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JOHNS HOPKINS
SCHOOL *of* ADVANCED
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DIVERSIFYING MEDICAL SUPPLY: LESSONS FROM COVID-19



**COVID-19 Policy Research Task Force
Reischauer Center for East Asian Studies
Johns Hopkins University SAIS
February 2021**



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**By COVID-19 Policy Research Task Force
Reischauer Center for East Asian
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- **COVID-19 shortages for critical medical supplies have accelerated the US focus on reshoring manufacturing capabilities from overseas.**
- **A huge surge in demand has revealed the vulnerability of existing medical supply chain dependencies on China, most notably for personal protective equipment (PPE) and pharmaceuticals.**
- **In light of the pandemic, many countries, including the US and others key partners across the Indo-Pacific, have taken concrete measures to diversify health-related production bases away from China.**
- **Over the long-term, regional initiatives around a “Quad Plus” framework with partners, such as Japan, Australia, India, and Southeast Asia could be instrumental in helping the US to “nearshore” or replace dependency on China for key medical supply.**

INTRODUCTION:

While the trend of US companies shifting production and manufacturing overseas has become more prominent over the last decade, the recent coronavirus pandemic has exposed the faults of becoming over-reliant on a single country for critical medical supplies. As the world recovers from the COVID-19 virus and takes measures to prevent a future pandemic, reshoring—or the process of bringing manufacturing capabilities back home—will be a key national focus and at the forefront of the US policy agenda.

In this report, we layout the “reshoring challenge” accelerated by the pandemic and the dilemma of relying overwhelmingly on one single country or source for production. We assess the US response to shift medical manufacturing and production domestically, China’s role in disrupting global medical supply chains, and the growing attention to regional supply chain initiatives in the Indo-Pacific as the US looks to diversify highly concentrated production bases away from China with trusted allies.

THE CHALLENGE:

While China has traditionally been the primary global supplier of key medical supplies, accounting for more than 40% of all US medical imports, in early February the Chinese government nationalized PPE production and restricted medical exports to the rest of the world to ensure its domestic needs were met.¹ Consequently, the impact of China's export restrictions caused large-scale disruptions, as hospitals and frontline workers in the US experienced severe delays and shortages from overseas manufacturers that were limited in exporting PPE outside of China.

According to the US Food and Drug Administration, 63 US manufactures producing essential medical devices in China were prone to serious disruptions.² For example, 3M—a large-scale US manufacturer of N95 respirations—reported delays as masks produced in its Shanghai factory were sold for domestic use only in compliance with the Chinese government's state-controlled orders.³ More than ninety other countries, including many in Asia and Europe, also imposed embargo limits and formal restrictions on medical exports which limited global supply, according to the World Trade Organization.⁴

When the virus reached the US in late-January and the number of infected cases began to surge, the US government then faced an imminent healthcare crisis as the demand for PPE and medical equipment rose drastically. In February, the Department of Health and Human Services, which oversees the national stockpile of medical supplies, estimated that the US required 300 million N95 respirator masks in the federal stockpile to adequately respond to the COVID-19 outbreak.⁵ However, by March, the remaining US national stockpile had become depleted, with an estimated 12 million N95 respirator masks and only 30 million surgical masks in stock, less than 1% of what as needed.⁶ In terms of gowns, the White House COVID-19 Task Force estimated nearly 200 million were also needed in March, but the US domestic production capacity was well under 15 million, just 7.5%.⁷

Due to limited domestic production capacity and over-reliance on China, US suppliers were thereby unable to meet the rising PPE demands at home which had grave consequences. A survey from the American Nurses Association of over 20,000 nurses, for instance, discovered that 68% of US healthcare professionals since March had to reuse single-use PPE, such as N95 masks, due to persistent shortages and overseas delays.⁸ Additionally, the high demand for PPE created a rise in counterfeit supply further complicating distribution. By June, according to the US Customs Bureau, the US had seized more than 750,000 counterfeit face masks and 107,000 unapproved test kits from overseas—with a majority of violations coming from China and Hong Kong.⁹

In light of these overwhelming challenges to secure critical medical supply, US policymakers have now faced broad public scrutiny to review dependency on China and other countries for essential manufacturing, as well as opportunities to expand production domestically and in nearby markets with close allies.

SNAPSHOT OF US MEDICAL SUPPLY CHAINS

Increasingly the pandemic has revealed the vulnerability of US medical supply chains to countries where production is highly concentrated. In 2019 alone, according to data sourced from the US International Trade Commission, China was the top exporter of PPE-related products to the US by value, as shown in Table 1, accounting for 47.2% of over \$10 trillion in total imports. Even before the pandemic, China has long dominated the PPE market for masks, gowns, and N-95 respirators due to highly subsidized manufacturers that have developed large-scale production capacity.¹⁰

Malaysia, another top supplier of PPE to the US at 16.2%, has seen similar success in mass producing in-need products, such as nitrile medical gloves, at a low-cost rate.¹¹ On a global scale, Malaysia accounts for more than 60% of world supply for disposable rubber gloves, which has led the country to play a key role in PPE production, particularly given its contrasting approach to China over the pandemic with less stringent export restrictions.¹² Other rapidly growing Indo-Pacific economies, like Vietnam and India, have also demonstrated significant potential as global exporters in cheap textiles and manufactured products, yet they have only accounted for 2.5% and 1.6% of total US PPE imports in 2019, respectively. In both countries, fragmented processes between local suppliers and manufacturers along with low-volume production centers have served as significant challenges, or bottlenecks, to scaling up production to meet global demand.¹³

TABLE 1:

