

Bolstering Disaster Preparedness and Operational Resilience in the Healthcare Supply Chain

Overview

In recent years, numerous events such as hurricanes, geopolitical conflict and disease outbreaks have demonstrated the impact of disruptions to supply chain operations. As a result of the COVID-19 pandemic, the healthcare supply chain initially faced increased strains due to surges in demand for medical products, combined with shortages of raw materials and an available frontline workforce. However, due to a combination of experience and expertise in operating through unexpected crises and multiple partnerships between the public and private sectors, distributors and other members of the healthcare supply chain were able to swiftly adapt to and operate under new conditions. The disruptions, combined with the agile response of organizations across the healthcare supply chain, proves there is a continuing need to maintain and improve upon operational resilience in the healthcare supply chain.



The healthcare supply chain is an extensive network of public and private stakeholders with unique expertise to ensure medical products are manufactured, distributed and dispensed to patients safely. Healthcare distributors are a critical part of, but often play a less visible role on the supply chain. Distributors, represented by the Healthcare Distribution Alliance (HDA), ensure that the providers and the communities they serve — approximately 330,000 sites of care — have access to the drugs, vaccines and other medical products that they need regardless of circumstance.

Public-private partnerships, or PPPs, are cooperative efforts between public, private and nonprofit actors to split resources and decision-making abilities to work toward specific outcomes in both steady-state and crisis scenarios. During crises, PPPs are often used to build and improve upon public-private communication and coordination. PPPs succeed by leveraging the respective expertise of public and private sectors that allow them to simultaneously work towards their specified goals. PPPs can leverage various tools, ranging from [toolkits](#) that provide recommendations and mitigation strategies for supply chain organizations to [specific initiatives](#) that can increase vaccine development and manufacturing capabilities. Furthermore, PPPs also provide a framework for future collaborations and help to build cross-sector relationships — both of which can help to bolster both supply chain and operational resilience in anticipation of future disruptions.

The COVID-19 pandemic has shown the importance of ensuring operational resilience and maintaining contingency plans for unexpected disruptions across industries. The healthcare supply chain is no exception, and the COVID-19 pandemic has sparked renewed interest from members of the private and public sector alike to improve its operational resilience, disaster preparedness and response planning. HDA members

are uniquely qualified to offer robust insight on enhancing these areas due to a combination of their extensive expertise and proven capabilities to operate through disasters. Distributors help to strengthen the resilience of the healthcare supply chain by offering their insights for healthcare pharmacies, providers and manufacturers to fortify their disaster preparedness efforts. Additionally, by doing so, HDA members advance HDA's [mission](#) of supporting patient access to medical products through safe, efficient and effective distribution.

This issue brief provides an overview of the potential operational resilience, disaster preparedness and response challenges faced by the healthcare supply chain. It also highlights the lessons learned by healthcare distributors, who have implemented innovative strategies during both steady-state and crisis scenarios. The brief concludes with recommendations that may be implemented by healthcare supply chain organizations to bolster operational resilience.

Background

Operational resilience is an organization's ability to resist, adapt to and recover from system disruptions that have the potential to hinder its capabilities. Operational resilience also includes the organization's ability to both formulate preparedness and response strategies so they may be swiftly implemented when needed. The term does not refer to an organization's readiness for any one specific threat; rather, it emphasizes the ability to sustain operations amid an array of diverse, potentially simultaneous threats. Healthcare distributors must continuously monitor and reinforce their operational resilience to sustain a flexible and functional supply chain in both steady-state and crisis scenarios. *Supply chain resilience* can be defined as the ability for the supply chain to manage disruptions without significant interruption to healthcare delivery — and ultimately to patient care.



The role of distributors during both steady-state and crisis scenarios is to maintain the flow of medical products from manufacturers to dispensers. Distributors work with supply chain organizations to monitor medical product supply and demand, and to anticipate and mitigate challenges to delivering product. When steady-state supply chain operations are threatened, distributors activate response strategies to preserve the efficient and equitable delivery of medical products and ultimately patient care. For example, during the early stages of the COVID-19 pandemic, distributors took action to [ensure the efficient distribution of drugs](#) and [preserve the health and safety of their frontline employees](#). Additionally, distributors served as a [critical nexus between manufacturers and over 50,000 healthcare providers](#) to ensure the delivery of COVID-19 vaccines and other products throughout the pandemic.

