Healthcare Supply Chain in Novel Coronavirus (COVID-19) Crisis

Snapshot Highlights – April 7–15, 2020

About This Document

Given the fluid situation, this document is prepared to provide a snapshot of COVID-19 impacts on healthcare supply chains and trends in responding strategies. With few exceptions, data are based on a review of literature published during April 7–15, 2020, including managerial journals, industry reports, and relevant web resources. Content was analyzed to discern key developments at the time of this review to get supply chain managers up to speed on changing landscape and development in healthcare supply chains amid the COVID-19 crisis.

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Healthcare Supply Chain Challenges in the Wake of COVID-19 Crisis

Healthcare is among sectors hardest hit by the COVID-19 pandemic that is creating industry-wide challenges as a result of Coronavirus-related disruptions to supply chains, combined with drastic increases in demand due to the global outbreak.

**Demand Challenges**

- **Demand spike for COVID-19–related medical supplies.** Coronavirus infections continue to grow and as they do, demand for medical supplies to treat COVID-19 patients surges. Some of the direst needs include Personal Protective Equipment (PPE), testing equipment, human ventilators, and ventilator-related drugs such as sedatives, anesthesia, and painkillers (Sandler 2020; Schneller 2020).

  ![Image of medical supplies needed](image)

  *Source: Lacina (2020)*

- **Demand spike for certain essential drugs.** The COVID-19 pandemic has led to a significant increased demand for certain prescription medicines, notably those for patients in intensive and supportive care who need intubation, respiratory and cardiac medicines, a concomitant therapy with anesthetics, antibiotics, muscle relaxants, anti-clotting medicines, resuscitation medicines, anti-diuretics, medical nutrition, and large-volume parenterals. The increased off-label uses of medicines (uses of medicines outside their authorized indications) to treat COVID-19 pneumonia can also threaten their availability for patients using them to manage their chronic conditions such as lupus, HIV, rheumatoid arthritis, and asthma (CVS Health 2020; European Commission 2020). Notable examples of medicine at risk of shortage due to the COVID-19 pandemic are acetaminophen and hydroxychloroquine that has emerged as a controversial treatment therapy for Covid-19 (Alexander and Qato 2020; Schneller 2020).

- **Stockpiling/Over ordering.** Distributors in the United States experienced ordering increase at 2%–300% of historical purchases, and multiple orders being placed with multiple suppliers, according to Health Industry Distributor Association (HIDA 2020). One of common reasons for over ordering is...
stockpiling practices in anticipation of possible shortages that create scarcity even if there is enough supply to satisfy immediate demand (European Commission 2020; Ouellette et al. 2020).

- **Increases in demand from non-traditional customers.** There is an urgent need for medical products and PPE, not only for healthcare workers, but also for non-patient care facilities, first responders, law enforcement, and other essential workers (FedEx 2020; HIDA 2020).

- **Increases in demand for traditionally low-volume products.** Products such as Tyvek hazmat suits that are not typically carried in large quantities by the healthcare supply chain are now in high demand by first responders and medical workers, particularly in high-impact regions. Generally, pre-existing business relationship between med-surgical distributors and Tyvek suit suppliers are limited, creating demand challenges for this pressingly needed product (HIDA 2020).

### Supply Challenges

A number of factors have contributed to supply constraints across healthcare service delivery, registered starting materials, active pharmaceutical ingredients (APIs), excipients, consumables (e.g. syringes, needles, sutures, staples, tubing), packaging materials, personal protective equipment (PPE), medicine, medical device (notably, respirators and ventilators), and COVID-19 testing swabs and kits (Cunnane 2020; Sandler 2020).

- **Production disruptions.** Existing production operations around the globe are disrupted due to lockdown and factory closure to curb the spread of the virus (Nawrat 2020; Ouellette et al. 2020).
  - **PPE products.** China and the adjoining Asia-Pacific region produces a large percentage of the global supply of PPE products, such as sanitizers, medical masks, gloves, and gowns (Ferrari 2020).
  - **Medicines**
    - China, and specifically Hubei Province, is home of a large number of APIs required for many medicines and drugs. Procedurally, pharmaceutical and drug companies had bulked up safety stock levels to prepare for the Lunar New Year production shutdown in China. General safety stock levels are also usually planned at higher levels because of the criticality of supply. Nonetheless, there remains a lot of concern if China API suppliers cannot resume required supply levels to support a global pandemic (Ferrari 2020).
    - **India.** India is a major producer of generic and branded pharmaceuticals. Almost 30 percent of India’s pharma exports are to North America, 16 percent to Europe, and 17 percent to Africa (Suneja 2020). As India has initiated its own measure to shutdown commerce and require people to shelter in residence, there are growing concerns as to what that implies for drug supply chains (Ferrari 2020).

