

GHSC-PSM COVID-19 TECHNICAL BRIEF: GLOBAL SUPPLY CHAIN, MARCH 2020–MARCH 2021

KEEPING OUR COMMITMENTS: AGILITY IN THE FACE OF COVID-19 DISRUPTIONS TO THE GLOBAL HEALTH SUPPLY CHAIN

EXECUTIVE SUMMARY

On March 11, 2020, the World Health Organization (WHO) categorized COVID-19 as a pandemic. The unprecedented scale and rapid spread of the virus tested the strength of existing structures and exposed the weaknesses in health systems around the world. Several months before that declaration, the USAID Global Health Supply Chain Program-Procurement and Supply Management (GHSC-PSM) project was already feeling and responding to the impacts of the pandemic on its global health supply chain.

The global health supply chain needed to simultaneously incorporate a surge of commodities to address the pandemic while maintaining the reliable supply of commodities that keep critical health programs running and patients safe. Upstream closures of factories, offices, warehouses, and transport companies, as well as shortages of key starting materials (KSMs), active pharmaceutical ingredients (APIs), packaging, and workforce adversely affected manufacturing capacity and severely limited the quantity of available health commodities. Downstream closed or understaffed borders and reduced transit options led to bottlenecks at ports and delayed shipments; social distancing and movement restrictions delayed in-country and last mile distribution (LMD) even further.

Throughout the pandemic, which continues today, GHSC-PSM has maintained its existing commitments, successfully pivoting to ensure that U.S. government (USG)-supported health programs for HIV/AIDS, malaria, family planning/reproductive health (FP/RH), and maternal and child health continue uninterrupted. The project also took on additional responsibilities in response to the USG's direct call to action. GHSC-PSM leveraged experience from previous "[black swan](#)"¹ events and worked with USAID, country leadership, and global stakeholders to proactively manage and mitigate supply chain disruptions. From March 2020 to March 2021, the project achieved an average of 90 percent on-time delivery (OTD) (71.7 percent COVID-19 impacted²), continuing to exceed the project's targets that were established under pre-pandemic conditions. GHSC-PSM also procured and delivered additional commodities, such as ventilators and oxygen supplies, and provided relevant technical assistance to support the USG's Global Response to COVID-19.

COVID-19 has had an irreversible impact on the global health supply chain. Even when the WHO officially declares an end to the pandemic, the global community must remain committed to the long-term sustainability and strengthening of the health supply chain to mitigate the residual effects and impacts of this virus and of future shocks and crises. Many changes engendered by this crisis have further strengthened the supply chain and filled gaps that existed — from fostering greater collaboration and coordination between key supply chain actors, such as governments, donors, suppliers, and logistics service providers, to accelerated development and use of digital tools to enhance forecasting, planning, and visibility of commodities. These improved processes, tools, and reports continue to be used by GHSC-PSM to manage its global supply chain activities.

COVID-19'S IMPACT ON THE GLOBAL HEALTH SUPPLY CHAIN

MATERIAL SHORTAGES AND REDUCED MANUFACTURING CAPACITY

The concentration of suppliers of raw materials, KSMs, APIs, and finished pharmaceutical products (FPP) in a few critical countries had a ripple effect across the entire supply chain. China, where the virus first began to circulate widely³, is a primary supplier of raw materials, KSMs, and APIs. India, which has the second-highest number of confirmed COVID-19 cases in the world⁴, is a major supplier of APIs and manufactures most of the FPPs procured by GHSC-PSM. Even though India-based manufacturers had several months of KSMs and

¹A "black swan" event refers to something that is unpredictable and often extremely rare, that can have severe impact or consequences.

²During the COVID-19 pandemic, GHSC-PSM has been using two versions of its usual OTD indicator. The first is the "standard" version, calculated according to the indicator definition as laid out in the project's monitoring and evaluation plan and in accordance with all associated policies/standard operating procedures (SOPs). These policies and SOPs allow for USAID-approved adjustments to agreed delivery dates in case of interruptions that are beyond the project's manageable control, including pandemics. The "standard" version of OTD will, therefore, show the project's performance, controlling for impacts of COVID-19 and other external disruptions. The second calculation of OTD is the "COVID-19-impacted" version. This version follows the same rules and definitions as the standard indicator, but the "control" for pandemic impacts will not be used. All pandemic-impacted line items will be assessed as on time or not, according to the agreed delivery date at the time the order was approved. While the delays cannot be attributed to GHSC-PSM, we are committed to sharing these outcomes in the interest of full transparency and acknowledgement of the challenging and unprecedented circumstances presented by COVID-19.

APIs in stock, the project quickly realized that this stock was insufficient to withstand the severity and duration of the supply disruption. The situation was compounded by the reduced manufacturing and mobility of people and products, as well as by the reallocation of manufacturing capacity to support the development of COVID-19-related equipment and supplies.⁵

From antiretroviral (ARVs) drugs for HIV/AIDS to artemisinin-based combination therapy (ACTs) for malaria, many of the health commodities procured by GHSC-PSM faced these supplier-level shocks. “COVID-19 brought to light that, while we may have a diverse pool of suppliers for a particular commodity, at least for ARVs, and particularly tenofovir, lamivudine, and dolutegravir (TLD), the majority is in India. So, we need to look at how to diversify the [geographic] landscape,” advised GHSC-PSM Supplier Relationship Manager Yesenia Saulino.

In the case of ARVs and FP/RH commodities, the highly coordinated model and centralized sourcing strategy — including management of central inventory in regional distribution centers (RDCs), global forecast capabilities, procurement agreements, and long-term partnerships — helped absorb some of the initial COVID-19-related disruptions and maintain steady prices.

