INSCRIPT

Member Case Studies

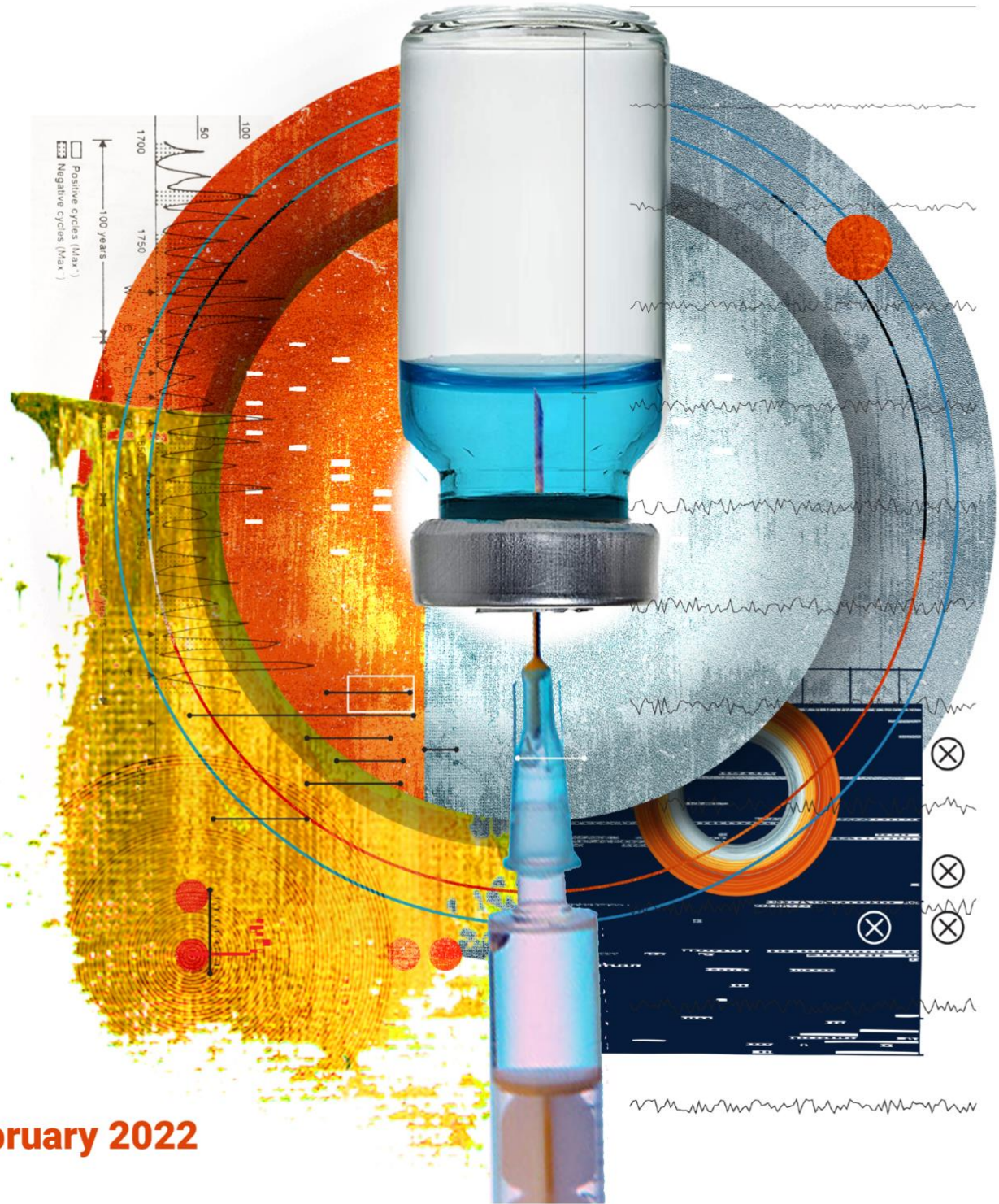
History of Drug Shortages

Data-Driven Approach to Drug Shortage Preparedness

Building Drug Supply Chain Resiliency

DRUG SHORTAGES

Pervasive Challenges, Proven Solutions



February 2022

PREMIER

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EXECUTIVE SUMMARY <<

Two decades and counting into the nation's drug shortage crisis, healthcare providers continue to navigate about 200 active drug shortages every quarter — shortages that contribute to additional costs and suboptimal patient outcomes nationwide. COVID-19 has, undoubtedly, exacerbated the problem.

A recent Premier survey of 150 health system pharmacy leaders and front-line staff revealed that **94 percent of respondents** have been impacted by interruptions in their pharmaceutical supply in the past 18 months. **More than two-thirds** feel only somewhat prepared to prevent the near-term impact of shortages in the coming year and beyond.

Severe production outages arising from natural disasters, manufacturing quality issues, raw materials sourcing and now, a global pandemic, have served as a clarion call to address pharmaceutical supply chain fragility and help ensure sustainable access to high-quality, critical, lifesaving medications to meet patient care needs.

A state of preparedness needs a backbone of data and transparency to inform action.

Extensive research exists to pinpoint the challenges and root causes that contribute to drug shortages. Despite heightened awareness, a fragmented supply chain and lack of visibility has largely left stakeholders in a reactionary mode. In shifting to a proactive approach grounded in innovations that may stave off the clinical impact of disruptions, providers are seeking expertise, insights and data signals to help mitigate the impact of essential medication shortages.

Demand predictability plays a significant role in maintaining a stable supply chain.

As providers react to challenges at the end-user level, suppliers face challenges of their own. Premier's survey of 56 generic drug manufacturers found that a majority face uncertainty in lead times to acquire active pharmaceutical ingredients (APIs) and/or component materials. Manufacturers are also constantly readjusting their forecasts to meet uncertain demand and unpredictable volume change. Most often, manufacturers have acted to mitigate these impacts by increasing communication with trading partners and providers, diversifying raw material sources, installing new production lines, and partnering with contracting organizations to prepare for shortages. From a manufacturer's perspective, redundancies and raw material safety stock are key, but equally important is a steady demand signal from the market.

The economics and behaviors of the generic pharmaceutical market juxtaposed against current regulatory proposals may pose a zero-sum game to manufacturers.

In March 2020, several provisions from the Mitigating Emergency Drug Shortages (MEDS) Act were passed as part of the Coronavirus Aid, Relief, and Economic Security (CARES) Act. These provisions elevate drug shortages as a national security risk and call for enhanced reporting and full disclosure of manufacturing problems, as well as redundancy measures. A U.S. Food & Drug Administration (FDA) report on drug shortages proposed a ranking system based on manufacturer investment in quality management systems. Recent supply chain resiliency proposals have an increased focus on domestic or nearshore manufacturing. Taken individually, each of these recommendations may seem a logical next step to solving the drug shortage problem.

But to make meaningful progress, a combination of diversification, commitment, predictive data, advocacy and market-based strategies are needed.

Drug shortages are a multi-faceted issue that requires a thoughtful, diversified strategy. As such, a key first step to an enduring solution is recognizing that this is a multi-stakeholder problem requiring action by all parties. What follows is a forward-looking thesis of recommended actions that U.S. regulators, manufacturers, distributors, purchasing groups and providers should consider to manage and mitigate future drug shortages.

Protecting patient care and the health of our communities is at the heart of our mission. Premier has been a leader in bringing innovative solutions to the marketplace with a keen intent to bolster drug supply resiliency. This includes our private label program PremierProRx®, our industry-leading drug shortage committed program ProvideGx®, investments in domestic pharmaceutical manufacturing, the PINC AI™ technology suite and unwavering advocacy efforts on behalf of our members, to name a few.

Through our programs and proven solutions, Premier members have supply safeguards and access to a broad range of shortage products. Although there is still much to do to fix global drug shortages, our commitment to protect providers and patients from drug supply disruption will never waiver.

Jessica Daley
RPh, BS, MA, PharmD
Chief Pharmacy Officer and Group Vice President of Supply Chain, Premier

PREMIER'S RECOMMENDATIONS FOR A STRONGER, HEALTHIER AND RESILIENT PHARMACEUTICAL SUPPLY CHAIN <<

Building greater transparency, expanding supply chain infrastructure and eliminating drug shortages for good cannot take place overnight. For decades, the pharmaceutical market has rewarded the lowest-priced products – discouraging competition, driving manufacturers overseas and creating an unhealthy, unsustainable "race-to-the-bottom" environment.

To truly tackle drug shortages once and for all, stakeholders must collaborate to influence behaviors that pivot towards quality and sustainability rather than price alone. Sustainable solutions must decrease barriers to entry, namely the time and cost to enter the marketplace, while maintaining product quality and safety.

The following are Premier's recommendations and some provocative ideas for stakeholders to consider in their strategies to combat the drug shortage crisis.