- **Exports restrictions imposed by the government in response to the impact of COVID 19**
  - **PPE products.** To address the sudden surge in the demand for critical PPE products, a majority of countries have restricted the export of these products to protect domestic supply needs during the health crisis. This restriction has created major supply disruptions in the PPE markets across countries, particularly those are heavily reliant on the medical imports (Business Wire 2020a; Ferrari 2020). This is the case in the United States in which a large portion of PPE supply comes from China (CBS News 2020).
India export ban. India restricted the exports of APIs outside of the country because of the Covid-19 pandemic to ensure there is no shortage of drugs in India due to the lockdown in China’s Hubei’s province, a major source for these raw materials. Among affected drugs are several antibiotics (e.g. tinidazole and erythromycin), the hormone progesterone, Vitamin B12, and drugs used to put patients on ventilation. India has also placed restrictions on the export of most diagnostic testing kits, and in recent weeks, the export of ventilators, masks, and other protective gear needed by both patients and medical staff. The export restrictions on 24 API and formulations were removed a month after imposing them, including anti-malaria drug hydroxychloroquine, the experimental COVID-19 treatment. However, exports of hydroxychloroquine will depend on availability of stock after meeting domestic requirements and existing orders, limiting supply for the United States that relies heavily on India makers. In fact, according to data compiled by Bloomberg Intelligence, 47 percent of the US supply of the drug in 2019 came from India makers. Only a handful of suppliers in the top 10 are non-Indian, such as Actavis, now a subsidiary of Israeli generics giant Teva Pharmaceutical Industries Ltd. (Nawrat 2020; Ouellette et al. 2020; Chaudhary 2020; Suneja 2020).

Distribution and logistics capacity constraints. Workforce disruptions due to sickness and worldwide confinement measures have led to domestic logistics issues in affected countries. Travel bans and blank sailings have also disrupted international air freight and ocean shipping service capacity that have a direct impact on the distribution of healthcare-related supply (Alexander and Qato 2020; European Commission 2020).

Increase in scams and counterfeit PPE products. PPE scams by gray marketers have multiplied, with supplies surfacing on the gray market including N95 masks, isolation gowns, testing kits, swabs used for specimen collection, hand sanitizer, and other products in scarcity (Powell 2020).

Healthcare Supply Chain Responding Strategies and Initiatives

Various demand- and supply-side levers are used in the healthcare supply chain amid the COVID-19 crisis, many of which involve collaborations, ranging from government-led to private sector–led initiatives. Notable collaboration initiatives are:

Government-led public-private collaboration: FEMA whole-of-America response's Supply Chain Task Force. The Supply Chain Task Force executes a strategy maximizing the availability of critical protective and lifesaving resources through the Federal Emergency Management Agency (FEMA) for a whole-of-America response. Efforts to date have focused on reducing the medical supply chain capacity gap to both satisfy and relieve demand pressure on medical supply capacity (FEMA 2020a).
Industry pro-competitive collaboration. With approval from the Department of Justice (DOJ) in relation to antitrust concerns, five private medical suppliers—Cardinal Health, Henry Schein, McKesson, Medline Industries and Owens & Minor—are collaborating to prevent and eliminate supply chain bottlenecks of crucial PPE and other medical supplies needed to fight the COVID-19 pandemic. The collaborations involve manufacturing, finding and creating new supply sources, monitoring demand, distributing supplies to FEMA-designated hotspots, monitoring and negotiating pricing, and sharing various types of data concerned with all of these functions. The companies are required to send written notice to the DOJ when the COVID-19 pandemic is resolved, stating this enhanced degree of cooperation is no longer required and is thereby dissolved (Cosgrove 2020).

Demand-Side Responding Strategies: Preservation Measures

Demand-side levers exercise preservation measures that focus on making the best use of supply at hand, thus reducing the impacts of demand surge on the healthcare supply chain (FEMA 2020a).

Reuse. This measure involves techniques such as decontamination and sterilization for reuse (Singhal et al. 2020). Examples include:

- Decontamination of N95 respirator masks. As N95 respirator masks are in high demand with low availability, decontamination for reuse can help to bridge demand-supply gap until the supply chain for new masks can meet demand (Singhal et al. 2020). This approach is made legally feasible when the US Food and Drug Administration (FDA) issued an emergency use authorization (EUA) that has the potential to decontaminate approximately 4 million N95 or N95-equivalent respirators per day in the United States for reuse by healthcare workers in hospital settings (FDA 2020). In this effort, Battelle was awarded the contract by the Defense Logistics Agency (DLA) on behalf of the US Department of Health and Human Services (HHS) and FEMA. Under the contract, the cost of decontaminating N95 respirator masks will be funded by the federal government up to $400 million across 60 deployment sites, thus the services will be
offered at no charge to healthcare providers. The Battelle CCDS Critical Care Decontamination System is operating in Central Ohio, Long Island, NY, and Washington state. Additional systems are scheduled for operation in Boston, Brooklyn, Chicago, and the National Capital Region (Business Wire 2020b).