THE KEY TO MALARIA TREATMENT

Before March 2020, GHSC-PSM worked with 11 eligible suppliers for ACTs. ACTs are critical to treating malaria and require a KSM that is derived from a plant that is cultivated only in China. The rapid spread of the virus, coupled with movement restrictions, delayed production and distribution of this KSM. Furthermore, local governments in India shut down many business operations to stem the spread of COVID-19. This action further delayed production of the pharmaceutical products. Several of GHSC-PSM’s ACT manufacturers in the state of Maharashtra were impacted by these restrictions because of their dependence on the Mumbai port there.¹

Manufacturer stockpiles of KSMs, APIs, and FPPs meant that orders delivered in January and February 2020 proceeded without interruption. When the pandemic escalated in March, however, global shutdowns led to many manufacturers’ halting production or reducing their workforce to protect workers. In India, labor restrictions decreased the production capacity of voluntary medical male circumcision kits, tuberculosis (TB) preventive treatment, and other HIV/AIDS and malaria commodities. Several suppliers voluntarily slowed or stopped production of FP/RH commodities to pivot their operations for another purpose. In some states in India, packaging material for health commodities, such as bottles, were considered an essential business, which closed manufacturing plants and further constrained delivery of FPPs. In April 2020, manufacturing capacity began dropping; by June, had dropped by 30 to 70 percent of its pre-COVID-19 levels. While this eased slightly toward the latter half of 2020, the resurgence of the virus in India in April 2021 inhibited a full recovery. Furthermore, in India, Europe, and elsewhere — as a second wave of the virus threatened to destabilize countries once again — some governments

suspended export of certain pharma and non-pharma products to cater to domestic demand, constraining global supply even further.⁶

TRANSPORTATION AND LOGISTICS CHALLENGES

In addition to the manufacturing challenges, COVID-19 also prompted unprecedented stress on global, regional, and in-country logistics that had upstream and downstream impacts.



To curb the spread of COVID-19, countries quickly shut down borders and suspended or greatly reduced the frequency of nearly all passenger air travel. According to the International Air Transport Association, more than 185,000 passenger flights were cancelled between the end of January and early March 2020.⁷ Before the pandemic, 50 percent of all commercial cargo flew on passenger aircraft. Flight restrictions and international travel bans severely limited the ability to ship commodities by air. Even amid promising signs of recovery, industrywide cargo capacity was still 12.6 percent lower in August 2020 than the year before.⁸

The passenger flights that remained operational in 2020 were plagued by delays, backlogs, and financial losses. Airlines grappled with their hemorrhaging financial losses by economizing flights and imposing “pivot” weight fees to make up for empty space. In some cases, airfreight costs tripled.⁹ They rerouted planes from smaller destinations to serve profitable routes, which made it especially difficult to transport commodities to smaller countries — such as Burundi, Madagascar, Malawi, Sierra Leone, and Togo — that are not on major flight paths. Airlines became averse to moving cold chain products in this environment, making it nearly impossible to source flights for frozen reagents. This includes oxytocin, an essential medication that prevents postpartum hemorrhage and must be stored at -20 C and re-iced every two days. This was especially concerning with the renewed challenge of maintaining the cold chain to deliver COVID-19 vaccines.



The ocean freight industry implemented early a disciplined approach to vessel scheduling to maintain viable capacity. The result was the decreased need for cargo vessels and cancellation of many sailings. Ocean shipments, faced with the

¹<https://www.who.int/publications/i/item/who-convened-global-study-of-origins-of-sars-cov-2-china-part>

²<https://covid19.who.int/>

³<https://www.france24.com/en/africa/20210425-covid-19-s-seriously-negative-impact-on-fight-against-malaria>

⁴<https://www.reuters.com/world/india/india-bans-exports-anti-viral-drug-remdesivir-covid-19-cases-surge-2021-04-11/>

⁵<https://www.iata.org/en/pressroom/pr/2020-03-16-01/>

⁶<https://www.iata.org/en/iata-repository/publications/economic-reports/air-freight-monthly-analysis---august-2020/>

⁷<https://www.wsj.com/articles/another-coronavirus-business-problem-skyrocketing-cost-of-air-cargo-11588687216>



many “blank,” i.e., canceled sailings, had longer lead times. Container shortages at various origin locations — such as China, India, and Vietnam — that resulted from the imbalance between supply and demand across the global supply chain, congested ports. As well, fewer operational vessels and irregular global trade patterns further exacerbated delays.¹⁰ Container prices also increased exponentially, from less than \$2,000 per 40-ft container in April 2020 to more than \$8,000 in June 2021.¹¹

There were challenges even at the ports. Maritime crews were not allowed to disembark at select ports for fear of potential COVID-19 exposure, and many ships were not permitted to dock or were quarantined because of country policies at destination points, leading to further delays. Upstream, ports of departure in India were inaccessible for much of 2020 due to the country’s own lockdown measures.¹²

 Air and ocean freight restrictions, combined with the unprecedented strain on the supply chain from COVID-19, impacted ground transportation. In some countries, like India, countrywide lockdowns severely impacted intrastate/long-haul trucking to ports of departure. Even when products reached the ports, air and ocean backlogs led to further congestion in and out of ports. Travel and transport across borders was also restricted to slow the spread of the virus, which inhibited GHSC-PSM’s ability to deliver to landlocked countries. In some instances, trucking across borders to inland countries was hampered by officials’ subjective interpretations of vague quarantine and testing requirements. Once initiated, these requirements morphed into arduous testing processes, prompting the backup of long-haul trucks at the Kenya-Uganda border that stretched up to 50 miles, stranding truck drivers on the side of the road for days, sometimes even weeks.¹³ As the movement of goods came to a standstill, products piled up in origin and destination countries. Transshipment hubs, such as Addis Ababa, Ethiopia, were flooded with cargo, and warehouses were packed to capacity. Ports of entry, operating with a skeleton crew under social distancing requirements, could not quickly process and clear products for delivery. Continental and in-country border regulations and movement restrictions (e.g., quarantines and checkpoints) led to delays at cargo entry points and shortages in drivers and trucks. Europe’s COVID-19 policies restricted ground handling crews.

GHSC-PSM’S RESPONSE AND PIVOT

PROACTIVE PROCUREMENT STRATEGIES

At the onset of the pandemic, GHSC-PSM established a cross-functional team to monitor, manage, and mitigate the impact on the GHSC-PSM global supply chain. This team executed several proactive procurement strategies to ensure the availability of key health commodities. These strategies are designed to move rapidly by leveraging USAID’s revolving funding mechanisms to secure large volumes of supplier capacity in markets where supply is particularly constrained. The project places orders based on data-driven demand signals, which enables it to secure production capacity far earlier in the ordering process — often well in advance of receiving actual orders. The intent of these proactive procurement strategies is to ensure access to the supply of critical commodities when countries need them, to reduce fulfillment lead times, and to hedge against the considerable uncertainty and disruption in these markets. These strategies are enabled, in part, by a more robust use of demand data — derived from country supply plans and health area-specific Procurement Planning Monitoring Reports — that the project translates into country stock risk dashboards that illustrate the timing and scope of upcoming stock risks. The strategies are designed, in part, to mitigate these future stock risks.