> *To truly tackle drug shortages once and for all,* **stakeholders must collaborate to influence behaviors** *that pivot towards quality and sustainability rather than price alone.*

FROM PRICE TO VALUE 1

Providers/Purchasers	Purchasing Groups	Suppliers	Distributors	Government
Hold **transparent discussions** with leaders and staff on the importance of quality in generic drugs. **Empower purchasers with information** shared through participation in the GPO contract vetting process. **Quantify risk and response** to recalls, dollars and hours spent in pursuing alternatives (non-ROI) for financial justification to budget. **Communicate the importance of supplier reliability** over lowest cost. Elevate buyers' charge from purchasing the lowest-cost generic to one that mirrors an overall, **enterprise-wide commitment to quality and resiliency**.	**Educate stakeholders** on the need to move beyond a price conversation to a combined cost, quality, and outcomes discussion. **Promote long-term contracting** with suppliers that demonstrate manufacturing resiliency and quality investments; drive negotiations that focus on quality and sustainability.	**Increase transparency on investments** in manufacturing, capacity and production schedules so partners can plan for committed volume availability. **Share with contracting partners and providers** to increase appreciation on quality as it relates to overall value. Consider **generic manufacturing investments** that reflect a good FDA track record, redundancy, and quality in raw material sourcing.	Consider **scenarios beyond cost minus** to drive value. Cost-minus model relies on manufacturer fees which contribute to higher manufacturing costs and **may lead to shortages** due to decreased supply or manufacturer discontinuation. **Permit flexibility** in wholesaler contracts to account for alternative sourcing. Engage in conversations on when to employ **first-in-first-out approach** based on clinical need versus allocation based on usage history.	Consider **incentives for manufacturers** to enter and sustain low-ROI product categories. **Waive or decrease GDUFA fees** for shortage or low-ROI drugs. Commit to **longer-term contracts for generics**. Current contracts are typically one year in length, and longer-term commitments would create more sustainability. As one example, Premier recommends three-year contracts for VA/DOD purchasing, which is approximately 8% of all U.S. drug purchasing. Continue to **foster competition** by approving generics for medications that have only a single-source manufacturer.

FROM REACTION TO PREPAREDNESS 2

Providers/Purchasers	Purchasing Groups	Suppliers	Distributors	Government
Incorporate drug supply outages into the health system's emergency preparedness and planning process. Through drug shortage task force discussions, **identify and elevate shortages** at high risk for significant impact on patient care to local/state preparedness agencies.	Serve as **early indicators of potential disruption** through info and data sharing with stakeholders; this can prompt solutions deployment, such as SNS requests. Promote **contracting with suppliers who provide transparency** and data on product and raw materials sourcing locations, safety stock, safety records and rapid replenishment capabilities. Drive greater transparency and risk mitigation through **supply chain mapping and supplier risk assessments** based on geographic diversity, recovery time, quality, Environmental, Social and Governance (ESG) and sustainability practices, and other key criteria. Increase preparedness through **investments in technology and manufacturing capacity/ redundancy**.	Increase preparedness through **investments in technology and manufacturing capacity/redundancy**.	Serve as **early indicators of potential disruption** through information sharing and data network collaboration with local, state and federal agencies. Consider **allocation based on clinical need** and backup safety stock in strategic regions across the country.	Actively **consult with providers, GPOs and supply chain stakeholders** on a thorough and complete essential drugs list for both the acute and non-acute spaces. Incorporate discussions on supply/drug shortages into **emergency preparedness protocols**. When a drug/supply shortage is flagged as highly impactful to healthcare delivery, **convene and facilitate guideline development** (e.g., conservation, use of alternatives, assign utilization criteria) in collaboration with health systems through an emergency preparedness framework. **Leverage local/regional supply chain data** for early identification and response to outages. Reduce strain on resources and inventory by **preventing duplication of effort** at facilities and facilitating conservation implementation efforts earlier in the response. Investigate potential for **standardizing procurement avenues** for critical supplies.

REMOVE REGULATORY HURDLES 3

Government/Regulatory Agencies

Remove procurement rules that act as barriers to accessing available inventory (e.g., private label drugs) for covered entities participating in the 340B program.

Enable outsourcing compounders to continue producing specific drugs not on the shortage list based on specific criteria, such as a short-term or regional shortages or demand surges for certain dosage strengths and/or packaging sizes. This proved particularly helpful during the pandemic, as it allowed 503B compounders to address capacity gaps and alleviate spot shortages before they became severe enough to spread nationwide.

Provide additional notice to manufacturers being forced to exit the marketplace secondary to the Unapproved Drug Initiative, and to providers — allowing them to prepare for and avoid disruption to patient care.

Use real-world data and evidence to **demonstrate the safety and efficacy for decades-old essential drugs as sustainable and attainable solutions** that impact sustainability and drug prices.

Carefully consider how a reduction in manufacturing quotas for certain opioids could exacerbate recent drug shortages for injectable opioids (many of which are used in the surgical context and are not at risk for abuse by individuals) and have a negative effect on preparedness and readiness. In addition, Premier urges **DEA to consider increased demand due to potential federal and state stockpiling requirements**.

IMPROVE DATA AND TRANSPARENCY ACROSS THE SUPPLY CHAIN 4

Providers/ Purchasers	Purchasing Groups	Suppliers	Distributors	Government
Consider **investment in technology and analytics** to help identify potential outages and enable implementation of mitigation plans. Increased **visibility to utilization data** by facility may also be needed for more predictable forecasting.	Educate participating members on **rationale behind supplier contract awards**, including API stability, history of reliable, sustainable production, and commitment to quality (in addition to price negotiations). As with Premier, move beyond a traditional GPO model to **develop technology and data investments and capabilities** for risk mitigation and preparedness. Drive **greater transparency and risk mitigation** through supply chain mapping and supplier risk assessments based on geographic diversity, recovery time, quality, Environmental, Social and Governance (ESG) and sustainability practices, and other key criteria.	**Share supply status/market discontinuation information** for raw material, contract manufacturing, and finished drug dosage forms with FDA and other stakeholders.	**Build on allocation strategies** based on clinical need and backup safety stock in strategic regions across the country. **Provide additional visibility on backorders** to allow providers to plan for contingency.	Actively **consult with providers, GPOs and other supply chain stakeholders** on a thorough and complete essential drugs list for both the acute and non-acute settings. Use authority granted in the CARES Act to **solicit deeper level of reporting on manufacture/quality sources and delays**. Use information to make decisions on approaching alternate suppliers, communicate with state and local healthcare agencies; consider requiring transparency of wholesaler fees charged to suppliers. Modernize the nation's supply chain data infrastructure by establishing a **real-time tracking and data collection of critical drugs** during a public health emergency.

ALL STAKEHOLDERS: Stand up a **public-private advisory council** along with an **integrated, antitrust-compliant data infrastructure** that utilizes clinical and supply predictive analytics to forecast geographical disease progression and surge demands.

CASE STUDY:
MOUNT SINAI HEALTH SYSTEM

THE IMPORTANCE OF DATA TRANSPARENCY

The Mount Sinai Health System is an integrated healthcare system inclusive of the Icahn School of Medicine at Mount Sinai, eight hospital campuses in the New York metropolitan area, as well as a large, regional ambulatory footprint across the city.

As the system weathered severe disruptions in generic medications supply during the COVID-19 pandemic, the pharmacy team emerged with lessons learned on the necessity to proactively manage contingency for critical generic medications. Broad visibility and oversight of inventory has been a paramount effort at the health system. Currently, the supply chain staff strives to keep at least one week's additional inventory on-hand and use their weekly supply availability report to assess potential impact. In addition, the pharmacy team's leadership is plugged into Premier's national and regional supply chain/buyers' touchpoints to mitigate near-term risk and take actions as necessary.

Looking ahead, Mt. Sinai has efforts underway to "improve our internal supply chain performance by developing/investing in a Pharmacy Supply Chain Dashboard that clearly and concisely measures performance with metrics around quality, reliability, cost and risk," says Pharmacy Supply Chain Director, Vikram Mulchandani. This investment would strengthen the system's analytical capability, offering their pharmacy leadership an effective means to identify, prioritize and implement actionable opportunities. "The ideal notification system is one that takes multiple data points such as supplier manufacturing status, drug recall information, global and domestic events that impact the supply chain, regulatory inspection insights along with local backorder reports and fill rate data to get to a reliable, predictive/mitigative model," says Mr. Mulchandani.

Through Premier's investment in predictive analytics, the CognitiveRx technology platform aims to do just that to enable preparedness and increase workflow efficiency within hospital pharmacy departments.

