Building Resilient Healthcare Supply Chains: Lessons from the COVID-19 Crisis and Future Strategies

The healthcare supply chain forms the backbone of patient care and public health infrastructure, ensuring the timely availability of essential medical supplies and equipment. The COVID-19 pandemic placed an unprecedented strain on these global networks, exposing critical vulnerabilities and leading to severe disruptions in the delivery of healthcare services. This report analyzes the profound impact of the pandemic on healthcare supply chains, identifies the weaknesses that were brought to light, and proposes future strategies to build more resilient systems capable of withstanding future crises and ongoing challenges [1]. The experiences of the past few years offer invaluable lessons that must be integrated into a proactive and forward-looking approach to supply chain management in the healthcare sector.

The COVID-19 pandemic served as a significant stress test for global healthcare supply chains, revealing the fragility of systems that were often optimized for efficiency over resilience. The scale and speed of the pandemic, coupled with its global reach, created a perfect storm of challenges for healthcare organizations worldwide [2]. A substantial majority of hospital leaders, approximately 98%, acknowledged that the pandemic exposed significant vulnerabilities within their supply chains [1]. The crisis manifested in numerous ways, most notably through widespread shortages of critical supplies, escalating costs, and disruptions across the entire supply chain ecosystem, from manufacturing to logistics [1]. These challenges forced healthcare organizations to adapt their procurement processes and overall supply chain management strategies in real-time [1]. The pandemic's impact extended beyond immediate supply shortages, fundamentally altering the scope and perceived importance of supply chain management within healthcare systems [1].

The vulnerabilities that underpinned the disruptions during the COVID-19 pandemic were often inherent in the pre-existing structure and operational models of healthcare supply chains. A significant weakness was the **reliance on single suppliers and geographical concentration** of manufacturing [4]. The fact that over 200 Fortune 500 companies had a presence in Wuhan, the initial epicenter of the outbreak, underscores the high degree of geographical concentration that made the global supply chain susceptible to localized disruptions [4]. This dependence was not limited to general manufacturing; critical pharmaceutical components, such as active pharmaceutical ingredients (APIs) and excipients needed for drugs like those used to treat HIV, also faced shortages due to reliance on specific suppliers or regions [5]. Furthermore, the United States' heavy reliance on mask imports from China

demonstrated the risks associated with depending on a single country for essential medical supplies [6]. When these concentrated sources of supply faced lockdowns or prioritized domestic needs, the global flow of critical healthcare goods was severely impeded.

Another critical vulnerability was the **lack of transparency and real-time visibility** throughout the supply chain [7]. Many healthcare organizations relied on manual inventory management processes, which inherently limited their ability to track the status of supplies, leading to both stockouts and overstocking [7]. A breakdown of trust among supply chain stakeholders also emerged, suggesting a lack of reliable data and open communication. Buyers often questioned the accuracy of information provided by suppliers, hindering effective decision-making during the crisis [8]. The fundamental need for the ability to track products at every point in the supply chain and effectively manage inventory became strikingly clear [9]. Without this end-to-end visibility, healthcare organizations struggled to anticipate shortages, optimize resource allocation, and respond effectively to the rapidly evolving situation.

The prevailing **inadequate inventory management practices**, particularly the widespread adoption of just-in-time (JIT) and lean inventory models, proved to be a major weakness [6]. The JIT strategy, focused on minimizing stockpiles and moving supplies just before they were needed, and lean inventory management, which aimed to reduce stockpiling to the absolute minimum, were ill-equipped to handle the sudden and extreme surge in demand and the breakdown of global logistics [6]. These efficiency-driven models lacked the necessary buffers to absorb the shocks of the pandemic, leading to rapid depletion of inventories when international supplies became inaccessible [8]. The reduction in medical stockpiles, a direct consequence of lean management principles, eliminated a crucial safety net that could have mitigated the initial impact of the crisis [8].

Finally, the **limitations of manual and outdated processes** within healthcare supply chains exacerbated the challenges [1]. Organizations that continued to operate with disjointed systems and manual procedures faced significantly greater difficulties in locating and distributing needed supplies [1]. Manual procure-to-pay (P2P) and inventory management processes were not only time-consuming but also increased the risk of errors and severely limited visibility into supply status [7]. The lack of digitalization and automation hindered the ability of healthcare organizations to adapt quickly to the dynamic demands of the pandemic.