**US Imports of PPE-related Products
by Top 10 Sources, 2019**

Country	Value (USD)	Percent Share of Total
China	4,791,595,156	47.2%
Malaysia	1,650,146,772	16.2%
Mexico	839,704,405	8.3%
Thailand	718,216,288	7.1%
Canada	381,081,727	3.8%
Vietnam	249,745,714	2.5%
Taiwan	234,608,334	2.3%

India	158,015,459	1.6%
Indonesia	153,257,390	1.5%
Germany	93,853,105	0.9%

*Data sourced from US International Trade Commission Database.
HS system defined as COVID-19-related “personal protective equipment.”*

Over the last decade, the US trade imbalance for PPE has also widened. US spending on total PPE imports, in general, has increased by nearly 30% since 2012, with China accounting for almost half of US purchases each year.¹⁴ By contrast, domestic PPE exports from the US have remained stagnant, and a mere fraction of total imports, less than 1%. Such data affirms that the US has primarily outsourced essential production for medical equipment, leaving domestic capacity limited in the event of a major crisis, like the COVID-19 pandemic.

At a more nuanced level, as shown in Table 2, China has also been the primary exporter to the US of key “COVID-19 Related Goods,” deemed as essential products by the World Custom’s Organization and the US Commerce Department. In particular, China has ranked as the number one provider to the US for textile face masks, surgical and medical garments, protective goggles, and plastic gloves. Moreover, China has been a substantial manufacturer and exporter to the US of medical devices and COVID-19 related diagnostics tests used largely by hospitals and healthcare professionals.

TABLE 2:

**Select US Medical Imports from China in 2019:
COVID-19 Related Goods**

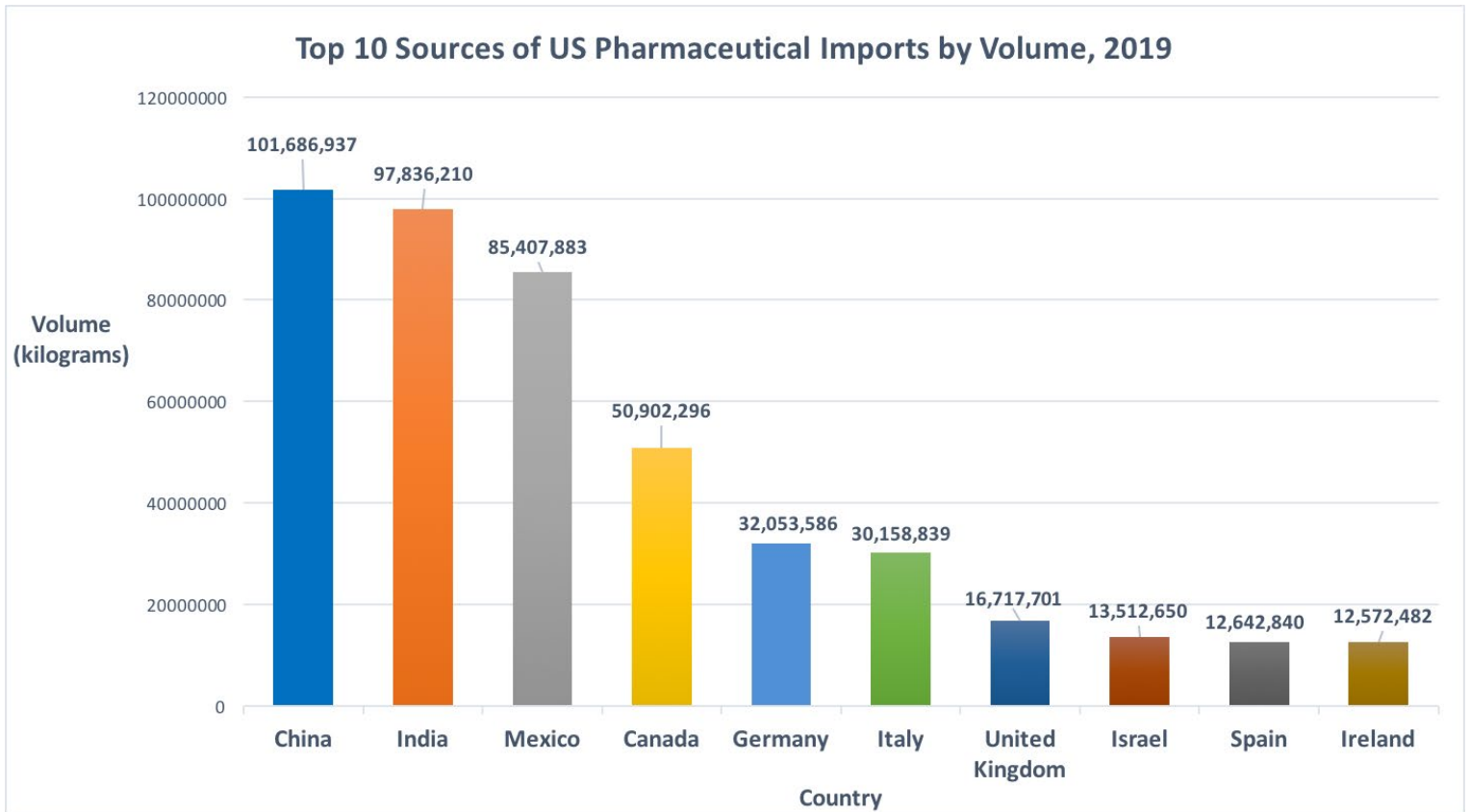
HS Code	Description	China’s Rank	Value (US Dollars)	Share of Total US Imports (%)
Protective Gear				
6307.90	Textile face masks, including surgical masks and disposable marks	1	3,182,965,955	71.8
6210.10	Protective garments for surgical/medical use made up of felt or nonwovens	1	440,561,626	54.3
9020.00	Gas masks with mechanical parts; masks with eye protection or face shields	7	10,002,578	4.0
9004.90	Protective spectacles and goggles	1	503,787,243	54.8

