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Envisioning the Future of the Pharmaceutical Supply Chain to Advance Public Health in the United States

Sarah Wells Kocsis, Christina Dialynas, and Rachel Perkins

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The Center for Public Health aims to improve health outcomes through research, programs, and policy initiatives with health equity as a central tenet. Following a public health approach, we engage with partners across sectors to raise awareness, propel action, and envision and pursue practical solutions toward measurable progress for complex health issues.

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INTRODUCTION: SETTING THE STAGE

The US pharmaceutical supply chain (PSC) is an intricate and interconnected public health system that plays a vital role in ensuring that individuals and communities have access to the medications they need to protect their health, prevent disease, manage treatments, and improve health outcomes. (Communities, as defined by the Centers for Disease Control and Prevention [CDC], are where people live, learn, work, and play as individuals and in groups.) The PSC encompasses and serves end-to-end stakeholders. Traditionally, stakeholders include the sources and suppliers of active pharmaceutical ingredients (APIs), pharmaceutical manufacturers, health-care distributors, pharmacies, and health-care delivery providers. However, recent public health emergencies have highlighted the importance of including communities and patients as key stakeholders in the PSC (see Figure 1).



Ideally, a PSC should deliver medicines of the highest quality, in the right quantity, to the right customer at the right place and time. For the past few years, the PSC has confronted significant disruptions due to globalization, geopolitical issues, and the COVID-19 pandemic, among other emergent issues affecting public health. Although the PSC met challenges at the start of the pandemic because of reported drug shortages, it rapidly adjusted to disruptions and delivered medications across the country.¹ Similarly, rapid innovation and the PSC response were demonstrated through Operation Warp Speed, a partnership linking the US Department of Health and Human Services, the US Department of Defense, and the private sector to accelerate the development, manufacture, and distribution of COVID-19 vaccines. This effort resulted in 68 percent of the US population being fully vaccinated by the first quarter of 2022.²

Although COVID-19 demonstrated the fundamental resilience of the PSC, it laid bare widespread fragilities and inequities in *all* the systems impacting US health. (“Systems” encompasses health-care delivery systems along with their ancillary systems, which the PSC touches daily.) The PSC proved unbroken, but it is prudent to envision how the chain can best function in a globalized, interconnected, fast-paced world where future pandemics are likely, if we are to ensure the timely and equitable end-to-end delivery of medications. Examining lessons learned through the broader lens of public health is important to identify actionable opportunities where the PSC can not only strengthen and sustain its operational resilience but also accelerate progress in advancing US public health goals.

The Milken Institute Center for Public Health (CPH) leveraged its expertise through research and by convening esteemed experts, innovators, and influencers from various backgrounds and sectors to gain a better understanding of how the PSC in the US supports the public health ecosystem under both crisis conditions, such as the pandemic, and the steady state. (Steady state in this context is considered to be a nonemergency period, whereas crisis conditions describe a period of public health emergency.) The experts who agreed to participate represented the many sectors and industries making up a socioecological model of the supply chain (see Figure 2).

FIGURE 2: A SOCIOECOLOGICAL MODEL OF THE PHARMACEUTICAL SUPPLY CHAIN



Note: For Figure 2, the Milken Institute used an adaptation of the social ecological model of health to build and engage a group of diverse thought leaders across the public health and health-care delivery ecosystems, emphasizing the individual, community, physical, social, and political environments that shape individual and population health.

Source: Milken Institute (2023) adapted from CDC (2017)

From analysis of insights and lessons learned, this report provides key takeaways and actionable opportunities for future focus to strengthen the PSC and better support public health, centering on three areas featured in real-world case studies: health equity, trust and communication, and public-private partnerships (PPPs).

OVERVIEW OF KEY ISSUES

During the research process, the Institute interviewed 35 subject experts, hosted two in-person roundtable discussions, surveyed roundtable participants, and conducted secondary research. Initial assessment of the PSC landscape centered around four overarching themes: equity, resiliency, security, and sustainability. In gathering diverse input, perspectives, and learnings from thought leaders, the team narrowed in on three recurrent subthemes to prioritize and further explore—health equity, trust and communication, and public-private partnerships—which are outlined below.

Health Equity: An equitable PSC is fair, just, and includes all involved end-to-end stakeholders and communities. At each touchpoint within the chain, numerous decision makers and decisions reverberate up- and downstream. COVID-19 and other recent public health responses highlighted the need for decision-makers to engage diverse stakeholders and communities in ensuring all voices are appropriately represented, especially those that are under-resourced or historically marginalized.

People must have access to the pharmaceutical products they need *when* they need them. This means going beyond the conventional last-mile delivery aspect of the PSC to think about accessibility through the more comprehensive “last-inch delivery” approach. From a public health perspective, last-inch delivery includes the needs of communities and individuals for access to health-care products and services and emphasizes the vital role that pharmacies, Federally Qualified Health Centers (FQHCs), and clinics play within communities to provide fair opportunity for access to health-care products and services. Last-inch delivery touches *every* community, each unique and facing its own needs and challenges, further underscoring how critical it is to ensure diversity, inclusion, and equity at every link of the PSC.