The COVID-19 crisis resulted in numerous specific examples of severe supply chain disruptions that directly impacted patient care. One of the most visible and widely

reported issues was the **shortage of Personal Protective Equipment (PPE)** [1]. Healthcare organizations globally struggled to procure essential PPE such as masks, gowns, and gloves, leading to dramatic price increases. For instance, the prices for isolation gowns surged by 2,000%, and N95 masks saw an even more staggering increase of 6,136% between March and April 2020 [1]. Even months into the pandemic, a significant percentage of facilities, around 70%, reported ongoing difficulties in securing adequate PPE [1]. The World Health Organization (WHO) estimated a massive global monthly consumption of 89 million masks, 76 million gloves, and 1.6 million goggles, a demand that existing supply chains were unable to meet [8]. This scarcity instilled fear among frontline healthcare workers and compromised their ability to deliver care safely [8].

The pandemic also led to a critical **scarcity of ventilators and other essential medical equipment** [8]. The demand for ventilators, crucial for treating patients with severe COVID-19, rose exponentially, with the United States alone needing hundreds of thousands of units [8]. Healthcare systems in countries like the United Kingdom also faced severe ventilator shortages at the onset of the pandemic [10]. This lack of essential equipment placed immense pressure on intensive care units and forced difficult decisions regarding patient care.

Furthermore, the supply of **pharmaceuticals and active pharmaceutical ingredients (APIs)** experienced significant disruptions [3]. Shortages of key medicines and testing reagents were common, and concerns arose regarding the availability of APIs and excipients needed for the production of essential drugs, including those for HIV treatment [5]. In Canada, a two-month shortage of essential medicines saw a 32% increase compared to previous years, while demand surged by 108% [5]. These disruptions in the pharmaceutical supply chain had the potential to impact a wide range of patients requiring regular medication.

Beyond PPE, ventilators, and pharmaceuticals, the pandemic also highlighted disruptions in the supply of **testing reagents and other essential supplies** [3]. The lack of sufficient testing capacity early in the pandemic hampered efforts to track and control the spread of the virus. Additionally, even seemingly routine supplies became scarce, impacting standard medical procedures. For example, the availability of materials and supplies necessary for standardized central line insertion and care bundles, which are critical for preventing infections, was disrupted, indirectly affecting patient safety [10].

The unprecedented challenges posed by the COVID-19 pandemic yielded crucial lessons regarding the building of resilient healthcare supply chains. One of the most

significant takeaways was the **critical importance of diversification of suppliers and manufacturing locations** [4]. The risks associated with relying on single sources of supply or geographically concentrated production became starkly evident. Moving forward, exploring and establishing multiple sources of supply across different regions is paramount for mitigating the impact of localized disruptions [4]. Diversifying supply chain channels fosters redundancy and agility, allowing for alternative sources when primary channels are compromised [12]. The pandemic has made companies more sensitive to the dangers of being single-sourced or dependent on a single geographical area [4].

Another key lesson learned is the **benefits of regionalization and nearshoring strategies** [11]. Bringing suppliers and production facilities closer to the point of use can significantly stabilize inventory replacement and reduce reliance on complex and lengthy international supply chains that are more vulnerable to global disruptions [12]. There is a growing recognition of the need to bring production facilities back onshore or engage in nearshoring to enhance control and reduce risks associated with distant global supply chains [13]. This shift towards regional supply chains and a greater reliance on local suppliers has become a noticeable trend since the pandemic [6].

The **necessity of enhanced supply chain visibility and data sharing** also emerged as a critical lesson [12]. Integrating supply chain planning into overall strategic frameworks and treating the supply chain as a vital communication channel are essential [12]. Just as physical resources move through the supply chain, so too must information flow seamlessly among all partners and employees [12]. Gaining greater upstream visibility by mapping and continuously monitoring the entire supply network is crucial [13]. Creating a holistic view of inventory through improved cooperation, information sharing, and alignment among all stakeholders enables proactive risk management and efficient resource allocation [13]. Achieving this level of visibility often requires investment in real-time tracking technologies and the adoption of Internet of Things (IoT) devices to monitor shipments and warehouse conditions effectively [9].