The COVID-19 Impact Dashboard that GHSC-PSM created helped the project identify and manage anticipated and realized delays; it also assessed the relative impact of delay to inform near-term operational decisions. This dashboard was coupled with a weekly summary and analysis report sent to USAID starting on March 17, 2020, with early ad hoc status reports starting as early as March 3. A secondary dashboard specific to ventilator procurement was also created.

When combined, supply chain impediments and the significant increase in global demand for health commodities resulted in soaring prices. Material and supply shortages caused commodity price hikes for many suppliers and purchasers. GHSC-PSM, however, was able to avoid the bulk of these increases in two ways: 1) using data to drive decision-making and increased collaboration with suppliers, and 2) negotiating long-term agreements with suppliers to lock in prices. Holding long-term agreements with suppliers that honored negotiated prices for established purchase orders and working with wholesalers to secure products also kept commodity prices stable. By relying on data to prioritize delivery based on stockout risk and programmatic impact, GHSC-PSM was able to ensure that the limited supply was effectively targeted and avoided paying unnecessary premiums.

¹⁰<https://home.kuehne-nagel.com/-/knowledge/market-insights/container-shortage>

¹¹<https://www.drewry.co.uk/supply-chain-advisors/supply-chain-expertise/world-container-index-assessed-by-drewry>

¹²<https://economictimes.indiatimes.com/industry/transportation/shipping/-transport/indias-ports-in-chaos-as-coronavirus-lockdown-hits-operations/articleshow/74811236.cms?from=mdr>

¹³<https://www.wsj.com/articles/at-africas-borders-vast-jams-as-truckers-are-tested-for-covid-19-11591963201>

SUPPLIER RISK REDUCTION

GHSC-PSM foresaw geographic risks presented by single-source countries even before the pandemic and had been encouraging in-country manufacturers to produce their own and to stockpile KSMs, APIs, and raw ingredients to prepare for potential interruptions to supplies from and within China. As early as January 2020, GHSC-PSM activated several internal mechanisms to actively monitor and manage health commodity sourcing risks caused by the COVID-19 virus. These included:

- **Commodity Risk Analysis, Supplier Profiles, Short-Term Supplier Insights, and Long-Term Supplier Strategy:** As part of GHSC-PSM's overall sourcing strategy, the project assesses the severity, probability, and timing of potential risks to various commodity portfolios. These maps and dashboards are informed by supplier surveys, communication with suppliers, market insights, and thorough data collection across suppliers and countries.
- **Commodity Risk Framework:** GHSC-PSM has created monthly profiles that examine each commodity's risks by health category based on geographical sourcing of ingredients, FPPs, and necessary packaging materials, as well as evaluating market and manufacturing capacity and logistics challenges. The project facilitates the forecasting and reallocation of stock on hand to place it where it is needed most.

In some instances, such as the case of malaria rapid diagnostic tests (mRDTs) — which were particularly impacted by manufacturers' reallocating production lines from mRDTs to COVID-19 testing — GHSC-PSM collaborated with a mRDT Task Force of global stakeholders.¹⁴ Together, they convinced a large mRDT manufacturer to reenter the market and to provide suppliers that were stalled by the WHO qualification process with corrective action preventive action reports to help expand the supplier base, while enhancing the project's testing measures to ensure that commodities procured are safe and of the highest quality.

PRE-POSITIONING AND REALLOCATING STOCK

To prevent stockouts and delays, GHSC-PSM monitored existing supply and reallocated it based on country urgency, replenishing orders sooner than usual. The project revised monthly forecasts to consider production capacity and requested goods availability dates for existing orders. GHSC-PSM prioritized commodities based on availability, location, and delivery dates; the project also worked with countries to move stock closer to facilities to mitigate distribution delays that were caused by in-country movement restrictions and to liberate space higher in the supply chain to pre-position other stock. GHSC-PSM kept goods moving by prioritizing critical countries that were at risk of stockout. The project used non-traditional mechanisms, such as charter flights, to alleviate reduced air shipping capacity. For example, in Nigeria and Dubai, GHSC-PSM bundled large orders with similar delivery dates and requested a large spot buy using charters. By doing so, the project ensured the OTD of several urgent HIV/AIDS and malaria commodities and averted a stockout.

GHSC-PSM used country stock data to prioritize shipments and identify programmatic risks. COVID-19 risk reports — which compiled a list of GHSC-PSM orders impacted by the COVID-19 pandemic by a supplier and/or logistics delay — were sent weekly to the project's global supply chain and country teams, as well as to USAID. GHSC-PSM used supply plan data to include the anticipated months of stock and the new estimated delivery date in the report. This allowed procurement and country teams to identify the impact of the COVID-19 delays and prioritize orders from a procurement and logistics standpoint to reduce stockout risk and programmatic impact. The project combined this data with other mitigation tactics — such as expediting country waivers

ACHIEVING GLOBAL GOALS THROUGH MMD AND DDD

MMD allows HIV/AIDS patients to receive several months of ARV supply at once, improving adherence and reducing cost to facilities and patients. DDD provides more convenient locations where clients can pick up their ARVs.

DDD and MMD together help public sector health programs bring lifesaving medicines for HIV/AIDS and other illnesses closer to clients. This, in turn, reduces the risk of HIV/AIDS treatment interruption or discontinuation, which is critical to countries achieving epidemic control in line with the United Nations Sustainable Development Goals.

MAKING SPACE FOR MALARIA COMMODITIES

In Burkina Faso, GHSC-PSM visited 110 sites for data collection from March 1 to 14, 2021. The preliminary results yielded several key findings:

- No stockouts of mRDTs on the day of the visit at the health facility or district store level
- At least one artemether-lumefantrine presentation on the day of the visit at most health facilities (98.9%)
- mRDT confirmation of 93% of malaria cases, thanks in part to high availability of mRDTs (92%) at the health facilities, as well as health providers' adherence to national guidelines for malaria case management

¹⁴mRDT Task Force members include the Clinton Health Access Initiative (CHAI), Foundation for Innovative New Diagnostics, the Bill & Melinda Gates Foundation (BMGF), the Global Fund, the Malaria Consortium, Médecins Sans Frontières (MSF), PATH, PMI, GHSC-PSM, United Nations Development Program (UNDP), United Nations Children's Fund (UNICEF), Unitaid, and WHO.

