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Learning from Regional Successes: Strengthening Afghanistan's Pharmaceutical Supply Chain through the Experiences of Pakistan, Iran, and India

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Abstract

This research examines the challenges confronting Afghanistan's pharmaceutical supply chain management (PSCM) in the aftermath of prolonged conflict, with an emphasis on enhancing access to essential medicines. The Afghan pharmaceutical sector is characterized by systemic inefficiencies, regulatory shortcomings, inadequate infrastructure, and disruptions stemming from years of instability. Drawing insights from the experiences of neighboring countries—Pakistan, Iran, and India—that have navigated similar obstacles, this study identifies strategic interventions to fortify Afghanistan's PSCM. This research follows a qualitative method and a deductive approach. Key recommendations include strengthening regulatory frameworks to ensure the quality and safety of pharmaceuticals, leveraging digital technologies for improved inventory and distribution management, and enhancing cold chain infrastructure for temperature-sensitive products. The role of centralized procurement systems and public-private partnerships (PPPs) is underscored as vital for increasing efficiency and reducing costs. Furthermore, fostering local pharmaceutical manufacturing is proposed as a crucial step toward self-sufficiency and resilience. By adapting successful strategies from its neighbors to its distinct context, Afghanistan can develop a more robust, transparent, and sustainable pharmaceutical supply chain, ultimately improving public health outcomes and ensuring consistent access to life-saving medications.

Keywords: Pharmaceutical Supply Chain Management (PSCM), Afghanistan, Regional Success, Post-War Recovery, Pakistan, Iran, India, Supply Chain Strengthening, Healthcare Infrastructure.

Introduction

The pharmaceutical supply chain management (PSCM) system is a pivotal element of any nation's healthcare infrastructure, integral to ensuring the reliable and efficient delivery of

medications necessary to meet public health demands. A well-functioning PSCM framework is essential not only for enhancing health outcomes and lowering mortality rates but also for facilitating equitable access to essential medicines across diverse populations (Roien et al., 2022). Unfortunately, many low-income and conflict-affected nations, including Afghanistan, grapple with fragmented and inefficient pharmaceutical supply chains, severely undermined by political instability, inadequate regulatory frameworks, and substandard infrastructure.

Afghanistan's healthcare sector, having endured protracted periods of conflict and instability, faces a myriad of challenges in the procurement, distribution, and regulation of pharmaceuticals (Salehi et al., 2018). These difficulties are exacerbated by limited governmental capacity, logistical impediments, and a heavy reliance on international aid to address critical shortages in medicine availability. Consequently, Afghanistan experiences persistent issues such as frequent drug shortages, the proliferation of counterfeit medications, and an unreliable cold chain for temperature-sensitive products—each indicative of a deeply dysfunctional pharmaceutical supply chain system (Nemat et al., 2022).

In contrast, neighboring countries such as Pakistan, Iran, and India have managed to cultivate more resilient and efficient pharmaceutical supply chain systems, despite encountering their own sets of challenges (MACDONALD, 2017). While these nations are not immune to systemic issues, they have successfully implemented a range of policies, technological advancements, and infrastructure enhancements that have fortified their PSCM frameworks. Learning from the experiences of these regional counterparts presents a significant opportunity for Afghanistan to reform and strengthen its own pharmaceutical supply chain. By adopting best practices and innovative solutions tailored to its unique context, Afghanistan can aspire to build a more robust, transparent, and sustainable PSCM system that ultimately enhances public health outcomes and ensures consistent access to life-saving medications for its population.

Problem Statement

Afghanistan's pharmaceutical supply chain is beset by critical challenges that significantly undermine the availability, quality, and efficacy of healthcare services. Chronic shortages of essential medicines arise from systemic inefficiencies exacerbated by ongoing political instability, thereby compromising patient care and public health outcomes. The proliferation of counterfeit and substandard medications poses a serious threat to patient safety, driven by inadequate regulatory frameworks and insufficient capacity to monitor drug quality. Furthermore, the maintenance of a reliable cold chain for temperature-sensitive pharmaceuticals, including vaccines, is severely hampered by Afghanistan's rugged terrain and persistent security concerns. The fragmented nature of supply chain management, characterized by the disjointed operations of diverse stakeholders—ranging from governmental bodies to non-governmental organizations (NGOs) and private suppliers—further complicates coordination efforts and contributes to operational inefficiencies. Collectively, these issues not only impede access to life-saving medications but also hinder the overall effectiveness of the healthcare system in Afghanistan. This research seeks to investigate how Afghanistan can enhance its pharmaceutical supply chain by leveraging best practices and successful strategies

employed by neighboring countries, thereby fostering a more resilient, efficient, and equitable healthcare delivery system.