The pandemic also underscored the vital role of **strategic stockpiling and buffer inventories** [8]. The reduction in medical stockpiles resulting from lean management practices highlighted the need for these reserves as essential buffers during crises [8]. Maintaining extra inventory of essential healthcare items, along with having excess manufacturing capacity for critical products and contracts with backup suppliers, are important strategies for building resilience [13]. Strategic positioning of safety stocks within the supply chain can provide much-needed resilience without incurring exorbitant costs [13]. A balanced approach that utilizes both just-in-time and just-in-case inventory models for essential supplies can help optimize efficiency

under normal conditions while providing a safety net during unexpected demand surges or supply disruptions [11].

Finally, the experience of the COVID-19 pandemic emphasized the **need for agile and adaptable supply chain models** [12]. Agility, defined as the capacity to react quickly to erratic changes in supply and demand, is crucial for navigating turbulent times [14]. Supply chains must be able to adapt and adjust as rapidly as possible to evolving circumstances [12]. Building flexibility into the supply chain, such as the ability to quickly shift production to different products or suppliers, is essential for responding effectively to unforeseen events [12]. Taking proactive and agile action, informed by real-time data and strong communication channels, is key to ensuring supply chain resilience and stakeholder well-being [12].

Key Vulnerabilities Exposed by COVID-19 and Corresponding Resilience Strategies

Vulnerability	Corresponding Resilience Strategy
Reliance on single suppliers/geographical concentration	Diversification of suppliers across different regions; nearshoring/reshoring of critical production
Lack of transparency and real-time visibility	Investment in digital technologies for tracking and monitoring; enhanced data sharing among stakeholders
Inadequate inventory management (JIT/Lean)	Strategic stockpiling of essential supplies; hybrid JIT/JIC models; maintaining buffer inventories
Limitations of manual and outdated processes	Digitalization and automation of supply chain processes (e.g., procurement, inventory management)

Building upon the lessons learned, several future strategies are essential for creating more resilient healthcare supply chains. **Investing in and incentivizing domestic manufacturing capacity for critical medical supplies** is a key element of this

strategy [13]. Bringing production facilities back onshore or engaging in nearshoring can reduce reliance on potentially unstable international sources and enhance national security regarding the availability of essential medical equipment [13]. Government support through increased funding and favorable procurement policies can help domestic manufacturers expand and remain competitive [15]. Policy proposals, such as reimbursing hospitals for purchasing domestically sourced medical supplies, can further incentivize this shift [16]. Focusing on advanced and continuous manufacturing technologies for critical drugs and APIs can improve efficiency and strengthen the domestic supply chain [17]. Identifying and prioritizing essential medicines and their components for domestic production is also crucial for targeted investment [17].

Developing and implementing robust national and regional stockpiling programs is another vital strategy [13]. Enhancing the visibility and transparency of the Strategic National Stockpile (SNS) is essential for effective emergency preparedness [13]. Empowering states to develop and maintain their own strategic stockpiles of critical medical supplies can address region-specific needs and supplement the federal SNS [18]. Regularly updating the list of medicines and devices included in the SNS based on evolving threats and expanding its scope to include emerging countermeasures like monoclonal antibodies are crucial steps [17]. Fostering better coordination between federal and state stockpiling efforts and incentivizing the creation of private-sector reserves can further strengthen the nation's preparedness [17].

Leveraging advanced data analytics for accurate demand forecasting and proactive risk management is increasingly important [7]. Utilizing artificial intelligence (AI) and machine learning algorithms to analyze historical data, demographics, and other relevant factors can significantly improve the accuracy of demand forecasting [11]. This allows healthcare organizations to maintain optimal inventory levels and reduce the risk of both shortages and overstocking [7]. AI can also play a crucial role in proactively identifying potential disruptions in the supply chain due to natural disasters, geopolitical events, or pandemics, enabling organizations to develop mitigation strategies [22]. The application of various types of healthcare data analytics, including descriptive, diagnostic, predictive, and prescriptive analytics, can provide valuable insights for improving patient outcomes, enhancing operational efficiency, and enabling preventive care [21].

Fostering stronger strategic partnerships between healthcare providers, suppliers, and governments is essential for building resilient supply chains [1]. The pandemic highlighted the value of reliable relationships with suppliers, and forming strategic partnerships is now a top priority for many healthcare providers [1]. Collaboration between the private and public sectors can ensure greater protection

and reduced financial risk for the supply chain [6]. A multi-stakeholder approach that brings together manufacturers, healthcare providers, and government agencies is crucial for identifying challenges and developing collaborative solutions to enhance resilience and adaptability [23].