¹⁵<http://www.ghsupplychain.org/supply-chain-considerations-implementing-decentralized-drug-distribution>



— and, by strategically utilizing RDCs to mitigate supply shocks by moving shipments forward and advancing procurement to keep supply chains flowing and support accelerated distribution in countries through multi-month dispensing (MMD) and decentralized drug distribution (DDD) (see box on preceding page [■](#)).¹⁵

In Namibia, GHSC-PSM worked with the Ministry of Health and Social Services to rush four months of ARVs to health facilities after the country implemented social distancing and quarantine requirements on March 27, 2020. This amount was based on the number of patients per facility for first-line ARVs. GHSC-PSM used the Pharmaceutical Information Dashboard, which the project supports and maintains, to track and monitor stock levels at health facilities, identify supply risks, and mobilize stock redistribution from other regions with less need. One key feature of this online tool is the ARV Treatment (ART) Dashboard, which summarizes the number of patients accessing HIV treatment and ARV stock levels at every facility; which was used to pre-position the stock. This, combined with MMD, enabled the government of Namibia to ensure sufficient supply of first-line ARVs to meet patient demand throughout lockdown while adhering to movement restrictions.

The impact of COVID-19 on upstream malaria commodity supply chains was felt most acutely. To mitigate these impacts, GHSC-PSM issued a short-term volume-based tender that included prequalifying nine new malaria pharmaceuticals, mRDTs, and long-lasting insecticide-treated nets (LLINs) to expand the supplier pool and allow greater access to commodities. Between January and March 2021, the project issued long-term tenders to determine allocations of expected demand in 2022 for ACTs and certain severe malaria treatments among existing and potential new vendors. GHSC-PSM also finalized a strategic approach and the corresponding LLIN tender and conducted a solicitation to add third-party laboratory services to expand LLIN testing capacity. GHSC-PSM continued to collaborate globally to explore robust and creative sourcing strategies to meet demand; and invested in proactive procurement of key malaria commodities.

ADJUSTMENTS TO TRANSPORTATION AND LOGISTICS APPROACHES

Each step of logistics required proactive management and swift decision-making. GHSC-PSM used a combination of tactics to re-establish the flow of transport, such as:

- *Working with USAID Missions, governments, and other in-country partners* to secure and expedite import duty waivers and customs clearance; obtain essential personnel designations for supply chain workers, including logistics providers; and secure safe passage for commodities crossing international borders by land. This was especially critical in places like Nigeria, where the president ordered a total lockdown of the country's largest city and economic hub Lagos and the capital of Abuja¹⁶; regional governors followed suit by closing their own states' borders¹⁷. It also was critical in Zambia, which imposed a mandatory quarantine for truck drivers in March/April 2020.¹⁸
- *Sharing with country offices the weekly reports* of orders ready to ship to confirm their ability to expedite waivers, readiness to receive in warehouse, and ability to quarantine, if needed.
- *Utilizing charter flights and consolidating efforts* across health areas to counter the limited availability and reduced frequency of passenger flights. In May 2020, GHSC-PSM successfully completed two critical charter flights to transport 352 pallets of HIV/AIDS and malaria commodities and 113 pallets of HIV/AIDS commodities from suppliers in India to distribution centers in Nigeria. This was the first time in project history that international cargo from two separate task orders — HIV/AIDS and malaria — were combined into one shipment.
- *Rerouting deliveries* to avoid delays. In late 2020, the border crossing between Zimbabwe and South Africa became heavily congested due to delays caused by COVID-19 testing. To avoid HIV/AIDS commodity delays, GHSC-PSM routed through different ports according to mode to in-land countries, such as Botswana.
- *Shifting to a spot-bidding model* with local logistics providers. With the cost of air freight increasing due to reduced capacity, spot bidding allowed the project to procure cargo space closest to the market rate.

Using data to recalibrate freight options for the best value, GHSC-PSM estimated from a preliminary analysis that the average price increase for air freight was 30 percent, but only 10 percent for ocean freight. With this information, the project proactively secured USAID approval to incur additional freight charges where needed, which allowed for swift decision-making to secure limited air and ocean capacity.

¹⁶<https://www.cnbcfranca.com/2020/covid-19-nigeria-extends-lockdown-by-two-weeks-in-lagos-abuja-ogun-states/>

¹⁷<https://www.vanguardngr.com/2020/04/nigerians-stranded-as-states-close-doors-over-coronavirus/>

¹⁸<https://www.tralac.org/blog/article/14502-coronavirus-and-freight-forwarding-in-sadc.html>

¹⁹ Add date/confirm numbers

²⁰The Automated Requisition Tracking Management Information System (ARTMIS) is the cloud-based procurement application that supports GHSC-PSM. ARTMIS is central to achieving USAID's vision of one end-to-end, comprehensive health supply chain that provides real-time data and reliable services to country programs and missions. <https://www.ghsupplychain.org/ARTMIS>

COVID-19 PROCUREMENTS

In addition to mitigating disruptions to the regular supply and to delivering HIV/AIDS; malaria; FP/RH; and maternal, newborn, and child health (MNCH) commodities on time to 46 countries, USAID requested that GHSC-PSM assist in the procurement and delivery of critical health commodities to respond specifically to the pandemic. The project rose to the challenge and established dedicated teams to manage six COVID-19-specific workstreams (see below). By establishing these dedicated teams, GHSC-PSM ensured that existing health commodity groups had the support to maintain operations while being flexible and responsive to additional COVID-19-related emergency activities.