The healthcare supply chain may operate differently while under significant strain (i.e., under catastrophic or unprecedented circumstances). Strain can appear through supply chain issues like production bottlenecks, product shortages and delivery disruptions. However, these pressures can also expose existing structural flaws and highlight areas for improvement to better prepare for the future. For example, the earlier stages of the COVID-19 pandemic [exposed shortcomings](#) in U.S.-based businesses that depend on global supply chains for raw materials and medical products. This experience prompted policymakers and healthcare providers and manufacturers to give [increased thought to relocating or resourcing](#) the production and procurement of some medical products to increase medical supply chain resilience.

Disaster Types and Scope of Impact

The characteristics of supply chain disruptions influence how distributors prepare and respond. Response plans range from developing mitigation plans for known or anticipated risks, to the development and implementation of emergency plans and government partnerships, to maintaining the flow of medical products during periods of strain.

Depending on their origins, disasters can be categorized as an extreme weather event, a disease outbreak or a geopolitical event. Extreme weather events often include hurricanes, wildfires and floods. The disease outbreak category primarily refers to the outbreak of an epidemic or pandemic, like COVID-19 or Mpox. The events in these two groups can also be categorized by the amount of time it takes for disasters to occur and the scale of their impact. These categories are slow-onset (epidemics, droughts, etc.), rapid-onset (earthquakes, flash floods, landslides, etc.) and catastrophic hazards (pandemics and other globally impactful events).

Geopolitical disasters are more diverse than their counterparts for two reasons. First, they include a wider variety of potential disruptions including social-political influences, labor force disruptions (i.e. worker strikes), changes in government, the outbreak of a conflict or war, a terrorist attack and cybersecurity threats such as [phishing](#) or [ransomware](#) attacks. Second, the short- and long-term impacts of each of these events on the healthcare supply chain vary. Some may cause little to no disruption, while others may impact manufacturing practices due to increased costs or the loss of sites or personnel. Additionally, the supply chain's response to these events will also differ. In some cases, production may be halted while strikers negotiate for better wages or benefits. In others, production of products may face long-term resource constraints or be completely rerouted due to geopolitical conflict or war.



Each disruption type places unique stresses on and can threaten specific or multiple parts of the healthcare supply chain. For example, disruptions that occur upstream (i.e., sourcing and manufacturing processes) can lead to raw material shortages, border crossing restrictions and export bans. Meanwhile, demand-side disruptions occurring downstream (i.e., toward consumers) are typically induced by extrinsic or societal factors (e.g., changes in public awareness or sentiment about a product, increase in demand or hoarding behaviors). Disruptions can also involve other critical infrastructure sectors, such as energy, transportation and water. Disruptions to the energy (power grid, fuel) and transportation (roadways, mass transit, railway, aviation, maritime) sectors are most likely to affect distributor operations. Furthermore, the scale of a disruption can differ widely depending on how far-reaching its consequences are and any factors that may exacerbate it (for example, a worker's strike that breaks out during a product shortage or conflict).

Despite the unique circumstances that cause supply chain disruptions, their consequences can appear similar. However, if an organization does not focus on the complexities of each type of disaster during its planning, its response and recovery efforts will likely be inefficient, or possibly even fail. For example, despite being vastly different in their origins and the specific parts of the supply chain that would be impacted, hurricanes and a large-scale cyberattack can result in both the destruction of health infrastructure and the temporary disruption of the production and delivery of medical products.

Institutions that only respond to the damaged infrastructure or production disruption rather than the nuances that contribute to them can undermine or hurt their response plans (and ultimately themselves) by using

limited resources inefficiently. Because supply chain disruptions and the lack of proper mitigation efforts or response plans can significantly complicate the continuity of care, members of the healthcare supply chain must have proper and well-informed contingency plans in place to respond to specific crises in a timely and efficient manner.

Operational Resilience During Extreme Weather Events

Over the past 40 years, extreme weather events have [increased in frequency](#), become deadlier and have resulted in [damages totaling over 2 trillion dollars](#). The increased occurrence and potential damage of climate disasters have resulted in providers undertaking actions such as climate-caused hospital evacuations at [an unprecedented rate](#).

Extreme weather events can range from short disasters (e.g., hurricanes, tornados) to longer-term events (e.g., wildfires, floods). Regardless of the initial event's duration, every disaster can have long-lasting impacts on the affected area's ability to provide public health services. Impacts may include the damaging or complete destruction of manufacturing and residential areas, long-term periods without power and a smaller number of operational providers becoming overburdened with patients.