Research Objectives

The objective of this study is to explore and identify the best practices in pharmaceutical supply chain management (PSCM) from regional countries, specifically Pakistan, Iran, and India, and assess their applicability to Afghanistan. The study will focus on the following key objectives:

1. To assess the current state of Afghanistan's pharmaceutical supply chain and identify its key challenges.
2. To examine the strategies and systems implemented by Pakistan, Iran, and India to address PSCM challenges in similar contexts.
3. To identify transferable best practices from these countries that could improve Afghanistan's PSCM system.
4. To provide policy recommendations for Afghanistan's policymakers and stakeholders, with an emphasis on practical, context-specific solutions.

Rationale of the Study

This study is critical for Afghanistan's health system as it provides a comparative analysis of pharmaceutical supply chain systems in countries that share similar challenges but have made progress in improving their systems. Learning from these regional countries will offer Afghanistan insights into:

- Strengthening regulatory frameworks
- Improving medicine procurement and distribution logistics
- Adopting technology solutions for tracking and inventory management
- Enhancing cold chain management for vaccines and essential drugs
- Building partnerships between government, NGOs, and the private sector

By focusing on Pakistan, Iran, and India, countries that are geographically and contextually close to Afghanistan, this research can highlight region-specific solutions and avoid strategies that might be impractical due to Afghanistan's unique challenges.

The lessons drawn from this comparative study can guide Afghanistan's health policymakers and international donors in their efforts to reform and strengthen the pharmaceutical supply chain, ultimately improving healthcare access for the Afghan population.

Research Questions

To guide the exploration of Afghanistan's pharmaceutical supply chain and its potential improvements, this study will address the following key research questions:

1. What are the main weaknesses in Afghanistan's pharmaceutical supply chain?
2. How have Pakistan, Iran, and India overcome similar challenges in their pharmaceutical supply chains?

3. What specific best practices from these countries can be adapted to Afghanistan's unique context?
4. What actionable policy and operational recommendations can be made for Afghanistan to strengthen its pharmaceutical supply chain?

Literature Review

Pharmaceutical Supply Chain Management in Fragile and Conflict-Affected Contexts

Pharmaceutical supply chain management (PSCM) in fragile and conflict-affected countries is often marked by inefficiencies, lack of infrastructure, and political instability. These factors create a vicious cycle where a disrupted supply chain results in medication shortages, which in turn further weakens the overall healthcare system. For Afghanistan, such challenges are exacerbated by its geographical and political instability, which has limited the development of a robust pharmaceutical infrastructure.

Key challenges identified in literature:

1. Inadequate Regulatory Frameworks: In fragile and conflict‑affected settings, weak pharmaceutical governance, outdated or unenforced laws, and limited surveillance capacity facilitate the proliferation of substandard and falsified medicines, undermining public health goals. Research reviews have shown that in many LMICs, regulatory authorities lack sufficient legal frameworks, technical capacity, and post‑market monitoring, making them vulnerable to infiltration by SF medicines (Ozawa et al., 2018).
2. Logistical Barriers: Geography plays a critical role in the efficiency of pharmaceutical distribution. Afghanistan's rugged terrain, along with insecurity in many regions, makes transportation of medicines and vaccines highly unreliable. Cold chain disruptions are a significant issue for temperature-sensitive medicines, especially vaccines (UNICEF, 2021).
3. Over-reliance on Donors: Humanitarian aid organizations play a large role in providing medicines, often filling gaps left by the government. However, dependence on foreign aid can be inconsistent, making it difficult for the Afghan health system to ensure sustainability and independence in the long term (Roien et al., 2021)

Pakistan's Pharmaceutical Supply Chain: Lessons for Afghanistan

Pakistan faces challenges similar to Afghanistan in terms of political instability, drug regulation, and supply chain inefficiencies. However, Pakistan has implemented a range of reforms and systems that offer valuable lessons for Afghanistan.