Trust and Communication: The PSC cannot operate efficiently or equitably without established trust and clear communication. It has two important paths of communication and trust: across the supply chain itself and the communities the PSC serves. Across the *PSC*, stakeholders must instill consistent and accurate information that flows end-to-end, with a clear chain of command to navigate regulatory authority. Across *communities*, there must be trusted messengers who understand each community’s unique conditions and support the community accordingly.

By encouraging the use of agreed-upon, plain language across supply-chain stakeholders, trusted community partners are better equipped to engage those they serve. Regardless of an emergency or steady-state condition, individuals rely on their local communities to serve them well, but if they receive inaccurate or outdated information, the trust they have built with local agencies may wane. Without trusted community partners, individuals cannot make informed decisions, which may adversely impact their health and well-being.

Public-Private Partnerships: Public health responses to the COVID-19 crisis demonstrated the strength of public-private partnerships in enabling resilience across the PSC up to last-inch delivery. PPPs made it clear that *all* sectors (broader health and non-health sectors) can act as agents of public health to promote policies, systems, and environments that protect and advance the health of people in *all* communities. PPPs coordinate the production, distribution, and delivery of critical medicines and supplies. By sharing expertise, resources, and capabilities, they also respond to supply chain disruptions and shortages more efficiently and effectively than individual entities could.

Importantly, PPPs demonstrate a commitment to the common goal of protecting public health, which builds trust and confidence across the traditional PSC, enabling partnerships that extend to informal networks in the community.

This report’s discussion of PPPs stems from, and builds on, the Milken Institute CPH report, [Learning from COVID-19: Reimagining Public-Private Partnerships in Public Health](#), which calls for an evolved model of partnerships that emphasizes a shared responsibility of all sectors, industries, and communities as agents of public health and accountability for the public good.

FIGURE 3: THE 10 ESSENTIAL PUBLIC HEALTH SERVICES



Note: Figure 3 represents a widely recognized equity-centered framework for carrying out the mission of public health that naturally extends to the PSC and is used as a guiding framework for this paper and its recommendations.

Source: Adapted from The Public Health National Center for Innovations, 2020

HEALTH EQUITY: ISSUES AND RECOMMENDATIONS

An equitable PSC is fair and just, and includes all the involved end-to-end stakeholders and communities. “Equality” means access to, and distribution of, specified resources evenly across individuals, whereas a PSC focused on “equity” enables access to, and distribution of, resources according to need.³ In practice, this translates to all stakeholders having equitable access to resources and opportunities, as well as the absence of discrimination based on factors including—but not limited to—gender, race and ethnicity, geography, and socioeconomic status. Further, communities that are under-resourced, due to any combination of the factors previously mentioned, should not run the risk of being left behind in accessing the health care and medications they require, and the PSC has a role to play in achieving that end.

“In communities with little investment, the only business may be a pharmacy—retail or independent. When pharmacies go offline in these communities, there are significant public health impacts. It is essential to keep pharmacies operational and stocked with the items that individuals need.”

—Local public health thought leader

Ideally, with an equitable PSC, all parties are represented, ensuring that all needs and concerns are considered. When all communities receive the resources and care they need, the health disparity gap narrows, increasing the potential for health outcomes to improve. As discussed in *Advancing Health Equity: Guide to Language, Narrative, and Concepts*: “...achieving health equity is not a utopian dream. On the contrary, we have the technical capacity and material resources to make health equity a reality—to assure that all communities have the conditions, resources, opportunities and power to attain optimal health, and to know that health is a human right.”⁴

Issues

The COVID-19 pandemic shed light on areas of opportunity for the PSC not only to get products to pharmacies, hospitals, and other dispensing locations, but also to focus on reaching communities and going the “last inch” to reach patients. This is especially important for those who have been historically marginalized and under-resourced, such as communities of color. At the same time, the pandemic exposed the need for greater diversity and inclusion throughout the public health ecosystem. Ensuring everyone has equal access to information and resources is critical to establishing an equitable response to future public health emergencies—extending across federal, state, and local levels. This includes engaging with communities that have been historically marginalized and under-resourced, by identifying sustainable solutions to target structural barriers limiting access to health-care products and services that the supply chain touches daily.

Key Insights

1. Identifying the role and responsibility of each stakeholder to institute health equity at each touch point of the PSC ensures communities that have been historically marginalized receive the information and resources they need to improve health outcomes. Without a concerted effort to embed health equity into the decision-making process, the PSC will not reach all communities, thus exacerbating current disparities in health outcomes stemming from lack of access to, and availability of, good-quality health-care products and services.
2. There is a health *care* component that the PSC touches daily, and when the two converge and operate concurrently, there is an opportunity to advance public health broadly. For example, there is a clear distinction between delivering vaccines to states and administering shots into arms. It is thus important to identify *who* is responsible for allocating products—especially in times of crisis, when goods may be allocated outside the traditional PSC, and there may be less transparency. Equitable allocation—ultimately, delivery—may be strengthened by recognizing and including nontraditional partners embedded within communities that are systemically under-resourced. Diverse representation of these decision-makers—who adequately understand and can articulate the needs of the community—is critical to serve and benefit communities that are marginalized and under-resourced.
3. Many efforts to make the PSC more equitable tend to confuse “equality” with “equity.” Actions and recommendations to make the PSC more equitable must recognize that some communities may require more targeted efforts and coordination to ensure adequate access to products and services.