Compared to other providers on the healthcare supply chain, [the pharmaceutical industry is especially vulnerable](#) to manufacturer-side disruptions due to the limited number of suppliers. As a result, if an extreme weather event strikes an area where large quantities of medical products are produced, there may be lasting disruptions. For example, 2017's Hurricane Maria devastated Puerto Rico, which disrupted both U.S. and global medical supply chains due to the number of [critical pharmaceuticals and medical devices](#) produced solely or primarily on the island. The hurricane also resulted in a prolonged power failure that diminished manufacturer capabilities and forced U.S. entities to [reroute medical product imports](#).

The immediate disaster is not always the primary threat to supply chain operations. Organizations on the healthcare supply chain must be prepared for aftereffects that may cause more damage than the original crisis, such as extended power outages. The strain from extended impacts can potentially overwhelm the supply chain in several ways. For example, providers may face larger patient counts due to the emergency or because travel is made difficult because of it. Meanwhile, manufacturers may be forced to temporarily shut down operations; potentially resulting in product shortages.

However, when members of the healthcare supply chain are prepared for crisis events, they fare well. In 2021, the state of Texas experienced [multiple widespread power grid failures](#) due to stretches of frigid weather. This disaster was not unexpected; experts previously recommended that the state government reinforce the power grid against the cold leading up to and after the previous failures. However, the state of Texas consistently failed to implement expert recommendations. Despite Texas not taking the state government's recommendation, providers did. Hospitals in the impacted regions were [prepared and remained operational](#) throughout the blackout due to maintaining and using backup generators and enacting emergency contingency plans.

Healthcare-sector stakeholders are becoming increasingly cognizant of the potential dangers that extreme weather events pose to their organizations. However, the level of concern is not uniform across the sector. According to a U.S. House of Representatives' Ways and Means Committee staff report, most responding

providers [dedicated](#) some level of resources or forming executive level working groups in relation to extreme weather events and climate change. However, only a little over one-third reported having begun preparation through the development of [climate action or preparedness plans \(CAPPs\)](#). A CAPP is a plan to limit organizational risk when facing extreme weather events. It outlines strategies or contingencies which can be used in disaster scenarios.

In addition to a CAPP, healthcare organizations also safeguard against climate disasters by using and abiding by federal regulations such as the [CMS Emergency Preparedness Rule](#). The CMS Emergency Preparedness Rule aims to ensure adequate planning for climate and man-made disasters, including organizational coordination with federal, state, regional and other relevant emergency preparedness systems. Further, members of the healthcare supply chain also institute enterprise resilience programs that focus on the mitigation of, preparedness for and contingency planning in response to climate disruptions on an ongoing basis.

In addition to using the aforementioned tools, healthcare supply chain stakeholders bring forward the lessons learned from previous disasters and their responses to further increase operational resilience. For example, Hurricane Fiona did not cause severe disruptions on the medical product and pharmaceutical supply chains. This was in part due to manufacturers using [lessons learned](#) to strengthen the vulnerabilities exposed by the previous hurricane.

Manufacturers recognized the severity of the damage done to physical infrastructure by both hurricanes and subsequent floods. Accordingly, manufacturers made stronger investments in flood guards, roads, backup generators, etc., to not only repair but also ensure that necessary infrastructure would be better protected in future times of extreme weather. Manufacturers also altered their preparation methods based on the issues arising from Hurricane Maria. One notable adaptation manufacturers made was to increase diesel fuel reserves to ensure they could operate in an absence of power. Additionally, manufacturers increased potable water storage to continue operations and enacted plans to shift finished product to other facilities to mitigate the potential impact of immediate disruptions to production.

Operational Resilience During Disease Outbreaks

A major disease outbreak (i.e., an epidemic or pandemic) can strain healthcare supply chain capabilities. Depending on the severity of the outbreak, supply chain strains may be relatively short as organizations enact response plans or adjust to crisis conditions. However, if the healthcare supply chain (or specific members of it) do not have contingency plans or resources on hand (PPE, reserve staff in case of burnout, reliable access to essential products), then disruptions may range from several months to over a year(s). Lack of preparation for a disease outbreak may result in an array of problems ranging from supply issues such as production bottlenecks or product shortages to complications in coordination between supply chain or private and public sector actors. These issues will likely coincide with others, such as surges in demand for medical products, and providers and pharmacies being overwhelmed by large numbers of patients.