1. Drug Regulatory Authority (DRAP): Pakistan's DRAP has worked to strengthen the regulation of pharmaceutical imports, manufacturing, and distribution. Pakistan has introduced medicines price regulation and market surveillance mechanisms to counteract the circulation of counterfeit medicines. These regulatory improvements have been essential for increasing confidence in the national pharmaceutical supply chain (Farooq et al., 2020). (Iqbal & Younas, 2021).

2. Logistics Management Information System (LMIS): Pakistan has initiated eLMIS pilots to improve tracking and monitoring of medicines. The system helps monitor stock levels, reducing stockouts and ensuring efficient distribution across the country (Panhwar, 2021). This is an area where Afghanistan can benefit significantly by digitizing supply chain operations and introducing real-time data tracking.
3. Public-Private Partnerships: In Pakistan, public-private partnerships have played a crucial role in addressing supply chain inefficiencies, especially in the rural areas. These partnerships have facilitated the distribution of essential medicines and the creation of distribution hubs to overcome logistical barriers (Zaidi et al., 2013)

Iran's Pharmaceutical Supply Chain: A Model of Self-Sufficiency and Regulation

Iran offers a unique example of how a country can develop a self-sufficient pharmaceutical industry while improving regulatory frameworks. Despite facing international sanctions, Iran has built a relatively resilient pharmaceutical supply chain that Afghanistan can learn from.

1. Local Pharmaceutical Production: Iran has developed a robust domestic pharmaceutical manufacturing sector, producing over 90% of the medicines consumed within the country. This capacity has enabled Iran to maintain a high degree of independence from foreign suppliers, even during periods of international sanctions that have limited access to imported medicines (Tehran Times, 2019). The Iranian pharmaceutical industry comprises numerous domestic companies, with many state-owned and public bodies playing a major role in production, collectively manufacturing billions of drug units annually to meet nearly all domestic demand. Such a model demonstrates the potential benefits of investing in local pharmaceutical production, including increased national health security, reduced dependence on external aid, and cost savings. (Shahbahrami et al., 2024) Afghanistan, facing significant reliance on imported medicines and international donors, could benefit from adopting a similar approach, gradually building its domestic pharmaceutical capacity to improve access, affordability, and sustainability of essential medicines.
2. Pharmaceutical Regulation: Iran's Iran Food and Drug Administration (IFDA) has a strong regulatory system that monitors both the quality and the safety of medicines. Iran has also introduced measures to ensure affordable access to essential medicines through state subsidies. These regulatory mechanisms ensure that medicines distributed within the country are safe and effective, addressing many of the issues that plague Afghanistan's supply chain (Aboulhallaj et al., 2024).
3. Technology Integration: Iran has made strides in implementing barcode systems and track-and-trace technologies for pharmaceuticals, ensuring better management of stock and reducing the risk of counterfeit drugs entering the market. This is an area where Afghanistan could improve by adopting similar technologies to enhance the efficiency and reliability of its pharmaceutical supply chain (Ghiasvand et al., 2021).

India's Pharmaceutical Supply Chain: The Power of Innovation and Scale

India represents one of the most successful pharmaceutical supply chain models in Asia. Despite its own health system challenges, India has made significant strides in pharmaceutical distribution, particularly through technology and regulation.