Opportunities and Recommendations for Future Focus

1. **Embed health equity as a foundational principle that guides and motivates how each stakeholder within the PSC can be accountable for advancing public health.** As illustrated by the 10 Essential Public Health Services hub-and-spoke framework (see Figure 3), health equity is a core tenet of public health and should underpin the decision-making processes of stakeholders upstream and downstream within the PSC. Therefore, making a conscious effort to listen to and incorporate the needs of those who live in communities that are historically marginalized and under-resourced can help meet the health-care needs of individuals where they are.
2. **Engage PSC stakeholders and decision makers to recognize informal distribution networks that include nontraditional partners and expand them in communities that are under-resourced. In doing so, it is important to include community-based organizations, which can advocate for the populations they serve.** Community-based organizations are generally trusted entities that understand the community and its needs. Ensuring local organizations have a voice could enhance economic opportunities that are intrinsically linked to improved health outcomes.
3. **Lean on pharmacies, Federally Qualified Health Centers, and clinics, which play an essential role in reaching individuals in their communities, as an effective way to account for equity in access to products and services.** Different types of health care access points support their communities in different ways. Regardless, they must be resourced appropriately to respond to shifting supply and demand for health care services and pharmaceutical products. Health-care access points, such as pharmacies, FQHCs, and clinics in communities that are under-resourced are stretched thin and may benefit from financial support to offset costs.

Case Study 1: Pharmacies as Health Access Points

Pharmacies faced immense burdens during the COVID-19 pandemic as they stepped in to administer tests and vaccines. The ability of pharmacies to adapt to the challenges of the public health emergency and meet unprecedented demand was due, in large part, to their ability to mobilize financial and human resources in innovative ways and leverage their position as trusted, decentralized health access points. During the pandemic, pharmacies were crucial providers of vaccines. Eighty percent of COVID-19 vaccines were administered in the pharmacy setting, reflecting an overwhelming preference for how individuals accessed COVID-19 vaccines.

Retail chain pharmacies, such as CVS Health and Walgreens, leveraged partnerships with state and local governments, nonprofit organizations, and the private sector to strengthen their COVID-19 vaccination efforts and reach communities. For example, approved vaccine sites were required to upgrade their freezers with digital data loggers to report temperatures directly to the CDC, a measure most easily accomplished by well-resourced retail pharmacies. However, some independent pharmacies faced roadblocks to participating in the initial COVID-19 vaccination rollout and had to rely on alternative facilities to withstand the pressing demand. Independent pharmacies—Hilltop Pharmacy in Pittsburgh, Pennsylvania, is one example—turned local church halls, fire stations, restaurants, and recreation centers into informal gathering places for administering COVID-19 vaccines. At times when they could not meet people where they were, pharmacies like Hilltop organized transportation and mobilized volunteers to get people to and from vaccine appointments.



“The benefit to independent pharmacies was not an increase in business. We did not necessarily gain new patients. It was more of doing the right thing because we could and had access to COVID-19 vaccines.”

—Independent pharmacy thought leader

In recognizing the burdens that the pandemic placed on independent pharmacies—and the broader implications for health equity—the federal government included four networks of independent pharmacies as part of its Federal Retail Pharmacy Program. Launched in February 2021, this nationwide vaccine distribution program partnered the CDC with 21 pharmacy chains—representing more than 40,000 pharmacy locations nationwide. Independent pharmacies could participate from the outset of the program through distributors’ pharmacy programs, such as AmerisourceBergen’s Good Neighbor Pharmacy, McKesson’s Health Mart, and Cardinal Health’s Medicine Shoppe, among others.

Participating pharmacies (chain and independent) received COVID-19 vaccine supply directly from the federal government and provided vaccinations to the public at no cost. As of January 2023, the Federal Retail Pharmacy Program reported approximately 300 million COVID-19 vaccine doses administered by participating pharmacies. This is one example of how the federal government and pharmacies can partner to uphold equity in distribution, drawing on the strengths of both retail and independent pharmacies to reach communities in unprecedented ways and ensure access to life-saving vaccinations for all.

Pharmacies are viewed by many as a critical component of the health ecosystem, providing fair opportunities for individuals to access health products and services within their communities. From a health-equity perspective, pharmacies ensure that people who are underserved through limited access to the health sector are not left behind by a failure to coordinate or mobilize resources at the federal, state, and local levels. Taking lessons learned from the COVID-19 pandemic, pharmacies represent a crucial point of contact with the health sector for communities that are marginalized and under-resourced. Future public health responses may be able to mitigate disparate health outcomes by engaging retail and independent pharmacies to engage with and actively address the health needs of the communities they serve.