1. **Global Procurement:** GHSC-PSM successfully procured and delivered COVID-19-related medical equipment, supplies, pharmaceuticals, and non-medical supplies (excluding ventilators and oxygen) valued at more than \$11 million for 17 countries between March 2020 and March 2021.¹⁹
2. **In-Country Procurement:** GHSC-PSM supported individual countries to identify suppliers and facilitate delivery of COVID-19-related commodities from a list of 332 products deemed eligible by USAID. This included conducting research on sourcing, evaluating market conditions, and developing automated tools. For example, the project's COVID-19 Essential Medicines Allocation Tool decentralizes procurement for these commodities and shortens the allocation process from weeks to days. This allows users to quickly select suppliers and allocate purchases using data and supplier information from the project's centralized management information system (MIS).²⁰
3. **Support to Italy:** GHSC-PSM procured and delivered 100 ventilators, 200 syringe pumps, 120 defibrillators, and 10,472 continuous positive air pressure helmets to the government of Italy as a part of USAID's COVID-19 response assistance package. In early 2021, the project also delivered 460 patient vital sign monitors to a central warehouse in Italy to be distributed to the regions hardest hit by COVID-19; additional procurements of intensive care unit beds, central monitoring stations, echocardiography machines, and non-invasive ventilation helmets were in progress. GHSC-PSM successfully secured value-added tax exemption for all of its Italy procurements, saving the USG \$389,223 and removing a major roadblock for the program's remaining procurements and deliveries.
4. **Market Research:** GHSC-PSM conducted market research for sourcing and procuring COVID-19-related commodities, such as rapid-deploying field intensive care units, local supply of oxygen in sub-Saharan Africa, COVID-19 treatment (remdesivir), and landscaping studies of COVID-19 diagnostics availability.
5. **Ventilators:** In May 2020, USAID requested that GHSC-PSM procure ventilators for South Africa's COVID-19 response. The project contracted with a U.S. supplier identified by the National Security Council, obtained and packaged 50 ventilators, secured documentation and export waivers, booked flights, and saw the ventilators arrive to a warm welcome from the U.S. Ambassador to South Africa — all, in seven days. This process in non-pandemic times could take several months to complete. GHSC-PSM successfully procured from three identified manufacturers and delivered 8,722 ventilators to 43 countries and the North Atlantic Treaty Organization from May 2020 through early 2021. The sustained speed and flexibility in this activity represent an extraordinarily collaborative effort across the project, USAID, USG, and country governments; the project mobilized all available resources, including supply chain actors, to ensure the fluid movement of ventilators. The project developed a dashboard to track ventilator procurement and delivery; it was shared with USAID to help monitor the COVID-19 funding stream's procurement and use.
6. **Oxygen (O₂):** In late 2020, as oxygen support quickly became the primary clinical intervention for patients suffering from COVID-19, GHSC-PSM was tasked with coordinating in-country oxygen supply activities; procuring oxygen-related equipment (such as oxygen cylinders, liquid oxygen, concentrators, and consumables) to ensure safe and effective oxygen delivery to patients; and providing clinical and non-clinical technical assistance to eight countries: Afghanistan, Ghana, Guatemala, Haiti, Honduras, Kenya, Mozambique, and Tajikistan. GHSC-PSM immediately conducted two complex competitive sourcing events to identify suppliers of oxygen generating plants and concentrators. By December 22, 2020, the project had awarded multiple basic ordering agreements to eligible suppliers. As of March 31, 2021, GHSC-PSM submitted purchase orders for 12 Pressure Swing Adsorption units earmarked for delivery to Afghanistan, Ghana, Mozambique, and Tajikistan. The project issued five purchase orders for 233 concentrators to meet demand

NEW TOOLS FOR DECENTRALIZATION AND RAPID FULFILLMENT

In June 2020, the project began developing a COVID-19 Allocation Tool for Essential Medicines. Using an existing voluntary medical male circumcision allocation tool as a starting point, GHSC-PSM customized the tool to respond to time-sensitive COVID-19 essential medicine demand. This Excel-based tool allows users to quickly select suppliers and allocate purchase orders using order data from the project's existing ARTMIS software and matching it with the supplier contract data, considering numerous points to select the best-value supplier. These considerations include ability to meet the countries' importation requirements, and the project's requested delivery dates and minimum order quantities; price; shelf life requirements; and supplier past performance. The tool allows the project to confirm availability with all suppliers that submitted a quote for a particular product when an order comes in. It also has the capacity to send supplier confirmations, enter responses, and finalize the selected supplier.

"It is not an exaggeration to confidently state that [GHSC-] PSM was absolutely integral to the [ventilator] donation program. Without PSM as a key leader and driver of the donation program, the Mission would have been a failure."

—Kevin Mulligan, Senior Advisor
at USAID/Global Health

in Ghana, Guatemala, Haiti, Honduras, and Mozambique. The requisition orders (ROs) issued in 2021 for oxygen consumables and durables underwent a thorough analysis of air freight versus consolidated mix of freight options to maximize cost efficiencies across all ROs and countries. These ROs included 223 lines and seven pick-up points across four countries and three suppliers. GHSC-PSM also developed an oxygen product catalog and oxygen commodity quantification and budget calculator to continue supporting this initiative.

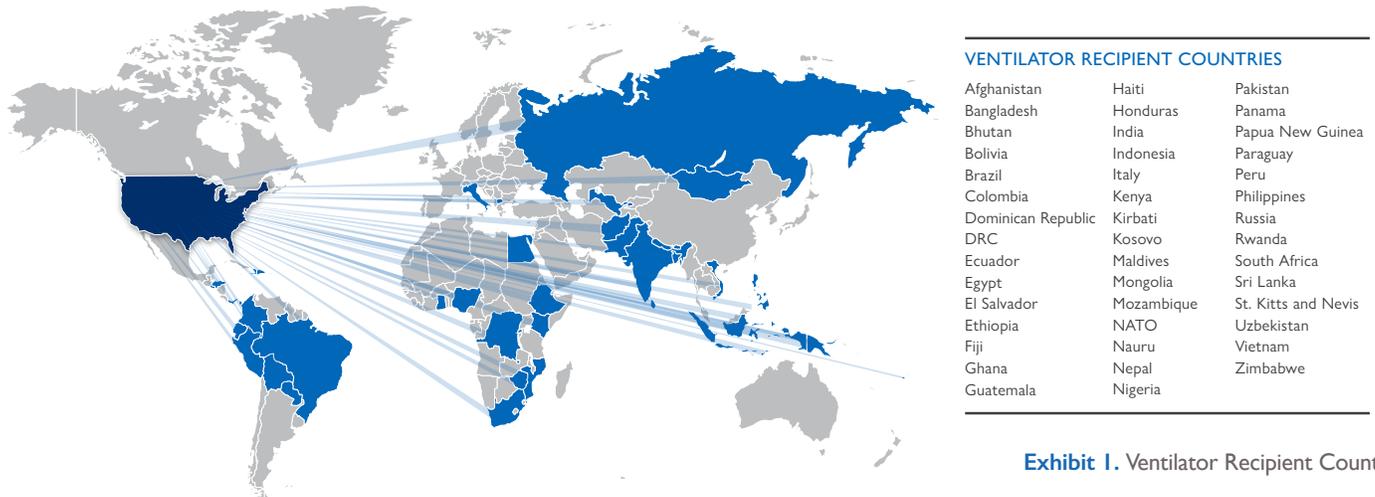


Exhibit 1. Ventilator Recipient Countries

STRENGTHENING THE GLOBAL SUPPLY CHAIN FOR FUTURE SHOCKS

The COVID-19 pandemic highlighted many gaps and vulnerabilities in the global health supply chain, forcing supply chain actors to quickly adapt to the changing landscape and identify new, flexible, and resilient ways of working. For GHSC-PSM, this meant enhanced strategies to strengthen core supply chain operations and mitigate risk while adapting to the rapid evolution of supply chain practices and use of new technologies. The project implemented new tools, processes, and reports to move product nearer to end destinations more quickly, deliver commodities with higher remaining shelf life, and optimize limited cargo and storage space. These adaptations continue to be applied to strengthen the supply chain in the long-term and mitigate the effects of future shocks.