1. Affordable Medicines: India is known for its robust generic drug industry, which has led to significant improvements in the affordability of medicines across the country and the world (Brahmbhatt & Misra, 2018). Policy interventions have reinforced India's pharmaceutical sector by designing structured pricing and compliance mechanism (Bhaskarabhatla, 2018). Through initiatives like the Pradhan Mantri Bhartiya Janaushadhi Pariyojana (PMBJP), India has been able to expand access to low-cost, high-quality medicines in rural and underserved areas. Afghanistan can draw on these experiences to expand access to affordable generic medicines (Roy, Dhaneshwar, & Bhasin, 2020).
2. eVIN (Electronic Vaccine Intelligence Network): India has made significant investments in using digital tools to improve vaccine distribution. The eVIN system is a nationwide platform that tracks vaccine storage and ensures that the cold chain is maintained. India's success with eVIN provides a blueprint for Afghanistan to adopt similar digital tracking systems for vaccines and other temperature-sensitive medicines (Kumar et al., 2019).
3. Public-Private Collaboration: India has successfully engaged both the public and private sectors to tackle challenges in medicine distribution, particularly in remote areas. These collaborations have been key in ensuring that medicines are available where they are needed most, particularly in rural and underserved regions. Afghanistan can benefit from adopting a similar collaborative model to address its own distribution challenges (Nanda et al., 2010).

Synthesis of Key Themes

From the literature reviewed, several key themes emerge that Afghanistan can draw on to strengthen its pharmaceutical supply chain:

1. Regulatory Strengthening: Countries like Pakistan, Iran, and India have made significant progress in improving the regulatory framework for pharmaceuticals, ensuring quality control and the reduction of counterfeit drugs. Afghanistan must develop a stronger regulatory body and enforcement mechanisms to ensure better monitoring and distribution of medicines.
2. Technology Integration: The use of LMIS, track-and-trace systems, and digital inventory management is vital to improving visibility and efficiency in the pharmaceutical supply chain. Afghanistan must invest in digital infrastructure to improve tracking and minimize stock outs.
3. Public-Private Partnerships: Successful examples from Pakistan, India, and Iran demonstrate the importance of engaging both the public and private sectors in managing and improving the pharmaceutical supply chain. Afghanistan should foster collaborative partnerships to overcome logistical barriers and distribution challenges.

Research Method

Research Design

This study adopts a qualitative comparative approach, utilizing secondary data to analyze and compare the pharmaceutical supply chain management (PSCM) systems of Afghanistan, Pakistan, Iran, and India. The main aim is to identify successful strategies and best practices from Pakistan, Iran, and India that can be adapted and implemented in Afghanistan to strengthen its own PSCM system.

The research will primarily rely on secondary data from existing reports, academic articles, and grey literature published by reputable sources such as the World Health Organization (WHO), United Nations (UNICEF), national ministries, non-governmental organizations (NGOs), and peer-reviewed journals. This approach is appropriate for understanding and synthesizing existing knowledge on PSCM systems in the selected countries, particularly given the complexity and broad scope of the subject.

Data Collection

To address the research questions and objectives, data will be collected from the following secondary sources:

1. Peer-Reviewed Academic Literature: Articles and research papers from academic databases such as PubMed, Google Scholar, and ScienceDirect will provide insights into PSCM systems, regulatory frameworks, and challenges in Afghanistan, Pakistan, Iran, and India.
2. Reports and Publications from International Organizations:
    - WHO reports on pharmaceutical supply chain issues and best practices in low-income countries.
    - UNICEF reports on cold chain management and vaccination programs.
    - World Bank and USAID documents detailing pharmaceutical supply chain reforms in conflict-affected or low-income countries.
3. Government and Regulatory Authority Reports:
    - Pakistan: Reports from the Drug Regulatory Authority of Pakistan (DRAP), Ministry of National Health Services, and Logistics Management Information System (eLMIS) documents.
    - Iran: Publications from the Iran Food and Drug Administration (IFDA) and reports on pharmaceutical self-sufficiency and regulation.
    - India: Documents from the Central Drugs Standard Control Organization (CDSCO), Ministry of Health and Family Welfare, and case studies on the eVIN system and Janaushadhi program.
4. Grey Literature:
    - NGO Reports and donor agency publications that discuss local pharmaceutical supply chain practices and challenges.
    - Conference papers and presentations related to PSCM in Afghanistan and neighboring countries.

5. National Health Surveys and Pharmaceutical Data: National health surveys and pharmaceutical databases from countries involved will provide statistical data on the pharmaceutical sector in each country.

Inclusion Criteria

- Publications that discuss pharmaceutical supply chain issues, regulations, cold chain management, and medicine access.
- Country-specific case studies from Pakistan, Iran, and India.
- Reports that provide comparative analysis of PSCM systems across low-income or conflict-affected countries.