PHARMACIES AS HEALTH ACCESS POINTS: THE IMPORTANCE OF ADDRESSING DISPARITIES

A July 2022 analysis revealed that approximately 90 percent of the US population lives within five miles of a community pharmacy.⁵ However, “five miles” is not experienced equally across the country because of constraints of transportation, time, and available resources. Living within five miles of a community pharmacy, therefore, does not necessarily translate to equitable access to a pharmacy, especially for people living in communities that are rural and under-resourced, where the population faces additional geographical challenges that restrict access to pharmacy services. Between 2003 and 2018, before the COVID-19 emergency, approximately 1,200 independent pharmacies in primarily rural communities closed their doors, leaving 630 communities without access to a pharmacy for essential health products and services.⁶ Closures left the communities with little or no accessible health-care infrastructure and added to the burden of the remaining pharmacies, which made the response to COVID-19 all the more challenging.⁷

A 2021 report from the Rural Policy Research Institute found that 111 rural counties in the United States—mainly between the Mississippi River and the Rocky Mountains—lacked access within 20 miles to a pharmacy that could administer COVID-19 vaccines.⁸ This report supported a concurrent CDC study that found COVID-19 vaccine coverage to be lower in rural than in urban counties (38.9 percent versus 45.7 percent, respectively). Disparities in COVID-19 vaccine access hindered progress toward ending the pandemic and protecting individuals and communities at high risk due to severe health complications.

TRUST AND COMMUNICATION: ISSUES AND RECOMMENDATIONS

“A big lesson learned from the public health emergency is that communication and messaging are necessary for public health. It is important that pharmaceutical supply-chain stakeholders figure out how to communicate to earn [and maintain] the trust of the public.”

—Emergency response and preparedness thought leader

Our nation’s large-scale, multiyear response to the COVID-19 pandemic brought public health to the forefront of American consciousness. The public’s perception of public health is intrinsically linked with its trust in the system that is charged with promoting and protecting the health of Americans and the communities where they live, learn, work, and play. This concept naturally extends to the PSC, which has earned the country’s trust by delivering the right products to the right patients at the right times, thus ensuring patient safety.

The pandemic further magnified the role of supply chains and logistics. If medication delivery is to maintain this high standard, the PSC must continue evolving to remain secure, sophisticated, and efficient. End-to-end stakeholders must build even greater trust across all partners concerned with operating ethically, in compliance with regulations and in a timely manner. Moreover, the various stakeholders must be able to pivot simultaneously, allowing the supply chain to serve all communities during both times of crisis and the steady state. Thus, building and maintaining trust in the PSC is a responsibility shared among all parties.

One of the challenges of maintaining trust in the supply chain stems from the complexities of the chain itself. Medications pass through multiple stages and stakeholders before reaching patients. An upstream challenge spawning trust concerns is the manufacture of APIs.

Monitoring the API supply is crucial to identifying vulnerabilities, such as shortages and delays, in the PSC, as well as pinpointing potential priorities for domestic production.⁹ The US supply of generic drugs heavily depends on foreign suppliers of the global supply chain for sources of generic APIs for the US pharmaceutical market. In addition, continued improvements in robust communication systems are needed to keep stakeholders apprised of production and delivery status.

Regardless of an emergency or steady-state condition, communities rely on the PSC to efficiently deliver high-quality medications. It is key that end-to-end stakeholders communicate accurate, timely information so communities can prepare for disruptions. Individuals rely on their local communities to serve them well, and if they receive inaccurate or outdated information, trust in local agencies may wane. Without trusted community partners, people cannot make informed decisions, which may impact their health and well-being.

Issues

The COVID-19 pandemic intensified the need for accurate, trusted, public information about science and health encompassing the PSC. Instead, the US observed how rapidly spreading dis- and misinformation fueled mistrust and, in some cases, endangered health and well-being. End-to-end stakeholders of the PSC need to work in unison—engaging trusted community partners—to communicate information supporting informed decision-making and enhancing the health and well-being of communities.

Key Insights

1. Supply-chain stakeholders may have concerns about sharing proprietary information because of security risks (e.g., cyber-security attacks), lack of bandwidth, and mistrust. This is especially true when it's unclear why information is being shared, with whom, through what mechanism, and for what purpose. Moreover, there is the potential for misuse of shared data, including misinterpretation or allocation of product in ways that inadvertently add strain for customers and patients. This skepticism limits the openness and transparency needed for a well-functioning supply chain.
2. During the COVID-19 pandemic, confusion arose concerning leadership and accountability roles across the public versus private sectors, given the interdisciplinary nature of the supply chain. Without cross-sector role alignment and clarity, end-to-end stakeholders of the PSC are unable to proactively ensure the availability and access to medicines.
3. The language used across the PSC often means different things at different stages. This can lead to confusion and may lead to incorrect interpretation. With agreed definitions of key terms, miscommunication across the various functions of the PSC would be limited.
4. The pandemic revealed the inherent pitfalls and lack of data visibility across manufacturing plants overseas, prompting a growing trend to increase US pharmaceutical manufacturing capabilities. This will spark opportunities for investment in pharmaceutical manufacturers to modernize existing facilities and adopt advanced automation technologies such as 3D printing, which enhances the speed and flexibility of the manufacturing process.¹⁰ Further, AI-powered algorithms can potentially reduce stockouts and supply-chain disruptions by predicting demand and identifying areas for cost savings.
5. With misinformation and disinformation fueling the social and news media, communities and organizations don't always know whom or what to trust, which can lead to chaos and misuse of resources. This, in turn, can trigger hoarding and retentive storage of essential goods and medicines, which increases pressure on the PSC and prevents it from serving the larger community. The public needs accurate, timely information about shortages, along with education on where to seek such information.

