**USAID GLOBAL HEALTH SUPPLY CHAIN PROGRAM**
Procurement and Supply Management

# Recovery Strategies for Public Health Supply Chains Post-Black Swan Event

## Scenario Planning and Recommendations

RECOVERY RESPONSE

USAID
FROM THE AMERICAN PEOPLE


# Table of Contents



ghsupplychain.org | @ghsupplychain

**December 10, 2020**



*PHOTO CREDIT (cover): Mickaël Bréard | USAID GHSC-PSM*

*PHOTO CREDIT (this page): Andi Gultom*

# Acknowledgements

The USAID Global Health Supply Chain Program-Procurement and Supply Management (GHSC-PSM) project is funded under USAID Contract No. AID-OAA-I-15-0004. GHSC-PSM connects technical solutions and proven commercial processes to promote efficient and cost-effective health supply chains worldwide. Our goal is to ensure uninterrupted supplies of health commodities to save lives and create a healthier future for all. The project purchases and delivers health commodities, offers comprehensive technical assistance to strengthen national supply chain systems, and provides global supply chain leadership.

**GHSC-PSM is implemented by Chemonics International**, in collaboration with Arbola Inc., Axios International Inc., IDA Foundation, IBM, IntraHealth International, Kuehne + Nagel Inc., McKinsey & Company, Panagora Group, Population Services International, SGS Nederland B.V., and University Research Co., LLC. To learn more, visit **ghsupplychain.org**

**Lead GHSC-PSM author:** Joseph Shobe, Track and Trace Solution Architect, GHSC-PSM

**GHSC-PSM contributing authors:** Jaya Chimnani, Barry Chovitz, Alan George, Andrew Inglis, Steven Thomas, Ralph Titus, and Ryan Triche

# Acronyms

| | |
|---|---|
| **3PLs** | Third-party logistics providers |
| **ESC** | Emergency supply chain |
| **GHSC-PSM** | Global Health Supply Chain Program-Procurement and Supply Management project |
| **HMIS** | Health management information system |
| **LMIC** | Low- and middle-income country |
| **LMIS** | Logistics management information system |
| **SDP** | Service delivery point |
| **USAID** | United States Agency for International Development |

# 01.

## Foreword

PHOTO CREDIT: Chemonics/Light in Captivity

As I write this foreword, I think back to a year ago — February 2020 — when the world was on the cusp of a major life-altering pandemic. Having worked in public health supply chain management for many years, I knew how important good supply chain practices were for ensuring a reliable supply of essential health commodities to clients in need. But witnessing the events of the past year brought to light how every facet of our lives was dependent on supply chains — from protective masks to household paper towels. How could we have anticipated such an event? Is there a way to plan for the unpredictable?

**Such unpredictable events like the COVID-19 global pandemic, which would be characterized as a "black swan" event because of its extreme rarity and severe impact, posed new challenges to the global health supply chain community.** Our community had already dealt with Ebola and other zoonotic disease outbreaks, and supported the development of emergency preparedness materials, including "playbooks" to help programs manage health supply chains during times of crisis. But equally important is to also consider the recovery stage of supply chains. Yes, much like the impact of a virus itself on its host, supply chains also need to recover! The Global Health Supply Chain Program-Procurement and Supply Management (GHSC-PSM) project has created this strategy guide to help field program managers define and manage disruptions to both supply and demand, and to think through recovery strategies for public health supply chains. It is the intent that this guide will assist stakeholders as they plan and strategize for the future — ultimately building more resilient supply chains that can recover quickly after a black swan event.

We hope that this guide will be useful, and we welcome your comments and learnings as you implement your recovery strategies.

**SHARMILA RAJ**
*Deputy Division Chief,*
*USAID Commodity Security & Logistics Division*

02.