Despite the myriad disruptions and unprecedented challenges, the project met its programmatic commitments, delivering products on time and averting stockouts. Even with COVID-19-impacted reason codes, the project achieved an average of more than 70 percent OTD and 72 percent on-time in-full from March 2020 to March 2021.

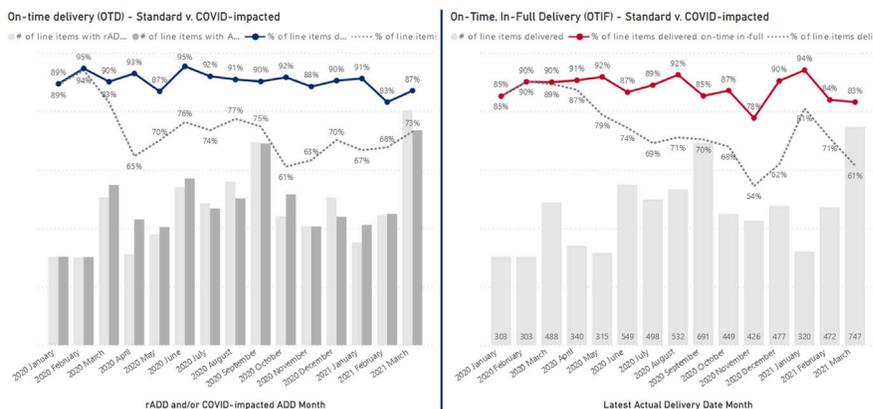


Exhibit 2. GHSC-PSM OTD and On-Time In-Full During the COVID-19 Pandemic

USING DATA TO SUPPORT LONG-TERM PLANNING

Assessing the availability of existing commodities through supply chain-wide data collection allowed greater precision in forecasting and procurement plans, making it possible to source and deliver constrained supplies of health commodities in the quantities required. To aid in these efforts, GHSC-PSM developed global dashboards and tools that increased supply plan data visibility across the project, such as the Multi-Month Simulation (MuMS) tool. MuMS was created to help countries respond to the President's Emergency Plan for AIDS Relief (PEPFAR) guidance for accelerating ART MMD. GHSC-PSM created the tool to answer a simple question: Based on current

supply plans, does the country have sufficient stock to provide three or six months of supply to every ART patient? All GHSC-PSM country teams received access to MuMS. Access to in-country data facilitated conversations between supply chain and clinical partners to accelerate an immediate transition to three-or six-month scripting of ARVs, recommended by PEPFAR to reduce COVID-19 exposure among ART patients. To move forward as much as possible, GHSC-PSM country offices submitted supply plans a month earlier than usual to help streamline identification and mitigation of potential supply disruptions.

Introducing commodity-specific and supplier risk profiles that combine procurement data analysis with qualitative supplier intelligence informed short- to medium-term sourcing and allocation strategies. It also allowed the project to systematically assess risk for health commodities considered of high programmatic importance. The risk profiles — combined with commodity-specific procurement data analysis that is informed by MuMS, supply plans, and other tools, with qualitative supplier intelligence — inform short- to medium-term sourcing and allocation strategies. These tactics have allowed GHSC-PSM to identify shortages in starting raw materials, KSMs, APIs, FPPs, and packaging across the global health supply chain and to plan for shortages and avert stockouts by purchasing commodities in advance and encouraging manufacturers to stockpile.

Increased data and monitoring positively impacted decision-making: They allowed the project to leap ahead in strategically sourcing inventory, make longer-term market commitments, and support MMD.

PRE-POSITIONING STOCK

RDCs where the project maintains key commodities in Europe, the Middle East, and Africa enabled GHSC-PSM to strategically pre-position stock. Prioritization exercises conducted across products and countries informed the placement of products closer to service delivery points, ensuring that the most urgent country needs were met. Pre-positioning orders alleviated longer-than-usual production times and allowed suppliers to be prepared to receive and process orders and secure KSMs. By advancing critical stock to destination countries to be as close to service delivery points as possible, GHSC-PSM freed RDC storage space to be used for routine supplies and COVID-19 commodities. This stock shift ensured a supply to maintain treatments and mitigate extended shipping delays.

In one instance, the project anticipated shortages because of production changes in artesunate injectables, a commodity for severe malaria cases. If production issues were not addressed, the injectables would have had up to three-month delays between estimated delivery date and actual delivery. To secure production slots and meet global demand, GHSC-PSM placed several large orders to pre-position deliveries through early 2021. In another instance, the anti-malarial lumefantrine market's constraints led the project to pre-position inventory orders for ACTs directly with the suppliers. These inventory orders were reassigned to countries with earlier delivery dates based on stock status and need. The project could deliver commodities earlier than with a traditional fulfillment strategy with pre-positioning. GHSC-PSM continues to work with Missions to finalize high-priority commodity orders as early as possible to ensure that central medical stores are replenished as products move downstream.

MAKING ADVANCED MARKET COMMITMENTS

The enhanced supply chain visibility that was brought by the increased access to and organization of data through visualization tools (such as dashboards) enabled GHSC-PSM to anticipate health commodity demand and make longer-term market commitments with suppliers. These longer-term commitments made it possible for GHSC-PSM to secure supply and top up national supply chains that responded quickly to COVID-19 by placing advance orders to ensure reliable supply, despite manufacturing and logistics delays, strict cross-border and in-country movement restrictions, and revised patient-centered distribution strategies. Advance, longer-term commitments gave suppliers greater stability in an otherwise fragile market; and, by locking in fixed pricing for 90 or 120 days, GHSC-PSM kept rates steady and obtained best value for the USG.

For example, in March 2020 — just after the project's quarterly ARV replenishment — GHSC-PSM submitted an additional order for 4.2 million 90-count bottles of TLD, the preferred daily ARV medication to treat HIV/AIDS, valued at \$66 million; and another 158 orders

“[Because of COVID-19], we are much more attuned to not just who we are procuring from and who our suppliers are, but also who our supplier's suppliers are and knowing where they get their raw materials and how they mitigate risk in their own supply chains. Previously, we would typically rely on just that first point of contact with our suppliers, but now we want to have a deeper and more direct relationship because it is all so interconnected.”