Opportunities and Recommendations for Future Focus

- 1. Continue conversations with end-to-end stakeholders on ways to make the PSC more transparent and secure.** Currently, no long-term, regulated way to enhance transparency across the PSC exists. Ideally, the supply chain would develop and incentivize a mechanism to provide greater transparency, including accurate and timely information about production time and pharmaceutical product supply and demand. This would require strengthening real-time surveillance and public health messaging to enhance community-informed responses. Government entities, manufacturers, and distributors must optimize procurement planning, require forecasting, and manage inventory.¹¹ Using a control-tower model reinforced for crises other than COVID-19 could foster future forecasting and allow for more coordinated and collaborative public health responses drawing on multiple data sources and inputs.
- 2. Clarify the roles of government agencies and private sector partners within the pharmaceutical supply chain during a public health response.** Once the roles and responsibilities are made clear, it is equally important to develop open communication and establish a chain of command across the entities. This requires organizations to build partnerships that enable them to respond efficiently and effectively to public health crises or threats.
- 3. Use plain, clear language when communicating about the PSC.** Presenting data in a digestible and usable way, rather than a highly technical one, helps stakeholders better understand the state of the supply chain.
- 4. Bring critical pharmaceutical manufacturing capabilities to US soil.** Increased domestic manufacturing capabilities would enhance security and trust across the pharmaceutical supply chain, mitigating product sourcing problems and other disruptions. Many complexities, such as cost and environmental factors, would need to be overcome to achieve this long-term goal driven by changes in government policies, including funding for research and development, and incentives to promote local manufacturing.
- 5. Address misinformation and disinformation at the community level.** Community-based organizations and pharmacies must advocate for the resources that will allow them to serve their communities best during both steady states and times of crisis. Ensuring intersectionality among trusted partners across the supply chain and the communities would enable people to receive needed medications. Further, sensationalized information can have a disproportionate, adverse impact on the public's perception and response during public health emergencies. Improving the health literacy of communities by communicating up-to-date information would limit the risk of chaos and panic buying. If people are unsure how to respond to public health emergencies, they should seek the guidance of a medical professional or a trusted community resource.

Case Study 2: Three-Part Epidemic Response

Beginning in the winter of 2022, the US faced a three-part epidemic: the concurrence of respiratory syncytial virus (RSV), flu, and COVID-19. As respiratory illnesses spread across the country, social media and news media fueled a frenzy around rising cases and deaths, leading many households to stockpile cold and flu medications.

On the heels of COVID-19, the spread of misinformation and disinformation was akin to what Americans had experienced merely two years before. The result was localized, “spot” shortages of Tamiflu®, the most widely used flu medication in the US, and albuterol, a generic asthma treatment that helps open the airways in the lungs. First-line antibiotics (e.g., amoxicillin and Augmentin®) often used to treat bacterial infections but ineffective against viral conditions, were also declared in shortage. Alongside households, hospitals began stockpiling these medications, which made it difficult for pharmacies to get what they needed to meet community demands. It’s commonly acknowledged that when respiratory viruses spread, antibiotics are often prescribed—inappropriately, because although highly effective against bacterial infections, antibiotics are not effective against viruses.

Manufacturers did not anticipate the increase in demand, which led to spot shortages.¹² The supply chain was prepared for the emergence of these illnesses, but consumers bought more medication than was needed, causing an artificial shortage.

“These ‘spot shortages’ became a self-fulfilling prophecy, where the less that was communicated about them, the more panic-buying there was.”

—Emergency response preparedness thought leader

Times of crisis tend to foster confusion, which makes it imperative to have trusted messengers across the supply chain and within communities. Greater transparency across the supply chain would allow distributors and manufacturers to understand and communicate true supply and demand holistically. This would better inform decisions to release public health stockpiles, help facilitate redistribution, or provide alternative guidance when the recommended medications were unavailable.¹³

At the same time, it is key that people identify trusted messengers within their communities. Health-care providers and pharmacists are among the most trusted messengers; they regularly top the list of Gallup’s Honesty and Ethics of Professions Rankings.¹⁴ However, during the three-part epidemic, the need to bring children to primary health-care centers was not emphasized; instead, many parents brought their children to hospitals. This was an inefficient, expensive way to get health care. Had the public health system encouraged patients to go to their primary care providers, they could have obtained clear, accurate information about appropriate levels of care and would have known how to prepare for and treat RSV, flu, or COVID-19 symptoms.

Trusted medical professionals must know how to talk to parents and children about their state of health and the risks of illnesses. Health literacy education could quell panic-buying, prevent artificial shortages, and incentivize people to follow best practices when sicknesses are spreading.



PUBLIC-PRIVATE PARTNERSHIPS: ISSUES AND RECOMMENDATIONS

As discussed in *Learning from COVID-19: Reimagining Public-Private Partnerships in Public Health*, the World Bank defines a public-private partnership as a “long term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance.”¹⁵

“During the pandemic, federal government observed a ‘trifecta effect’ among private-sector partners where when x company needed y thing, z supplier was willing to help, with government stepping in to deconflict any levers.”

—Federal government thought leader

Integral to the COVID-19 response, PPPs made it clear that *all* sectors can act as agents of public health to promote policies, systems, and environments that protect and promote the health of all people in *all* communities. During the height of the pandemic, we saw the emergence of many unique PPPs from which we can learn to bolster the resiliency of the PSC in support of public health nationally, regionally, and locally.

