



Paper Type: Original Article

Drug Supply Chain Management in COVID-19 Pandemic: Lessons from Iran and Preparation for Future

Younes Nobakht¹* 

¹ Department of Management and Accounting, Faculty of Humanities and Arts, Technical and Vocational University (TVU), Tehran, Iran; younes.n2010@gmail.com.

Citation:

Received: 01 March 2025

Revised: 06 May 2025

Accepted: 11 July 2025

Nobakht, Y. (2025). Drug supply chain management during the COVID-19 pandemic: lessons from Iran and preparation for the future. *Research annals of industrial and systems engineering*, 2(3), 190-195.


Abstract


The COVID-19 pandemic has caused unprecedented challenges to all nations worldwide. Among these challenges, a drug shortage can have adverse effects on the health of the world community. This paper in the evaluation of drug supply chain management during the COVID-19 pandemic focuses on the potential resources of drug shortage, initial preparation, and plans for eliminating probable shortages and improving Iran's drug supply chain management. The paper also makes some evidence-based suggestions to ensure the accessibility of drugs and improvement in drug supply chain management both during a pandemic and in the long run. Everyone involved in the supply chain needs to cooperate in a bid to achieve preparation and formulate transparent emergency plans to deal with the drug shortage caused by the COVID-19 pandemic. Therefore, it is essential to revise and improve supply chain management strategies, ensure transparent information, adopt active management, and maintain timely and comprehensive communication to sustain drug supply during a disease outbreak. In addition, raising public awareness of drug shortages, confronting misinformation, and providing timely responses to public opinion are among the factors that should be considered.


Keywords: Supply chain management, Drug supply chain, Production, Pandemic, Drug shortage.

1 | Introduction

Before the COVID-19 pandemic, many of the world's leading drug producers and sellers took practical steps to build extensive, robust, agile, and sustainable supply chains. However, the COVID-19 crisis that crossed borders and caused massive shocks to different economies posed serious challenges to the drug supply chain. Quarantine laws and other broad restrictions seriously damaged the domestic and international transportation

 Corresponding Author: younes.n2010@gmail.com

 <https://doi.org/10.22105/raise.vi.72>

 Licensee System Analytics. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0>).

sectors of the pharmaceutical industry. Moreover, many countries imposed restrictions on the export of drugs and raw materials used in pharmaceutical products to meet domestic requirements. Therefore, weaknesses of supply chains with different features have affected the pharmaceutical industry more than anything else in every country. This has worried people and authorities in different countries. Thus, the need to revise and improve drug supply chains became a critical issue in the pharmaceutical industry.

Amid the COVID-19 pandemic, Iran effectively contained it through a combination of public and private sector efforts, public assistance, and emerged as a global model in fighting the pandemic. These cases included widespread disinfection of public places, shutting down public centers, widespread mask use, social distancing, accelerating diagnostic testing, tracking patients through smart contact tracing, keeping patients in quarantine, and isolating them. Other factors included activating public health systems, preparing, using hospital capacity, employing voluntary human resources to accelerate diagnostic testing, providing advice, and promoting hygienic practices. Despite the initial success, the continuation of the COVID-19 pandemic and emergence of the new strains of this disease revealed the need for special drugs, drug shortages, and even a lack of some drugs. Therefore, the pandemic resulted in emergencies and caused new challenges to the stability and integrity of the drug supply. This situation highlighted the need to revise and improve effective pharmaceutical management strategies [1], [2].

This paper, in evaluating drug supply chain management during the COVID-19 pandemic, focuses on potential sources of drug shortages, initial preparations, and plans to eliminate potential shortages and improve Iran's drug supply chain management. The paper also makes some evidence-based suggestions to ensure the accessibility of drugs and improvement in drug supply chain management, both during a pandemic and in the long run .

2 | Background

In drug production, the availability and quality of the raw material (active pharmaceutical ingredient, API) are essential. India and China are the most significant producers of drugs and APIs in the world [3]. Furthermore, only a few countries can produce standard drugs from APIs. Thus, most countries are dependent on drugs or APIs made in India and China.