Introduction

PHOTO CREDIT: USAID GHSC-PSM

# Dealing with Supply Chain Shocks Means Aiming for a "New Normal"

**Supply chain managers deal with normal constraints and delays as part of their daily activities. But how do they react when an event beyond their control impacts not only their local logistics environment but an entire region or the globe?**

While some global public health officials had warned of an impending pandemic, few saw the COVID-19 crisis spreading with the speed it did beyond China's borders. Everyone felt the effects. How would supply chain managers have reacted if they had advance warning? What steps would they have taken to protect a once healthy and functioning supply chain? What would you do if a "black swan" event overwhelmed your operations? What steps will you take to recover?

A black swan event — named because of the rarity of black swans — is described as an unpredictable and extremely rare episode with severe systematic consequences.

These events have devastating consequences for fragile public health supply chains.

Some recent examples of past regional black swan events that have caused disruptions in public health supply chains include earthquakes in Haiti and Nepal in 2010 and 2015, respectively, and the Ebola outbreak in West Africa from 2014-2016. Global black swan events cause dual shocks to the world's supply chain that involve both origination and destination as both suppliers and patients are impacted, sending everyone scrambling to leverage the same limited resources.

One potential outcome of a weak supply chain is the "bullwhip effect," also known as the Forrester effect.[1,2,3,4] This is when demand information is distorted as it travels up the supply chain. This can lead to overstock, poor product forecasts or gaps in service delivery. A bullwhip effect can occur for many reasons, including inaccurate demand data, poor data visibility, rationing and shortages; a black swan event can worsen the effect as demand patterns change and supply availability fluctuates.

The aim, once these reactions are in play, is to limit disruption of programs and the supply chain and embark successfully on what will be a "new normal".

[1] APICS Operations Management Body of Knowledge Framework, Third Edition. Found at: https://www.apics.org/apics-for-individuals/apics-magazine-home/resources/ombok/apics-ombok-framework-table-of-contents/apics-ombok-framework-3.2.

[2] Summer 2018 • CTL.CFx – MicroMaster Key Concepts • MITx MicroMasters in Supply Chain Management MIT Center for Transportation & Logistics • Cambridge, MA 02142 USA • scm_mm@mit.edu. This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.

[3] MIT Sloan. 1997. The Bullwhip Effect in Supply Chains. Found at: https://sloanreview.mit.edu/article/the-bullwhip-effect-in-supply-chains.

[4] Ohio University. How the Bullwhip Effect Impacts the Supply Chain. Found at: https://onlinemasters.ohio.edu/blog/how-the-bullwhip-effect-impacts-the-supply-chain.

# 03.

Scenario Mapping & Planning

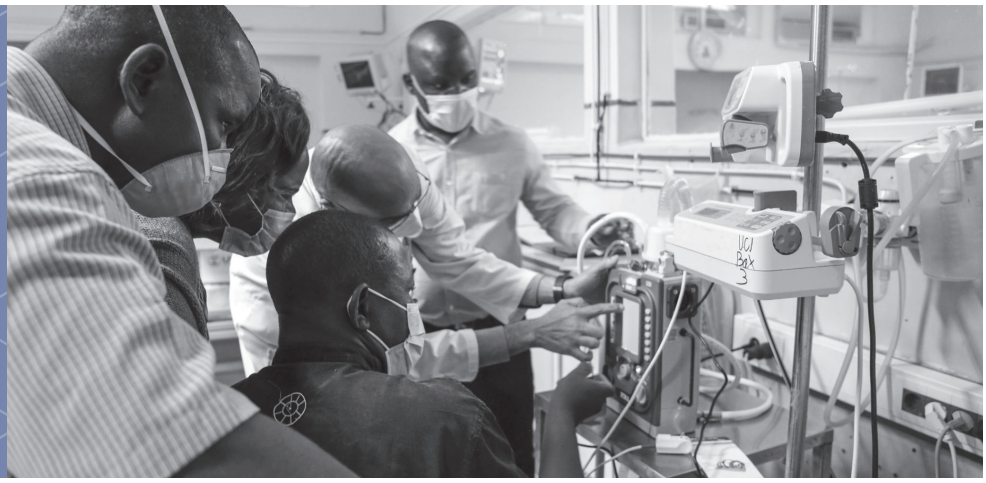


PHOTO CREDIT: USAID GHSC-PSM

## Systematic Planning and Readjusting as Needed are Critical for Supply Chain Recovery

**This guide uses scenario mapping — predicting what might happen in the future and how your program/supply chain might operate — to help decision makers plan for recovery, weigh the information and advice they have received and make informed decisions.**