—Alan Pringle, Global Supply Chain Director, GHSC-PSM

²¹<http://www.ghsupplychain.org/supply-chain-considerations-implementing-decentralized-drug-distribution>

²²https://www.ghsupplychain.org/sites/default/files/2021-03/DDD_handbook_final_March_2021.pdf

²³Pharma Task Force members include the Asia Pacific Leaders Malaria Alliance Secretariat, CHAI, BMGF, GHSC-PSM, the Global Fund, Impact Malaria, the Malaria Consortium, Medicines for Malaria Venture (MMV), MSF, Pan-American Health Organization, PATH, PMI, UNICEF and WHO.

²⁴mRDT Task Force members include CHAI, Foundation for Innovative New Diagnostics, BMGF, the Global Fund, the Malaria Consortium, MSF, PATH, PMI, GHSC-PSM, UNDP, UNICEF, Unitaid, and WHO.

²⁵IRS/ITN Task Force members include the Against Malaria Foundation, CHAI, BMGF, GHSC-PSM, the Global Fund, Innovative Vector Control Consortium, International Federation Red Cross, MMV, MSF, PMI, Population Services International, Results In Health, UNICEF, Unitaid, and WHO.

²⁶KSM/API Working Group members include CHAI, BMGF, GHSC-PSM, the Global Fund, Medicines for All Institute, MMV, Maisha Meds, PATH, Unitaid, PMI, and the WHO.

for an additional \$109 million ARVs. This enabled manufacturers to secure supplies of raw materials in a challenging market — because 95 percent of GHSC-PSM's ARV orders, including TLD, originate in India — and allowed GHSC-PSM to secure time on the manufacturer production lines. Malaria commodities, which are typically replenished monthly, were ordered several months in advance. The project anticipated a constrained supply of sulfadoxine-pyrimethamine + amodiaquine, the key medication in seasonal malaria chemoprevention campaigns. To ensure the availability of this commodity for fiscal year 2021 campaigns, GHSC-PSM started placing orders in June 2020 and reserved goods availability dates for these commodities from August to October 2020.

EMPLOYING PATIENT-CENTERED DISTRIBUTION STRATEGIES

MULTI-MONTH DISPENSING

Reducing the need for patients to visit health facilities for medications minimizes contact and can lower the risk of contracting COVID-19. The pandemic increased the urgency around scaling MMD to reduce patients' trips to health care facilities while preventing gaps in treatment. While GHSC-PSM was already procuring and delivering 90- and 180-count bottles of TLD, by October 2020, the project had rapidly scaled MMD and delivered more than 13 million bottles of TLD to 20 countries. To help countries plan their MMD needs, GHSC-PSM created a dashboard so countries can enter and test scenarios to determine an optimal strategy to accelerate MMD.

In Angola, for instance, GHSC-PSM supported the country with the scale up to MMD starting in July 2020 that resulted in some 8,000 patients on three-month MMD at PEPFAR-supported sites. Commodity availability also increased across the board, with most-used first-line ARVs at more than 90 percent availability at PEPFAR-supported sites throughout the country in 2020.

Additionally, GHSC-PSM helped move the country from zero to 100 percent MMD data visibility and use through data gathering and analysis; reporting; and remote, online quantification exercises to support the transition to TLD for MMD.

DECENTRALIZED DRUG DISTRIBUTION²¹

Delivery disruptions from international suppliers caused by COVID-19 increased supply risks at all levels of the supply chain. In conjunction with MMD, DDD is a patient-centric approach that brings products closer to patients. There are two primary approaches to DDD: one that includes private-sector distribution points, in which public-sector clients pick up their medication; another that deploys health workers or community members to distribute from the health facility to the community level. While DDD usually comes with increased costs and responsibilities for health programs that deploy it, GHSC-PSM successfully supported several countries with private-sector and community-based approaches to scaling implementation.

Through GHSC-PSM's supportive supervision program, the project helped countries like Eswatini to scale MMD and DDD of ARVs. While DDD is not a new approach for the country, all PEPFAR-implementing partners developed a joint approach to scaling DDD in early 2020 that was approved by the Ministry of Health in April 2020 and included nearly 600 commodity distribution points.²² Also, in support of MMD and DDD, the supportive supervision program monitored data in the logistics MIS, verified the accuracy of reports submitted to the central medical store, promoted good record keeping, updated stock cards, and conducted monthly physical stock counts. Because the existing routine reporting through the commodity tracking system allowed for only monthly status updates, GHSC-PSM developed a regional facility-level stock status monitoring tool to provide near real-time data on stock status of commodities in short supply at the central medical stores. This tool leveraged the regional teams' mobility and clinical mentors who would collect stock status on Google Forms during facility visits. Regional logistics advisors and regional pharmacists use the resulting data analysis to make distribution decisions to prevent stockouts and, notably, treatment interruption for patients taking ARVs.

“We have not experienced a shortage of ARVs in the last nine months despite COVID-related restrictions, and we have ensured that clients receive their medication by reaching those who could not travel to the sites.”

—Sam Omalla, Supply Chain Management Officer,
Regional Health Integration to Enhance Services
in Uganda

²¹ <http://lmis.gov.pk/sctdmis>



COVID-19 MIS TOOLS IN PAKISTAN

- *Travelers' Surveillance MIS:* Developed in less than 48 hours through collaboration with the Pakistan Ministry of Health and National Institute of Health, this online system provides real-time data from entry-point screening, as well as tools for tracing transmission. From February to March 2020, staff in four airports and one seaport were trained, as well as nearly 120 government officials. Since the tool's launch, data from more than 27,000 travelers on 910 flights was entered in the system by different entry point users. GHSC-PSM also developed a mobile application for supply chain managers to view real-time dashboards.
- *COVID-19 Procurement Module:* This tool auto-calculates to forecast three months of required COVID-19 commodities, such as PPE, ventilators, and other equipment. The calculation considers the number of health care workers, patients, quarantine and isolation facilities, and a buffer percentage for each COVID-19 commodity.
- *COVID-19 PPE Online Calculator:* The calculator uses an open-source algorithm to help the government better calculate its needs as it relates to PPE.

COLLABORATING WITH GLOBAL AND LOCAL PARTNERS

While global collaboration has always been a key component to the success of GHSC-PSM's work to strengthen and support the global health supply chain, engagement with global and local stakeholders took on even greater significance with the COVID-19 pandemic.