Iran produces approximately 95% of the drugs that it requires. However, its dependence on APIs amounts to 30–35% [4], a rate considerably higher than that of many other countries. Therefore, a reason for drug shortage in Iran is the approximately 30–35% dependence of its pharmaceutical industry on the imported APIs. Another problem in this regard is dumping by major API producers. Recently, the chairperson of the board of the owners' union of Human Pharmaceutical Industries in Iran stated, "We think, in most cases, the lower price of the APIs produced by the international companies in comparison with the APIs produced in domestic companies can lead to dumping by these companies to attract more customers." In addition, producing some APIs in Iran does not confer a competitive advantage. It is sometimes inevitable that the price of APIs produced in Iran is higher than in foreign countries. For instance, producing a type of API consumed up to 100 tons in Iran is more expensive than producing 10,000 tons of the same product in China, because there is an inverse relationship between price and production volume. This signifies that the more the production volume, the lower the price of that product. Therefore, Iranian companies will never be able to compete with their Chinese counterparts. Other factors include the lower prices of the drugs produced in Iran or imported into Iran, which drive pharmaceutical arbitrage. The most important cause of the lower price of drugs in Iran is the currency support, which the government provides for the producers and importers of drugs and APIs. Therefore, allocating low-priced currency results in pharmaceutical arbitrage imposed by Iran on other countries. Moreover, the low price of the production factors in Iran is another factor that reduces the price of the drugs and APIs. Another problem is the US sanctions, resulting in drug shortages in Iran. Even though the US authorities claim that Iran is not under pharmaceutical sanctions, the closure of financial channels obstructs the possibility of transferring funds and purchasing drugs for Iran in practice [5].

3 | Materials and Methods

This research is a qualitative descriptive study and uses an exploratory analysis approach. The exploratory analysis entails examining experimental data to discover and identify indicators and their relationships without relying on a specific model. To obtain the results, articles and studies on the pharmaceutical supply chain and COVID-19 were reviewed. The required data and information were extracted and analyzed from the accredited international online databases.

4 | Initial Preparation and Plans for Dealing With Potential Drug Shortage

Before the COVID-19 crisis, the Iranian Food and Drug Administration (IR.FDA) developed the TTAC Informatics System for drug supply in 2013, following the currency crisis and drug shortage in 2011. This system was designed to clarify the process, combat administrative corruption, collect data, manage and supervise the supply chain, remove bottlenecks, address drug shortages, manage financial resources, and enable insurers to make purposeful payments. This system enables users to observe the drug distribution from suppliers to pharmaceutical distribution companies, and from pharmaceutical distribution companies to pharmacies. The system is connected to the information centers of other related organizations to exchange information. This system also aims to ensure the supply of drugs to real consumers, complete the final loop of the drug supply chain, provide information on the country's real drug needs, formulate further plans for production, meet domestic pharmaceutical needs, and export drugs.

After the COVID-19 pandemic, the National Task Force for Fighting Coronavirus was established in early February 2020, chaired by the Minister of Health and Medical Education, upon ratification by the National Supreme Security Council. This task force developed several strategies as the initial and preventive actions in response to the potential drug shortage due to the COVID-19 crisis. Some of these strategies are as follows: 1) The program for maximizing the attraction of pharmaceutical help from other countries, 2) Issuing a temporary permit for importing drugs and raw materials for pharmaceutical products without paying the determined tariff, 3) Taking the necessary actions for preventing the illegal exit of drugs from the country, 4) Imposing Customs duty relief for importing drugs, and 5) Creating other financial incentives for drug importers [6]. In addition, the government has improved the distribution of information on drug shortages by providing updates via hotlines and press conferences, ensuring active accountability and transparency when necessary. These measures must be taken to improve public awareness of drug shortages, combat misinformation, and provide timely responses to public opinion.

Furthermore, the Scientific Committee of Iran's National Task Force for Fighting Coronavirus published a collection of health and treatment protocols to contain the COVID-19 pandemic in late June 2020 by emphasizing the manner of dealing with inpatients and outpatients. This collection can be updated in the required time intervals [7]. This collection of instructions is crucial in the management of drug supply and the prevention of inaccurate allocation of drugs and drug waste. These strategies specify the principles of providing, distributing, and consuming drugs by the respective agents. Given that there was no therapeutic or pharmaceutical intervention with proven effects on patients during the initial stages of the COVID-19 pandemic, the team developing the protocols used results from the ongoing clinical trial with follow-ups, as well as reports from future reviews. Therefore, a variety of drugs were tested and used during the early days of the pandemic. After a while, it was revealed that Remdesivir and Hydroxychloroquine were proven to be more effective than other drugs and that there might be an increase in their demand. The studies demonstrated that not only did Remdesivir reduce the time to improvement in the disease, but it also decreased the probability of death in adults with mild or severe COVID-19 symptoms. This drug can stop the growth and reproduction of the novel coronavirus in lung cells [1]. Hydroxychloroquine does not reduce the severity of the disease but improves the status of adult patients with primary COVID-19 symptoms or those hospitalized with mild or moderate COVID-19. However, it may cause more side effects on the heart

or the liver [8], [9]. The Iranian drug production companies were prepared immediately to produce these drugs. The first company (Ronak Company) discovered the formulation for producing Remdesivir after three months of research in July 2020. After that, several other companies initiated the actions necessary to examine and develop this drug. Currently, nearly eight Iranian companies are producing this drug. However, the APIs required to produce this drug must be sourced from China. Given that APIs for producing Hydroxychloroquine were available in the purchase portfolios of some Iranian pharmaceutical API production companies, there were no specific problems in this regard.