Helping decision makers think through the likely consequences of their decisions enables them to assess and determine the actions needed that will lead to recovery. Most importantly, more frequent planning to evaluate different recovery scenarios is necessary to assess the rapidly changing conditions in the supply chain; stakeholders will need to frequently refine their decisions, improving the supply chain's responsiveness and resiliency.

The four main steps in this process are outlined in ***Figure 1***. It's important to note that previous expectations do not hold. For example, demand may decrease or increase significantly and sporadically. This will affect the recovery, thus the need to plan more frequently to change course as needed.

### 1. Define the Disruptions

The disruptions caused by a crisis can come in many forms and can be different by product, product group, geography or populations. In this first step, supply chain stakeholders identify disruptions being experienced and define product groups and specific high-risk products for scenario planning. They then set priorities for where recovery efforts will be most critical.

### 2. Analyze Path to Recovery

Once stakeholders identify the disruptions across the product groups and establish priorities, the next step is to determine possible paths to recovery.

### 3. Scenario Planning With Stakeholders

This step aims to guide stakeholders through various recovery paths as they identify both weaknesses and strengths at different steps in the supply chain. They will do this by using data that provides an opportunity to review recovery at the different stages of the supply chain.

***Figure 1*** includes three steps under "Scenario Planning with Stakeholders" to guide this process:

- Determine the best path for recovery by examining various scenarios with stakeholders.
- Plan the actions for recovery for the selected path and identify actions to be taken by whom in the supply chain.
- Evaluate the path for recovery and discuss with stakeholders what a successful recovery will look like and what might be the potential risks.

The aim is to proactively think through the possible recovery strategies to identify a common purpose and differences and agree on the best path forward based on current conditions.