- **Clean rooms for patient monitoring equipment.** Transportation and logistics service provider Pilot Freight Services created the “clean rooms” system within its logistics facility in Piscataway, NJ, that allows medical engineers and technicians to inspect, clean, test, and validate patient monitoring equipment. As a result, medical equipment can be cleaned, tested, and repacked for delivery to hospitals in New York City, all within 24 hours of arrival (DC Velocity 2020a).

- **Adaptation of existing products: Human ventilators.** Physicians and health care experts at hospitals such as Mount Sinai Health System in New York have devised a way to retrofit/repurpose machines used to treat sleep apnea to help some COVID-19 patients when ventilators are in short supply. The machines can help COVID-19 patients who are not the worst off, freeing up full-scale ventilators for the most critical cases (Ferrari 2020; McCoy 2020).

- **Domestic demand: Supply allocation.** Given the reality that demand for several COVID-19 critical medical products outpaces supply, suppliers (e.g. 3M, McKesson, Medline) prioritize allocation of these products to serve the most critical areas and users. Restrictions are also introduced on sales and dispensing of essential medicines (e.g. CVS Health) at risk of shortages or subject to increased demand to safeguard the inventory on hand and lengthen availability for customers (Alexander and Qato 2020; Business Wire 2020c; CVS Health 2020; European Commission 2020; McKesson 2020).

- **International demand: Export restrictions.** On Friday, April 3, President Trump issued “Memorandum on Allocating Certain Scarce or Threatened Health and Medical Resources to Domestic Use” directing the Department of Homeland Security (DHS), FEMA, in consultation with the HHS, to use the Defense Production Act to keep scarce medical resources within the United States for domestic use. PPE products subject to this policy include: N95 respirators and a variety of other filtering respirators; air-purifying respirators; surgical masks; and surgical gloves. FEMA and the US Customs and Border Protection (CBP) are working together to prevent domestic brokers, distributors, and other intermediaries from diverting these critical medical resources overseas (FEMA 2020b).

**Supply-Side Responding Strategies**

**Production Capacity Expansion**

Production capacity expansion focuses on generating capacity with both traditional and non-traditional manufacturers (FEMA 2020a).

**Existing Traditional Manufacturers**

Existing traditional manufacturers are ramping up production through investments in additional machinery, re-tooling existing assembly lines to produce much needed products, and extending operating hours (Singhal et al. 2020). Some examples are:

- **Additional capacity investment**
3M. Beginning in January, 3M ramped up production of N95 respirators and doubled its global output to 1.1 billion per year, including the 35 million currently produce each month in the United States. On the first week of April, President Donald Trump invoked the Defense Production Act to order 3M to ramp up production of N95 respirator masks. 3M has already put into motion additional investments and actions that will enable it to double its capacity again to 2 billion globally within 12 months, with additional capacity to begin coming online in the next 60 to 90 days. In the United States, 3M expects to be producing N95 respirators at a rate of 50 million per month in June, a 40 percent increase from current levels (Business Wire 2020c; Industry Week 2020a). Meanwhile, to supplement the 35 million N95 respirators 3M currently produce per month in the United States, 3M will import 166.5 million respirators over the next three months, primarily from its manufacturing facility in China, starting in April. The Trump Administration is committed to working to address and remove export and regulatory restrictions to enable this import plan (Business Wire 2020c; Industry Week 2020a).

Medline. For isolation gowns, head/footwear and coveralls, Medline has successfully increased the production capacity at factories in Southeast Asia and anticipate that it will continue to ramp up output there. Medline also doubles the production of reusable PPE such as reusable facemasks and gowns manufactured in Latin America, while working to source additional manufacturing capabilities worldwide (Medline 2020).

Cardinal Health. Cardinal Health is acquiring additional equipment to expand production of isolation gowns and face masks in its facilities (Cardinal Health 2020).

- **Retrofit existing production lines**
  - Medline. Medline restructured manufacturing operations in Wisconsin and Connecticut, with teams modifying equipment and ventilation systems, so that it can produce additional volume of hand sanitizer, surpassing its goal of 150,000 bottles per week by more than 200 percent (Medline 2020).
  - Cardinal Health. Cardinal Health is exploring how to retrofit and add equipment to production lines in order to increase production of items in most need (face masks, gowns and other essential PPEs) (Cardinal Health 2020).

- **Extend operating hours**: Cardinal Health. Increasing manufacturing shifts and over-time (Cardinal Health 2020).