5 | Proposed Strategies for Ensuring the Accessibility of Drugs and Improving the Drug Supply Chain Management

The inter-organizational group on drug shortages, led by the US Food and Drug Administration, published a report in October 2019 that identified the main reasons for drug shortages in the US and provided recommendations to improve drug supply chain management. Since the reasons for drug shortages across countries are essentially the same, it is crucial to mention a few points. This report proposed the main reasons for drug shortage as follows [10]: 1) Drug producers are not motivated to produce low-profit drugs; 2) The market does not recognize the producers using the Complete Quality Management Systems for early detection of the problems in the supply chain and does not reward them; and 3) The logistic and supervisory challenges cause difficulty in improving the market disruptions. This group provided the following recommendations for improving supply chain management: 1) There is the need for creating a common understanding of the effects of drug shortage on patients, providing healthcare, the cost of healthcare, and contracting methods that can solve the shortage; 2) The government must develop a ranking system to motivate investment in acquiring the complete quality management system for drug producers. A complete quality management system is created through the following elements: Updating equipment, educating personnel to improve their understanding and increase their participation in the product's quality and the process of its production, constantly supervising the process of production and laboratories by using the statistical methods and risk management methods, all of which are more than the explicit necessities conducted in the current production method. and 3) There is a need for upgrading stable contracts with the private sector (for instance, with drug importers) to ensure that there is a reliable source for drugs.

In addition, several strategies can be adopted for reducing drug shortages and ensuring the quality and security of drugs during a pandemic or even for long-term periods. These items will differ in terms of conditions, equipment, and resources across countries (*Table 1*). The government must also create various methods for obtaining drugs, especially for public pharmacies, and enable them to obtain the required drugs from different sources. However, delegating it to the free market can lead to immoral price increases and endanger patients. Furthermore, the government can benefit from the consultation and cooperation of experts in healthcare, industry, finance, and economics to determine specific drug profits [1]. As a result, companies are encouraged to produce low-profit drugs. The governments also intervene in importing or participating in the production of drugs for any reason whatsoever that the private sector is unable to conduct or refuses to conduct, especially during pandemics. Countries such as Iran depend significantly on the APIs rather than the drug itself; therefore, the strategies of the drug supply chain must focus on the production and import of the APIs instead of the import of drugs. Supporting knowledge-based companies (with their strong scientific and technical structures) is crucial in this regard, enabling them to obtain the technology and formulations to produce these drugs faster than other countries. Finally, as with any other preparation plans, it is necessary to conduct regular inventory checks and practices for the distribution and allocation of drugs [1], [11].

Table 1. Proposed strategies to reduce drug shortages and ensure the quality and security of drugs.

Strategy	Description
In pandemic	<ul style="list-style-type: none"> - Provide immediate tax exemptions and customs duties for importers of drugs and APIs - Reinforce the audit procedures to ensure the supply-demand balance of drugs. - Equip and improve testing centers for imported drugs and APIs - Track supply chain links from production/import to the consumption - Improve inventory management along supply chains - Continue refining pharmaceutical administration and laws to perfect the systems of the distribution, allocation, and dispensing of drugs.
In long-term	<ul style="list-style-type: none"> - Consider drugs and APIs as a strategic asset instead of a commodity - Create a list of drugs and APIs that are essential for national security in the field of public health - Improve tracking and forecasting of the essential drug supply chain - Equip and improve testing centers for drugs and APIs - Establish and maintain some vulnerable pharmaceutical agents within the strategic national stockpile - Prevent dumping of large drug companies and APIs by means such as imposing heavy customs tariffs - Create a competitive advantage for domestic products through methods such as export awards - Support insurers to avoid drug arbitrage instead of supporting manufacturers/importers and consumers - Increase government oversight of manufacturers and importers of drugs and APIs - Provide economic and financial incentives for the production of drugs and APIs - Get more support from manufacturers of drugs and APIs than from importers - Avoid monopolies by increasing the number of importers of drugs and APIs - Improve inventory management along supply chains - Take the necessary measures to prevent the illegal departure of drugs from the country.