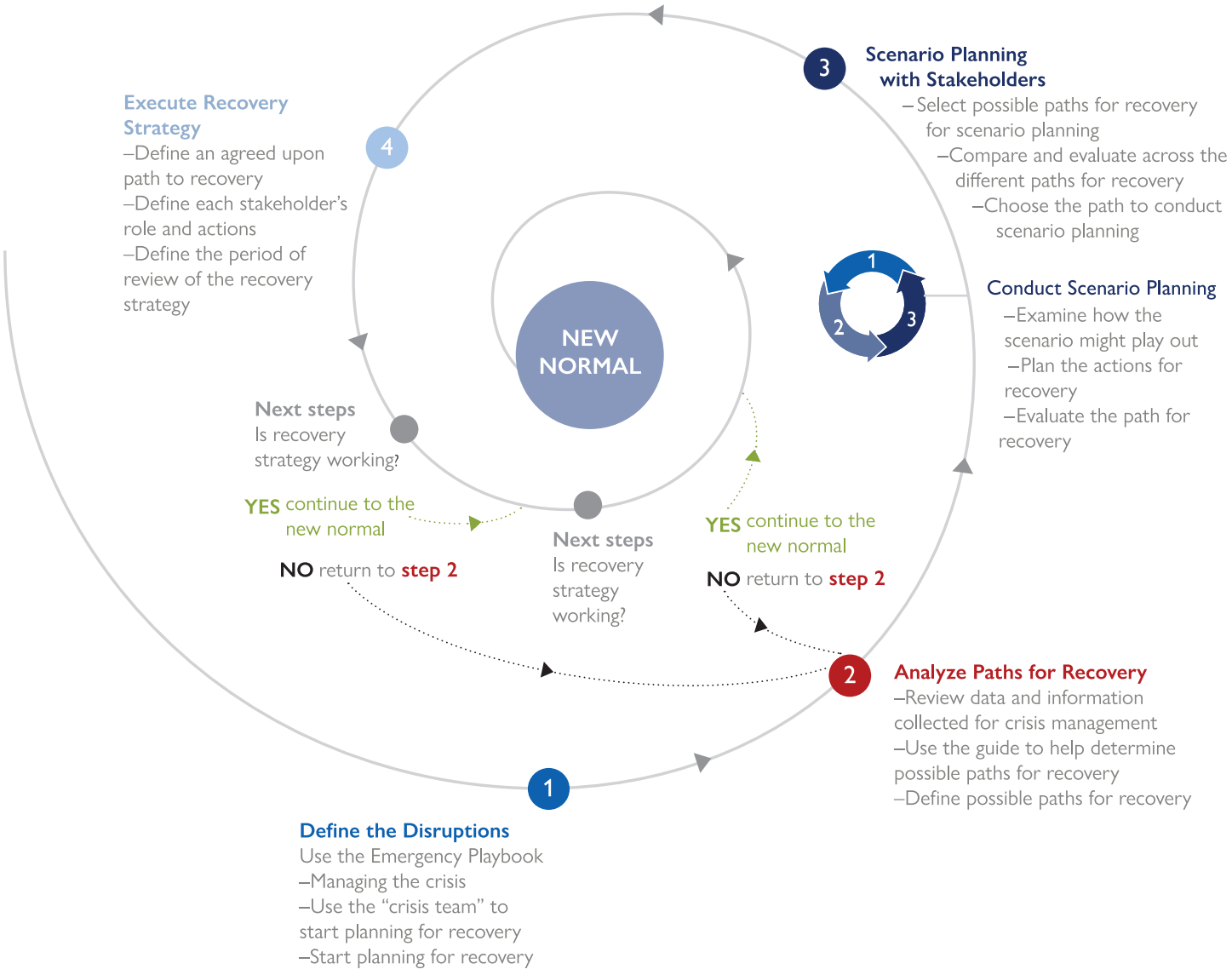
### 4. Execute Recovery Strategy

First, the role and actions of each stakeholder must be defined, followed by setting up or continuing a process to resolve issues affecting the recovery. A timetable must be established and planned actions for recovery mapped out.

### Is the Recovery Strategy Working?

When reviewing progress toward recovering to the new normal, stakeholders must determine if the supply chain is heading in the right direction. Is demand returning as expected and becoming more predictable? Is supply lead-time becoming more reliable, and is it possible to plan a sustainable and resilient supply chain strategy? If there are doubts, stakeholders can re-run the scenario planning. This will proceed quicker because it builds on the past scenario planning. The new normal provides the opportunity to adopt more frequent reviews of demand and supply balancing to achieve focus and alignment.

## FIGURE 1. SUPPLY CHAIN RECOVERY STRATEGY



04.

Demand Disruptions

PHOTO CREDIT: USAID GHSC-PSM

# Supply Chain Shocks Rattle Demand Forecasting

**Addressing demand-side disruptions is the first stage of supply chain recovery. There are a number of components to demand disruption, each of which need to be addressed fully.**

## Pre-Disruption Stage

Health product quantification (demand and supply planning) is a multi-stakeholder process used in low- and middle-income countries (LMIC). Often, demand forecasts are updated each year, covering 24-36 months, while the resulting supply plans are monitored quarterly or monthly to provide visibility into stock projections for the next 18-24 months. These routine projections usually include assumptions based on historic consumption or health service statistics data, disease morbidity data, seasonality, population characteristics and programmatic targets. Usually, all these data are regularly collected and monitored through logistics management information systems (LMIS) and/or health management information systems (HMIS). Demand planners use that data to model the increase or decrease of a product's consumption to contribute to a health program's clinical objectives. However, these quantification exercises would not consider how a black swan event would affect demand during and after the event.