Exclusion Criteria

- Studies that focus on high-income countries or those with vastly different health systems and infrastructures.
- Data that is outdated or lacks reliability and relevance.

Comparative Analysis Framework

The comparative analysis will be conducted using the following key components of the pharmaceutical supply chain, which will be examined across Afghanistan, Pakistan, Iran, and India:

1. Regulatory Systems:
    - Structure and effectiveness of regulatory bodies.
    - Mechanisms for monitoring and controlling medicine quality and safety.
    - Measures taken to combat counterfeit and substandard drugs.
2. Procurement and Logistics Management:
    - Centralized vs. decentralized procurement systems.
    - Distribution networks and logistics infrastructure (e.g., road conditions, transport methods).
    - Efficiency and reliability of supply chains in urban vs. rural areas.
3. Technology Integration:
    - Use of Logistics Management Information Systems (LMIS) for tracking inventories.
    - Integration of digital systems for cold chain management and temperature monitoring (e.g., eVIN, barcode systems).
    - Supply chain traceability technologies for monitoring the movement of medicines.
4. Local Pharmaceutical Production:
    - Capacity for domestic manufacturing of medicines.
    - Policies encouraging generic drug production and self-sufficiency.
    - Investment in local pharmaceutical infrastructure.

5. Public-Private Partnerships:
    - Collaboration between government agencies, private sector, and NGOs in managing the pharmaceutical supply chain.
    - The role of pharmaceutical companies in ensuring access to essential medicines in remote areas.
6. Cold Chain and Last-Mile Delivery:
    - Strategies to maintain cold chain integrity for vaccines and temperature-sensitive medicines.
    - Distribution strategies for ensuring last-mile delivery, particularly in remote or conflict-affected regions.

Data Analysis

The data analysis will follow a thematic and comparative approach:

1. Thematic Analysis: Data will be categorized into themes based on the key components of PSCM (regulation, procurement, logistics, technology, local production, etc.). This will help identify patterns and recurring themes across the selected countries.
2. Comparative Matrix: A comparative matrix will be created to visually map out the strengths and weaknesses of the PSCM systems in Afghanistan, Pakistan, Iran, and India across each of the thematic areas. This will help highlight best practices and identify gaps in Afghanistan's current PSCM system.
3. Gap Analysis: A gap analysis will be conducted to compare Afghanistan's existing PSCM system with those of Pakistan, Iran, and India. This will help identify areas where Afghanistan can improve, as well as potential barriers to implementing successful practices from these countries.

Justification for Secondary Data

Using secondary data is an appropriate choice for this study for several reasons:

- Cost and Time Efficiency: Secondary data allows for a broad analysis without the need for costly and time-consuming fieldwork.
- Access to Comprehensive Information: Secondary data provides access to existing reports, surveys, and published literature that cover a wide range of issues related to PSCM systems, often including data from multiple sources and perspectives.
- Established Sources: The secondary data sources selected for this research come from credible and reliable institutions like WHO, UNICEF, and government ministries, ensuring the quality and trustworthiness of the information.

Result and Discussion

The comparative review of Afghanistan, Pakistan, Iran, and India highlights both common challenges and divergent strategies in pharmaceutical supply chain management

(PSCM). The analysis emphasizes four areas—regulation, procurement, technology, and public–private collaboration—where lessons from regional neighbors could inform reforms in Afghanistan.

Regulatory Systems and Medicine Safety

Afghanistan's regulatory environment remains fragile. The National Medicines and Health Products Regulatory Authority (NMHRA) has limited enforcement capacity, leaving the country vulnerable to counterfeit and substandard medicines (UNODC, 2020). In contrast, Pakistan has strengthened oversight through the Drug Regulatory Authority of Pakistan (DRAP), which monitors quality and applies price controls, though enforcement is weaker in rural areas (Farooq et al., 2020). Iran's Food and Drug Administration (IFDA) operates a comprehensive regulatory framework with strict market surveillance and strong domestic production, reducing dependence on imports (Aboulhallaj et al., 2024). India's Central Drugs Standard Control Organization (CDSCO) is considered one of the strongest in the region, with robust pharmacovigilance systems and global recognition for ensuring safe, affordable access (Rault-Chodankar & Kale, 2023). These comparisons show Afghanistan's significant regulatory gap, underscoring the need to build institutional capacity and enforcement mechanisms.

