5(45.45)	
Planning Specialist	4(40)	6(60)	
Others (e.g., Planning manager, supply chain director, director of pharmacy, etc. ...)	17(73.91)	6(26.09)	
<b>Years of experience in pharmaceutical supply chain</b>			
< 1 yr.	4(66.67)	2(33.33)	0.2048
1–5 yrs.	11(61.11)	7(38.89)	
5–10 yrs.	6(37.50)	10(62.50)	
> 10 yrs.	27(69.23)	12(30.77)	
<b>Employer</b>			
Ministry of Health	24(61.54)	15(38.46)	0.5904
Military Healthcare affairs (e.g., National Guards, Ministry of Defense, Ministry of Security Forces, etc. ...)	17(58.62)	12(41.38)	
Pharmaceutical Industry	6(66.66)	3(33.33)	
Private Healthcare Institutions	0(0.0)	1(100)	
King Faisal Specialist Hospital and Research Center (KFSH&RC)	1(100)	0(0.0)	

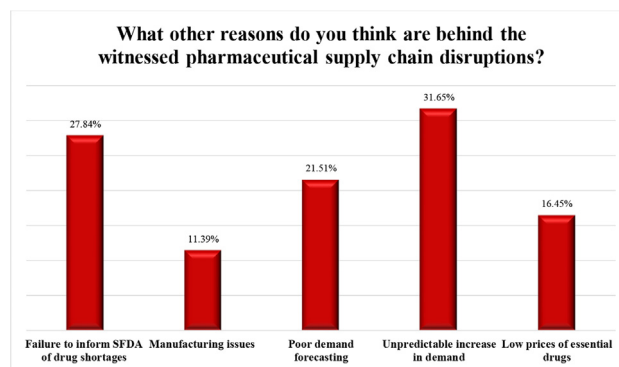


Fig. 3. Respondents' other reported reasons for the disruption in the supplies of essential medicines.

#### 4. Discussion

Saudi Arabia is undergoing a massive transformation in its healthcare system under the national transformation program (NPT) of the new economic Vision 2030 launched in 2016 (Chowdhury et al., 2021). These ongoing changes in the healthcare system aimed at revitalizing the current healthcare system and improve population health while ensuring sustainable development and spending efficiency in healthcare (Rahman and Qattan 2021). Public spending on pharmaceuticals is growing at a rate that

outpaces the inflation rate for numerous reasons, such as the high incidence rates of chronic diseases (e.g., diabetes, dyslipidemia, and hypertension), the reluctance of some health organizations to switch to generic medications, and market entry of innovative and expensive therapies (AlRuthia et al., 2021). Therefore, the centralized procurement of pharmaceuticals for all public sectors has been enforced in the past five to seven years to strengthen the bargaining power of the public health sector, receive lower prices, improve governance, and ensure access and equity (Baldi and Vannoni 2017, AlRuthia et al., 2021, Wang et al., 2021, Vogler et al., 2022). The procurement is performed through a single body. It is being overseen by other government bodies to ensure spending efficiency and improve the contribution of the government purchases to the local content (Khan and Iqbal 2020). However, the rates of essential medicine shortages have been increasing in the past seven years, and many employees in the pharmaceutical planning and purchasing departments in some public health sectors have attributed that to the practices of centralized pharmaceutical procurement, as the findings of this study suggest. The fact that more than two-thirds of the respondents perceived the role of centralized pharmaceutical procurement negatively is worth examining the root causes of the disruption in the pharmaceutical supply of some essential medicines. The respondents have reported several reasons behind the negative impact that the centralized pharmaceutical procurement had on the supply of essential medicines, such as the procurement of unregistered medications by the SFDA which resulted in the withdrawal of some of these generic medications from the market after reports of therapeutic failure by some public health institutions. There are multiple potential reasons behind the procurement from other prescription medicines suppliers or manufacturers whom the SFDA

did not register their products, such as the absence of any local manufacturer or supplier of some essential prescription medicines, the failure of local suppliers to meet demand, shortage of active pharmaceutical ingredients, and the failure to pay suppliers within a reasonable timeframe (Dill and Ahn 2014, Modisakeng et al., 2020). Moreover, the fact that a single procurement agency is responsible for supplying all public health institutions with the needed quantities of prescription medicines has led to long lead time and delays in treatment which might have resulted in negative clinical outcomes (Phuong et al., 2019). However, this is not always the case, as some countries with centralized public procurement of pharmaceuticals, such as Italy and China, have reported improved access to essential medicines and lower prices (Ferraresi et al., 2021, Wang et al., 2021, Zhang et al., 2022). Furthermore, some respondents reported that the centralized pharmaceutical procurement has failed to supply their institutions with the requested quantities of some essential medicines forcing them to place direct purchasing orders, which led to delayed treatment of patients in some instances. Others reported that poor communication between the centralized pharmaceutical procurement staff and the requesting health institutions occasionally led to the disruption of pharmaceutical supplies. These issues are not unique to the Saudi healthcare system, as many countries with centralized pharmaceutical procurement faced similar challenges due to defective tendering practices (Maniadakis et al., 2018). These defective tendering practices, such as unclear and inconsistent tender award criteria, focusing on generic medicines with the lowest prices and ignoring other equally important criteria (e.g., the capacity of the vendor to supply needed quantities and quality of pharmaceutical products), awarding contracts to a single-winner and failure to split contracts between two or more suppliers which in turn lead to the increased market power of the selected bidder, and absence of impact monitoring have been reported in other country contexts as well (Organization 2016, Maniadakis et al., 2018). In the case of Saudi Arabia, centralized pharmaceutical procurement is overseen by different governmental agencies with sometimes conflicting key performance indicators. As Saudi Arabia is trying its best to reduce its economy's reliance on oil exports, different initiatives were launched to incentivize foreign investors to come and invest in Saudi Arabia, such as giving priority in governmental purchases to pharmaceutical manufacturers with clear plans to localize some of their pharmaceutical products in Saudi Arabia. However, many multinational manufacturers find it hard to localize some or most of their products without a commitment from the public health sector to procure fixed quantities of their pharmaceutical products to make it worthwhile for them to invest in the local market. Therefore, revising the procurement strategies of the centralized pharmaceutical procurement and including innovative reimbursement schemes, such as outcome-based agreement, is imperative more than any time before (AlRuthia et al., 2021).