However, the healthcare supply chain [has proven](#) it can withstand the strain caused by disease outbreaks with proper plans. The COVID-19 pandemic showcased the necessity of maintaining both pandemic preparedness and [response strategies and close coordination](#) at every level. This includes the public sector maintaining coordination with private-sector entities, which allows both sectors to leverage their expertise and vast networks to address the threat(s) at hand. The pandemic also highlighted the pivotal roles that providers, distributors and suppliers play in combating disease outbreaks — by continuously procuring, producing and distributing medical products where they were most needed. Furthermore, the pandemic highlighted the impact of extended disruptions on everyday operations while also demonstrating the role PPPs can play to bolster the public sector's immediate and long-term disaster preparedness capabilities.

During the COVID-19 pandemic, PPPs focused on disaster mitigation and response, such as [Operation Warp Speed](#), [Project Airbridge](#) and [The Public Health Emergency Medical Countermeasures Enterprise](#), were activated to great effect. Operation Warp Speed, for example, was essential to supporting and expediting the development of multiple COVID-19 vaccine candidates. In addition to their original operation, PPPs can bolster disaster preparedness and resilience by continuously enhancing public sector capabilities, forging partnerships and networks and consulting or redeploying their blueprints in future crises.

Continuously updating and maintaining disaster preparedness strategies is a crucial aspect for anticipating, preventing and resolving supply chain challenges. However, there were fears that relatively fresh lessons from the COVID-19 pandemic would not be applied in time (if at all). In 2022, the U.S. faced an intensifying Mpox outbreak while also preparing for potential flu-season, RSV and COVID-19 surges. Despite the Biden administration's [efforts to combat and control the Mpox outbreak](#), public health officials and infectious disease experts criticized [the lack of urgency from U.S. health agencies to combat virus spread](#). The Mpox emergency [has since subsided](#), dropping from [500 to 5](#) new U.S. cases per day. This drop was due to a combination of factors, most prominently [the efforts](#) of public health officials to tackle the virus, and members of the LGBTQ+ community who increased their efforts to curtail virus spread.

Operational Resilience and Geopolitical Events

Geopolitical crises include the outbreak of war, a cyber or terrorist attack or a large-scale accident; all of which can disrupt the healthcare supply chain in numerous ways. In wartime, an industrial pivot toward wartime priorities or economic sanctions can cause disruptions to supply chains. The outbreak of a war may strain resources due to increased demand, see a country's workforce flee or become displaced or restrict access to key raw materials. Alternatively, a cyber or terrorist attack can undermine essential infrastructure and disrupt key air or road delivery routes.

Like wildfires or floods, geopolitical events may have lasting effects on critical infrastructure or force supply chain workers to evacuate for their own safety. While evacuations from a terrorist attack will likely be shorter than those from a wildfire or hurricane, the outbreak of a war may catalyze worker migration, which can last just as long or longer. Finally, accidents such as vehicle crashes, power outages or important [major shipping route blockages](#) can slow down both the production and delivery of goods, resulting in delayed delivery of critical raw materials or medical products.



Innovation Among Healthcare Distributors

Healthcare distributors are at the forefront of operational resilience in the healthcare sector. Distributors have pioneered enhancements in operational resilience amid the sector's ever-changing landscape by adopting innovative technologies as they become available and exemplifying nimbleness. For example, [Cardinal Health has partnered with the drone operator Zipline International](#) to launch a potentially groundbreaking pilot program to deliver medical products to local pharmacies by drones. In the future, this model can be used to support providers with emergency inventory during or in the aftermath of a crisis event or in cases where normal deliveries may be delayed.

The healthcare sector's focus on operational resilience has resulted in ample financial opportunities for supply chain organizations. Some distributors, such as [Aerospace Global](#), addressed the nation's pressing need for more reliable, sustainable innovations in the biopharmaceutical industry by providing cold-chain technology, thereby growing its business and increasing its bottom line. Another example is the partnership between [Cardinal Health and Ember Technologies](#) to develop unique cold-chain technology. Additionally, [Cardinal Health is working with the software startup FourKites](#) to develop a cognitive supply chain network to better help distributors predict demand and manage and protect products in transit. In addition to technological innovations, distributors have increased their investments in all facets of operation to bolster operational resilience. Some distributors, such as McKesson, strengthened organizational resilience by [supporting their workers](#). Others [opted to support local](#) communities through improving communal access to information, providing grants and financial relief and donating medical products.