Gloves				
3926.20	Plastic gloves	1	863,056,388	77.2
4015.19	Surgical rubber gloves	3	252,443,610	11.0
Diagnostics				
3822.00	COVID-19 test kits (diagnostic reagents based on polymerase chain reaction nucleic acid test)	7	212,3219,127	5.4
9027.80	COVID-19 diagnostic test instrument and apparatus (used in clinical laboratories for In Vitro Diagnosis)	3	155,359,874	9.5
Medical Devices				
9018.90	Medical imaging, diagnostics, and other equipment	5	758,088,695	5.8
9019.20	Medical ventilators and oxygen therapy apparatus	2	449,688,296	17.0
9022.12	Computed tomography (CT) scanners	4	49,051,037	7.2
9025.11	Liquid filled thermometers	1	15,364,796	20.6

Sources: Data collected from the US Department of Commerce, US Congressional Research Service, and US International Trade Commission's Data Web. Note: 6-digit HS classification system used for items identified by the World Custom's Organization as "COVID-19 Related Goods."

Beyond personal protective equipment and medical gear, the trade data confirms that the US has also relied tremendously on China and overseas manufacturers for prescription drugs and pharmaceuticals, largely outsourcing production for lower cost and less regulation for manufacturers. Since 2012, for example, US imports of pharmaceuticals have more than doubled to \$132 billion in value while pharmaceutical exports by the US have largely flattened, at less than 6% of total imports each year.¹⁵ In addition, China was the top supplier of pharmaceuticals to the US by volume in 2019 at 101.6 million kilograms or 18.5% (Figure 1). India and Mexico followed closely at 17.8% and 15.5%, respectively, showing potential to eclipse China with greater investment in future manufacturing capacity. China, however, has extended its strong grip on certain in-need drug products, accounting for 97% of antibiotics, 95% of ibuprofen, and about 40% of penicillin and heparin imports imported by the US, according to the US Commerce Department.¹⁶ This has led many US lawmakers, as a result, to worry about the "national security risks" stemming from China's dominant role, particularly given the Chinese government's ability to cut back supply or manipulate prices during a crisis.¹⁷

FIGURE 1



Data sourced from the US International Trade Commission, HS-30.

By value, though, European countries have become the top exporters of high-end pharmaceutical products to the US, as highlighted in Table 3 below. Ireland, Germany, and Switzerland, for example, combined have accounted for 48.2% of all US pharmaceutical imports (by value) in 2019. Of note, the US has relied extensively on companies in Ireland for nearly 61% of remdesivir imports, a costly FDA-approved drug that has been used to treat COVID-19 patients at up to \$1,300 per treatment.¹⁸ Compared to the US, many European countries have been able to maintain such a sizeable share of domestic production among companies due to relatively vast government subsidies and advanced research programs that foster innovation and help these companies off-set the costs of production.¹⁹

TABLE 3:

**US Imports of Pharmaceuticals
by Top 10 Sources in Value, 2019**

Country	Value (USD)	Percent Share of Total
Ireland	29,941,412,236	22.7%
Germany	17,384,724,249	13.2%
Switzerland	16,199,981,152	12.3%
Italy	7,680,798,675	5.8%
India	7,596,893,039	5.7%
Belgium	6,577,089,689	5.0%
Denmark	6,385,550,525	4.8%
Canada	5,301,455,656	4.0%
United Kingdom	5,101,366,559	3.9%
Japan	4,262,335,325	3.2%

Data sourced from US International Trade Commission Database, HS 30 classification system.

Yet, even with a more diversified flow of US pharmaceutical imports (by value and volume), relative to PPE, there are still underlying dependencies tracing back to China that raise concern for US policymakers. For instance, the US International Trade Administration estimates that 75-80% of US imports for Active Pharmaceutical Ingredients (APIs)—the chemical stimulant of finished medical drugs—are sourced from China and India.²⁰ More concerning, India, which supplies approximately 40% of generic pharmaceuticals to the US, imports 70% of its starting API requirements from China.²¹ Thus, the percentage of APIs from China to the US is likely underrepresented, and even greater than realized, as China continues to be a major supplier of initial raw ingredients and deeply embedded in the development process and supply chains of many countries producing pharmaceuticals.

In order to overcome these dependencies on foreign medical supply, which have intensified and been exposed since the pandemic, US attention has shifted substantially to the reshoring of manufacturing capabilities as a viable solution to secure new production capacity. As former US trade representative Robert Lighthizer has put, “over-dependence on other countries as a source of cheap medical products has created a strategic vulnerability” that must be addressed over the long-term.²²

THE US RESPONSE: MOBILIZING MANUFACTURING TOWARD PPE

- **Over the course of the pandemic, PPE needs have ebbed and flowed which has required the US to adapt its supply chains strategy.**
- **By investing in new public private partnerships, the US has raised its profile as a potential manufacturing hub for critical medical supply.**
- **Strong bi-partisan support exists to diversify US medical supply chains away from China and to create more resilient production bases at home.**

In order to mitigate COVID-19 related disruptions from overseas suppliers, the US government has taken serious measures to speed the domestic production of medical equipment. On March 25, 2020 the US Congress passed the Coronavirus Aid, Relief, and Economic Security (CARES) Act—a \$2 trillion economic stimulus holding noteworthy provisions to investigate US medical supply chains, as well as new funding for federal agencies to buy domestically made medical supply and incentivize production.²³ The US Department of Health and Human Services, for example, received \$8.4 billion in funds to foster a broad range of public-private manufacturing partnerships that would help to replenish the US Strategic National Stockpile with necessary equipment.²⁴