**Non-Traditional Manufacturers**

Many companies outside of the healthcare industry have pivoted operations to produce medical supplies to help with pandemic relief efforts. They are working with the FDA and CDC to get special permission to produce needed products that are not ones that they usually manufacture (Sandler 2020). Examples relating to productions of much needed PPE and human ventilators are:

**PPE Production**

- **PPE by Manufacturing Coalition.** Manufacturing Coalition represents hundreds of manufacturing companies nationwide. The aim is to combine the expertise and knowledge within the manufacturing members to support the public and private sectors in their efforts to mitigate against the COVID-19 spread and assist essential workers who are in dire need of PPE. A vast
majority of coalition members can pivot their production lines to create COVID-19 related products and supplies such as N95 masks, disposable gloves, sanitizing gels and liquids, ventilators and ventilator housings, COVID-19 testing kits, aluminum components for blood analysis tools, and more in less than seven days and begin distribution as needed at a fair cost. This swift transition is possible because members have diverse manufacturing capabilities including: Metal/Pre-Fabrication, Food and Beverage, Medical device manufacturing, Clothing and Textile, Injection Molding, Petroleum, Chemicals, Plastics, Transportation and Supply Chain, Paper and Wood and 3D printing. More information on pricing, orders and how to get involved is available at www.manufacturingcoalition.com (Manufacturing Coalition 2020).

### PPE by athletic companies

- **Nike:** **Face shields & respirator lenses.** Nike’s innovation, manufacturing and product teams have developed face shields and powered, air-purifying respirator (PAPR) lenses in partnership with health professionals from Oregon Health & Science University (OHSU). Elements of both apparel and footwear were combined in order to produce the shields and lenses. Collar padding that would have been used to manufacture Nike sneakers was repurposed and the clear plastic on both the face shield and the PAPR lenses was manufactured using Nike Air TPU. The PPE is being provided to medical systems located in the vicinity of its Oregon world headquarters, including Providence, Legacy Health Systems and Kaiser Permanente (Chochrek 2020; Hall 2020).

- **Under Armour:** **Face masks, face shields & fanny packs.** Under Armour has begun to manufacture and assemble face masks, face shields, and specially equipped fanny packs for the 28,000 health care providers and staff at the University of Maryland Medical System. It has delivered 1,300 face shields to the University of Maryland Medical System and expects to make more than 500,000 fabric face masks and 50,000 fanny packs. The brand also will begin providing face masks to LifeBridge, a regional health care organization based in Baltimore. Additionally, Under Armour is currently discussing supply needs with Johns Hopkins Medicine, MedStar and other local medical institutions (Chochrek 2020; Taylor 2020).

- **New Balance:** **Face masks.** New Balance is creating masks in its Lawrence, MA, manufacturing facility to be used by health-care professionals (Chochrek 2020).

### PPE by apparel retailers. By late March, retailers like Neiman Marcus, JOANN, Ralph Lauren, LVMH, Canada Goose, and Gap, among many others, had begun taking steps to combat COVID-19 by manufacturing their own masks, gloves, scrubs and even hand sanitizer (Taylor 2020).

- **Nordstrom:** **Face masks.** Nordstrom is teaming up with manufacturing factory Kaas Tailored to have its alterations teams in Washington, Oregon, Texas and California sew more than 100,000 masks. Once made, these masks will be sanitized and donated to Providence Health & Services. Kaas Tailored is currently embarking on a 100 Million Mask Challenge to reach that goal and fill the worldwide need for PPE masks (Taylor 2020).

- **Reformation:** **Face masks.** Reformation is partnering with the City of Los Angeles and Kaiser Permanente to establish LA Protects, which has a goal of manufacturing 5 million non-medical masks for people who need protection, including grocery store workers, non-medical staff in hospitals and others providing essential services during the COVID-19 crisis. The retailer also is selling masks on its site, and shoppers can opt to purchase masks to donate (Taylor 2020).

- **Fanatics:** **Face masks & gowns.** Sports apparel and merchandise retailer, Fanatics plans to convert its Easton, Pennsylvania, facility that makes official MLB jerseys into facilities that
produce masks and gowns for hospital workers, using jersey fabric to produce the products (Crets 2020).

- **PPE by automotive companies:** Ford Motor face masks, respirators, reusable gowns. Ford is now producing face masks, in collaboration with the UAW, at its Van Dyke Transmission Plant for internal use globally. Ford is also leading an effort to scale production of reusable gowns with airbag supplier Joyson Safety Systems for healthcare workers. Production of gowns will be scaled up to 100,000 gowns for the week of April 19 and beyond. Moreover, Ford is working with 3M, the primary US producer of N95 masks, to step up production of the masks and an all-new air-purifying respirator (PAPR). The development team expects the new respirator design will meet the pending National Institute for Occupational Safety and Health (NIOSH) limited-use protocol to respond to the COVID-19 public health emergency, with approval anticipated by the end of April. Since late March, Ford manufacturing, purchasing and supply chain experts have been embedded at 3M manufacturing facilities to help increase production output of PAPRs and N95 respirators at 3M’s US-based manufacturing facilities (Automotive Fleet 2020; Newmarker 2020).