In addition to its efforts on supply contingency, Mt. Sinai, like many other health systems, is keenly focused on investments that manufacturers are making to improve the quality, safety, efficacy and reliability of generic medications. While healthcare continues to face intense pressure to reduce cost, supply vulnerabilities brought, in part, by low margins and labor shortages in the current supply chain landscape, the importance of sustainable quality in drug manufacturing cannot be understated. To that end, the system is working closely with Premier to devise a contracting strategy that places quality before cost and demonstrates clear evidence of this approach.

MOVE FROM QUALITY RATING TO QUALITY GOLD STANDARD 5

Providers/Purchasers	Purchasing Groups	Government
Demand transparency on supplier investments made in manufacturing quality and supply stability. Develop consensus with organizational leadership and team about **commitment to quality over price.**	**Incorporate inquiries into supplier quality investments** during contract negotiation process. **Increase transparency** to providers on contract awards for supplier resiliency.	Consider **redefining the gold standard for quality** in manufacturing, elevating the minimum required cGMP standards expected for all suppliers. **Elevation of standards could be complemented with incentives** such as zero-interest loans and sufficient duration to achieve without worsening current supply levels. Level the playing field with **financial backing in quality**, rather than pinning return on supplier investment to contract negotiations and purchaser behavior. Create **consistency in inspections for domestic vs foreign manufacturers** as well as finished dose forms (FDF) and API manufacturers. All should be held to the same standards.

STABILIZE DEMAND PREDICTABILITY 6

Providers/Purchasers	Purchasing Groups	Suppliers	Distributors	Government
Focus on, and commit to, planning. Consider **stability in ordering** as wide fluctuations lead to upstream inventory and manufacturing disparities. Incorporate **commitment programs as one part of an overall resiliency approach**; seek quality and sustainability information rather than purchasing solely on price points. **Eliminate just-in-time purchasing standards for critical products** at greater risk of disruption; consider routine, comfortable supply cushion (e.g., 1 month) to mitigate reflexive purchasing.	**Educate stakeholders** on the value of commitment and aggregate purchasing power to yield predictable demand forecast to manufacturers. Consider **novel approaches to minimize "winners and losers"** in the contracting process.	Consider **market endurance and sustainability** when making pricing decisions. Provide **advanced notification of expected shortages** to providers. Offer **transparency in cases of unexpected interruptions** to circumvent reflexive panic buying.	Support **contracts negotiated by purchasing groups** with consistent product inventory and demand generation. **Monitor and deter automatic contract loads** that are not governed under failure-to-supply clauses and specific price terms.	Regulatory agency: **Evaluate a "J-curve" approach to generic ANDA approvals** where more than a certain number of manufacturers for a particular drug may contribute to an unhealthy market by driving a race-to-the-bottom in pricing. When a particular generic medication has 10+ manufacturers, it creates a paradoxical situation for drug shortages as market share competition among many manufacturers may create price wars, drive unsustainable margins and ultimately force manufacturers to exit a given product category or even the entire market. Consider stipulations for market launch for generic products at the time of approval to **deter "ANDA-on-the-shelf" scenarios** (not marketed despite approval).

STRENGTHEN THE SNS 7

Providers/Purchasers	Purchasing Groups	Suppliers	Distributors	Government
Health systems could **serve as potential stockpile operators** working in concert with purchasing groups, managing regional stockpiles and helping assure accountability for stockpile rotation. Potentially **assist with creation of a customized stockpile for nursing homes** with appropriate supplies, drugs and other needs.	Partner with stakeholders to **accurately forecast demand**. As potential stockpile operators, regional purchasing groups could also **manage and assure stockpile accountability** for a given region.	Ensure that government contracts committing to manufacture for a federal stockpile **do not inadvertently reduce commercial supply levels**.	Partner with stakeholders to **accurately forecast demand**. Offer **access to soon-to-expire stock** out of the SNS and into health systems at a discounted rate.	Create a national standard that integrates stockpiling needs at the federal, state and health system levels and **implement a hub-and-spoke model that leverages the SNS.** Implement ongoing efforts to **improve drugs being added to the stockpile, mechanisms for providers to access the SNS and offer clarity to the public** on when the SNS is accessed. To circumvent drugs in the SNS reaching expiry in a preparedness model, consider a **public-private partnership** to ensure access, monitor inventory and rotate stock on-hand to maintain products.

ALL STAKEHOLDERS: Stand up a **public-private advisory council** along with an **integrated, antitrust compliant data infrastructure** that utilizes clinical and supply predictive analytics to forecast geographical disease progression and surge demands.

LEVERAGE AND INCENT DIVERSIFIED PRODUCTION 8

Providers/ Purchasers	Purchasing Groups/ Private Sector	Suppliers	Distributors	Government
Consider **pre-commitment to a certain volume of products** to create predictable demand and incent manufacturers. **Working with purchasing groups** can lead to less variability in supply and demand. Consider the **impact of generic market prices** as it relates to manufacturing; lowest price does not incent manufacturers to build capabilities.	Increase investments to **support greater diversity of drug manufacturing** and suppliers, including greater domestic production. Create **investment criteria and prioritization** for product categories that lack adequate competition, geographic diversity or stable sources of contingency supply. Prioritize investments that **leverage existing production capacity** to support a more sustainable approach to domestic production rather than building from the ground up.	Pursue strategies and investments with a **goal of increasing domestic and diverse manufacturing capacity**.	Work with purchasing groups to **jointly assist in forecasting demand** for suppliers.	Develop policies and regulations that **encourage investment in domestic and diverse manufacturing**. **Consider at least three global suppliers** of the finished dose forms, ancillary products and raw materials for critical medical supplies and drugs. To stimulate domestic manufacturing, consider a **two-part approach that leverages tax credits as a mechanism for achieving these goals**: **Part I: A 30% tax incentive** for domestic manufacturing investments of critical medical supplies and drugs, including their raw materials. Examples of how the tax incentive could be applied (not intended to be all inclusive) are provided. **Part II: A 10% tax credit** on income generated from the sale of domestically manufactured goods. This would also help lower the cost of domestically produced goods and make them price competitive with globally sourced products. **Couple incentives for onshoring manufacturing with committed purchasing volumes** so new market entrants have a guaranteed sales channel (e.g., government purchasers' requirements to contract for critical medical supplies and drugs from a mix of onshore, near-shore (such as Canada, Central and South American countries) and off-shore countries. Consider **incentives for providers to purchase domestically manufactured critical medical supplies and drugs** through programs such as tax incentives, CMS bonus payments, etc. to create committed purchasing volume for domestic suppliers and offset higher acquisition costs.

A PROBLEM DECADES IN THE MAKING <<

While the pandemic laid bare the dire consequences of a prolonged crisis in pharmaceutical sourcing, those consequences were the result of cracks in the supply chain makeup that originated long ago. Reviewing these problems in totality can offer insight into strategies for solutions to drug shortages.

"RACE TO THE BOTTOM" ECONOMICS

Generics are traditionally welcomed as low-cost, preferred therapies that help ease pressure on drug prices – which otherwise might eat up more than $756 per inpatient admission. The competitive dynamics manufacturers face leads to a race for market share, competing solely on price until it becomes unsustainable. Eventually, many manufacturers make the difficult decision of reducing production or exiting the market entirely – two actions that can, and have, triggered drug shortages.

For GPOs, **finding the lowest cost generic is not always the optimal option to protect the supply chain.** *Balancing critical product features like diversity in manufacturer and API sources, history of clean FDA inspections, supplier reliability, number of competitors in the market, and ability to meet market demand is critical for making decisions around GPO contracting that protects access to critical drugs.*

GENERICS AS ESSENTIAL DRUGS VS. COMMODITY

Generics have long been the deflationary force against soaring drug costs, which has taken the focus away from their vital role in therapeutics and relegated them to a commodity. Being viewed as a commodity comes at a price – for generics, it results in shortages. Premier analyzed all products on contract as of November 2021, yielding some illuminating statistics:

Of the more than 400 contracted drugs that cost $3 or less per vial, nearly **42 percent were in active shortage.**

In contrast, only 6 percent of drugs that cost more than $10 per vial were in shortage. With unabated shortages for so many years, the FDA finally created a list of essential drugs with a goal of protecting the public with sufficient domestic supplies. While intended as an important step in protecting product availability, a static list lacking other substantive measures to improve supply will struggle to meet the dynamic needs of patients and providers. Additionally, such a list necessitates public and provider feedback, and should account for special patient populations with varying acute needs such as pediatrics and others.

LACK OF A QUALITY REWARD

Hand in hand with the race to the bottom is the lack of any form of quality premium, including payment for reliably meeting buyers' supply requirements. Absent any reward for meeting supply and quality expectations, manufacturers compete solely on price. In some cases, this pressure creates a commoditization effect that lowers pricing to unsustainable levels. Because of the economic dynamics, about 40 percent of all generic drugs are supplied by a single manufacturer and the median number of manufacturers per generic drug is just two.