In a span of months, the US had then mobilized its industry in an unprecedented way to reduce its dependency on off-shored manufacturing facilities, despite initial delays. Under the Defense Production Act, a list of large-scale US manufacturers, including General Motors, General Electric, 3M, Hill-Rom, Medtronic were compelled by the Trump administration to redirect their ongoing domestic production to help overcome supply shortages in ventilators and masks.²⁵ Ford Motor Company and General Electric, for example, expanded their manufacturing capacity to produce 50,000 ventilators in less than a hundred days in Michigan.²⁶ The Department of Defense had also awarded \$133 million in contracts to accelerate production of N-95 masks.²⁷

By the end of the summer, US companies had collectively produced nearly 181,000 ventilators and 166.5 million respirators on priority contracts, according to reports by the US Government Accountability Office.²⁸ As a testament of this manufacturing capacity, over 8,000 surplus ventilators were donated by the US to 37 developing countries, revealing the US capability at becoming a potential global supplier. By September, the US had also reached a capacity to sustain and produce over 140 million N95 respirator masks a month, far surpassing its monthly production in April of 40 million masks.²⁹

As the need for PPE continued to intensify, the reshoring of manufacturing capabilities also garnered substantial congressional interest, as the number of bi-partisan bills to secure and protect US medical supply grew. US senators from opposing parties, for example, have joined forces to investigate the national security threat of overreliance on Chinese prescription drugs and pharmaceuticals.³⁰ Others have introduced a \$5 billion

plan to replenish the strategic national stockpile with necessary medical devices, PPE, and drugs to ensure pandemic preparedness over the next ten years.³¹ Most recent legislative action includes:

- H.R. 7548, Made in America: Preparation for a Pandemic Act
- H.R. 7574, Strengthening America’s Strategic National Stockpile Act
- H.R. 7594, The Reshoring Manufacturing Act
- S. 4158, PPE Supply Chain Transparency Act
- S. 4191, US Pharmaceutical Supply Chain Act

Following the November 2020 US Presidential Election, the newly elected Biden administration has further proposed a number of significant policy initiatives to strengthen domestic supply chains, including an “Offshoring Tax Penalty” to reduce US companies from outsourcing manufacturing jobs. As a part of his administration’s broader “Made in America” proposal, US companies would face a 28% corporate tax rate, plus a 10% offshoring surtax, on profits for any production of goods delivered from overseas.³² At the same time, the proposal offers a 10% tax credit to incentivize investment in manufacturing at home for critical material and medical supply.

Contrary to the Trump administration’s frequent delays and de-centralized approach to using the DPA, the Biden administration has also taken a strong federal position in its first weeks to boost manufacturing for the most in-demand PPE items. In particular, the White House has mobilized the private sector to build raw material plants for nitrile medical gloves, as well as separate factories to produce the gloves.³³ By the end of 2021, they estimate the US will be able to produce more than a billion surgical gloves a month, reducing dependency on overseas suppliers in China and Malaysia, which have consumed the majority of US glove imports combined.³⁴

In recent weeks, national attention has also shifted drastically to the production of rapid at-home test kits to strengthen and expand contact tracing. According to the US Department of Defense, the Biden administration has signed a \$231.8 million contract with Australian company Ellume to onshore production of its FDA-approved test kit and secure 61 million tests by the end of the summer.³⁵ Once built, the US-based plant will have a production capacity of nearly 640,000 tests per day, allowing the US to “rapidly surge domestic testing capability” for a greater portion of the population.³⁶

In sum, these newly targeted reshoring initiatives and private-public partnerships have demonstrated the US ability to become more self-sufficient and resilient against future supply chain disruptions. With the creation of new manufacturing plants at home and expanded production capacity among current companies, there is also great potential for the US to become a primary exporter in certain healthcare products, such as ventilators and test-kits, allowing the US to emerge as a leader in the global health recovery.

US-CHINA TRADE TENSION: A CONTRIBUTING FACTOR TO RESHORE

- **Trade friction has driven uncertainty about China’s market, leading US companies to consider alternative production bases, long before COVID-19.**
- **China’s global manufacturing role is gradually waning due to rising labor costs in traditionally cheap and low-skilled sectors.**
- **Escalation over trade could push some US companies to expand further into Southeast Asia where production footprints already exist.**

While the pandemic has certainly accelerated the focus on reshoring, the deteriorating economic relationship between the US and China has also been a compelling factor for many US companies to rethink and adjust their supply chain dependencies. According to a 2020 survey by the US-China Business Council, the increased costs from US-China trade uncertainty served as the number one reason US companies have been reducing their investment in China, followed by the pandemic’s economic consequences.³⁷

In particular, the Trump Administration’s Section 232 tariffs on Chinese steel and aluminum have gradually increased the costs of manufactured products from China, leading US companies to search for cost-effective alternatives back home and in neighboring countries to bypass tariffs.³⁸ US manufactured imports from China, for example, dropped nearly 17% or \$88 billion over 2019.³⁹ To date, the US government has also imposed up to 25% tariffs on \$370 billion in Chinese goods, which has further aggravated the trade environment and prompted China to respond with \$185 billion in retaliatory tariffs on US products.⁴⁰

As a result of this expanding trade protectionism in both countries, there has also been a renewed national security imperative in the US to diversify key supply chains in manufacturing and technology away from China.⁴¹ Exacerbated by the Chinese government’s \$300 billion “Made in China 2025” industrial plan, the US has viewed China’s control and leverage over these strategic supply chains, primarily through forced technology transfers and intellectual property theft, as “unreasonable and discriminatory.”⁴² Equally concerning has been the Chinese government’s targeted subsidies to reach 70% self-sufficiency in high-tech industries and “basic core components and materials,” which would put US companies at a competitive disadvantage.⁴³