- **PPE by logistics companies:** Schaefer Systems International face masks. Packaging, automation, and material handling system provider Schaefer Systems International Inc. is using its corporate equipment and assets to produce face masks for its clients, retail distribution center employees, and waste collection workers classified as “essential” workers in the fight against the coronavirus. The first prototypes have already been completed, and the company plans to ramp up production to as many as 1,000 masks per week (DC Velocity 2020b).

- **PPE by tech companies:** Google face masks. Google plans to work with Magid Glove and Safety Manufacturing LLC, a supplier based in Illinois, to produce 2-3 million face masks (Crets 2020).

- **PPE by packaging firms:** Fiber Shield disposable face shields. Over 40 packaging firms from 20 countries have come together to create an organization called “Fiber Shield” to create single-use, disposable face shields in response to COVID-19 and the global shortage of PPE for medical professionals. Every participating company is committing to donate at least 100,000 shields. For instance, Zumbiel Packaging committed to providing 200,000 paperboard/poly face shields; while Pawi, Zumbiel Packaging and Pulver Packaging have already committed to donating over 700,000 shields to medical providers in Europe and North America. Together as a group, Fiber Shield is confident that it can produce and distribute over 10 million face shields in the next several weeks (Sookne 2020).

- **PPE by individual tailors and seamstresses:** Face masks. Masks are in increasingly high demand in the United States as officials have advised most people to wear some covering when they go out in public. Unlike the medical-grade masks, civilian protection masks can be quickly constructed by anyone with a sewing machine and some elastic. National, local and individual tailors and seamstress’s have now volunteered to supply, doing what they can to contribute to a supply shortage (Ferrari 2020). Etsy Inc., an online marketplace, also stepped up in rallying this effort, sending a push notification to every craftsperson on its website in the United States: “Calling all sellers. Start making face masks” (Crets 2020).

- **PPE by 3D printing community.** Professional AM providers, makers, and designers in the 3D printing community is coming together with a number of initiatives to respond to the health crisis by volunteering their respective skills and 3D printing capabilities to produce needed masks and
plastic shields, easing pressure on supply chains and governments (Cunnane 2020; Ferrari 2020; Petch 2020).

» **Hewlett Packard: Medical parts.** HP Home & Home Office Store is mobilizing its 3D-printing team and HP’s digital manufacturing partner network to design, validate and produce essential parts for medical responders and hospitals. This includes parts such as ventilator valves, breathing filters and face mask clasps. The company will make available any HP proprietary design files for these parts so they can be produced anywhere in the world (Crets 2020).

» **NASCAR: Face shields.** NASCAR’s research and technology center that uses 3D printing to build composite parts and the next generation of stock cars is now running 18 hours a day to manufacture face shields to donate to hospitals (Cunnane 2020).

» **ZVerse: Face shields.** A 20-person digital manufacturing company, ZVerse has overhauled its business model to become one of the largest producers of reusable face shields in the United States. Leveraging its digital manufacturing ecosystem, the company brought together designers, materials and manufacturing partners to accelerate mass production. ZVerse is currently producing 50,000 shields per day. By mid-April, capacity will grow to 100,000 shields per day (Globe Newswire 2020).

» **SmileDirectClub: Face shields, respirators & testing supplies.** A Nashville-based tele-dentistry company, more widely known for using 3D printing as part of a process to produce dental aligners, is a large scale manufacturer of medical devices and will be using its resources to establish a 3D printing facility focused on producing medical supplies required to respond to the COVID-19 pandemic. The company has swiftly begun 3D printing medical-grade face shields for healthcare workers in March. First shipment of 1,000 shields were sent to St. Luke’s Boise Medical Center one week after the company announced medical supply 3D printing efforts. SmileDirectClub has capacity to print up to 7,500 face shields per day and is accepting orders from healthcare organizations and governmental bodies across the United States and Canada. SmileDirectClub is also working to 3D print and manufacture respirator face masks that may be sanitized and reused repeatedly by healthcare workers. SmileDirectClub is also exploring using its manufacturing capabilities for other needed items such as testing supplies (Petch 2020; SmileDirectClub 2020).

**Human Ventilator Production**

While manufacturers of human ventilators have been ramping-up production, retooling or ramping up production operations takes time, particularly for complex products like ventilators. Unorthodox partnerships emerge to speed the process along by combining expertise and capabilities from different industries and parts of the supply chain (Ferrari 2020; Schoenherr, Talluri, and Verter 2020). Examples are:

» **Human ventilators by automotive companies.** Governments call on domestic auto manufacturers to convert manufacturing and assembly lines to the additional production of ventilators. In response, auto manufacturers are partnering with existing branded ventilator manufacturers to provide manufacturing volume scale to increase output of needed machines (Automotive Fleet 2020; Cunnane 2020; Dow Jones Newswires 2020; Ferrari 2020; Newmarker 2020).