Distributors are attempting to continuously improve operational resilience in a rapidly evolving environment. Future changes to the healthcare landscape can dramatically impact distributors and how they conduct operations. To best adapt to future circumstances, distributors aim to primarily leverage their expertise in [four areas](#): logistical expertise; their networks and overall role in the healthcare sector; technological advancements they have funded; and growing data pools, which will enhance healthcare sector efficiency. Distributors also aim to work with partners on all levels to continue innovation and bolster sector-wide preparedness for future crises.

Despite the challenges they face, distributors continue to look ahead and are continuously equipping their organizations to build on their strengths and transform their essential role going forward. They do so by supporting the healthcare sector and supply chain by leveraging their expertise; along with aiding other supply chain organizations in composing or adopting climate adaptation and disaster preparedness strategies to enhance operational resilience. Additionally, distributors hope to inform the public sector by offering key insights for future resilience building and other relevant policies.

Recommendations for Advancing Operational Resilience Across the Supply Chain

HDA has prepared multiple recommendations for the healthcare private and public sectors to continue advancing their disaster preparedness strategies and capabilities.



Providers, Pharmacists, Manufacturers and Other Supply Chain Organizations

- Outline and commit appropriate resources to organizational operational resilience planning.
- Diversify the geographic location of manufacturing plants from which medical products are produced or procured as resources, workforce and capacities allow.
- Bolster the infrastructure and overall resilience of manufacturing plants in vulnerable areas against extreme weather:
 - This includes using backup generators, reinforcing walls, roads and other physical infrastructure; establishing flood guards and draining systems; and maintaining other contingencies to minimize disruption;
 - Manufacturers, distributors and providers also may wish to investigate potential vulnerabilities in areas projected to experience increased extreme weather events.
- Participate in data visibility initiatives and PPPs (e.g., [Supply Chain Control Tower](#)) in public health emergencies as a tool to amalgamate and send data concerning potential drug shortages without compromising competitiveness.

- Maintain a protected and robust workforce to reduce potential staffing shortages during times of crisis:
 - This can include ensuring workers needed for manufacturing have homes or residences that can withstand extreme weather events, as well as having safety practices and equipment essential for frontline workers during the pandemic.
- Prepare emergency evacuation routes for patients during extreme weather events that may compromise the location's ability to provide treatment.



Public Sector and Policymakers

- Review previously implemented PPPs to prepare them for renewal or model new partnerships on their blueprints when necessary.
- Prepare contingencies for importing necessities that are at higher risk for supply chain disruption such as raw materials or medical products.
- Work with private sector entities and climatologists to create working groups to better inform extreme weather contingency planning decision-making.
- Review previous disaster coordination efforts to inform future responses.
- Sponsor additional PPPs focused on both the research and development and equitable distribution of new medical countermeasures similar to the National Institute of Health's partnerships with the private sector that catalyzed the development of COVID-19 vaccines and treatments.
- Increase the number of community-level PPPs and grants to bolster communal trust, knowledge and preparedness for disasters.
- Use private sector and community-level tools and knowledge, such as [Healthcare Ready's Community Disaster Resilience Tool](#) or community health workers and organizations, to identify local vulnerabilities.
 - The disaster resilience tool can also be used to help anticipate a community's vulnerability to extreme weather or natural disasters.



Public Sector and Public-Private Partnerships

- Strengthen and expand the capacities of the Strategic National Stockpile (SNS) to provide reinforcements during emergencies:
 - An enhanced SNS can give distributors and frontline providers time to adjust to disaster conditions and alleviate supply chain pressures during demand surges.
- Incorporate an expanded vendor-managed inventory model:
 - Distributors [already have](#) both the capacity and expertise to support stockpile expansions.
 - Shifting to an expanded vendor managed inventory model will allow distributors to employ their full capacity and expertise to better support other actors in the supply chain.
- Implement initiatives that continuously bolster the resilience of the healthcare supply chain workforce:
 - Support the capacity and safety of personnel during and after emergencies is critical for maintaining operational resilience.
 - Build a stronger upwards mobility pipeline for the workforce.