Procurement and Logistics Management

Procurement and logistics in Afghanistan are fragmented among government agencies, NGOs, and donors, often resulting in inefficiencies and frequent cold chain disruptions (Roien et al., 2021) Pakistan has developed more centralized procurement structures, supported by the Federal Directorate of Immunization and pilot Logistics Management Information Systems (LMIS), though distribution to remote regions remains a challenge (Panhwar, 2021). Iran benefits from a coordinated procurement system with strong government involvement and regional distribution networks, ensuring consistent medicine availability (Sajadi & Majdzadeh, 2021). India stands out with the Central Medical Services Society (CMSS), which oversees large-scale, cost-efficient procurement, complemented by a tiered cold chain system that ensures reliable national coverage (Kumar et al., 2019). Relative to its neighbors, Afghanistan requires greater centralization and technological support to overcome fragmentation and enhance reliability.

Technology Integration and Innovation

Afghanistan's PSCM remains mostly manual, with limited adoption of digital systems for inventory management or supply monitoring (UNICEF, 2021). Pakistan has introduced eLMIS and barcoding systems that improve traceability and minimize shortages (Panhwar, 2021). Iran employs advanced barcoding, track-and-trace systems, and e-health platforms that enable accountability and efficient decision-making (Ghiasvand et al., 2021). India's Electronic Vaccine Intelligence Network (eVIN) has revolutionized vaccine distribution by monitoring cold chain integrity nationwide and using analytics to optimize logistics (Kumar et al., 2019). These innovations suggest that Afghanistan could significantly improve efficiency and resilience by adopting digital platforms to reduce stockouts and strengthen oversight.

Public–Private Partnerships and Collaboration

Afghanistan has limited experience with structured public–private partnerships (PPPs), relying instead on NGOs and international donors. While this ensures short-term availability, the approach lacks sustainability. In Pakistan, PPPs have improved medicine distribution in rural areas (Zaidi et al., 2019). Iran collaborates extensively with domestic pharmaceutical firms, supporting self-sufficiency and efficient supply chains (Sajadi & Majdzadah, 2021). India demonstrates a comprehensive model where government agencies, NGOs, and private companies cooperate to extend access, particularly in rural settings (Sharma et al., 2022). Institutionalizing PPPs in Afghanistan would promote long-term stability and efficiency in medicine distribution.

Summary of Comparative Insights

Overall, Afghanistan faces persistent weaknesses across all dimensions of PSCM, particularly in regulation, coordination, technology adoption, and partnership frameworks. By contrast, Pakistan, Iran, and India provide examples of incremental progress: stronger regulatory enforcement, centralized procurement, digitized logistics, and collaborative governance. For Afghanistan, the most relevant lessons include strengthening the regulatory role of NMHRA, investing in LMIS and cold chain technologies, and formalizing PPPs to reduce dependency on external donors. Drawing on these regional best practices could help Afghanistan build a more resilient, efficient, and sustainable pharmaceutical supply chain.

Recommendations for Strengthening Afghanistan’s Pharmaceutical Supply Chain

Strengthening the Regulatory Framework

Afghanistan should establish a centralized and empowered pharmaceutical regulatory authority, modeled after Pakistan’s DRAP or Iran’s IFDA, to enforce drug quality standards, monitor imports and production, and implement counterfeit detection mechanisms. Developing real-time drug tracking and market surveillance systems, similar to those in Iran, would help ensure medicine safety. Equally important is investing in the training and capacity building of regulatory personnel to align oversight with international standards.

Enhancing Procurement and Logistics Systems

Centralizing procurement under a dedicated agency would streamline purchasing, reduce fragmentation, and ensure cost efficiency, as seen in India and Pakistan. Investment in Logistics Management Information Systems (LMIS), comparable to Pakistan’s eLMIS or India’s eVIN, would improve inventory management and minimize stockouts. Additionally, strengthening cold chain infrastructure is critical for safeguarding vaccines and temperature-sensitive medicines, drawing lessons from Iran’s systematic cold chain strategies.