Additionally, factors in China such as rising labor costs and the risks of operating supply chains further away from markets have all compounded the growing concerns of US companies remaining in the country. In low-value industries, such as textiles and garments, labor costs in China have consumed roughly two-thirds of the revenue, making these low-cost production sectors twice as expensive as in neighboring Asian countries.⁴⁴

Vietnam, as a result, has become a large beneficiary of the US-China trade fallout, witnessing its manufactured exports to the US spike by \$14 billion in 2019, while Chinese manufactured goods dropped, as previously mentioned, by 17%.⁴⁵ Such evidence confirms, that some US firms have begun to divert their production away from China to nearby markets, despite an overall reluctance to leave over the long-term.⁴⁶

Meanwhile, there have also been some notable successes towards domestic reshoring. Major US technology and manufacturing companies, including Apple, Whirlpool, and Stanley Black and Decker, for example, have all committed to not expanding their production in China and bringing more manufacturing jobs back home, as described by former US trade official Robert Lighthizer.⁴⁷ Alternatively, growth in US manufacturing output has been another measure to quantify recent reshoring efforts. For instance, the five-year trend of rising manufacturing imports to the US from fourteen Asian countries, including China, fell 7.2% in 2019, from \$816 billion to \$757 billion in value, according to the Kearney Reshoring Index.⁴⁸ By contrast, US manufacturing output the same year increased by 6% to \$6.27 trillion in value—a sign that new domestic manufacturing capabilities have begun to substitute existing US supply chain dependencies in Asia.

IS RESHORING THE ANSWER?

- **Reshoring does not necessarily guarantee immediate resilience, as shifting health-related production requires long-term investment and time.**
- **Many Asian countries, including governments from Japan, Australia, and India have already begun to take concrete steps individually and together to restructure their supply chains outside of China.**
- **Moving forward, a “Quad Plus” framework could be instrumental in helping the US to replace dependency on China for key medical supply and to create more diversified production bases.**

As a consequence of the pandemic, countries are now coming under greater political pressure to reduce their dependency on China for critical medical supplies. In the past, many US companies have sought to reshore manufacturing for a variety of reasons, including closer supply chains, rising labor costs in foreign markets, the risks of losing intellectual property rights, as well as the “hidden costs” of off-shoring.

While the COVID-19 pandemic has revealed these vulnerabilities in global supply chains, especially those for PPE and pharmaceuticals from China, the complete reshoring of medical production is not entirely viable without considerable long-term investment, infrastructure, and time. If not done correctly, the expenses of transitioning production

from overseas could also exceed the profit, making the costs less worthwhile.⁴⁹ Many US companies, in fact, still rely heavily on China for low-end products and secondary parts. In addition, approximately a third of US exports are composed of parts made around the world.⁵⁰ Given this complex interdependence on global value chains, the relocation of some portions of medical supply production back home, as well as to trusted Indo-Pacific partners could make the US less dependent on China and more diversified over time.

NEARSHORING: AN OVERVIEW OF STRATEGIC ALLIES

In the long run, “nearshoring” efforts—the process of transferring production to geopolitically important locations relative to current manufacturing hubs—will become increasingly necessary as the US looks to de-risk and restructure medical supply chains away from China. The Indo-Pacific region, particularly, offers great potential and opportunity for engagement, as being home to the world’s fastest growing markets and half of the global population. It is, therefore, important for the US to understand the ongoing supply chain efforts of strategically aligned allies in the region, who are also diversifying and expanding their healthcare production as a result of the pandemic.

Multilaterally, for instance, the US may seek to utilize diplomatic coalitions to shape and develop the region’s supply chain markets. Notably, the new COVID-19 Supply Chain Resilience Initiative (SCRI) launched by the trade ministers of Japan, Australia, and India in September 2020 could be a key partnership to strengthen alternate production bases around a “free, fair, inclusive, and non-discriminatory” trade environment.⁵¹ While the program is still in an early stage, this initiative poses a unique opportunity for the US to potentially join and extend traditional security cooperation with members of the Quadrilateral Strategic Dialogue (QUAD) to focus on building regional health infrastructure and supply chains more broadly across the Indo-Pacific.

Under the Trump administration, the US-created “Economic Prosperity Network,” a regional framework developed in the wake of COVID-19 with Japan, Australia, India, New Zealand, South Korea, and Vietnam could also prove fruitful as a group of like-minded partners to restructure global supply chains.⁵² This type of “Quad-Plus” framework is greatly expansible, so it could be adjusted to include new partners and attractive destinations for partnership. As US policymakers consider these different options to strengthen supply chains, the following section unpacks the COVID-19 measures key Indo-Pacific allies have taken to diversify and strengthen their own health production. Understanding these critical partner initiatives can better help the US align its own supply chain policies moving forward.