The project has been participating in the Global Logistics Continuity Working Group (led by the Logistics Cluster, World Food Program) on a global logistics network for humanitarian goods, creating options to move global health products when commercial freight is not available. Collaborating with the USAID GHSC-QA (quality assurance) program, GHSC-PSM has been increasing the use of a risk-based approach to reduce inspections and testing to help minimize order delays. GHSC-PSM has also engaged in commodity-specific task forces, such as three focused on malaria — the Malaria Pharma Task Force²³, mRDT Task Force²⁴, and Indoor Residual Spraying/Insecticide-Treated Nets (IRS/ITN) Task Force²⁵ — and meets bimonthly with UNICEF and the Global Fund to align priorities for strengthening supplier capacity and response. The project plays a leading role in the Malaria Pharma Task Force's KSM/ API Working Group, which increases visibility and identifies and mitigates risks related to the upstream supply chains of KSM and API for finished malaria pharmaceutical products. In Q2 FY 2021, the project took the lead to develop a tool for collective data capture and sharing, as well as to liaise with stakeholders to drive analysis and investigation into specific drugs, molecules, and their associated risks. The monthly Global Donor Technical Working Group²⁶ devises strategies and coordinates actions to deal with suppliers who are unable to fulfill demands because of capacity constraints due to COVID-19. GHSC-PSM also coordinated with the Global Fund to discuss QA/QC (quality control) activities to mitigate COVID-19 restrictions, out-of-specification investigations, and other shared experiences for malaria products to minimize delays.

For MNCH commodities, GHSC-PSM presented to UNICEF and the Maternal Health Supplies Caucus in May 2021 on observations of the global supply of MNCH commodities and impacts on in-country MNCH supply chains. As a result of this collaboration, UNICEF and the Maternal Health Supplies Caucus committed to

increase coordination through joint meetings to monitor the impact of COVID-19, with GHSC-PSM contributing to mitigation actions where possible. The project has regularly participated in FP/RH fora to discuss the COVID-19 effects and supply chain disruptions with key stakeholders, including the Consensus Planning Group, in collaboration with the United Nations Population Fund. All of these engagements provided the project and co-attendees with a more comprehensive picture of the global supply chain challenges due to the pandemic and provided a forum organizations to work together to ensure reliable supply of health commodities to the people who need them.

At the country level, the project worked with various global and national partners to develop tools and provide guidance on responding to the supply chain impacts of the pandemic. In collaboration with the government of Pakistan; USAID; the Global Fund; Foreign, Commonwealth & Development Office (FCDO); Gavi; WHO; BMGF; and UNICEF, GHSC-PSM supported the development of several MIS tools that aided Pakistan in its fight against COVID. These included the Travelers' Surveillance MIS, COVID-19 Procurement Module and Inventory Management System, and the COVID-19 PPE Online Calculator. Following a request from the Pakistan National Institute of Health, the GHSC-PSM team in Pakistan also designed the supply chain component of a lab information management system for COVID-19 and future infectious disease outbreaks — the Sindh COVID-19 Training MIS²⁷. The system is scalable and has the capacity to be used across the public health laboratory network nationwide.



COVID-19 RECOVERY

While the development and distribution of the COVID-19 vaccine offers hope that the virus will subside and, with it, the “return to normal” for the global health supply chain, GHSC-PSM continues to mitigate upstream risks — by identifying alternate source of supply, fulfillment, and delivery mechanisms — and downstream risks — through collaboration with key stakeholders and using data-based tools to enhance visibility for better decision-making.

The project is incorporating these lessons learned into its work and has adopted many of these tools and practices as SOPs. Sharing relevant tools, guidance, and best practices (see below) with USAID, PEPFAR, U.S. President’s Malaria Initiative (PMI), in-country governments, donors, implementing partners, the private sector, and other key stakeholders is critical to ensure that patients receive the health commodities they need, especially during times of crisis.

- [Guidelines: Recovery Strategies for Public Health Supply Chains Post-Black Swan Event](#). This post-COVID-19 recovery guide can be used by in-country decision-makers to support LMD. The guide outlines insights and lessons learned from historical black swan events, including the first-hand experiences of several GHSC-PSM country directors and USAID staff across the three major types of supply chain shocks: demand, supply, and combined supply and demand shocks. The guide also introduces the principle of more frequent planning cycles after rare events like a pandemic, where demand is projected, adjusted, and frequently assessed to prioritize and reprioritize supply plans. This process provides stakeholders with an approach to think through their recovery strategy internally within an organization and as part of a greater supply chain network.
- [Stronger Together: Preparing Supply Chains for What’s Next with COVID-19 Response](#). This is a quick guide with targeted actions to support scenario planning for potential adverse events and developing strategies to mitigate them, such as reallocating stock among health facilities, increasing in-country distribution capacity, and planning for waste disposal.
- [Tool: COVID-19 Commodity Quantification & Budget Calculator](#). Intended for use by USAID Missions and GHSC country offices, this dynamic tool supports documentation of total known commodities demand and quantification against orders for commodities within defined budgets. This resource will be updated routinely as additional commodities are added to the USAID COVID-19 Response Allowable Commodities list, and pricing and freight estimates are further refined based on market conditions.
- [Technical Report: Last Mile Dynamic Routing](#). LMD is a critical step in the supply chain, but logistics challenges can slow deliveries considerably. The COVID-19 pandemic has further strained supply chains, making tools for running them efficiently all the more important. The GHSC-PSM team conducted extensive market research on three tiers of last-mile dynamic routing tools to help facilitate cost-efficient and reliable planning.
- [Technical Report: Ensuring Maternal, Newborn and Child Health Commodity Availability During COVID-19](#). This comprehensive resource offers distribution and dispensing considerations for the public sector supply chain and MNCH stakeholders, such as an explanation of how MNCH commodity needs have shifted during COVID-19, recommendations for which MNCH commodities to prioritize and fully supply at health facilities, and alternative options for dispensing and distributing MNCH commodities to ensure availability.
- [Fact Sheet: Supporting the Scale Up of Tuberculosis Preventive Treatment \(TPT\) in PEPFAR-Supported Countries](#). Globally, TB is the leading cause of death among people living with HIV. As the world fights the COVID-19 pandemic with social distancing and lockdowns, reports from the STOP TB Partnership indicate a significant reduction of TB case notification that can potentially reverse progress toward TB treatment and prevention. This two-pager provides an overview on the supply chain role of TB treatment regimens to reduce the pill burden on TB/HIV patients.