Leveraging Technology and Innovation

Digital solutions such as barcoding, track-and-trace systems, and integrated e-health platforms should be prioritized to enhance transparency and traceability. Afghanistan could also benefit from adopting smart logistics platforms using data analytics and artificial

intelligence to optimize distribution routes, anticipate demand, and reduce wastage. Partnerships with international organizations and private technology providers would facilitate the development of such infrastructure.

Strengthening Public–Private Partnerships

Afghanistan should institutionalize public–private partnerships (PPPs) to expand medicine access, particularly in remote areas. Collaborations between government, private pharmaceutical firms, NGOs, and donors—as demonstrated in Pakistan and India—can enhance distribution capacity and ensure last-mile delivery. Incentives such as tax breaks and subsidies should also be introduced to encourage local pharmaceutical manufacturing, following Iran's model of self-sufficiency.

Training and Capacity Building

Developing human resources is central to long-term PSCM reform. Afghanistan should invest in training healthcare personnel in supply chain management, pharmaceutical logistics, and cold chain operations, with technical support from organizations such as WHO and UNICEF. Building capacity for emergency preparedness—including rapid procurement and distribution systems—will also be essential in a country prone to crises.

Conclusion

This study demonstrates that Afghanistan's pharmaceutical supply chain faces critical challenges in regulation, logistics, technology, and institutional collaboration. However, valuable lessons can be drawn from regional neighbors. India's success with centralized procurement, strong regulation, and digital tools such as eVIN; Iran's effective regulatory oversight and local production capacity; and Pakistan's progress in LMIS and PPP-driven distribution all offer models for reform.

For Afghanistan, adopting these practices requires careful adaptation to its socio-political realities. Strengthening regulatory enforcement, investing in cold chain and digital technologies, and institutionalizing PPPs are essential for building a resilient system. By pursuing these reforms, Afghanistan can move toward a sustainable pharmaceutical supply chain that ensures medicine quality, availability, and affordability.

Improving Afghanistan's pharmaceutical supply chain is not only a technical challenge but also a strategic imperative for the broader healthcare system. A reformed PSCM—grounded in regulation, technology, capacity building, and collaboration—can secure equitable access to essential medicines and foster public trust in the health sector. Although the path to reform may be gradual, committed efforts and regional learning can enable Afghanistan to transition toward a stronger, safer, and more sustainable pharmaceutical sector.

Policy Implications and Further Research Areas

This section has outlined several important policy implications for improving Afghanistan's pharmaceutical supply chain management, as well as identified promising areas for further research. These efforts will not only support policy development and strategic planning for the Afghan government, but will also provide a framework for future studies aimed at strengthening supply chains in other low-income or conflict-affected countries.

The ongoing research and policy work in this area will be crucial in developing a more resilient, efficient, and sustainable pharmaceutical supply chain in Afghanistan, which ultimately contributes to better healthcare delivery and improved public health outcomes.

Policy Implications

The findings of this research suggest several important policy implications for Afghanistan's pharmaceutical supply chain management. These implications provide a foundation for policymakers to make informed decisions and prioritize reforms in the healthcare and pharmaceutical sectors. Below are the key policy implications:

Strengthening National Regulatory Bodies

Policy Focus: The government should prioritize the empowerment and resourcing of Afghanistan's pharmaceutical regulatory bodies, such as the National Medicines and Health Products Regulatory Authority (NMHRA). Strengthening these bodies through training, infrastructure investment, and legislative support would enable more effective oversight and regulation of the pharmaceutical sector.

Strategic Action: The government should allocate funds to develop the capacity of regulatory authorities and ensure they are well-equipped to handle modern challenges, such as counterfeit drugs, market surveillance, and supply chain disruptions. Additionally, it is vital to establish clear regulations for the importation, distribution, and manufacturing of medicines.

Promoting Technological Integration in the Pharmaceutical Supply Chain

Policy Focus: Afghanistan should adopt digital technologies to address inefficiencies in the pharmaceutical supply chain. This includes systems for inventory management, tracking drug shipments, cold chain monitoring, and data analysis for demand forecasting. Technological upgrades should be a central aspect of future policies to modernize the supply chain.