ADDRESSING CHALLENGES TO SUSTAINABLE QUALITY IN MANUFACTURING

In its paper on root causes of drug shortages, the FDA expounded on creating a rating system to incent manufacturer investment in quality management processes, stating that cGMP requirements are only a minimum threshold. Investment in manufacturing quality systems is a core goal for supply chain resiliency and sustainable production. However, rating systems may be inherently subject to bias and may generate downstream consequences such as the implications of scoring any rating other than the highest value.

VARIABLE VOLUMES

Generic drug manufacturers often report unpredictable product demand as preferences change and buyers shift purchasing, based on formulary or price-driven decisions. Inconsistent volumes mean that manufacturers have difficulty planning optimal production levels. Produce too little, and the manufacturer has disappointed customers and failed to capture much needed dollars. Produce too much, and they must absorb the carrying costs associated with excess or expiring inventory.

According to a November survey of manufacturers, Premier found that **unpredictable volumes was the number one challenge** *associated with supplying the market and could be a significant driver of supplier market exits and limited investments.*

MARKET CONSOLIDATION AND OFF-SHORE CONCENTRATION

A lack of competition and high level of generics market concentration creates overreliance on just a few manufacturers, which are operating at capacity and therefore can't accommodate demand surges or supply disruptions. In addition, historical industry consolidation and drug company mergers can often lead to product discontinuations, capacity reduction, shifts in

CASE STUDY: ATRIUM HEALTH

THREE TIERS TO MANAGE DRUG SHORTAGES

Based in Charlotte, North Carolina, Atrium Health is an integrated, nonprofit health system with 40 hospitals and more than 1,400 care locations across the Southeast. Managing supply chain needs in a pharmacy enterprise across multiple locations is a complex logistics network. Prior to the significant impact on drug delivery due to Hurricane Maria, Atrium Health oversaw pharmacy procurement locally at each of its facilities. Since then, Atrium Health has adopted a centralized purchasing model with controlled distribution for medication kits, vaccines for COVID-19 and medications experiencing supply constraints.

The health system employs a three-tiered approach to managing drug shortages, categorizing supply interruptions based on the expected duration and the number of facilities impacted. The categories are:

Micro-shortage (Green)– expected duration < 2 wks
- Supply interruption typically managed at the facility level
- May involve help from centralized Buyer

Mid-term shortage (Yellow)– expected duration < one month & 1 or 2 facilities impacted
- Supply interruption typically managed at the facility level
- May involve help from centralized Buyer
- Centralized purchasing and distribution may occur

Long-term shortage (Red) – expected duration > one month & > 3 facilities impacted
- Supply interruption requires implementation of clinical/therapeutic alternative
- Centralized P&T Committee involvement
- Centralized purchasing and distribution implemented
- Centralized communication to Nurses and Providers

Atrium's corporate supply chain team also includes a dedicated buyer focused on managing drug shortages for the enterprise. To stay nimble, medications signaling a potential shortage are often centrally purchased and distributed to the individual sites based on utilization, expected run-rates and delivery needs.

However, committing lean resources to manage multiple shortages simultaneously is not without its own cost or strain. While a recent survey proposed a multi-million-dollar price tag on additional labor hours dedicated to drug shortages, it is important to note that hospital pharmacy departments are operating under a fixed staffing model and resource investment should be considered an opportunity cost using existing personnel versus added staffing resources.

Michael Molby, PharmD, Pharmacy Supply Chain Manager at Atrium Health, expressed that the pandemic has increased awareness about the volatile pharmaceutical supply chain. For the duration of the public health emergency, the system leadership has approved higher inventory par levels for essential drugs while acknowledging the added expense. "Forecasting and budgeting for shortages and monitoring variance to budget" is an important initiative as "trust in the supply chain has been compromised particularly since Hurricane Maria," says Dr. Molby. "Traditional supply chain procurement processes tend to decline at the hint of a supply chain disruption." Dr. Molby credits Premier with introducing timely programs like Rapid Commit that provide an opportunity to make spot purchases within allocation limits and assurance of dealing with reputable suppliers. "When Premier invests in innovative programs and domestic manufacturing, it adds incentive for manufacturers to stay in the market and promotes stability."

manufacturing to another facility, etc., all of which can result in delayed availability and/or shortages.

Much has been said about reliance on global pharmaceutical supply for API and finished dose forms, and there is a push for expanding domestic manufacturing for generics. There are notable barriers to domestic production that should be addressed through government policy, including 1) capacity; 2) environmental regulations; 3) labor costs; 4) raw materials availability; and 5) historical policies that advantaged offshoring. While Premier recognizes a need to incent domestic manufacturing, it is also imperative to ensure global diversity in production. For critical drugs, we need at least three global suppliers in the market from multiple regions, with at least one based in the U.S.

REGULATORY HURDLES

The FDA has made strides to encourage market entry of, and investment in, additional manufacturers to begin to stabilize the most at-risk pharmaceutical classes, but a number of regulatory hurdles remain.

> *Premier's supplier survey ranked* **expedited approvals as the single most effective strategy** *to alleviate drug shortages.*

Outsourced compounding, or 503B facilities, have emerged as an alternative sourcing stream with a relatively shorter time to market entry, but they also face their own set of barriers to quick market entry, including state-by-state licensure requirements. In addition, a 2017 Pew Charitable Trusts report interviewed manufacturers and found that many were reluctant to incur the costs and the regulatory scrutiny required to upgrade facilities or equipment.

LACK OF A CENTRALIZED PROCESS FOR DRUG SHORTAGE RESPONSE

Exploring the concept of emergency preparedness through the lens of drug shortages, the CMS 2016 final Emergency Preparedness Rule for participating providers and suppliers has many similarities to drug shortage mitigation efforts, including risk assessment and planning, policies and procedure development, communication planning, testing and training.

While drug shortage management and response has never been elevated to this status, when reviewing the framework, it's apparent that individual providers operate within their own modified emergency framework. In many cases, providers are duplicating effort several-fold at each organization — lacking the benefit of a systematic vulnerabilities assessment and the support of a multi-agency infrastructure to react to shortages and help streamline approaches to access and care.

OPAQUE SUPPLY CHAINS

The drug supply chain has become a labyrinth of manufacturers, assemblers, contract manufacturers, raw material suppliers, subcontractors and more. The FDA collects information on the number of registered manufacturers in each country, but a blind spot is the actual volume of product, including API volume produced by each facility. Even less is known about where API raw materials are produced. This knowledge gap severely limits proactive emergency and contingency planning that could avoid shortages before they occur. Instead, the industry is forced to react to events as they become disasters. Providers primarily receive supply chain updates from their GPO and wholesaler partners, and according to Premier's recent survey they ranked confidence in supply availability as the biggest influencing factor in purchasing strategy.

We're pleased to see the FDA move forward with collecting manufacturing volume data for drugs and biologics, a new authority granted under the CARES Act. But with initial reporting slated for February 2022, we have yet to see the results and impact of this effort.

PANIC BUYING

Because it's impossible to plan ahead or know exactly how long a shortage will last, the mere suggestion of a supply problem triggers panic buying. According to the American Hospital Association, 85 percent of supply chain managers purchase excess inventory as their standard response to a shortage, primarily because of a lack of trust that the market will provide. Panic buying can lengthen or exacerbate national drug shortages, piling up backorders that must be fulfilled before new orders can be accepted. Panic buying also creates winners and losers, where those that got their orders in first sit on overly large inventories, while others have no access.

DISTRIBUTION CHALLENGES

Pharmaceutical wholesalers distribute supplies according to their contracts with hospitals, retail pharmacies and others, however, this approach was developed to address non-crisis market needs. A wholesaler's ability to adjust and redistribute product across facilities or geographies is impeded by its lack of information on specific facilities' disease burden as well as existing contractual agreements. Looking ahead, it's clear that more sophisticated allocation methods are necessary — where product is funneled to those most in need, considering where hot spots are, as well as the projected caseloads.

LACK OF AN ACCESSIBLE SUPPLY CHAIN FAIL-SAFE

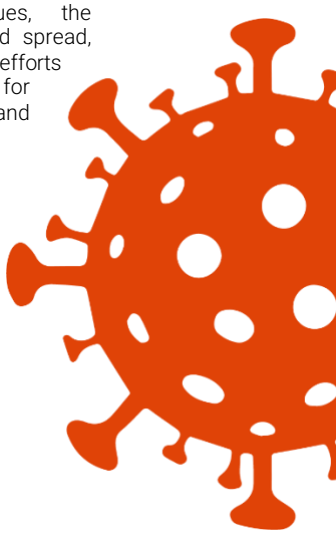
In the face of growing access constraints, providers turn to what has become a conditioned response to the last 20 years of drug shortages – stockpiling. In June 2020, Premier reported that nearly 90 percent of providers were contributing to stockpiles of critical medical supplies and drugs. Experiences accessing stockpiles early in the pandemic highlighted problems associated with relying on the government for product replenishment. Not only did the Strategic National Stockpile (SNS) run out of products in early April 2020, but in the case of pharmaceuticals, drugs in dire need were not even part of the SNS makeup.