» **Ford Motor.** Ford Motor Co. is working with GE Healthcare to build air-pressured ventilators, with a goal of manufacturing 50,000 units in the next 100 days (Automotive Fleet 2020; Cunnane 2020; Dow Jones Newswires 2020; Ferrari 2020; Newmarker 2020).
General Motors. Of the Big 3, GM was the only one called out by President Donald Trump, who then invoked the Defense Production Act to compel the business to comply on March 27 (Hitch 2020). GM, partnering with Ventec Life Systems, is now making 30,000 ventilators for the national stockpile in a $489.4 million contract with the Department of Health and Human Services. Under the contract, GM is expected to deliver 6,132 ventilators by June 1 and the remainder by the end of August. In order to ramp up production, GM converted its auto-parts plant in Kokomo, IN, into a ventilator factory staffed by paid volunteers from the United Auto Workers union, which represents GM employees (Cunnane 2020; Dow Jones Newswires 2020; Ferrari 2020; Industry Week 2020b).

Toyota. Toyota is building face shields and collaborating with medical device companies to speed the manufacturing of ventilators (Cunnane 2020; Ferrari 2020).

Tesla. Tesla, an electric vehicle and clean energy company, has stepped up to make ventilators, primarily using existing electrical and air conditioning components designed for their vehicles as well as car parts ranging from manifolds to infotainment computer boards. Tesla reportedly delivered 1,000 ventilators so far, with 300 going to Detroit (Ferrari 2020; Hitch 2020).

Human ventilators by Xerox. In a Connecticut-California agreement, Xerox, best known for its office copying machines, is partnering with Vortran Medical Technology to produce single-use, disposable resuscitators for use as backup ventilators during disease outbreaks, mass casualty events and other disasters. Each unit is designed to be used once for a patient in the early stages of respiratory diseases (McCoy 2020).

Human ventilators by Dyson. One surprising entrant into the ventilator race is Dyson. The company collaborated with TTP, a medical technology company, to leverage its expertise in air flow devices like vacuum cleaners and hair dryers, and designed a new type of ventilator, CoVent, in just 10 days (Schoenherr, Talluri, and Verter 2020).

Sourcing Channel Expansion

As the healthcare supply chain has been disrupted by the health crisis and is struggling to handle a demand shock of pandemic magnitude, healthcare providers are struggling to find new way to source supply (Daga 2020; Masini 2020). In this effort, many state and federal agencies, individual companies, non-profit organizations, and software solution vendors are coming together to identify and expand sources for products (primarily PPE and test kits) (Sandler 2020), using virtual channel formats such as B2B marketplace/exchange platforms, virtual clearinghouses, and web portals. Examples are:

Pennsylvania Manufacturing Call to Action Portal. In response to the COVID-19 pandemic, Pennsylvania Department of Community & Economic Development created a new website, Pennsylvania Manufacturing Call to Action Portal aimed to: (1) Match manufacturers and distributors to fill specific supply chain needs; (2) Assist manufacturers that have workforce needs or gaps and aid them in identifying skilled workers; and (3) Identify manufacturers that can pivot or innovate to fulfill the demand for medical supplies and related products (Pennsylvania Department of Community & Economic Development 2020). For more information, please visit https://spportal.dot.pa.gov/ppeinventory/pages/mschain.aspx

The Worldwide Supply Chain Federation global clearinghouse. The Worldwide Supply Chain Federation (TWSCF)—a collaborative, and mutually supportive coalition of open and
multidisciplinary grassroots communities focused on supply chain, innovation, and technology—created a global clearinghouse, in partnership with JOOR, to vet and onboard PPE and related suppliers along with set fixed pricing. This is orchestrated with the help of numerous donations and both US and overseas manufacturers. JOOR, the world’s industry-standard wholesale platform for fashion, beauty and home, is providing TWSCF a private marketplace for their verified suppliers and buyers, which enables instant access for manufacturers, and the ones who need it most on the front lines. Manufacturers are encouraged to participate by going to the TWSCF website to match production capabilities with a list of healthcare products in demand. Healthcare facilities can sign up for the PPE they most need and will be granted access to the private marketplace once onboarded (SupplyChainBrain 2020). For more information, please visit https://theworldwidesupplychainfederation.com/

The Exchange at Resilinc. In response to shortages caused by the COVID-19 pandemic, California-based Stanford Health Care, along with group purchasing organization Premier and Resilinc, a supply chain risk management software company, have created a cloud-based platform for the healthcare industry. The partnership also includes UPS Healthcare. The platform allows hospitals to interact with vetted peer organizations to locate and then initiate the process of borrowing or exchanging items listed on the platform. Medical distributors and other organizations also can use the platform to donate medical supplies, which will be disbursed through an integrated donation center within the exchange. It launches in mid-April and is available at no cost for hospitals and healthcare organizations. The platform is on track to register more than 2,000 hospitals and healthcare organizations by the end of April (Anderson 2020; Resilinc 2020). For more information, please visit https://theexchange.resilinc.com/healthcare/apply/

Protecting People Everywhere. American Hospital Association (AHA) has partnered with Microsoft, Kaiser Permanente, consulting firm Kearney, Merit Solutions, and UPS to launch Protecting People Everywhere, powered by HealthEquip™. This smart app will match individuals and organizations donating PPE with local hospitals based on needs-criteria. Hospitals and donors can register directly at www.health-equip.com (Bathija 2020).

