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Health Care Supply Chains: COVID-19 Challenges and Pressing Actions

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The coronavirus disease 2019 (COVID-19) outbreak has exposed significant glitches in health care supply chains, which are complex and highly fragmented. Health care requires 5 categories of products: pharmaceuticals, personal protective equipment, medical devices, medical supplies, and blood. Each of these categories has a distinct supply chain, and the failure of any 1 of these chains can wreak havoc on the health care system.

Pharmaceuticals

Drugs have long life cycles, their supply chain is global, and pharmaceutical imports are high—44% for branded and 38% for generic drugs—and increasing (1). Many active pharmaceutical ingredients are manufactured only overseas. An estimated two thirds (2) of the active ingredients of generic drugs used in the United States come from China. Italy, Belgium, and the United Kingdom are in the top 10 by dollar value of U.S. pharmaceutical imports (3), as well as by number of reported COVID-19 deaths per capita. Regulatory restrictions and virus-related manufacturing issues are disrupting global supply chains for pharmaceuticals. The United States has benefited so far from a substantial pipeline inventory, which is the result of long supply chains, batch manufacturing (which averts cross-contamination), large-scale production, and 3 months' worth (1) of stockpiled inventory at U.S. pharmaceutical companies. Once this pipeline inventory is depleted, however, shortages could follow. The immediate action plan should be to actively monitor drug supplies—not only within the United States but also back to tier 2 and 3 suppliers. End-to-end transparency will give us advance warning when upstream disruptions occur. A longer-term solution is to reshore drug manufacturing for critical drugs, or at least to develop a dual supply chain in which three fourths of the domestic demand is met by domestic production. This will improve the traceability, resiliency, and responsiveness of our pharmaceutical supply chain.

Personal Protective Equipment

Health care providers treating patients with COVID-19 must be fully protected with gowns, gloves, masks, and face shields. In early March, the nation's emergency stockpile had 12 million N95 respirators (4). The stockpile level should have been much higher, as evidenced by standard analysis of opportunity costs. Because U.S. manufacturing capacity is limited, it would take more than 4 months to fill the need for 300 million respirators (5); this limitation has put providers at risk. Although capacity has increased, new guidance from the Centers for Disease Control and Prevention has increased demand from the general public. The upshot is that providers are now forced to reuse protective masks. States, hospital systems, and the federal government are all competing for the same resources and paying a significant premium over list price—which can be prevented if these entities coordinate their plans. In the long run, a judiciously maintained emergency stockpile, rotated to keep inventory fresh, will prevent this situation from recurring.

Medical Devices

Medical devices have highly regulated supply chains (6). This is both a blessing and a curse: It ensures product functionality, reliability, and quality, but it keeps prices prohibitive. In addition, high entry barriers stifle competition, innovation, and commoditization. For instance, the United States has about 160 000 ventilators (7). Accurately forecasting demand is difficult because of the fluidity of the pandemic situation and the uncertainty surrounding ventilator effectiveness for COVID-19. But shortfalls can be costly, and limited capacity is hampering the few approved U.S. manufacturers from increasing production. Lack of standardization across brands exacerbates this problem (7). Whereas supply chains for computers, automobiles, and smartphones use interchangeable components, ventilators require specially manufactured components, so scaling up capacity is difficult. Augmenting capacity by involving manufacturers from other industries is a good first step. It is also necessary to try new methods, such as 3D printing, which is more versatile and could potentially utilize capacity in university laboratories. Recent initiatives to develop open-source ventilators can help establish alternate supply chains in the short run (although product reliability is at risk). It is also crucial to remember that user interfaces differ across ventilators; they are not like laptops or automobiles, for which switching brands is easy. Acclimatizing to different ventilators places an unnecessary burden on health care professionals, wresting valuable time and energy from patient care. Moreover, switching ventilators for successive patients may result in avoidable inefficiencies. Locations with various ventilator types will require a wider array of replacement parts, increasing the likelihood of mismatches between part availability and need. Therefore, coordinated procurement across the entire U.S. health care system is essential so that homogeneity of ventilators is maintained at each location. Looking ahead, we must create a more agile supply chain for ventilators and other critical medical devices by improving product design and judiciously relaxing underlying regulations.

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MEDICAL SUPPLIES

Medical supplies consist of testing materials, laboratory and intravenous kits, surgical center supplies, and other items, and they constitute a significant proportion of the total expense in a health system (8). Supply chain issues have frustrated response strategies. For example, only 2 companies supply the nasopharyngeal swabs needed to collect testing samples (9). Newer tests and alternate testing protocols (10) are helping now, but building redundancy and developing contingency plans for medical supplies will help prepare us better for the next lethal virus.

BLOOD

Blood has a unique supply chain, theoretically comprising billions of supply points and millions of demand points. Donations are mostly voluntary, with indirect reciprocity as a motive: If I help someone today, someone else may help a loved one or me sometime later. Voluntary donations work well in normal times, but they are problematic now. Blood supplies are low. Social distancing measures make collection at hospitals and community centers difficult, and some potential donors are unwilling to visit blood collection centers. Despite the obvious expense, decentralized collection—with centralized storage and distribution to address demand variability across different hospitals—seems to be the most viable option.

The implications of COVID-19 for the health care supply chains are powerful and far-reaching. Urgent action must be taken to ensure that our supply chains support our health care providers at this critical time and in the future.

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