Strategic Action: The Ministry of Public Health (MoPH) should work with international partners to introduce systems like Logistics Management Information Systems (LMIS) or eVIN, which have been successfully implemented in Pakistan and India. The government should also incentivize private sector investment in technology and digital platforms to support the pharmaceutical logistics sector.

Enhancing Public-Private Partnerships (PPPs)

Policy Focus: Policy should encourage the growth of public-private partnerships in the pharmaceutical sector. These partnerships can help bridge gaps in distribution, cold chain management, and last-mile delivery. Stronger collaboration with NGOs, pharmaceutical companies, and private logistics providers will enhance the sustainability and effectiveness of Afghanistan's pharmaceutical supply chain.

Strategic Action: The government should create incentive programs to encourage private companies to invest in local manufacturing, cold chain infrastructure, and pharmaceutical distribution networks. Additionally, regulations that foster transparent collaboration and joint initiatives between the public and private sectors should be established.

Improving Emergency Preparedness and Resilience

Policy Focus: In a country like Afghanistan, which is frequently affected by political instability and conflict, it is crucial to enhance emergency preparedness in the pharmaceutical supply chain. Policymakers should design strategies to ensure that essential medicines are readily available during times of crisis, such as natural disasters, pandemics, or internal conflict.

Strategic Action: The government should establish contingency plans for emergency procurement, distribution, and inventory management during crises. Special attention should be given to developing systems that allow for the rapid mobilization of medicines in high-need areas.

Building Local Pharmaceutical Manufacturing Capacity

Policy Focus: Afghanistan should focus on developing its local pharmaceutical manufacturing capacity to reduce dependency on foreign imports and improve self-sufficiency. This can also help stabilize prices and ensure the consistent availability of medicines.

Strategic Action: The government should create an enabling environment for pharmaceutical companies by offering tax incentives, subsidies, and training programs to boost local drug production. Support for research and development (R&D) in the pharmaceutical sector should be promoted to foster innovation in drug manufacturing.

Further Research Areas

While this study provides important insights into improving Afghanistan's pharmaceutical supply chain, several areas require further investigation. Further research could help refine strategies and policies for overcoming Afghanistan's pharmaceutical challenges, and could also be useful for other similar low-income or conflict-affected countries. Below are some potential areas for further research:

Assessing the Impact of Digital Technologies on Pharmaceutical Supply Chains

Research Focus: Further research should explore how digital technologies, such as eLMIS, AI-based forecasting, and track-and-trace systems, can impact the efficiency of Afghanistan's pharmaceutical supply chain. This research could include pilot projects to test how these technologies can help in inventory management, cold chain monitoring, and supply chain transparency.

Investigating the Role of Public-Private Partnerships (PPPs) in Pharmaceutical Supply Chains

Research Focus: While PPPs have shown promise in other countries, there is a need for further research into how these partnerships can be implemented effectively in Afghanistan. Research should assess the feasibility, cost-benefit analysis, and long-term sustainability of PPPs in improving Afghanistan's pharmaceutical supply chain.

Exploring the Effects of Local Pharmaceutical Manufacturing on Supply Chain Resilience

Research Focus: Future studies should investigate the potential for local pharmaceutical manufacturing to enhance Afghanistan's pharmaceutical supply chain. This research could evaluate the feasibility of setting up local drug production facilities, the impact on drug availability, and cost reduction from local production.

Understanding the Impact of Geopolitical Instability on Pharmaceutical Supply Chains

Research Focus: Afghanistan's pharmaceutical supply chain is deeply affected by the country's geopolitical instability. Further research should explore how conflict and political instability impact the distribution and availability of medicines, as well as how the country can better prepare for such disruptions.

Evaluating the Effectiveness of Pharmaceutical Regulatory Reforms in Low-Income Countries

Research Focus: Research should also be conducted to assess the effectiveness of pharmaceutical regulatory reforms in low-income countries, with a focus on lessons from Pakistan, Iran, and India. This would involve evaluating how strengthening regulation and improving drug quality control affect public health outcomes and the sustainability of the pharmaceutical supply chain.

Declaration of conflicting interest

The authors declare that there is no conflict of interest in this work.

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