- Targeted efforts to improve worker safety are essential precautions that can help to mitigate worker shortages and disruptions.
- Consult — and possibly reactivate — successful PPPs during crises:
 - Doing so will enable both private sector health infrastructure and networks to be utilized to their fullest extent to support of crisis response efforts;
 - Additionally, HDA encourages the expansion of PPPs and private-sector partnerships on the local level to improve the operational resilience of communities and the most vulnerable.
- The healthcare sector further explores and develops emergency plans in traditionally low-risk areas that are at increased risk of climate disasters in coming years.
- The public sector [empowers distributors to prepare for future disruptions](#) to global supply chains by incentivizing manufacturers and distributors that carry extra capacity or that increase onshore production.

References

Administration for Strategic Preparedness and Response. “Public Health Emergency Medical Countermeasures Enterprise Strategy for Chemical, Biological, Radiological and Nuclear Threats.” U.S. Department of Health and Human Services. Accessed December 15, 2022. <https://www.federalregister.gov/documents/2007/03/20/E7-50666/office-of-the-assistant-secretary-for-preparedness-and-response-hhs-public-health-emergency-medical>.

Aton, Adam. “Hurricane Maria Takes a Toll on Global Medical Supplies.” *Scientific American, E&E News*. October 25, 2017. <https://www.scientificamerican.com/article/hurricane-maria-takes-a-toll-on-global-medical-supplies/>.

BBC. “Egypt’s Suez Canal blocked by huge container ship.” March 24, 2021. <https://www.bbc.com/news/world-middle-east-56505413>.

Centers for Medicare and Medicaid Services. “Emergency Preparedness Rule.” Accessed December 15, 2022. <https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/SurveyCertEmergPrep/Emergency-Prep-Rule>.

Cyberark. “What’s Missing in Healthcare Ransomware and Supply Chain Defense.” June 22, 2022. <https://www.cyberark.com/resources/blog/what-s-missing-in-healthcare-ransomware-and-supply-chain-defense>.

Center for Climate and Energy Solutions. “Extreme Weather and Climate Change.” Accessed December 15, 2022. <https://www.c2es.org/content/extreme-weather-and-climate-change/>.

Davis, Jessica. “Hackers Targeting COVID-19 Vaccine Supply Chain Via Phishing Campaigns.” *Health IT Security*. December 3, 2020. <https://healthitsecurity.com/news/spear-phishing-campaign-targets-covid-19-vaccine-supply-chain>.

Dexheimer, Eric & Osborne, James. “Texas grid fails to weatherize, repeats mistake feds cited 10 years ago.” Accessed December 15, 2022 from <https://www.houstonchronicle.com/business/energy/article/Texas-grid-again-faces-scrutiny-over-cold-15955392.php>.

Federal Emergency Management Agency. “FEMA COVID-19 Supply Chain Task Force: Supply Chain Stabilization.” Accessed December 15, 2022. <https://www.fema.gov/news-release/20200725/nhom-cong-tac-chuoi-cung-ung-trong-dai-dich-covid-19-cua-fema-dinh-chuoi-cung>.

Frieden, Joyce. "How Can the U.S. Preserve Its Medical Supply Chain?" *MedPage Today*. March 4, 2022. <https://www.medpagetoday.com/publichealthpolicy/healthpolicy/97524>.

Garver, Rob. "US Monkeypox Response Draws Criticism". *Voanews*. Accessed December 15, 2022. <https://www.voanews.com/a/us-monkeypox-response-draws-criticism-/6682866.html>.

Government Accountability Office. *Operation Warpspeed: "Accelerated COVID-19 Vaccine Development Status and Efforts to Address Manufacturing Challenges."* Accessed December 15, 2022. <https://www.gao.gov/products/gao-21-319>.

Harvard University School of Public Health. "Coronavirus, Climate Change, and the Environment. A Conversation on COVID-19 with Dr. Aaron Bernstein, Director of Harvard Chan C-CHANGE." Accessed December 15, 2022. <https://www.hsph.harvard.edu/c-change/subtopics/coronavirus-and-climate-change/>.

Healthcare Distribution Alliance. "AmerisourceBergen and the Role of Local Philanthropy During COVID-19." Accessed December 15, 2022. <https://hda.org/perspectives/2020/amerisourcebergen-and-the-role-of-local-philanthropy-during-covid-19/>.

Healthcare Distribution Alliance. "Distribution Industry Remained Efficient and Resilient During First Year of COVID-19." Accessed December 15, 2022. <https://www.hda.org/newsroom/2022-c1ed2f77e1ef9d6e492904d8ed6535db/distribution-industry-remained-efficient-and-resilient-during-first-year-of-covid-19/>.