One Network Enterprises healthcare supply chain transparency platform. Supply chain software provider One Network Enterprises has partnered with healthcare solutions vendor Vizient Inc. to create a healthcare supply chain transparency platform that will adds visibility and improves collaboration between healthcare organizations and suppliers, improving the forecast, inventory availability, and consumption of goods. The product is planned to launch by April 20 and will be offered at no cost during the coronavirus crisis to Vizient’s healthcare members, distributors, and suppliers. The platform will support a two-sided marketplace, enabling Vizient members to track supply delivery timeliness and order completion, stock-out risks, and location-based alternatives when disruptions in the supply chain occurs. In addition, it can help Vizient members identify alternative products to source during supply disruptions (DC Velocity 2020a; One Network Enterprises 2020). For more information, please visit https://www.vizientinc.com/our-solutions/supply-chain-solutions

Amazon’s COVID-19 Supplies. Amazon introduced a new section of its B2B marketplaces, Amazon Business, called COVID-19 Supplies. It is seeking to build out its available inventory of PPE, ventilators, digital thermometers, exam gloves, and sanitizers that hospitals and other organizations need for the coronavirus pandemic. The company is investing in significant supplier recruitment and logistics to locate and expedite the delivery of this critical inventory across the globe. It will
waive all standard referral fees for third-party sellers who supply products to this effort. Amazon is currently onboarding thousands of accredited hospitals and government organizations, for which the products will be made available on a “first-come, first-served” basis (Demery 2020). For more information, please visit https://business.amazon.com/en/covid-19

**Dynamic Ventilator Reserve.** A new public-private program was announced on April 14 to aid in distributing ventilators to critical areas in the fight against COVID-19. This collaborative voluntary effort led by a group of US hospitals and health systems has created an online inventory of ventilators and associated supplies, such as tubing and filters, to support the overall needs of combatting the COVID-19 pandemic. Hospitals and health systems will input into the database available equipment that they are able to lend to others in the country. The American Hospital Association (AHA) will manage the virtual inventory and will work with FEMA when this virtual inventory might be needed to supplement the national emergency stockpile. Hospitals and health systems that would like to participate in the virtual network can get more information by contacting the AHA at 800-424-4301 (AHA 2020).

**SEKO CARES.** SEKO Logistics has launched a new SEKO CARES initiative in partnership with Project C.U.R.E., the non-profit humanitarian relief organization, to buy, donate and inspire support for frontline responders treating patients affected by COVID-19. SEKO will be supported in this endeavor by Inspire Marketing Services and Project C.U.R.E., which will help to distribute the equipment to the hospitals, clinics, and local health departments most in need. Until now, Inspire has been responsible for developing and managing the company’s own branded products, but as part of the SEKO CARES team, they are now exclusively focusing on the sourcing, management and distribution of vital PPE donations throughout the United States. These donations will initially focus on the hardest hit areas starting with New York, Chicago, Louisiana and Michigan, where the spread of coronavirus continues to peak for area hospitals. SEKO then plans to widen distribution to other locations such as Arizona, New Jersey, Colorado and Florida as needs arise (Lennane 2020). For more information, please visit https://www.sekologistics.com/us/about/seko-cares/

**Project N95.** Formed in late March, Project N95 helps coordinate the desperate search for PPE by nurses, doctors, fire departments, and others on the frontline of the COVID-19 crisis. A national clearinghouse, Project N95 website, hospitals and others report what supplies they need, and manufacturers and suppliers across the globe indicate what supplies they have, creating valuable demand-supply database (Daga 2020). Key partnerships include United States of CARE, KIND foundation, National PPE Coalition, and US Digital Response (Project N95 2020). For more information, please visit https://www.projectn95.org/

**Emergency Resource Exchange (ERx).** To move vital medical resources during the COVID-19 pandemic where they are needed most, Northwestern University is collaborating with Chicago startup Rheaply to create Emergency Resource Exchange (ERx), a central hub that quickly connects Illinois healthcare providers with supplies. Users will be able to register for free and create a request or listing (Masini 2020). For more information, please visit https://outreach.rheaply.com/covid19-response/