Finally, **emphasizing quality and resilience in procurement processes beyond cost considerations** is necessary for long-term supply chain health [13]. Procurement strategies should balance cost efficiency with supplier risk management and the overall resilience of the supply chain [13]. Raising awareness about the benefits of high-quality, domestically produced medical supplies can encourage healthcare organizations to prioritize reliability over solely focusing on the lowest cost [15]. Government incentives and greater transparency regarding manufacturer quality, such as publicly available quality management process ratings, can drive improvements in both product quality and supply chain resilience [17].

Technological innovation offers a significant advantage in building more resilient and efficient healthcare supply chains. **Blockchain technology** holds considerable potential for enhancing transparency, traceability, and combating the proliferation of counterfeit medical products [24]. Its decentralized and immutable nature allows for a secure and transparent record of a product's journey from manufacturer to end-user, ensuring authenticity and reducing the risk of counterfeiting [24]. Blockchain can facilitate secure data sharing among supply chain stakeholders, providing a comprehensive view of the entire network and enabling better analysis of inefficiencies [25]. The technology enables end-to-end traceability, which is crucial for quality assurance, verifying product distribution channels, and facilitating timely product recalls [26]. Various applications of blockchain in healthcare supply chains are being explored, including improving data security, optimizing inventory management, and ensuring compliance with regulatory standards [28].

Artificial Intelligence (AI) is another transformative technology that can significantly enhance healthcare supply chain resilience and efficiency [7]. AI-powered predictive analytics can accurately forecast demand, optimize inventory levels, and identify potential bottlenecks before they occur [7]. AI algorithms can analyze vast amounts of historical data and current trends to provide precise demand predictions, minimizing the risks of both stockouts and overstocking [32]. Beyond forecasting, AI can streamline supplier selection and evaluation, improve communication and collaboration with suppliers, and provide AI-driven risk management and mitigation strategies [22]. In logistics and distribution, AI can optimize delivery routes, provide real-time tracking of shipments, and even predict potential disruptions [22]. Furthermore, AI can automate procurement processes, improve contract management, and enhance overall

operational efficiency, ultimately leading to better patient care [32]. The integration of AI with **IoT and real-time tracking technologies** further enhances supply chain visibility by providing continuous monitoring of the condition and location of supplies, enabling proactive interventions and optimization [11].

Effective policy and governance are crucial for shaping a resilient healthcare supply chain ecosystem. Government initiatives at both national and international levels play a vital role in this endeavor [34]. Agencies like the Department of Health and Human Services (HHS) are actively working to strengthen the public health supply chain and industrial base through various strategies and executive orders [34]. The Defense Production Act (DPA) and similar government authorities can be leveraged to address medical supply shortages and incentivize the expansion of domestic manufacturing capabilities [35]. Policy recommendations from various organizations emphasize the need for legislative and regulatory solutions that incentivize advanced manufacturing, improve the function of national stockpiles, enhance international cooperation, and prioritize quality and resilience in the supply chain [17]. Regulatory frameworks should be designed to support diversification of suppliers and promote international collaboration to mitigate risks associated with over-reliance on single sources [17]. Incentivizing investment in supply chain infrastructure and technology, including the creation of private-sector reserves of essential medical supplies, is also crucial [17]. Finally, fostering international cooperation and information sharing on potential supply chain risks is essential for a coordinated global response to health emergencies [17].

In conclusion, building resilient healthcare supply chains in the post-pandemic era requires a fundamental shift in approach, moving beyond a singular focus on cost efficiency to prioritize preparedness, adaptability, and robustness. The COVID-19 crisis laid bare the vulnerabilities inherent in globally interconnected yet often opaque and leanly stocked supply chains. The lessons learned underscore the critical need for diversification of suppliers and manufacturing locations, the adoption of regionalization and nearshoring strategies, the implementation of enhanced supply chain visibility through data sharing and advanced tracking technologies, the maintenance of strategic stockpiles and buffer inventories, and the cultivation of agile and adaptable supply chain models. Future strategies must focus on incentivizing domestic manufacturing of critical medical supplies, developing robust national and regional stockpiling programs, leveraging the power of advanced data analytics for demand forecasting and risk management, fostering stronger partnerships across the healthcare ecosystem, and emphasizing quality and resilience in procurement processes. Technological innovations such as blockchain and artificial intelligence offer powerful tools to enhance transparency, traceability, efficiency, and predictive

capabilities within the supply chain. Ultimately, a resilient healthcare supply chain, supported by effective policy and governance, is essential to ensure a reliable and efficient supply of medical products, safeguarding patient health and well-being in the face of future health crises and ongoing challenges.