States and health systems need to know the contents of the SNS and feel confident in their ability to access it in an emergency. Traditionally, the SNS has functioned with relatively little transparency regarding the pathway to request pharmaceuticals, timeline for request processing and receipt of products from the SNS. When approaching a supply source of last resort blinded to product and process, providers face frustration and disappointment.

THE PANDEMIC'S IMPACT

During the pandemic, ongoing supply chain and transport challenges, export bans from some of the largest API producers, and demand spikes of more than 150 percent further exposed an already fractured system. COVID-19 exposed our nation's overreliance on foreign nations for finished dose product and APIs. It also underscored the market concentration issue, with a highly consolidated supply chain creating unreasonable demand and overreliance on manufacturers who find challenges in expanding production or shifting capacity in a resource-constrained environment.

Today, a wide spectrum of disruptions — from raw materials, labor and manufacturing, shipping, transportation, warehousing, distribution and "last-mile" delivery — are driving a significant global supply chain slowdown. Alongside this broad array of macro-level issues, the Omicron variant's rapid spread, continued vaccination efforts and the potential for ongoing product demand spikes, providers' ability to reliably access vital drug supply remains precarious.



POLICY AND REGULATORY DEVELOPMENTS: A LOOK BACK AND A LOOK FORWARD <<

Over the last five years, we've seen significant regulatory and legislative activity to address the prolonged challenges faced by suppliers, distributors and providers due to drug shortages. Since 2017, the FDA has:

- Fast-tracked approvals in shortage categories, increasing the number of drugs in the market by nearly 17 percent, while cutting average review times of new drug applications by six months.
- Began publishing a list of drugs that are off patent, but lack generic competition, giving manufacturers a clear set of opportune targets.
- Issued final guidance to deter the use of Citizen's Petition filings to delay generic drug approvals, an issue long advocated by Premier.
- Created a 180-day exclusivity pathway for manufacturers who receive generics approval through the Competitive Generics Therapy Designation as an incentive to promote competition – another issue advocated by Premier.
- Issued draft guidance in October 2021 for manufacturer reporting on API, finished drug forms, private label drugs and distribution kits. Manufacturers will be expected to submit annual reports beginning in February 2022.

COVID-19 pandemic advanced additional advocacy and policy action on drug shortages and supply chain disruptions:

- The CARES Act included powers to enhance the FDA's visibility into drug supply chains.
- The White House released an Executive Order that focused on securing critical supply chains. That same month, the FDA published a list of 227 drugs and biologicals that it considers essential pursuant to Executive Order 13944.
- Premier and 55 other organizations voiced support for the MEDS Act (S. 2723), which hands additional authority to the FDA for priority review, manufacturer incentives, reporting requirements, inter-agency coordination, consumer notification and national security risk assessment due to shortages.
- During the pandemic, Premier cautioned the Drug Enforcement Administration (DEA) to carefully consider how a reduction in manufacturing quotas for certain drugs could exacerbate shortages. Our advocacy work on this issue is ongoing as quota reductions are a subject of debate towards the end of each year. In 2018 and 2019, Premier's outreach to congressional legislators and other stakeholders resulted in the DEA agreeing to reallocate raw material quota to manufacturers' controlled substances.
- Introduced in January 2022, Premier is urging Congress to pass the Drug Shortages Shelf Life Extension Act, which aligns with Premier's recommendations to grant the FDA authority to temporarily extend expiration dates for drug shortage products if determined to be scientifically sound.

Certain regulations have also led to unintended consequences in the pharmaceutical market and supply chain:

- In November 2020, the Department of Health and Human Services (HHS) announced the withdrawal of guidance documents issued as part of the Unapproved Drugs Initiative (UDI), stating that while well-intentioned, the UDI has distorted markets, limited competition and resulted in price spikes and shortages. Premier saw this with potassium chloride liquid, which jumped from $40.86 in 2015 to $236.93 in 2016 due to the Drug Efficacy Study Implementation (DESI) drug pathway under UDI. In May 2021, under a new administration, HHS reversed their decision on UDI, claiming legal and factual inaccuracy.
- GPOs have invested in private label programs as one solution to provide high-quality products with long-term contracts and competitive prices. However, due to the Health Resource Services Administration's 2013-1 statutory interpretation, many 340B-eligible hospitals must opt out of GPO private label programs, unless faced with a shortage situation — even then, only after attempting to purchase product at list price and maintaining burdensome records. The current rule-making stance only taxes strained hospital staff already struggling to source much-needed therapies.

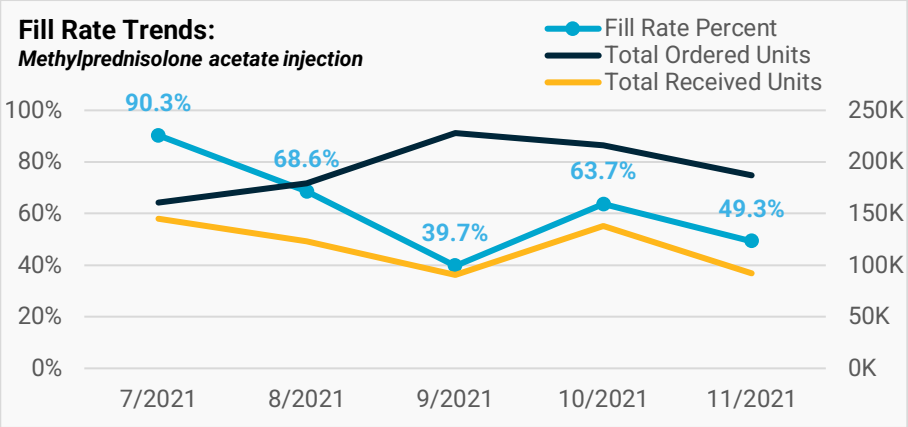
THE UNINTENDED CONSEQUENCES OF COVID-19 VACCINE MANUFACTURING: DRUG SHORTAGES <<

As pharmaceutical manufacturers are expected to prioritize vaccine production for the nation's COVID-19 response, Premier data finds that a range of drugs critical to patient care are slipping into shortage.

Premier leverages fill rate trends as one mechanism to help determine the health of the supply chain. For drugs, we consider a healthy fill rate to be above 90 percent, and anything that falls below 80 percent is an early indication that demand is outpacing supply and that shortages may be imminent.

For instance, consider the fill rate trends for methylprednisolone acetate injection. Premier's data as of December 2021 indicates that fill rates have been below 80 percent since at least August 2021 and continue to trend downwards. In the graph below:

+ The navy line reflects total units member hospitals have ordered through their wholesaler.
+ The yellow line reflects the total units hospitals received through their wholesaler.
+ The turquoise line reflects the subsequent fill rate.



The current fill rates for methylprednisolone acetate are not adequate to deliver quality patient care. This particular drug shortage is a result of two of the three FDA-approved suppliers encountering manufacturing issues simultaneously.

On Dec. 7, 2021, Premier formally reported a shortage of methylprednisolone acetate injection to the FDA. On Dec. 16, 2021, the FDA added this product to their drug shortage list.

Unfortunately, methylprednisolone acetate is not the only product to slip into shortage as the main producers of generic drugs and raw materials are forced to prioritize COVID-19 vaccines as well as vaccine-related supplies and components ahead of routine production schedules. Similar dynamics exist for a range of essential products (see chart below).

		Historical Fill Rate %	Fill Rate % By Month			Fill Rate % By Week			
Generic Name	Category	Baseline	Oct-21	Nov-21	Dec-21	11/7/21	11/14/21	11/21/21	11/28/21
0.9% SODIUM CHLORIDE	INJECTION	98.4%	50.5%	34.8%	21.6%	37.8%	40.6%	31.8%	25.3%
METHYLPREDNISOLONE ACETATE	INJECTION	97.4%	63.5%	50.1%	39.9%	57.6%	37.4%	34.7%	34.1%
METRONIDAZOLE/SODIUM CHLORIDE	INJECTION	95.6%	63.2%	19.3%	40.6%	10.7%	30.3%	20.2%	30.9%
POTASSIUM CHLORIDE	INJECTION	95.3%	20.4%	7.8%	6.0%	4.0%	4.1%	11.0%	12.1%
POTASSIUM PHOS, M-BASIC-D-BASIC	INJECTION	97.3%	75.6%	61.5%	63.2%	57.0%	64.6%	58.8%	62.6%
SODIUM CHLORIDE	INJECTION	90.9%	60.0%	60.5%	11.1%	59.5%	57.0%	66.9%	52.6%
WATER FOR INJECTION, BACTERIOSTATIC	INJECTION	99.4%	98.5%	47.5%	10.0%	52.5%	26.6%	26.5%	33.5%
WATER FOR INJECTION, STERILE	INJECTION	98.8%	78.3%	28.6%	16.1%	34.7%	22.6%	20.1%	10.7%

Source: Premier purchasing and fill rate data.