**A “QUAD PLUS” STRATEGY:
DE-RISKING SUPPLY CHAINS WITH INDO-PACIFIC PARTNERS**

	Japan	Australia	Vietnam	India
Gross Domestic Product (USD, 2019)⁵³	\$5.08 Trillion	\$1.39 Trillion	\$261.92 Billion	\$2.87 Trillion
IMF World Outlook Indicator for 2021 (year-over-year % change)⁵⁴	2.3% Advanced Economy	3.0% Advanced Economy	6.7% Emerging Market	8.8% Emerging Market
Total COVID-19 cases per 1 million (as of 2/8/21)⁵⁵	3,408 Cases	1,131 Cases	20 Cases	7,720 Cases
COVID-19 Fatality Rate (as of 2/8/21)⁵⁶	1.6%	3.2%	1.8%	1.4%
Pharmaceutical Industry (by value)⁵⁷	\$87 Billion	\$25 Billion	\$6.5 Billion	\$37 Billion
Reshoring Measures OR Current Business Environment	<ul style="list-style-type: none"> - \$2.05 billion subsidy program to diversify medical production of Japanese firms. - Targeted expansion in Japan and Southeast Asia. 	<ul style="list-style-type: none"> - \$1.5 billion subsidy program to encourage domestic manufacturing. - Tax incentive program. 	<ul style="list-style-type: none"> - Low-wage labor, low-cost production. - Strong investment climate. - Growth in free-trade policies. 	<ul style="list-style-type: none"> - \$1.3 billion incentive scheme to expand production of 53 key APIs and medical drugs. - 3 new drug manufacturing parks
Market Challenges	<ul style="list-style-type: none"> - Reliant on Chinese manufacturing in other industrial sectors. - Selectively decoupling production from China. 	<ul style="list-style-type: none"> - On the back-end of long, complex medical supply chains. - Exposed to Chinese tariffs and trade pressure. 	<ul style="list-style-type: none"> - Quality control issues for highly regulated overseas markets. - Intermediate goods largely sourced from China. 	<ul style="list-style-type: none"> - APIs and starting drug materials mostly imported from China. - Intellectual property right concerns. - Rising drug prices.

JAPAN: Long-term Diversification of Healthcare Production

- **Japan has invested substantially in the reshoring and diversification of medical supply chains from China to Southeast Asia.**
- **The US and Japan could better coordinate and align aid to develop emerging Indo-Pacific healthcare markets and supply chains.**
- **Capital investment is one way for Japan to be more involved in areas of med-tech development and reshoring.**
- **Economic interdependence with China still poses challenges for Japan.**

Like the US, the COVID-19 pandemic has prompted Japan to rethink its medical supply chains. However, this is not the first time that Japan has had to seriously consider geopolitical disruptions. In 2010, Japan dealt with politically motivated restrictions by the Chinese government on rare earth exports (REEs), which caused an enormous shock to Japanese supply chains that imported 82% of rare earth materials from China.⁵⁸ Since then, the Japanese government expanded its national stockpiles and diversified its REE flows, having learned the consequence of over-reliance on a single country.

The COVID-19 pandemic, however, has yet again highlighted this important policy lesson and the need for diversified supply chain partners. In direct response to disruptions in medical production from China, the Japanese government developed a \$2.3 billion subsidy program to incentivize Japanese companies to move their supply production back home or to Southeast Asia.⁵⁹ While over 1,600 Japanese companies have applied to the program, 87 companies were selected as of June 2020, and 57 of them have committed to returning to Japan with 57.4 billion yen (\$545 million) in government assistance, while the remaining 30 look to shift production to Southeast.⁶⁰

Japan's COVID-19 subsidy program, in particular, has targeted in-need healthcare equipment. Japanese mask maker and subsidy recipient Iris Ohyama, for example, which has traditionally relied on a manufacturing facility in Suzhou, China has shifted its production to Miyagi, Japan to produce 150 million masks a month.⁶¹ Additionally, 46% of Japanese companies that applied to the program have already implemented plans to diversify their supply chains due to rising labor costs in China, according to a September 2020 poll by the Nikkei Shimbun and the Japan Center for Economic Research.⁶² Even then, non-health related companies, such as the well-known Japanese semiconductor maker Rohm, have participated in this broader "China exit" given new technologies and automated production lines that help to reduce labor costs elsewhere.⁶³

Beyond the subsidy program, Japan could also prove to be a significant partner for the US in helping to develop and co-finance healthcare markets in emerging Indo-Pacific countries. Since the pandemic, Japan's International Cooperation Agency (JICA) has provided substantial aid and investment through a COVID-19 Crisis Emergency Response

Support Loan to help governments respond to the pandemic and revitalize their economies.⁶⁴ More specifically, the Japanese government has issued over \$475 million loans (50 billion yen) to strategic regional partners, including India, Vietnam, the Philippines, and Bangladesh to build their healthcare capacity.⁶⁵ In the past, JICA has also partnered with the Asian Development Bank to co-finance over \$10 billion in the region's public infrastructure as a way to foster industrialization and improve supply chains.⁶⁶ By better coordinating regional aid and investment in the post-COVID world, both Japan and the US could further develop and ensure access to these growing healthcare markets.

More recently, capital investment is another avenue for Japan to contribute immensely to the development of new healthcare technologies. For example, Japan's technological advantages in stem-cell engineering, regenerative medicines, and robotics have led a number of advanced Japanese manufacturing companies to invest in the medical technology (med-tech) sector.⁶⁷ The acquisition of Toshiba Medical System, for instance, by the multinational Japanese film company Cannon has turned Toshiba into a top supplier for global diagnostic imaging and medical devices, providing Japan a comparative advantage in the medical field.⁶⁸ JSR, one of Japan's leading chemical companies, has also expanded inorganically in the med-tech market by acquiring a number of smaller companies and leveraging its in-house capabilities to develop new products.⁶⁹

In the near future, Japan's growth and innovation in the med-tech sector particularly shows great promise, as Japanese companies have secured twice the number of global patents compared to pharmaceutical peers.⁷⁰ Additionally, given that Japanese med-tech companies have built a strong net cash flow from being less involved in M&A transactions previously, they are uniquely positioned now and have the flexibility to invest in overseas markets and expand their presence in major tech hubs.

While Japan has taken a number of notable actions both nationally and in the private sector to diversify production away from China and to foster reshoring, the Japanese government still faces pushback from some larger companies, claiming that shifts elsewhere could be unnecessarily expensive and disruptive to current supply chains.⁷¹ Over time, as well, Japan's trade relationship with China has become more indispensable as China is Japan's largest trading partner, accounting for 23.9% of Japanese imports in 2019, or \$28.39 billion in goods.⁷² Cumulatively, Japanese companies have also invested over \$139 billion in China, making bilateral trade a central figure to both sides.⁷³ Hence, the challenge for Tokyo remains how to avoid entirely decoupling its economy with China, which would invariably compromise other industries, while still diversifying health-related manufacturing at home and across the region to reduce future supply chain risks and interruptions.