## Black Swan Stage

During a black swan event, little can be done to maintain operations as usual. Inaccurate demand signals could drive stock imbalances such as overstock, causing expiries; or stockouts, causing service disruptions. Demand pattern disruptions caused by black swan events are difficult to quickly monitor at the national level. The LMIS and/or HMIS are challenging to use as the main sources of information during such an event due to the inherent time lag in reporting. Additionally, weak monitoring and reporting in countries may fail to get a complete or accurate picture of demand. It could take several reporting periods to identify trends that can impact demand. Hence, it is important to understand the different ways these disruptive events can affect demand signals.

### How Can a Black Swan Event Affect Demand?

During a catastrophic event, demand changes could be policy-driven, such as country lockdowns or updated treatment guidelines. Or they could be driven by client/patient reactions, such as hoarding or displacement/mobility. These demand disruptions could mean a steep increase or suppression in demand, both of which could result in an overcorrection, which creates the bullwhip effect.

**COUNTRY EXAMPLE**

In May 2020, **Pakistan** reported an almost **50% reduction** in total **family planning** and **antenatal care** clinic visits compared to pre-COVID-19 periods.

### A. Clients/Patients Not Accessing Health Services Due to Fear of Exposure to a Virus

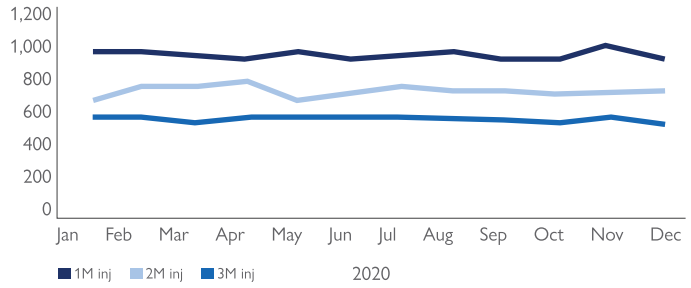
Fear of exposure and distrust in the health system can deter people from seeking routine health services. This is likely to increase incidence of HIV/AIDS, malaria and other diseases, and cause a surge in maternal mortality rates and child deaths from treatable illnesses, as was seen during the Ebola epidemic in West Africa.

### B. Clients/Patients Not Accessing Health Services Due to Government Policies

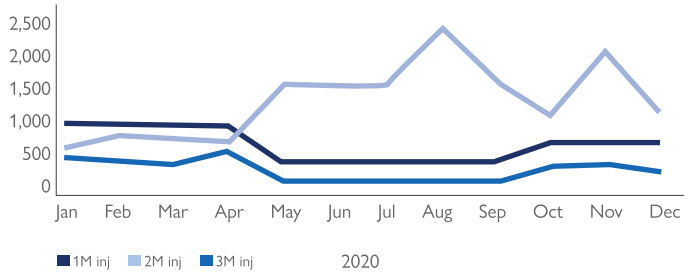
Emergency public policy measures imposed by governments to slow or mitigate the effects of a black swan event, such

## FIGURES 2 AND 3. INJECTABLES FORECAST AND CONSUMPTION

**Example:** One year forecast of 30-day, 60-day, and 90-day injectables based on past demand for FP services shows the regular demand patterns expected for the three items




**Example:** Sudden product substitution in May to provide extended family planning coverage caused actual consumption of 90-day injectable to spike seasonally during and after the Black Swan Event




as quarantines and restrictions on travel and trade, result in demand disruptions and a temporary breakdown of local and international trade and logistics services.

If local government policies shift resources from traditional health services to focus on acute care, some services become unavailable to clients. For example, the UN Population Fund (UNFPA) estimated that lockdowns would prevent 13 to 51 million women in LMIC from accessing modern contraceptives, leading to an additional 325,000 to 15 million unintended pregnancies, depending on the level of health service disruption. The effect could be especially pronounced for methods that require the availability of trained professionals, such as for intrauterine devices or implants. The shortage of providers could result in reduced demand.