Premier continues to monitor more than 300 drugs that are used to provide direct COVID-19 care, COVID-19 complication care, emergency and surgical care. This has allowed Premier to provide early communication to both our members and the FDA on potential or impending shortages. The faster we can respond by working with suppliers to shore up production and working with our members to review clinical protocols and patient demand, the more likely we are to protect patient care in the U.S.

ROLE OF A DATA-DRIVEN APPROACH TO DRUG SHORTAGE PREPAREDNESS AND RESPONSE: A POTENTIAL GAME-CHANGER <<

According to Premier's recent survey, health system pharmacy leaders ranked **developing shortage risk assessments as the most useful strategy** *to prevent or mitigate drug shortages. Manufacturers, for their part, cited improved communications with trading partners and providers as a top priority.*

These needs for both providers and suppliers can be addressed through the creation of robust, timely and transparent data to predict supply levels, product burn rates and sourcing challenges as well as the ability to pivot distribution response and share this vital information in a timely manner across the supply chain.

COVID-19 demonstrated that real change is necessary across the supply chain information technology (IT) ecosystem. The nation needs data that can comprehensively track critical product availability — from the raw materials, to manufacturer, to distribution, to state and national stockpiles, to hospital inventory. This will enable accurate inventory management, dynamic allocation and a data-driven approach to ramping up supply via market-based mechanisms (or, in appropriate circumstances, the Defense Production Act or other legislation). Not only will this help providers, suppliers and government officials anticipate demand for key products, but it will also allow the nation to better manage supplies during a crisis.

Premier is leveraging its robust data capabilities to help signal future shortages for the FDA, ASHP members and others. We're sharing data that underscores and quantifies the duration and severity of shortages and implications for clinical practice, but there is still more to be done.

For example, early in the pandemic, Premier created a near real-time technology system to gain visibility into hospital inventory, including stockpiles, providing visibility to the SKU level. Overlaying clinical and supply chain data can help entities in both the public and private sectors see where products are stocked as well as gaps in resources. This progressive monitoring approach needs to extend across the supply chain, providing advanced alerts of demand signaling and inventory levels, and enabling rapid movement of product to points of care.

It's clear that both in and out of a pandemic, organizations today must become increasingly proactive and predictive when it comes to understanding supply chain risk and preparedness. In other words, technology enablement is the key to a modern, more effective and more resilient supply chain.

LEVERAGING THE POWER OF TECHNOLOGY AND DATA

Premier has answered the call to action, creating an advanced analytics suite that helps to manage and solve for supply chain challenges and drug shortages through predictive and actionable data insights.

CognitiveRx®, the most comprehensive drug shortage risk prediction, management and communication platform available in the U.S., contains hundreds of millions of proprietary and open-source data points spanning more than 30 years. CognitiveRx holds capabilities for providers to:

- Pinpoint market signals for early shortage detection and management.
- Monitor reimbursement, and calculate and track cost savings.
- Plan and communicate medication strategies in advance with all caregivers.

CASE STUDY:

ST. LUKE'S UNIVERSITY HEALTH NETWORK

LEVERAGING COGNITIVERX AS A ONE-STOP SHOP

St. Luke's University Health Network (SLUHN) is a leading 13-hospital system providing comprehensive patient care throughout Eastern Pennsylvania and Western New Jersey.

Prior to the emergence of COVID-19, the SLUHN Pharmacy team recognized early on the need for greater visibility and predictability into their drug supply as well as the automation of cumbersome manual tasks. As such, SLUHN employed CognitiveRx for an innovative, technology-enabled approach to better understand product availability and risk, increase efficiencies and value, and help stabilize drug supply enterprise wide.

For SLUHN, CognitiveRx has served as a one-stop shop to look at their pharmaceutical supply chain – from purchasing to product utilization to price changes – saving the team time and energy to focus on other pressing items. The tool has also been key in helping the system manage inventory levels and anticipate buy-ins (or advance purchases) to help mitigate shipping delays and costs with some of their high-dollar products such as infusion medications. This buy-in feature enables a customer's delivery systems to manage products at high risk for predicted price increases.

"Knowledge is power. We can't understand, nor can we measure, what we can't see," said Peter Hlavinka, Director of Pharmacy at St. Luke's University Health Network. "CognitiveRx technology brings in all of our disparate data points for a more complete picture and single source of truth in considerably less time, and that's vital for us."

Hlavinka is also a proponent of increased supplier and wholesaler transparency and data sharing overall. "A lack of transparency and visibility leads to knee-jerk reactions as well larger pharmaceutical market and supply chain issues. With more information and data, I can better manage inventory and provider expectations, make necessary adjustments, and ultimately, not cause additional waves that contribute to the larger problem."

Honing predictive capabilities through intelligence from signals in sourcing and fulfillment, the tool can offer priceless value to providers - time and transparency - both of which allow for preparation and communication to respond to an outage before it impacts patient care. For example, a retrospective conducted on two recent shortages (paclitaxel protein-bound and protamine sulfate) that necessitated changes in therapeutic protocols illustrated progressively worsening supply shortages for both drugs in recent months (Figs A, B). Using identified shortages and establishing custom parameters, Premier pharmacy experts flagged signals weeks to months before official shortage notifications issued by the FDA. Additionally, leveraging CognitiveRx provides Premier sourcing professionals with information on routine drug supply volatility and encourages early engagement with suppliers to identify upstream challenges in sourcing raw materials and supplies that could impact long-term downstream consequences.

Figure A: Abraxane

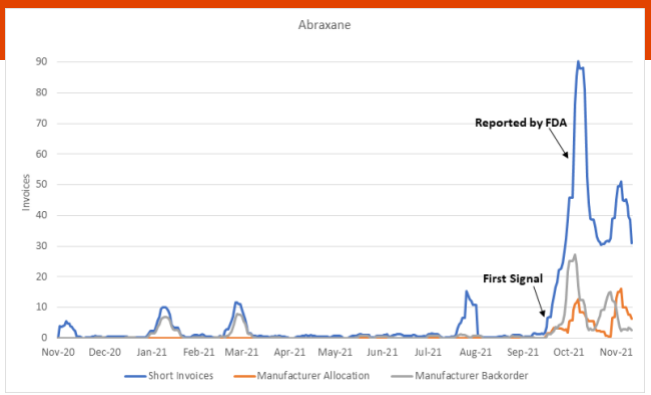
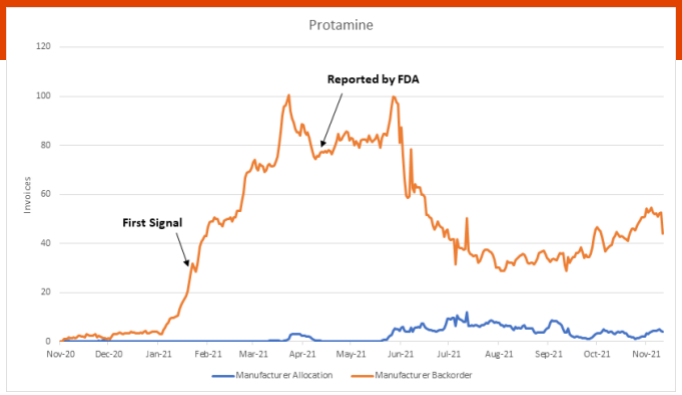


Figure B: Protamine



PINC AI technology is enabling providers to better quantify risk and mitigate future disruptions, more accurately manage contracts, automate invoicing and payments, streamline operations and manage supply chain costs all in one place.

Beyond supply chain management, an increasing number of pharmacy leaders are leveraging advanced technology with tools for utilization support, clinical decision making, budgeting and cost savings. For instance, pharmacists are leveraging Premier's clinical decision support tools at the point of care to help determine drugs' appropriate use and make evidence-based care decisions that best serve patients. These tools are particularly useful in a pandemic, where clinical management of a disease continues to evolve (e.g., as data on novel COVID-19 treatments emerges) and can outpace the initiation of new clinical trials.

PROVEN SOLUTIONS FOR ADDRESSING DRUG SHORTAGES <<

For more than 20 years, Premier and our members have been leaders in helping to eliminate drug shortages and create a healthy marketplace. Our contracting approach and competitive pricing, innovative partnerships and private-sector models have begun to fundamentally alter the economic dynamics and address the root causes that plague the generics market and put supplies at risk.