6 | Conclusion

For the past few months, there have been no announcements in Iran about the drug shortage emergency. The periodic shortage was due to increased demand during the COVID-19 spike, caused by reduced adherence to health protocols, the introduction of new strains and variants of the coronavirus into Iran, and their subsequent spread within the country. The US sanctions also cause the periodic drug shortage. Despite the numerous problems caused by the COVID-19 pandemic worldwide, this pandemic provided experts and designers of the drug supply chain with an opportunity to gain greater insight into supply chain issues and shortages, especially during such crises. Obtaining information can increase preparation in most countries for the future. It is also crucial to gain a better perception of the drug supply chain and the plans for extensive preparation to show immediate reactions and control shortages of unpredictable drugs. Like any other country, Iran faced an unprecedented global crisis called the COVID-19 pandemic and tried to fight it by using its equipment and resources. Employing active management, providing clear information, and building timely, widespread communication to ensure a sustainable drug supply are among the essential measures, especially during a pandemic. Other factors to be taken into account include following the recommendations of experts and specialists in the field of drug supply, developing long-term programs to address pharmaceutical needs, and reviewing, completing, and improving the drug supply chain.

Funding

The document does not explicitly mention any funding sources

Conflict of Interest

The authors declare that they have no conflict of interest.

Financial Support

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

- [1] Kuo, S., Ou, H. T., & Wang, C. J. (2021). Managing medication supply chains: Lessons learned from Taiwan during the COVID-19 pandemic and preparedness planning for the future. *Journal of the american pharmacists association*, 61(1), e12--e15. <https://doi.org/10.1016/j.japh.2020.08.029>
- [2] Jahangiri, S., Abolghasemian, M., Ghasemi, P., & Chobar, A. P. (2023). Simulation-based optimisation: analysis of the emergency department resources under COVID-19 conditions. *International journal of industrial and systems engineering*, 43(1), 1–19. <https://doi.org/10.1504/IJISE.2023.128399>
- [3] Horner, R. (2020). The world needs pharmaceuticals from China and India to beat coronavirus. *The conversation*, 25. <https://www.telegraph.co.uk/global-health/science-and-disease/world-needs-pharmaceuticals-china-india-beat-coronavirus/>
- [4] Olyaaeemanesh, A., Jaafaripooyan, E., Abdollahiasl, A., Davari, M., Mousavi, S. M., & Delpasand, M. (2021). Pharmaceutical subsidy policy in Iran: a qualitative stakeholder analysis. *Health research policy and systems*, 19(1), 150. <https://doi.org/10.1186/s12961-021-00762-6>
- [5] Cheraghali, A. M. (2013). Impacts of international sanctions on Iranian pharmaceutical market. *DARU journal of pharmaceutical sciences*, 21(1), 64. <https://doi.org/10.1186/2008-2231-21-64>
- [6] Kalinke, U., Barouch, D. H., Rizzi, R., Lagkadinou, E., Türeci, Ö., Pather, S., & Neels, P. (2022). Clinical development and approval of COVID-19 vaccines. *Expert review of vaccines*, 21(5), 609-619. <https://doi.org/10.1080/14760584.2022.2042257>
- [7] Kuriakose, S., Singh, K., Pau, A. K., Daar, E., Gandhi, R., Tebas, P., ... & Masur, H. (2021). Developing treatment guidelines during a pandemic health crisis: lessons learned from COVID-19. *Annals of internal medicine*, 174(8), 1151-1158. <https://doi.org/10.7326/M21-1647>
- [8] March, C. A., Flint, A., DeArment, D., Gilliland, A., Kelly, K., Rizzitano, E., ... & Libman, I. M. (2020). Paediatric diabetes care during the COVID-19 pandemic: Lessons learned in scaling up telemedicine services. *Endocrinology, diabetes & metabolism*, 4(1), e00202. <https://doi.org/10.1002/edm2.202>
- [9] Herper, M. (2020). *New Covid-19 study, despite flaws, adds to case against hydroxychloroquine.* <https://www.statnews.com/2020/07/16/new-covid-19-study-despite-flaws-adds-to-case-against-hydroxychloroquine/>
- [10] Drug Shortages Task Force. (2021). Drug Shortages: Root Causes and Potential Solutions. <https://www.fda.gov/media/131130/download>
- [11] Jahangiri, S., Abolghasemian, M., Pourghader Chobar, A., Nadaffard, A., & Mottaghi, V. (2021). Ranking of key resources in the humanitarian supply chain in the emergency department of iranian hospital: a real case study in COVID-19 conditions. *Journal of applied research on industrial engineering*, 8(Special Issue), 1–10. <https://doi.org/10.22105/jarie.2021.275255.1263>