Certain commodity categories are more susceptible to these policy decisions. For example, amidst an infectious disease epidemic, local governments may decide to forego mass campaigns (i.e. those for voluntary medical male circumcision or distribution of long-lasting insecticidal nets) to prevent risk of exposure. While this successfully reduces the spread of the epidemic, it will reduce consumption of commodities. As a result, reduced demand for preventive interventions as noted above could trigger an increase in the diseases they are designed to prevent. Conversely, a spike in such cases would increase demand for treatment commodities in the near to mid-term.

### C. Increase in Mortality and/or Population Mobility Because of the Black Swan Event

A peak in deaths and/or mass population movement due to the black swan event could impact future demand for the long-term. In the case of increased mortality, this impact would vary based on the effect of the event on different populations. For example, during a natural disaster, the impact could be felt symmetrically across population groups. However, a rapid onset disease outbreak could be felt asymmetrically in specific groups and disproportionately affect the more vulnerable.[5,6] An event that particularly affects one region could cause residents to leave, shifting demand to other areas.

### D. Product Substitutions by Client Choice or Policy Change

Certain products could be substituted with alternative options either due to client preference or due to policy shifts made by the national health program. This substitution could diminish demand for one product and increase demand for its substitute. This is especially true when free movement to access health services is a concern. A product which has a longer duration of efficacy could be given to clients. For example, if the current preferred family planning method is the 30-day injectable or the monthly oral contraceptive, a black swan event could precipitate a decision by either party (client or health program) to choose a longer-term method, such as the 90-day intra-muscular injectable (***Figures 2 and 3***). This change would allow the client to avoid unwanted pregnancies for a longer period with just one dose, thus reducing the frequency of clinic visits.

### E. Product Diversion From Its Regular Use

A policy that would increase the amount of dose or number of doses prescribed at one time would, in the short term, send a distorted demand signal that could be interpreted as an increase in consumption in the near term. Or, increased use of rapid diagnostic tests for malaria used instead for COVID-19-related fever, for example, would give false impression of a rise in malaria.

[5] Morse, B., Grépin, K. A., Blair, R. A., & Tsai, L. (2016). Patterns of demand for non-Ebola health services during and after the Ebola outbreak: panel survey evidence from Monrovia, Liberia. BMJ global health, 1(1), e000007. https://doi.org/10.1136/bmjgh-2015-000007.

[6] Ibid.

## Recovery Stage

Information is key to better predict the effect of an event on demand.

### A. Defining the Disruption(s)

Black swan events do not affect all public health services equally. Conversations around demand disruptions should begin by identifying commodity categories and then the disruptions that apply to each commodity group. Planners can model how the decisions of patients and policymakers could affect demand for the different health commodity categories by estimating an increase or decrease on the forecasted consumption for a determined period of time.

Demand disruptions should be categorized to help in estimating the impact and duration of the impact (***Figure 4***). For example, if the disruption is due to unavailability of supply, a return to normal demand patterns should occur when stocks are replenished; but if demand has been impacted by population displacement, you may have multiple locations where adjustments are needed to reflect both decreasing and increasing demands.

*Table 1* shows how segmenting by commodities could help identify the specific commodity disruption.

**FIGURES 4 AND 5. DEMAND DISRUPTIONS AND ADJUST FORECASTS**

**Categorize Demand Disruptions**

- Unavailability of supply
- Inability to visit facilities
- Reallocation of health workers
- Population displacement
- Discouraged or fearful population

**Adjust Forecasts for Anticipated Duration**

- Patients return when supplies restored
- Patients return post-black swan
- Patients return when services restored
- Patients relocate due to shifting demands
- Patients return after awareness campaign

Demand disruptions can be identified in phases:

— **Immediate**: The black swan event causes disruptions.

— **Near-term**: Stakeholders characterize demand patterns during the recovery stage.

— **Long-term**: Stakeholders estimate demand post recovery and into the new normal.