Overall, Premier believes that by initiating healthy competition between manufacturers and within the broader pharmaceutical market, we can enable greater access to at-risk products as well as extract best-in-class deals for providers via both our GPO agreements and committed programs.

From the perspective of drug manufacturers, unpredictable volumes rank among their top challenges to consistently supply drugs, according to the recent Premier survey. And when asked what they wished health systems better understood to help prevent or mitigate drug shortages, **"participating in a supplier's committed programs" emerged as the number one opportunity**.

CASE STUDY: BAYCARE HEALTH SYSTEM

PROVIDEGX DRUG SHORTAGE SOLUTIONS

BayCare Health System is a 15-hospital integrated delivery network in Florida that includes large, academic medical centers as well as rural hospitals in the Tampa area. While drug shortages are a challenge to hospitals of any size, large health systems depend on heightened inventory visibility, increased communication and a diversified approach to lessen the effect of multiple shortages at any given time. Experience from wide-spread shortages after Hurricane Maria and the COVID-19 pandemic has honed BayCare's response and preparedness method.

In the last few years, BayCare centralized its purchasing operations as an overlay to local management at each facility – a hub-and-spoke model. One of the differentiating strategies for BayCare has been to avoid pulling from the same source or alternative therapy for the entire system. Shortage assessment and response are discussed routinely during buyers' cost savings and leadership strategy meetings. Diversification includes analyzing weekly supplier availability reports, creating direct account portals with a few manufacturers, using e-commerce platforms to access surplus stock from manufacturers, and working closely with the Premier team for supply chain and sourcing intelligence.

Kyle Brauer, PharmD, MBA, manager of pharmacy supply chain at BayCare, says that Premier's approach to solution for drug shortages is a step in the right direction for supply chain stability. **"Having diverse response tactics is essential because drug shortages are a multi-factorial problem,"** per Dr. Brauer. Premier's private label program, stand-alone drug shortage commitment program, supplier short-term platforms for quick uptake, investment in domestic manufacturing and predictive technologies are all iterative to building a comprehensive solution.

Commenting specifically on the ProvideGx® program, Dr. Brauer, who sits on the drug shortage program's Advisory Committee, stated how supply for emergency syringes is no longer a process with high potential for error. Prior to the program, BayCare was plagued by incessant procurement disruptions, requiring a less desirable approach of manual manipulations to prepare medication trays for emergency response. Dr. Brauer shared, **"Having manufacturers come to the table in response to a steady demand signal and consistent forecast has resulted in a seamless receipt of vital medications that used to be a top-of-mind supply and safety concern."**

To address a hybrid problem, approaches need to be focused on long-term impact over short-term gains. Elevating the pharmacy enterprise as a service line instead of a cost center can shed light on the intricacies of the supply chain and train focus on generics through a lens of quality versus commodity.

BayCare's outlook to resiliency is a message the Premier team has been hearing from pharmacy leaders across the country. **"To effect change, we have to look beyond the bottom line at sustainable manufacturing, contracting and purchasing actions. Moreover, downstream impact of regulatory policies on providers needs constant advocacy. Premier has been a committed partner on all these fronts,"** says Brauer.

CASE STUDY: BAYSTATE HEALTH

SUPPORTING DOMESTIC PRODUCTION VIA EXELA PHARMA SCIENCES

Based in Springfield, Massachusetts, Baystate Health is a non-for-profit, integrated health system serving over 800,000 lives throughout western New England. In and out of a pandemic, the health system relies on a multi-pronged strategy to help manage and eliminate drug shortages – and mitigate their impact on Baystate Health's providers and patients.

Day-to-day, Baystate Health relies heavily on real-time communication and collaboration across departments, including frontline nurses, pharmacists and clinicians, as well as nursing, medical and administrative leaders. Key product issues are tracked and shared, with the Pharmacy Department reporting drug shortage management progress and prioritizing the most critical items. This approach gives Baystate Health an acute understanding of the essential drugs in critical patient care areas in its hospitals, including the emergency room, intensive care units and surgical suites.

Like many providers across the nation, the COVID-19 pandemic brought additional pharmaceutical sourcing challenges for the health system. At the height of the pandemic's first wave, for instance, demand for neuromuscular blockers spiked, and Baystate Health's inventory levels for these products were near impossible to manage.

To diversify its supply and secure reliable access to at-risk products, Baystate Health deployed an innovative, commitment-driven approach by investing alongside ten other Premier member health systems in U.S.-based producer Exela® Pharma Sciences. Baystate Health and the other leading health systems signed multi-year commitments to purchase a portion of their pharmaceutical products from Exela – supporting greater domestic and diverse manufacturing of critical drugs to help protect providers and patients from disruption.

Under the arrangement, Baystate Health and other participating Premier members are expected to have uninterrupted supply of 19 pharmaceutical products (as of Fall 2021), including several generic injectables that frequently appear on the FDA's drug shortage list, as well as 503B pharmaceutical products made by Exela. Exela primarily sources APIs from the United States and Europe, and manufactures finished-dose products in its recently expanded state-of-the-art U.S. manufacturing facility in Lenoir, NC. Exela's manufacturing capacity provides participating Premier members with a unique opportunity to bolster the supply of critical products and support domestic manufacturing infrastructure.

"This investment to co-develop at-risk drugs is a critical step forward in addressing supply chain challenges and pervasive drug shortages," said Gary Kerr, Chief Pharmacy Officer at Baystate Health. "The high cost of development coupled with the low return on investment for generic injectables typically serves as a deterrent for new manufacturers to enter the market."

Dr. Kerr credits these domestic investments with aiding to defend against overseas reliance on elements of the supply chain, whether for raw materials or finished product. Baystate Health and the other participating members also have seats on an advisory committee for Exela, providing input and direction on adding new products to the Exela portfolio. "This is an ongoing, critical management strategy for us," said Dr. Kerr. "These investments through Premier provide incentive for domestic manufacturers to bolster production and encourage the creation of a healthy, competitive pharmaceutical market."

To address the root causes of drug shortages, pharmacy-led organizations are leveraging commitment-driven "buyers' club" models, giving manufacturers proper demand signaling, predictable revenue and the surety needed to bolster production or enter new markets.

+ PremierProRx® focuses primarily on sterile injectable products and protects 91 NDCs that are currently on the FDA drug shortage list – driving access and value for Premier members.
+ ProvideGx® was created to expand innovative strategic relationships with select pharmaceutical manufacturers — to increase market competition, create a stable pharmaceutical supply chain, help alleviate drug shortages, reduce waste and mitigate irrational pricing. ProvideGx, uses long-term contracts to establish both consensus demand forecasting as well as minimum requirements on manufacturers to retain an average of three to six months of APIs and finished dose products.
+ Leveraging the ProvideGx platform, Rapid Commit™ assists Premier members with short-term drug market supply disruptions. Rapid Commit facilitates commitment to purchase orders for pre-approved quantities at specific limited time offers, enabling product availability while also driving cost savings.

With this vital safety stock, it was possible to **weather 150 percent demand spikes** during COVID-19's first wave peak with limited interruptions in supply. The program is also having a long-lasting impact on the industry overall, as **14 products added to ProvideGx have subsequently been delisted from the U.S. Food and Drug Administration (FDA) drug shortage list**.

> *In the most recent Omicron-surge related supply chain constraints,* **drug commitment requests for products in ProvideGx increased by 33 percent.**

+ Leveraging data to identify products most at-risk, pharmacy leaders are looking beyond committed contracts – taking it a step further to co-invest alongside Premier in domestic and diverse pharmaceutical suppliers – and for product categories that lack adequate competition, geographic diversity or stable sources of contingency supply.
    - Our investment with Exela Pharma Sciences is expected to supply 19 pharmaceutical products, including several shortage generic injectables well as 503B pharmaceutical products.
    - In December 2021, Premier announced the launch of the first drug developed through its existing partnership with VGYAAN Pharmaceuticals LLC.
    - Additional products for co-development with both collaborations are being identified with the guidance of Premier member health systems representing thousands of hospitals across the nation.

HOW DO THESE PROGRAMS WORK?

Together with our members, we:

- ✓ Identify high-priority shortage medications.
- ✓ Enter into long-term contracts with licensed, vetted and geographically diverse manufacturers to produce them.
- ✓ Engage with manufacturers that provide transparency on product and raw materials sourcing locations, safety stock, safety records data and rapid replenishment capabilities.
- ✓ Drive consistent supply, consistent quality and consistent savings of shortage products. Premier members serve at the center of program decision-making, allowing pharmacy leaders to prioritize need and quality – and to leverage a portfolio that saves more than nine percent annually in pharmaceutical expenses, on average, while also improving stable access to critical drug products.