Across the private sector, the PSC stood up well, largely because it was interconnected with end-to-end stakeholders, and its design incorporated the capacity to anticipate stakeholders’ needs. Competitors across the supply chain communicated and coordinated to enable resiliency, with players standing up to fulfill their respective parts. Nontraditional private-sector partners put aside their regular business models to form unique partnerships supporting the production of needed supplies. Companies that manufactured food products, for example, used their equipment and expertise to produce test tubes and vials that were considered essential medical supplies for pharmaceutical product development and administration.

Issues

The pandemic proved the power of PPPs in enabling resilience across the PSC up to last-inch delivery. During the pandemic, PPPs coordinated the production and distribution of critical medicines and supplies; responded to supply chain disruptions and shortages more efficiently and effectively than individual entities could have done; and shared expertise, resources, and capabilities. Importantly, PPPs demonstrated a commitment to the common goal of protecting public health, which built trust and confidence across the traditional PSC, enabling partnerships that extended to informal networks in the community. Communities that were able to connect their governmental, nonprofit, and for-profit entities saw many barriers crumble. However, communities that couldn’t form such partnerships faced relentless challenges, and many of those communities continue to struggle with the lasting effects of the pandemic.

Key Insights

1. There are many outstanding opportunities for PPPs to form across the PSC to advance public health. Private companies bring significant resources, recognition, and bandwidth with dedicated business operations focused on the logistics to make the PSC more efficient and meet individuals where they are.
2. PPPs also offer untapped but promising solutions for strengthening the PSC long-term. For example, adopting advanced manufacturing technologies can flexibly increase efficiency and production capacity, enabling quicker production switches for needed medicines in times of shortage.
3. Partnership strains were observed among stakeholders who were less willing to come to the table, resulting in offered solutions that were aggressive, slower, and less likely to succeed.
4. Often, under-resourced communities are overlooked or de-emphasized in the formation of PPPs. This oversight can undermine the overall intent and specific goals of a PSC partnership and its ability ultimately to advance broad public health goals.

Opportunities and Recommendations for Future Focus

1. **Evolve a high-functioning operating structure that balances public-private interests with clear governance, coordination, and accountability to facilitate efficient and impactful implementation.** Specifically, the US government could create more opportunities and incentives to leverage private-sector distribution networks and infrastructure in times of crisis. PSC wholesalers and distributors bring inventory management and logistics expertise, which allows rapid distribution of products to areas of need. A prime example is the Strategic National Stockpile.
2. **Create a national program that incentivizes private-sector entities to leverage expertise and capacity to support domestic supply chain production.** For example, federal or state government entities could provide financial support to private-sector companies to implement advanced manufacturing methods. In return, these companies could contribute to a strategic stockpile or make production capacity available for essential medicines in a public health emergency.
3. **Develop shared metrics that reward partner quality, reliability, and sustained engagement.** These partnerships should be recorded in a comprehensive registry of private-sector supply chain health partners that profiles their expertise, capacity, geographic reach, and other core competencies.
4. **Make diversity, equity, and inclusion (DEI) a central tenet of pharmaceutical supply chain partnerships.** Implementing DEI frameworks and metrics will help shift mindsets, behaviors, and practices toward more equitable and inclusive leadership, partners, and processes across the pharmaceutical supply chain and in communities. All end-to-end stakeholders must have a seat at the table.

Case Study 3: Localized Distribution of Vaccines

When COVID-19 vaccines became available, the state of Louisiana sought to provide a solution that allowed for the greatest potential population impact. The vaccine was in short supply, and the storage requirements were unique; not all institutions could accommodate ultra-cold storage. Because of the stringent requirements, many states turned to health-care institutions such as hospital systems or public health infrastructure, typically in large metropolitan areas, to administer vaccines. Louisiana, however, allowed any provider who was willing to meet the requirements—local family doctors, retail pharmacies, hospitals, clinics, and ambulance services, among others—to order vaccines. This Louisiana public health strategy was termed “low and wide,” where a low, single-use quantity of vaccine is accessible to a wide network of providers, in this case, “any willing provider.”



“This approach differed from a traditional hub-and-spoke distribution model other states were using that limited the population impact to those individuals who were able to travel to designated delivery sites.”

—Distributor thought leader

Morris & Dickson, the nation’s largest, independently owned, full-line pharmaceutical distributor, based in Shreveport, Louisiana, was uniquely positioned to offer assistance thanks to a longstanding relationship with the state and a willingness to devise an outside-the-box solution. As a result of the company’s experience in responding to hurricanes, Morris & Dickson had an existing contract with the state, enabling the partnership to pivot swiftly to meet the COVID-19 public health need.

A key challenge that had to be overcome stemmed from data coordination. Many public health systems (e.g., state immunization systems, vaccine-ordering portals) were siloed, and a substantial amount of manual work was required to receive and process orders because commonality and interfaces were lacking. For example, at times, Morris & Dickson might have one name or address for a customer and the state another, with no common identifier to make direct matches for existing customers. Morris & Dickson ultimately had to create and maintain cross-reference tables with assistance from the immunization team at the state and the Louisiana National Guard.