**TABLE 1.0**
Demand Disruption Examples per Health Commodity Type

| COMMODITY | DISRUPTION EXAMPLES |
|---|---|
| **90-Day Injectable** | Demand for 90-day injectable trends up rapidly as users of 30- and/or 60-day injectables prefer longer coverage to minimize risks during a black swan event. The higher demand could lead to stockouts. This uptick during a pandemic could also be indicative of sustained demand in the future (if preferences change). |
| **Maternal/Newborn Commodities** | Black swan events trigger higher fatality rates among women and children, thus decreasing the total population that would need these commodities, or deprioritizing these services altogether can severely impact demand. |
| **HIV Rapid Test Kits** | Demand could reduce during a pandemic as people decrease their visits to health facilities. Testing targets for the year might not be met. This could lead to overstock of screening/confirmatory tests and possible expiries. |
| **Malaria Pharma** | Black swan events disrupt the planned mass distribution of long-lasting insecticidal nets and other preventive interventions. As a result, malaria caseload increases and therefore demand for malaria drugs spikes, leading to potential stockouts of drugs. |

### B. Analyze Path to Recovery

Based on the demand disruptions, the team, including demand planners, will analyze and plot potential paths to health service delivery recovery and model how particular paths might affect demand. Several paths should be considered, including one where demand returns to what it was before the event, and one where it does not.

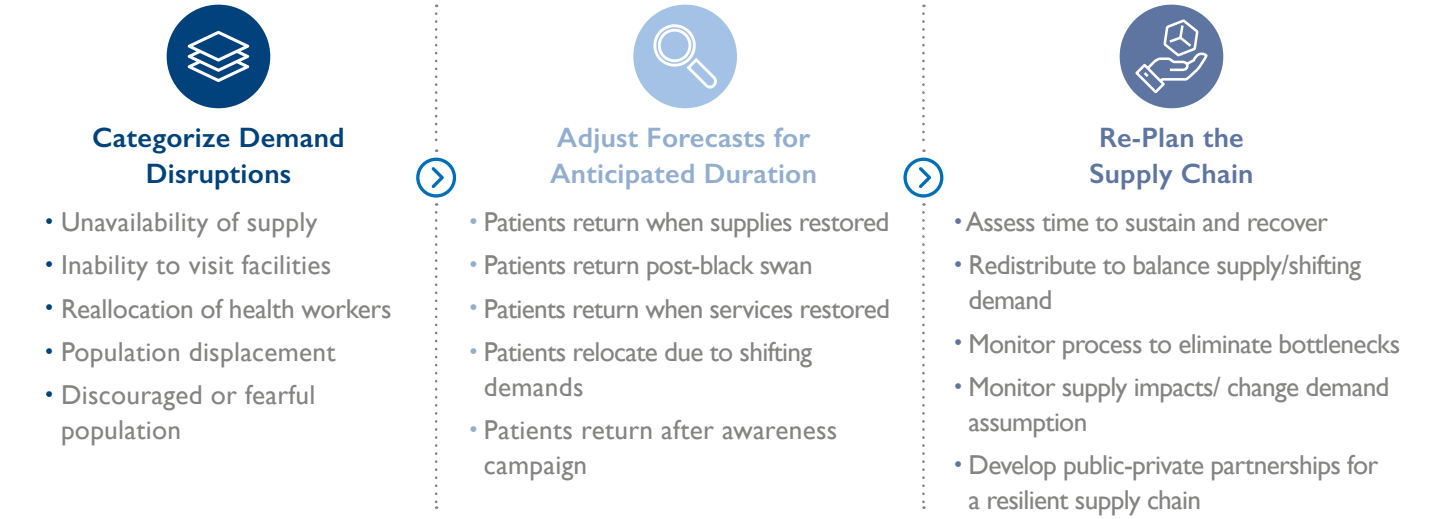
During the recovery period, managers should anticipate that demand will have shifted from what was planned before the black swan event and that some or all of the shift may be permanent (***Figure 5***). A return to normal demand patterns could take considerable time, or not return at all. As recovery begins, studies indicate that demand for routine health services rebounds quickly.[7] Thus, the paths to recovery must account for this and consider community outreach and government trust as likely influences in demand rebound.