Works cited

1. COVID-19: Impact and Lessons for Healthcare Supply Chains | GHX, accessed March 23, 2025, https://www.ghx.com/the-healthcare-hub/pandemic-healthcare-supply-chain-impact/
2. Impacts of COVID-19 on Global Supply Chains: Facts and Perspectives - PMC, accessed March 23, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC8768947/
3. Securing Medical Supply Chains in a Post-Pandemic World | OECD, accessed March 23, 2025, https://www.oecd.org/en/publications/securing-medical-supply-chains-in-a-post-pandemic-world_119c59d9-en.html
4. Seven COVID-19 Lessons Learned in Supply Chain - Jabil.com, accessed March 23, 2025, https://www.jabil.com/blog/covid-19-supply-chain-lessons.html
5. Global Health Commodities Supply Chain in the Era of COVID-19 Pandemic: Challenges, Impacts, and Prospects: A Systematic Review - PubMed Central, accessed March 23, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC11018129/
6. Healthcare Supply Chain Resilience: Lessons Learned from the ..., accessed March 23, 2025, https://www.news-medical.net/health/Healthcare-Supply-Chain-Resilience-Lessons-Learned-from-the-Pandemic-and-Strategies-for-the-Future.aspx
7. Supply Chain Issues in Healthcare and How to Manage Shortages - GHX, accessed March 23, 2025, https://www.ghx.com/the-healthcare-hub/supply-chain-issues/
8. At the Epicenter of COVID-19—the Tragic Failure of the ... - Frontiers, accessed March 23, 2025, https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2020.562882/full
9. Ways to Optimize Healthcare Supply Chains in Healthcare - Pathstone Partners, accessed March 23, 2025, https://pathstonepartners.com/news/ways-to-optimize-healthcare-supply-chains-in-healthcare/
10. The downstream effects of the COVID-19 pandemic: The supply chain failure, a wicked problem - PubMed Central, accessed March 23, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC9014739/
11. Strategies for Building Healthcare Supply Chains, accessed March 23, 2025, https://www.definitivehc.com/resources/how-to-guides/build-resilient-healthcare-supply-chain
12. Supply Chain Lessons From COVID-19 - Fitchburg State University Online, accessed March 23, 2025,

https://online.fitchburgstate.edu/degrees/business/mba/supply-chain-management/supply-chain-covid-19/
13. COVID-19 and the health care supply chain: impacts and lessons learned, accessed March 23, 2025, https://www.thescxchange.com/articles/4417-covid-19-and-the-health-care-supply-chain-impacts-and-lessons-learned
14. Enablers of resilience in the healthcare supply chain: A case study of U.S healthcare industry during COVID-19 pandemic - PMC - PubMed Central, accessed March 23, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC9675944/
15. Time to Revive Your Resilience Strategy - SafeSource Direct, accessed March 23, 2025, https://www.safesourcedirect.com/blog/time-to-revive-your-resilience-strategy-how-american-manufacturing-solves-healthcares-supply-chain-crisis
16. Medical Manufacturing: A Critical Supply Chain at Risk - American Affairs Journal, accessed March 23, 2025, https://americanaffairsjournal.org/2025/02/medical-manufacturing-a-critical-supply-chain-at-risk/
17. www.ashp.org, accessed March 23, 2025, https://www.ashp.org/-/media/assets/news-and-media/docs/Healthcare-Supply-Chain-Recommendations
18. Carter, Veasey, Miller-Meeks, Houlahan, and Mackenzie reintroduce bill supporting states' readiness for public health emergencies, accessed March 23, 2025, https://buddycarter.house.gov/news/documentsingle.aspx?DocumentID=15488
19. Michigan Strategic National Stockpile (MISNS), accessed March 23, 2025, https://www.michigan.gov/-/media/Project/Websites/michiganprepares/docs/pdf/02/MISNS_FAQ_Sheet_Final.pdf?rev=ec9ab6e9065d4233b50fd26b700aa31f
20. Strategic Stockpiling: How New State Policies will Impact Emergency Preparedness, accessed March 23, 2025, https://www.astho.org/communications/blog/strategic-stockpiling-how-new-state-policies-will-impact-emergency-preparedness/
21. Data Analytics in Healthcare: Transforming Patient Care Delivery | Park University, accessed March 23, 2025, https://www.park.edu/blog/data-analytics-in-healthcare-transforming-patient-care-delivery/
22. Leveraging AI in the healthcare supply chain - Digital Health Insights, accessed March 23, 2025, https://dhinsights.org/news/leveraging-ai-in-the-healthcare-supply-chain
23. Strengthening the Backbone of Healthcare: Navigating Supply Chain Challenges in the New Era - U.S. Chamber Foundation, accessed March 23, 2025, https://www.uschamberfoundation.org/disasters/strengthening-the-backbone-of-healthcare-navigating-supply-chain-challenges-in-the-new-era
24. The Role of Blockchain in Medical Supply Chain Management - NASSCOM Community, accessed March 23, 2025, https://community.nasscom.in/communities/blockchain/role-blockchain-medical-