Another hurdle was the process of breaking down the product safely to ensure that it was maintained in a cold chain throughout the process. Before the vaccine arrived, Morris & Dickson rehearsed the process of manipulating the vials in gloves and performed timed trials to ensure the product was not out of the freezer too long. The vials had custom packaging to prevent damage in transit. Once Morris & Dickson had the vaccine, they reduced waste by quickly completing orders. To sidestep providers’ having to place and manage large orders, Morris & Dickson maintained the vaccine frozen to maximize the expiration dates.

The low-and-wide solution worked, with Louisiana emerging as the top national performer in several categories as measured by the CDC *Morbidity and Mortality Weekly Report* (see Table 1), which contrasts with Louisiana’s historically low ranking in public health outcomes.

As of February 2023, more than 1.8 million doses of the vaccine had been successfully distributed to providers across Louisiana.

TABLE 1: COVID-19 VACCINE SECOND-DOSE COMPLETION AND INTERVAL BETWEEN FIRST AND SECOND DOSES AMONG VACCINATED PERSONS

	National Average	Louisiana Average	National State Ranking
Series Completed	88%	94.4%	3
Series Completed within Recommended Interval	95.6%	98.3%	1
Missed Second Dose	3.4%	0.9%	1

Source: CDC *Morbidity and Mortality Weekly Report* (December 14, 2020–February 14, 2021)

Case Study 4: Baltimore City's Public Health Response to COVID-19

The Baltimore City Health Department (BCHD) faced considerable challenges during the COVID-19 pandemic. Baltimore has a population of 593,490 people, and BCHD set a goal to vaccinate 80 percent of the eligible population by February 2022. This was accomplished through developing and implementing a multifaceted, population-based response that united local resources with those provided by federal and state counterparts. Underpinning the effort was the aim to vaccinate the highest number of residents by organizing partners citywide and optimally allocating resources. The health department supported the federal and state government with mass vaccination clinics, ensured that primary health-care providers had access to the vaccine, and led a local mobile response to special populations who either could not or would not be able to access mass vaccination sites.



“The pharmaceutical supply chain is starting to figure out how to sustain public-private partnerships—particularly from a lens of equity and access.”

—State and local government thought leader

Baltimore is a diverse city comprising 61.6 percent Black, 29.2 percent White, and 5.6 percent Hispanic residents.¹⁶ BCHD sought to build vaccine confidence and bolster COVID-19 vaccination uptake for all populations in the city. However, given the high prevalence of chronic conditions such as diabetes, obesity, and asthma¹⁷ in many city neighborhoods, along with the then-known disproportionate impact that COVID-19 had on communities of color, the BCHD emphasized meeting the needs of Black residents and subpopulations who were most vulnerable to COVID-19. To encourage these communities to get vaccinated, BCHD identified a goal to reduce vaccine hesitancy to less than 20 percent by providing accurate, clear information about the vaccine.

Informed by lessons from its 2020 flu vaccination campaign, BCHD divided its strategy into vaccine deployment (supply) and community engagement (demand). The department forged diverse partnerships with health systems, faith-based leaders, community-based organizations, schools, libraries, recreation and park sites, and local businesses. It used trusted messengers as educational agents and ambassadors. BCHD tailored vaccination approaches for the targeted communities.

While BCHD anticipated vaccinating 50 percent of the population through mass vaccination dispensing points, BCHD learned that residents were more inclined to receive the vaccine through existing health facilities and primary care offices or through BCHD's mobile response clinics and door-to-door services. BCHD contracted with more than 70 health and community partners during the pandemic to provide education and access to the vaccine.

The BCHD understood its diverse population and the inequities the community faced. It identified trusted messengers embedded in the community to accomplish last-mile delivery to communities with a higher risk of COVID transmission. By relying on the community partners and the visibility of federal pharmacy partners, Baltimore met its goal of vaccinating 80 percent of the eligible population by February 2022 and mitigated the impact of COVID-19 on its population.¹⁸

CONCLUSION

Though the patient is the ultimate stakeholder and the end of the PSC, we cannot ignore the important role of the community in this interconnected public health system. Understanding communities across the US will help make the PSC more equitable by incorporating diverse voices, more trustworthy by working with trusted community messengers, and more efficient by building partnerships among organizations. By further integrating health equity, trust, and PPPs across the PSC, we will see long-lasting resilience, even during times of crisis. As the PSC grows more resilient, it will also become more secure and sustainable in the longer term.

End-to-end PSC stakeholders must integrate and build on lessons learned from recent public health emergencies to tackle public health challenges with a sense of responsibility for the public good. This work must focus on root causes instead of reactions to a symptomatic crisis. Addressing health disparities and their drivers should be a central tenet of partnership formation, goal setting, and alignment.

Partners must work collaboratively to envision creative solutions and build road maps ready for crisis and steady-state conditions. All traditional and nontraditional supply-chain stakeholders must have foundational playbooks with aligned objectives that can be adapted to fit-for-purpose and tailored for under-resourced communities. Furthering this vision will require thoughtful policies and sufficient resources with funding mechanisms at the federal, state, and local levels.