SOUTHEAST ASIA AND AUSTRALIA: Fast Growing Alternatives for Supply Production

- **The US should seize investment opportunities in Vietnam’s medical supply chains. A revised commercial framework could reduce barriers.**
- **Vietnam has enormous potential as a key supplier of PPE, having redirected textile manufacturing to expand mask production.**
- **In Southeast Asia, Singapore’s has established itself as a rising hub for biotechnology, pharmaceuticals, and medical research.**
- **Regional health security with Southeast Asia and Australia is paramount for sustaining a future economic and health recovery.**

In light of the pandemic, members of ASEAN (the Association for Southeast Asian Nations) have become promising destinations for the relocation of medical production. The ten-country bloc representing over 650 million people is heavily integrated in the region’s supply chains and manufacturing, valued at over \$25 billion in total pharmaceutical and medical production.⁷⁴ As a whole, the region also accounts for almost a third of US PPE imports, with Malaysia, Thailand, and Vietnam as significant exporters of textiles, gowns, masks, and rubber gloves.⁷⁵

Among countries, Vietnam has especially fared well in keeping its supply chains open and managing the spread of the coronavirus, which has made the nation a top contender for “near-shoring” production away from China. In the first two months of the pandemic, for example, Vietnam’s manufactured exports expanded by 8% absorbing some of the reduced manufacturing output by Chinese factories.⁷⁶ To attract foreign business and investment, Vietnam has also launched a national plan to license medical exports and increase domestic PPE production capacity by 40% for nearly two hundred companies that export textiles overseas.⁷⁷ In addition, new resolutions at the national level have helped Vietnam to ensure that its widely in-demand products, such as textile face masks, meet international manufacturing standards for distribution.⁷⁸

As a result of Vietnam’s promising reform and openness to trade, many foreign companies have thus increased their investment over the course of the pandemic. Most notably, US-medical device company Medtronic has partnered with Vingroup, the largest conglomerate in Vietnam, to expand the country’s domestic production of core components for ventilators sold in the US and Europe. In less than a year, Medtronic also expects to expedite over 50,000 ventilator units from Vietnam, with 70% of the parts supplied locally.⁷⁹

While the US-Vietnam trade relationship is certainly growing, one place for improvement could be at the country level with a revised free trade agreement that fosters greater private sector industry collaboration. Many European healthcare firms, for instance,

have chosen Vietnam as a low-cost alternative to China and increased their direct investment, largely facilitated by the new European Union-Vietnam free trade agreement that has eliminated 99% of tariffs between EU members and Vietnam.⁸⁰ Swedish biotech company Astrazeneca, for example, has committed to investing \$250 million over five years to build Vietnam's healthcare industry, citing new market reforms around the trade deal as a top reason.⁸¹ By developing a similar free trade agreement at the country level with Vietnam that builds on the long outdated 2001 version the US could also incentivize major new private sector investment in Vietnam to help develop its health sector and manufacturing capacity.

In Southeast Asia, Singapore has become another important source for medical supply to the West, as a leading hub for business innovation, biotechnology, and high-end medical products. Despite a population of a under 6 million people, Singapore is home to more than 50 regional headquarters of premier medical technology firms, along with 25 established research and development centers of multinational companies.⁸² In addition, Singapore has a skilled pharmaceutical workforce of over 6,000 workers and hosts manufacturing centers of 8 of the top 10 global pharmaceutical companies—making it an alternative to produce key starting chemicals and medical drugs that many countries rely on from China. In the med-tech sector, especially, Singapore has enormous potential to expand its capacity, being home to 220 start-ups and small-to-medium businesses currently developing innovative solutions and next-generation medical technology.⁸³

As an emerging Indo-Pacific power, Australia, too, has taken considerable action to enhance its role in global supply chains and strengthen its manufacturing capabilities of medical equipment. To reduce reliance on China and diversify production, the Australian government under Prime Minister Scott Morrison has pledged \$1.5 billion in new investment over the next four years through its Modern Manufacturing Strategy, particularly targeted at the healthcare sector.⁸⁴ Realizing the importance of a multilateral approach, as well, the Australian government has allocated \$107.2 million in funds towards the trilateral Supply Chain Resiliency Initiative (SCRI), led alongside Japan and India to address shortages of critical medical supply flows.⁸⁵ In terms of building regional health security, Australia has the potential to be another leading voice and contributor among the US and Japan, having established the Indo-Pacific Health Security Initiative in 2017 and committing a \$300 million fund to fight infectious diseases.⁸⁶

By incorporating both Australia and Southeast Asia more deeply into regional health and supply chain initiatives, the US has an opportunity to strengthen ties with like-minded partners while also investing in growing healthcare markets that have remarkable potential for enhanced production.