Healthcare Distribution Alliance. "Drug and Medical Product Availability: Distributors Promote a Resilient Supply Chain." Accessed December 15, 2022. <https://healthdelivered.org/getmedia/45f48c39-69e6-4ff8-8919-af1c4cfb7432/Drug-and-Medical-Supply-Shortages.pdf>.

Healthcare Distribution Alliance. "About HDA." Accessed December 15, 2022. <https://www.hda.org/about/>.

Healthcare Distribution Alliance. "For McKesson, COVID-19 Response Begins with Supporting Employees." June 17, 2020. <https://hda.org/perspectives/2020/for-mckesson,-covid-19-response-begins-with-supporting-employees/>.

Healthcare Distribution Alliance. "How Cardinal Health Is Transforming the Pharmaceutical Supply Chain." March 1, 2022. <https://hda.org/perspectives/2022/how-cardinal-health-is-transforming-the-pharmaceutical-supply-chain/>.

Healthcare Distribution Alliance. "Member Spotlight: The Future of Cold Chain Solutions." September 12, 2022. <https://hda.org/perspectives/2022/member-spotlight-the-future-of-cold-chain-solutions/>.

Healthcare Distribution Alliance. "Specialty Distributors Navigated Pandemic's First Year to Reliably Deliver Lifesaving Medications." Accessed December 15, 2022. <https://www.hda.org/newsroom/2022-c1ed2f77e1ef9d6e492904d8ed6535db/specialty-distributors-navigated-pandemic%E2%80%99s-first-year-to-reliably-deliver-lifesaving-medications/>.

Healthcare Distribution Alliance Research Foundation. "How the US biopharmaceutical and medical product supply chain adapted to disruptions – and plans to build strategies for the future." 2022. <https://www.hda.org/publications/covid-19-after-action-report/>.

Healthcare Distribution Alliance and Deloitte LLP. *The Role of Distributors in the US Health Care Industry*. 2019. <https://www.hda.org/getmedia/88288d13-f0b2-430d-9771-b71db1497f35/HDA-Role-of-Distributors-in-the-US-Health-Care-Industry.pdf>.

Healthcare Distribution Alliance Research Foundation and Deloitte LLP. *The First 90 Days: US Biopharmaceutical Finished Goods. Supply Chain Response to COVID-19*. October 2020. <https://www.hda.org/getmedia/82b4e693-bedd-4d69-94b1-9592342a3197/US-Biopharma-Finished-Goods-Supply-Chain-Response-to-COVID-19.pdf>.

Stobbe, Mike. "Mpox has faded in the US. Who deserves the credit?" AP News. January 10, 2023. <https://apnews.com/article/monkeypox-health-medication-public-313a2781a28f6b17230843432a609118>.

U.S. Climate Resilience Toolkit. "Building Health Care Sector Resilience." U.S. Climate Resilience Toolkit. Last modified: August 6, 2021. <https://toolkit.climate.gov/topics/human-health/building-climate-resilience-health-sector>.

U.S. Department for Health and Human Services. "HHS Awards \$20 Million Contract to AmerisourceBergen to Expand, Quicken Distribution of Vaccines and Treatments for Monkeypox." September 6, 2022. <https://www.hhs.gov/about/news/2022/09/06/hhs-awards-20-million-contract-amerisourcebergen-expand-quicken-distribution-vaccines-treatments-for-monkeypox.html>.

U.S. House of Representatives Ways and Means Committee Majority Staff Report. "Healthcare and the Climate Crisis: Preparing America's Health Care Infrastructure." Accessed December 15, 2022. <https://web.archive.org/web/20220922063646/https://waysandmeans.house.gov/sites/democrats.waysandmeans.house.gov/files/documents/RFI2.pdf>.

About the Healthcare Distribution Alliance

The Healthcare Distribution Alliance (HDA) represents primary pharmaceutical distributors — the vital link between the nation's pharmaceutical manufacturers and pharmacies, hospitals, long-term care facilities, clinics, and others nationwide. Since 1876, HDA has helped members navigate regulations and innovations to get the right medicines to the right patients at the right time, safely and efficiently. The HDA Research Foundation, HDA's nonprofit charitable foundation, serves the healthcare industry by providing research and education focused on priority healthcare supply chain issues.