In late December 2022, Congress passed an omnibus spending bill that included the PREVENT Pandemics Act, representing a significant milestone in providing a policy framework around a more coordinated national response to public health emergencies in the US. Importantly, the legislation bolsters the capabilities of the Strategic National Stockpile with additional flexibility to create a distributor-based readiness model, authorizing the secretary of the Department of Health and Human Services to partner with distributors and manufacturers in managing a surge capacity of pandemic supplies. The Pandemic and All Hazard Preparedness Act—a major piece of legislation up for reauthorization in 2023—presents another milestone opportunity to strengthen and sustain PPPs. Possible solutions codified through the reauthorization process might include creating a drug-shortage early-warning system in collaboration with supply-chain stakeholders.

COVID-19 taught us that the next pandemic could come from anywhere at any time. Even with our recent progress, the nation must be better prepared to advance policy solutions that will meaningfully impact the PSC and the broader public health. It is incumbent on stakeholders in the end-to-end PSC to maintain dialog with policymakers about the complexities and vulnerabilities of the nation's health-care supply chain and work collaboratively as agents of public health to advance solutions supporting health equity for all. History suggests there has never been a better time to implement such efforts. The Milken Institute's Center for Public Health is ready to advance this public health approach in ensuring a future in which the pharmaceutical supply chain is resilient, equitable, secure, and sustainable.

GLOSSARY

Active pharmaceutical ingredient (API): The component that causes the desired therapeutic effect of a medication; some medications may include several APIs with different effects in the body.¹⁹

Allocation: Determination of amount and location of pharmaceutical product to be distributed to areas of need.²⁰

Community: Where people live, learn, work, and play.²¹

Drug shortage: Drug demand exceeds supply.²²

Equality: Each individual or group enjoys the same resources and opportunities.²³

Health equity: Every citizen and resident can attain their full potential for health and well-being.²⁴

Independent pharmacy: Single store with a sole proprietor or several stores owned by an individual or small group; not a retail chain.²⁵

Last-inch delivery: Effort and coordination required for a pharmaceutical product to reach the target end-user—ultimately, the patient—and ensure the product’s appropriate administration and consumption.²⁶

Last-mile delivery: The last leg of the supply chain process that refers to the journey of the products from the warehouse to the health care access point.²⁷

Marginalized: Refers to persons who experience material and social deprivation because of the inability to participate economically or socially in society, including the labor market.²⁸

Public health: Health of people and their communities.²⁹

Public health emergency: A condition threatening adverse health consequences with the potential to overwhelm routine remedial capabilities of the community.³⁰

Public-private partnership: A long-term contract between a private party and a government entity to provide a public asset or service. The private party bears significant risk and management responsibility, and remuneration is linked to performance.³¹

Resiliency: Adaptive capability of a supply chain to prepare for, respond to, and recover from disruptive events by maintaining continuity of operations at the desired level of connectedness and control over structure.³²

Retail pharmacy: A third-party vendor engaged in a retail business that owns or operates approximately 50 retail outlets where consumers may have prescriptions filled.³³

Supply Chain Control Tower: Traditionally defined as a connected, personalized dashboard of data, key business metrics and events across the supply chain that enables organizations to more fully understand, prioritize, and resolve critical issues in real time.³⁴

Strategic National Stockpile: Reserve of essential medicines and medical supplies from which states and federal government can draw when supply shocks occur; the stockpile is intended to strengthen national security and protect US foreign policy during times of crisis.³⁵

Transparency: Visibility and information-sharing throughout the pharmaceutical supply chain, from sourcing raw materials to delivering final products to the end consumer.

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Jennifer Zilka, AmerisourceBergen (now known as Cencora)²

ABOUT THE AUTHORS

Sarah Wells Kocsis is a director at the Milken Institute Center for Public Health, where she leads a portfolio of work focused on prevention, chronic disease, infrastructure, and other timely issues that are critical to advancing the role of public health in supporting healthy and productive communities. For the past two decades, she has helped organizations at the nexus of science, innovation, business, and philanthropy drive public policy solutions to optimize patient access to care. Wells Kocsis has held senior-level positions at Boston Scientific, Amgen, Hologic, and the Society for Women's Health Research. She holds a master of business administration from the University of Virginia Darden Graduate School of Business and a bachelor of science degree in biology from Tulane University.

Christina Dialynas is an associate director at the Milken Institute Center for Public Health. Prior to joining the Center for Public Health, Dialynas worked on the Milken Institute's Business and Program Development team as its project manager. Ahead of joining the Milken Institute, Dialynas worked on the research team at Feeding America, the Assertive Community Treatment team at Trilogy Behavioral Healthcare, and as a special projects associate at College Advising Corps. Dialynas holds a bachelor's degree from Duke University and a master's degree from the University of Chicago. She also serves as the secretary of the Duke Southern California Alumni Board.

Rachel Perkins is an associate at FasterCures, a center of the Milken Institute, providing research support and content development for the nonprofit capacity-building and global health workstreams. Prior to joining the Institute, Perkins was a health-care policy fellow at DC-based Leavitt Partners, where she assisted with health-specific research to advance client- and alliance-focused work. Perkins also served as a graduate research assistant at the Georgetown Center for Global Health Science and Security, where she supported the development of the COVID Analysis and Mapping of Policy site as part of the Georgetown Infectious Disease Atlas. Perkins has a BS in health sciences from Furman University and is pursuing her MS in global health at Georgetown University with concentrations in global health governance and health financing.



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