**GEP COVID-19 Help.** GEP, a leading provider of procurement and supply chain strategy, software and managed services to Fortune 500 companies, introduced a free platform and service to identify and connect the PPE suppliers with the health care providers. This service combines an online portal with the company’s procurement and supply chain specialists, for: (1) Suppliers with PPE equipment to be connected with the health care providers in need; (2) Manufacturers/small businesses to be
connected with subject matter experts for help in distributing excess capacity, repurposing equipment, or packaging; and (3) **Health care providers** to provide details of their required PPE products to be connected with suppliers in GEP’s database (GEP 2020). For more information, please visit [https://www.gep.com/covid19help/](https://www.gep.com/covid19help/)

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**Distribution and Logistics Responding Strategies**

Healthcare supply distribution and logistics responding strategies emphasize expediting shipment and increasing transport and logistics service capacity.

- **Public-private partnerships: Project Airbridge.** Coordinated by the US Department of Health and Human Services (HHS) and the Federal Emergency Management Agency (FEMA), the goal of Project Airbridge is to expedite the shipment of personal protective equipment and other supplies critical to COVID-19 relief efforts by fast-tracking shipments via air cargo, instead of traditional ocean shipping (Cosgrove 2020; FedEx 2020). As of April 13, Project Airbridge has completed 37 flights with an additional 43 scheduled for a total of approximately 80 flights. FEMA covers the cost to fly supplies into the US from overseas factories (FEMA 2020c). Companies collaborating in this effort are:

  - **FedEx.** In the first week of April, FedEx contracted with the US government through this effort. FedEx Express delivered its first shipments in the following week as a part of the program, flying PPE from manufacturers in and around Hanoi, Vietnam; Kuala Lumpur, Malaysia; and Shanghai, China, to the United States (FedEx 2020).

  - **UPS.** UPS is managing and brokering 25 charter flights in support of Project Airbridge, leveraging both third-party aircraft and UPS-owned aircraft. In total, the 25 UPS-managed flights will carry more than 3 million pounds of materials—the equivalent of 14 full Boeing 747 freighters. Cargo includes masks, surgical gowns, gloves, medical swabs and thermometers. At
the same time, UPS Healthcare opened a new 450,000-square-foot healthcare distribution center on April 4, with dedicated space for FEMA. The facility is located just a few miles from UPS Worldport, the company’s automated global air hub, in Louisville, Ken (Friedman 2020).

- **DuPont.** DuPont has fully activated 19 garment production facilities across 9 countries to deliver more than 9 million Tyvek® protective suits per month. Two of the initial shipments shipped by FedEx were coordinated with DuPont and included more than 450,000 Tyvek® protective suits. In the weeks ahead, DuPont expects to ship more than 500,000 suits each week to the United States (DuPont 2020; FedEx 2020).

- **Medline.** Collaboration in the Project Airbridge allows Medline to airfreight 24 more container planes of PPE for customers via chartered FedEx Express flights from Malaysia and China to the United States, which contained more than 7 million face masks, additional PPE and anesthesia supplies. Total facemask availability is anticipated to increase, with more than 70 million masks to be shipped in the next six weeks (FedEx 2020; Medline 2020).

- **3M.** Shipment of approximately 10 million FEMA-procured N95 masks from 3M began over the weekend, with the first flight carrying approximately 600,000 masks arriving on April 12. This is the first in a sequence of flights scheduled over the next four weeks (FEMA 2020c).

- **Major medical distributors.** US major commercial distributors—including Cardinal Health, McKesson, Medline Industries, and Henry Schein—are working with FEMA’s Supply Chain Task Force to facilitate the rapid distribution of critical resources in short supply to locations where they are needed most. Per agreements with major distributors, 50 percent of supplies on each plane are for customers within the hotspot areas with most critical needs. The remaining 50 percent is fed into distributors’ normal supply chain to their customers in other areas nationwide. HHS and FEMA determine hotspot areas based on CDC data, providing distributors with up-to-date information on the locations across the country hardest hit by COVID-19 or in most need of resources now and in the future. The distributors have agreed to focus portions of their distributions on these areas (FEMA 2020a; HDA 2020).

- **Logistics-related regulatory relief: Commercial vehicle drivers’ hours-of-service.** The Department of Transportation’s Federal Motor Carrier Safety Administration (FMCSA) issued national emergency declaration to provide hours-of-service (HOS) regulatory relief to commercial vehicle drivers transporting emergency relief in response to the nationwide coronavirus (COVID-19) outbreak. Originally issued on March 13, 2020, and slated to expire on April 12, 2020, the HOS regulatory relief has been extended through May 15, 2020 or until the revocation of the Presidentially-declared COVID-19 national emergency. The HOS regulatory relief is vital to address national emergency conditions that create a need for immediate transportation of essential medical supplies, equipment, and persons (Berman 2020).
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