INDIA: An Emerging Pharmaceutical Powerhouse and Health Partner

- **India is central to the region’s future health security.**
- **Both the US and India will be key players in the development of medical supply trade, as health and research collaboration between the two grows.**
- **India has strengthened at-home manufacturing for key pharmaceutical ingredients imported from China, in a plan to boost its self-sufficiency.**

Over the pandemic, US focus has shifted to India as another ideal partner to supplement existing trade dependencies on China. Particularly, over the years India’s trade relationship with the US has strengthened, as the US has become India’s largest export market for goods in 2019, with a two-way trade flow of over \$92 billion.⁸⁷ US officials, in particular, have taken special interest in India’s “rising position” in the global medical market, as India is the second largest exporter of pharmaceuticals to the US, and the US is the biggest supplier of medical devices to India.⁸⁸

Like many other countries, however, the pandemic has exposed India’s over-dependence on China, most notably for starting Active Pharmaceutical Ingredients (APIs)—of which 70% are estimated to come from China.⁸⁹ While the Indian government has previously recognized this vulnerability, India’s Prime Minister Narendra Modi has committed new initiatives since the pandemic to address the country’s underlying dependency. In July 2020, for example, India passed a \$1.3 billion national healthcare package to develop three new bulk drug parks.⁹⁰ Importantly, the package focuses on expanding domestic production for 53 Key Starting Materials (KSMs) and APIs that India has traditionally relied on China for making pharmaceutical drugs. Most notably for close allies like the US, this new initiative is a welcoming sign that India is evaluating the security of its entire production chains and building resilience against disruptions that have secondary consequences and impose delays on global markets.

Under Prime Minister Modi, India has also enacted a separate five-year Production Linked Incentive scheme to increase domestic manufacturing over the long-term, particularly for technology and pharmaceuticals.⁹¹ The \$6 billion plan offers initial subsidies to both domestic and foreign companies to produce goods locally in India, in a substantial effort to make India’s manufacturing market more competitive in obtaining foreign direct investment compared to neighboring markets in China and Vietnam.

In terms of building regional health security, there is also vast potential for the US and India to foster greater collaboration. For instance, the US has seized on the opportunity to support India’s pandemic response, providing more than \$26.6 million in funding to facilitate joint research projects between US and Indian companies that are developing and testing vaccines, diagnostics, and treatments.⁹² Additionally, the US Agency for International Development has helped India train over 46,000 health workers, 79,000

frontline COVID-19 workers, and supported 961 health facilities, in an effort to bolster the country's healthcare capacity and strengthen people-to-people ties.⁹³ Deepening US-India health cooperation in such promising areas of research development and training will allow both countries to contribute more concretely to a regional and global recovery.

While there is certainly momentum in the US-India partnership given India's emerging role in health and global supply chains, there still remain some concerns overall regarding India's industrial policies on intellectual property rights and data localization rules that may pose challenges to future investment and trade cooperation. As the two largest democracies in the world, however, there is great potential for the US and India to lead bilaterally and multilaterally in strengthening global supply chains and ensuring a long-term economic and health recovery.

A FORWARD OUTLOOK

In this report, we find the COVID-19 pandemic has largely accelerated the trend by many countries to reshore and diversify manufacturing capabilities. Essential medical products highly concentrated in China have garnered the most focus as they are still widely in demand by healthcare professionals and the global population. Reshoring of itself, though, will not solve the problem of supply shortages. While increasing manufacturing at home will certainly help secure health-related products and increase domestic job growth in the near-term, a full retreat from global supply chains will pose substantially more risks and cut US production bases off from other essential trade flows.

A strategy that, instead, incorporates diversified production bases at home and abroad through "near-shoring" and new bilateral and multilateral frameworks could prove to be most resilient in the post COVID-19 world. We outline three policies the US could take to secure medical supply chains over the long-term:

1) Diversifying Regional Production and Sourcing for Medical Products

In part to reduce dependency on a single export market, the US should strategically align with like-minded countries and allies who also seek to diversify sources of critical medical supply and pharmaceuticals. There is ample opportunity in the Indo-Pacific, a region home to some of the fastest-growing economic markets and a number of US treaty allies. By extending traditional security and geopolitical partnerships to include health and medical cooperation, such as with the "Quad" members, the US can develop a more robust regional health architecture to address future supply chain challenges. Diversification among a range of economies will also minimize the risk of being overexposed to supply shocks unique to a single country, such as politically motivated restrictions, natural disasters, or other unexpected circumstances that may impede free and open trade flows.

2) Aligning and Coordinating Development Assistance for New Alternatives

To enable a steady pathway for firms to diversify their production bases away from China, there is value in using bilateral and multilateral aid agencies to finance and develop critical supply chain markets in emerging Indo-Pacific countries. The US and Japan, for example, could leverage their robust aid and investment programs to deepen cooperation with countries, such as Vietnam and India, and support them in becoming more significant players in global and regional medical supply production. Doing so may require new interactive bilateral and regional dialogues of cooperative finance, as well as including specialist attached to overseas diplomatic and commercial posts.

Collaborative investment projects between the Japan Bank for International Cooperation (JBIC) and the US Development Finance Corporation (DFC) could also greatly enhance Indo-Pacific supply chain markets. While US-Japan projects have previously focused on improving hard infrastructure and connectivity across the region, mobilizing similar finance schemes to build resilient healthcare supply chains—for the production and distribution of PPE, ventilators, medical drugs, and vaccines—could be especially useful in sustaining a regional economic and health recovery.

3) Boosting Domestic Manufacturing within the Larger Diversification Strategy

While the COVID-19 pandemic has exposed the vulnerability of US medical supply chains to China, it has also posed a national imperative to diversify production, with domestic manufacturing as a core component. In his first days in office, for example, President Joe Biden signaled his intent to expand domestic production to address supply shortages by signing the Executive Order, “A Sustainable Public Health Supply Chain.” Moreover, the president’s national strategy on COVID-19 explicitly requires “Buy American” provisions to boost government spending on domestic manufacturing for PPE and vaccines, in addition to pursuing a multilateral-based approach with allies.

In the long-run, such manufacturing capacity at home will not be a replacement for the large amount of medical supplies that the US currently relies on through global supply chains. Rather, these new initiatives should help to supplement and diversify current supply flows. In a post-COVID world, a diverse network of Indo-Pacific supply chain partners paired with a resilient and expanded manufacturing base at home will help the US to reduce the shock and intensity of any future disruptions.

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