The respondents have also reported other factors that contributed to the disruption in the supplies of some essential medicines, such as failure of pharmaceutical manufacturers to inform the SFDA of potential shortages due to manufacturing or logistic reasons, manufacturing issues (e.g., shortages of raw materials), poor demand forecasting, unpredictable demand increase (e.g., COVID-19 pandemic), and low prices of essential medicines. These factors were identified in previous studies that explored the reasons behind medicine shortages in Saudi Arabia (AlRuthia et al., 2017, Alruthia et al., 2018). However, the fact that these reasons are still negatively impacting the supplies of essential medicines calls into question the seriousness of different health institutions in heeding the calls to implement highly needed reforms in their pharmaceutical planning and inventory management.

#### 4.1. Limitations

This is the first study that surveyed a relatively large number of pharmaceutical supply chain personnel nationally in Saudi Arabia. However, it has some limitations that need to be acknowledged. First, the study used purposive sampling due to the difficulty in reaching individuals working in pharmaceutical supplies. Therefore, the study has limited generalizability (Etikan et al., 2016). Furthermore, the study used a descriptive questionnaire which was based on the findings of previously published local studies with the option to write other possible reasons for the disruption in the pharmaceutical supplies of essential medicines in Saudi Arabia (Al-Aqeel et al., 2010, Al-Ruthia et al., 2017, AlRuthia et al., 2017, Alruthia et al., 2018). This method was chosen due to the difficulty in conducting a qualitative study, such as a focus group, due to the high level of cautiousness in revealing their identity by attending any meeting related to their work.

#### 5. Conclusion

The traditional procurement of pharmaceuticals for public health institutions is fraught with shortcomings that resulted in disruptions in essential medicines supply chain according to the majority of surveyed supply chain professionals working in different health sectors. These disruptions might have been exacerbated in the last five 5 to 10 years with the requirement of all public health sectors to request their needs of prescription drugs and medical supplies through a single procurement body that is overseen by different oversight bodies with sometimes conflicting objectives. Therefore, the public centralized pharmaceutical procurement needs to reform its procurement and purchasing practices and align them with vision 2030. Additionally, serious efforts should be made to reform different healthcare institutions' inventory management and demand forecasting to avoid frequent and unfortunate shortages of essential medicines.

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#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Appendix I

1. **Age:**
  - o 25–35 yrs.
  - o 35–45 yrs.
  - o 45–55 yrs.
  - o 55–65 yrs.
  - o > 65 yrs.
2. **Gender:**
  - o Male.
  - o Female.
3. **Educational level:**
  - o High school diploma.
  - o Associate degree.

- o Bachelor's degree.
  - o Professional degree (e.g., PharmD, MD, etc...).
  - o Graduate degrees (e.g., Master of Science or Doctor of Philosophy).
4. **Years of experience in pharmaceutical supply chain:**
- o < 1 yr.
  - o 1–5 yrs.
  - o 5–10 yrs.
  - o > 10 yrs.
5. **What is your current position in the organization that you work in?**
- o Pharmacist.
  - o Senior or Chief Pharmacist.
  - o Supply Chain Specialist.
  - o Planning Specialist.
  - o Others (e.g., Planning manager, supply chain director, director of pharmacy, etc...).
6. **Have you earned any post-graduate degree or certificate in supply chain management?**
- o Yes.
  - o No.
7. **Which sector your organization is affiliated with?**
- o Ministry of Health.
  - o Military Healthcare affairs (e.g., National Guards, Ministry of Defense, Ministry of Security Forces, etc...).
  - o Pharmaceutical Industry.
  - o National Unified Procurement Company (NUPCO).
  - o Private Healthcare Institutions.
  - o King Faisal Specialist Hospital and Research Center (KFSH&RC).
8. **What kind of impact the centralized procurement had on the supply chain of essential drugs?**
- o Positive.
  - o Negative.
  - o It did not have any impact.
9. **If your answer was “NEGATIVE”, please check-all-that-apply:**
- o Some pharmaceutical products were procured that were not registered by the Saudi Food and Drug Authority (SFDA).
  - o The procurement lead time is long compared to the past.
  - o The quality of generic pharmaceutical products is not taken into consideration especially for some products with history of recalls by the SFDA.
  - o Failure to supply different healthcare entities with the requested quantities of essential drugs.
  - o The Saudi pharmaceutical market became unattractive to many pharmaceutical companies to offer their generic products since NUPCO has taken over all the governmental purchases of pharmaceutical products.
  - o Poor communication with different healthcare institutions.
10. **What other reasons behind the witnessed pharmaceutical supply chain disruption over the past five years? please check-all-that-apply:**
- o Failure to inform SFDA of potential drug or medical devices shortages at least 6 months in advance by the multi-national or local manufacturers.
  - o Manufacturing issues (e.g., raw materials shortages).
  - o Poor demand forecasting.
  - o Logistic issues (e.g., shipping issues and insurance).
  - o COVID-19 impact on demand.
  - o Pharmaceutical companies marketing tactics (e.g., poor practices).
  - o Low prices of essential drugs.

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