It's important to note, however, that not all commitment programs are created equal. Many programs out in the market fail to actually follow the market, either by enabling product access at significantly higher prices or by providing little more than safety stock. Extending private-sector, commitment-driven models (like Premier's) that comprehensively target the root causes of shortage drugs is the most productive step we can take to increase competition, as well as manufacturers' ability to accommodate surge demand.

Premier has also significantly invested in distribution, and through our partner FFF Enterprises, we're enabling timely access to products and supporting our members in ways others simply cannot.

- \+ FFF provides ready access to all ProvideGx® products to participating members at relevant prices, including 340B and wholesale acquisition cost (WAC).
- \+ Through FFF, Premier has the ability to dynamically allocate products based on clinical need, rather than by purchase history, as other distributors traditionally do. During the pandemic, Premier arranged for product to be directly shipped to members in order to get supplies in advance to COVID-19 hotspots and avoid distributor allocations.

Shared commitments between member health systems, pharmaceutical suppliers, a targeted distributor and the Premier staff have created a collaborative environment where all who contribute share in the success. Suppliers get more accurate demand forecasting and committed purchases. Health systems get a guaranteed supply of critical medications at a fair price. **Committed purchasing, committed volume and reliable supply.**

Additionally, Premier has implemented key sourcing updates with the goal of driving greater transparency and creating a more proactive, nimble response to supply chain disruptions.

Highlights include:

- ✓ Supplier RFI/RFP questions (NEW) that address supply chain resiliency.
- ✓ Additional guarantee of delivery and failure to supply – Premier template terms and conditions.
- ✓ Enhanced Member Sourcing Committee guidance, information, feedback and tools.
- ✓ Real-time and updated supplier-provided information on backorders, allocations and shortages.
- ✓ Value Analysis Committee "watch list" on unhealthy markets compiled and reported to government and other stakeholders weekly.
- ✓ Expedited and accelerate sourcing process.

DID YOU KNOW?

- \+ Since 2012, more than one-quarter of SKUs in shortage were brought to market by Premier's programs.
- \+ Our overarching pharmacy portfolio includes 11,500+ contracted products, and we have helped our members save more than $100 million through our programs since 2018.
- \+ Premier includes failure to supply (FTS) clauses in manufacturer contracts to help health systems recoup increased expenditures as a result of purchasing higher-cost alternate medications during a drug shortage. Premier's FTS program has helped members recoup over $70 million of increased expenditures associated with drug shortages since its inception.

BRINGING SHORTAGE DRUGS BACK TO MARKET IN 2020

Product	Action/Result
Dexmedetomidine	According to Premier data, dexmedetomidine demand in April 2020 increased more than 360 percent when compared to the same period in 2019, and providers typically only received about 62 percent of what they ordered. Added to ProvideGx, stabilizing the long-term supply of a medication needed to care for the most acute COVID-19 cases.
Diprivan®	Experienced a 500 percent demand spike in the spring of 2020 per Premier data. Stock available through prime wholesalers was gone in less than two weeks, and many providers were stuck scrambling for product. In July 2020, ProvideGx introduced Diprivan to its portfolio.
Fentanyl citrate, diazepam, labetalol, lorazepam, and 0.9 percent sodium chloride injection	ProvideGx added fentanyl and four other drugs that are not only essential during the pandemic, but are also vital for routine and elective care longer term.
Emergency syringe products	Prior to the pandemic, Premier added emergency syringes, which have proven vital for providers treating highly acute cases of COVID-19 illness.
Cephalosporin antibiotics	Beyond essential COVID-19 products, ProvideGx brought in three cephalosporin antibiotics, creating sustainable supply of these medicines commonly used for routine patient care and treating bacterial infections.
Sterile water	ProvideGx gives members access to sterile water, an at-risk product throughout the pandemic due to its use in COVID-19 patient ventilation, manufacturing and administration of COVID-19 vaccines, and in a variety of other patient care settings.

10 WAYS PREMIER AND ITS MEMBERS ARE BUILDING GREATER DRUG SUPPLY CHAIN RESILIENCY – DURING COVID-19 AND FOR THE FUTURE <<

1. Developed **"free-to-join" drug shortage-related programs** with commitment from suppliers and providers, built on flexibility, and with more than 150 high-risk products protected (a Premier exclusive program).
2. Supporting sustainable domestic markets through our investments in U.S.-based generics manufacturers **Exela Pharma Science** and **VGYAAN Pharmaceuticals** (a Premier exclusive initiative).
3. Leveraging our own distribution partner, **FFF Enterprises**, to help enable timely access to products and support. Premier can dynamically allocate products to members based on clinical need in addition to purchase history, which facilitates a nimble response during tight constraints.
4. Developing advanced technology to enable greater transparency and preparedness. Through **CognitiveRx, predictive analytics** leveraging millions of proprietary and open-source data are surfacing signals that promote preparedness efforts.
5. Partnering with **Resilinc, a leading supply chain monitoring, mapping and resiliency solution**, to give Premier visibility down to the site, product and ingredient/part levels for its top supplier partners, allowing for greater transparency into potential vulnerabilities to help ensure continuity of supply (a Premier exclusive relationship).
6. Accessing unique market intelligence on production capacity and release of key products into the market to **nimbly connect suppliers with providers** that are in dire need.
7. **Championing advocacy efforts** on behalf of healthcare providers through Premier's Advocacy Team in Washington D.C. During the pandemic, we've secured more than 50 regulatory and legislative changes to enable providers' COVID-19 response.
8. Building **trusted supplier relationships** to enable open communication and sourcing avenues.
9. Keeping a **keen focus on quality, redundancy and sustainability** when vetting suppliers for contract addition.
10. **Dedicated Premier field pharmacists, supply chain experts and account managers** to listen and respond to member procurement challenges.

CASE STUDY: HOLY NAME MEDICAL CENTER

LEVERAGING PREMIER'S PHARMACY EXPERTISE

Holy Name is New Jersey's last remaining independent, Catholic health system, comprising a comprehensive 361-bed acute care medical center, a cancer center, medical fitness center, residential hospice, nursing school and physician network. As a stand-alone hospital, Holy Name's tight-knit pharmacy team emphasizes communication, networking and their ability to pivot quickly to meet pharmaceutical supply chain challenges.

Holy Name's pharmacy purchasing manager conducts a once-weekly review of the current shortage list published by ASHP against inventory on-hand. Participating in a state-wide health system networking every week to discuss challenges and alternatives and engaging with the Premier Field Pharmacy Team for sourcing concerns have now been embedded as a routine cadence. These network exchanges help the team implement alternatives before the shortage disrupt routine patient care. Joseph Cruz, PharmD, BCPS, Manager, Pharmacy Quality and Safety, highlighted the unique collaboration that partnering with Premier has brought to Holy Name Medical Center since the hospital became a Premier member in April 2021. **"The level of engagement from the Premier team, supply chain knowledge, response time, savings delivery, and attention to our sourcing needs has been superb and a differentiator in the marketplace."**

During the recent shortage of a vital chemotherapy agent, paclitaxel-protein bound (Abraxane), the medical center experienced a sudden interruption in allocation, which had the potential to affect patient care. **"Premier's team worked closely with the supplier and distributor to communicate the acute treatment need and we got our allocation restored that week,"** stated Dr. Cruz.

As a pharmacy manager in a stand-alone community hospital, Dr. Cruz recognizes the importance of transparency and an active pulse on risks/vulnerabilities to circumvent crisis management of drug shortages. Premier's announced partnership with Resilinc, a leading supply chain monitoring, mapping and resiliency solution, in October 2021 purports to do just that. Leveraging Resilinc's Multi-Tier Mapping service is expected to give Premier visibility down to the site, product and ingredient/part levels for its top supplier partners, allowing for greater transparency into potential vulnerabilities to help ensure continuity of supply. With the combination of investments in programs, technology and manufacturing, no other group purchasing organization has the comprehensive strategy and tools to help eliminate shortages and supply chain vulnerabilities.

CONTRIBUTORS

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About Premier

Premier Inc. (NASDAQ: PINC) is a leading healthcare improvement company, uniting an alliance of more than 4,400 U.S. hospitals and health systems and approximately 225,000 other providers and organizations to transform healthcare. With integrated data and analytics, collaboratives, supply chain solutions, and consulting and other services, Premier enables better care and outcomes at a lower cost. Premier plays a critical role in the rapidly evolving healthcare industry, collaborating with members to co-develop long-term innovations that reinvent and improve the way care is delivered to patients nationwide. Headquartered in Charlotte, NC, Premier is passionate about transforming American healthcare. Please visit Premier's news and investor sites on www.premierinc.com; as well as Twitter, Facebook, LinkedIn, YouTube, Instagram and Premier's blog for more information about the company.