supply-chain-management
25. Full article: Exploring blockchain implementation challenges in the context of healthcare supply chain (HCSC) - Taylor and Francis, accessed March 23, 2025, https://www.tandfonline.com/doi/full/10.1080/00207543.2023.2286491
26. Improving End-to-End Traceability and Pharma Supply Chain Resilience using Blockchain - PMC - PubMed Central, accessed March 23, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC9907421/
27. (PDF) Blockchain Technology Applications in Healthcare Supply Chains – A Review, accessed March 23, 2025, https://www.researchgate.net/publication/377072330_Blockchain_Technology_Applications_in_Healthcare_Supply_Chains_-_A_Review
28. 5 blockchain healthcare use cases in digital health - STL Partners, accessed March 23, 2025, https://stlpartners.com/articles/digital-health/5-blockchain-healthcare-use-cases/
29. Blockchain Revolutionizing Healthcare Industry: A Systematic Review of Blockchain Technology Benefits and Threats - PMC - PubMed Central, accessed March 23, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC10701638/
30. Blockchain Technology in Healthcare: Real-World Benefits & Solutions - Acropolium, accessed March 23, 2025, https://acropolium.com/blog/blockchain-technology-in-healthcare-real-world-benefits-solutions/
31. Future Trends in Healthcare Supply Chain: What's Next for Consolidated Service Centers?, accessed March 23, 2025, https://www.tecsys.com/blog/future-trends-in-healthcare-supply-chain-whats-next-for-consolidated-service-centers
32. The Impact of AI on Healthcare Supply Chain Efficiency | Thoughtful, accessed March 23, 2025, https://www.thoughtful.ai/blog/the-impact-of-al-on-healthcare-supply-chain-efficiency
33. Leveraging AI for Efficient Healthcare Supply Chain Management | Thoughtful, accessed March 23, 2025, https://www.thoughtful.ai/blog/leveraging-ai-for-efficient-healthcare-supply-chain-management
34. Public Health Supply Chain and Industrial Base One-Year Report in Response to Executive Order 14107 (February 2022) - ASPR, accessed March 23, 2025, https://aspr.hhs.gov/MCM/IBx/2022Report/Documents/Public-Health-Supply-Chain-and-Industrial-Base%20One-Year-Report-Feb2022.pdf
35. Defense Production Act: Opportunities Exist to Increase Transparency and Identify Future Actions to Mitigate Medical Supply Chain Issues: | U.S. GAO, accessed March 23, 2025, https://www.gao.gov/products/gao-21-108
36. Healthcare Policy: Recommendations to Achieve Better Quality - Premier, Inc., accessed March 23, 2025, https://premierinc.com/newsroom/blog/healthcare-policy-a-roadmap-for-the-118th-congress

37. AdvaMed White Paper Recommends Six Priority Areas for Building Medical Technology Supply Chain Resilience, accessed March 23, 2025, https://www.advamed.org/industry-updates/news/advamed-white-paper-recommends-six-priority-areas-for-building-medical-technology-supply-chain-resilience/