### C. Scenario Planning With Stakeholders

Once the paths to recovery are identified, demand planners can advise stakeholders on the feasibility of implementing these

[7] Morse, B., Grépin, K. A., Blair, R. A., & Tsai, L. (2016). Patterns of demand for non-Ebola health services during and after the Ebola outbreak: panel survey evidence from Monrovia, Liberia. BMJ global health, 1(1), e000007. https://doi.org/10.1136/bmjgh-2015-000007.

## FIGURES 6. RE-PLANNING THE SUPPLY CHAIN




paths based on how each scenario would impact stock status projections for each product or each health program, through the lens of multiple supply plan versions. When presenting alternative paths of recovery to stakeholders from a demand perspective, it is important to identify where demand shaping can occur to minimize the number of patients not receiving care (***Figure 6***). For example, if moving to a substitute product could reach more patients, explore the feasibility of promoting this move, and review the assumptions and risks this path introduces.

### D. Executing the Recovery Strategy

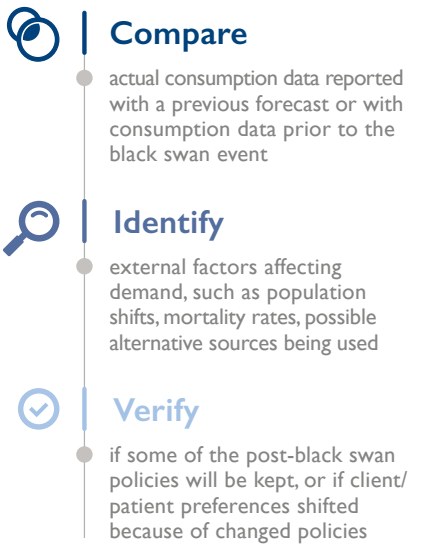
Demand planners can play a key role in the recovery strategy by closely monitoring consumption patterns and being involved in the process to resolve recovery challenges. Consumption data should be regularly collected and monitored to inform whether the strategies are being implemented successfully or if they need to be adapted. Updated forecasts and supply plans could be informed by:

- **Immediate**: Anecdotal/observed changes in patient behavior can be collected via simple surveys of healthcare workers. Behavior changes can include patients being turned away from or not visiting health facilities, moving away or complaining about lack of a product.
- **Near-term**: Early activity reporting (LMIS/HMIS) could show reductions in demand, validating survey results.
- **Long-term**: Changes to treatment options or migration to different parts of the country indicate potentially long-term shifts in demand.

In the mid- to long term, when estimating future demand utilizing actual LMIS or HMIS consumption or service data, planners should understand that statistics might be skewed in either direction due to various factors that could have affected demand. Planners should estimate how significant the skew is.

*Figure 7* shows some actions that planners can take to contextualize data reported during a black swan event to inform how demand has been affected during and post-recovery stage.

## FIGURE 7. CONTEXTUALIZING DEMAND DATA



05.

Supply Disruptions

PHOTO CREDIT: Nasser Bay

# Supply Disruptions Result in Stockouts, Delays, and Bottlenecks

**Supply-side shocks impact both the manufacturing and distribution levels of the supply chain. This extends to ground, sea, and air transportation.**

## Pre-Disruption Stage

Normal, day-to-day operations in the supply chain are important to fully understand the impact of black swan events. On the supply side, pre-event normal means that international, domestic and local suppliers and manufacturers respond to orders and requests, fulfill them according to schedule and demands, and achieve the "Six Rights – Right Product, Right Quantity, Right Condition, Right Place, Right Time and Right Cost".[8]

## Black Swan Stage

Risk mitigation is crucial for any successful supply chain. However, black swan events themselves often uncover previously invisible risks or risks that were perceived as a low probability or low impact. On the supply side, this could mean abrupt halts to transportation lanes or air service, or export restrictions. Some of the biggest supply-side impacts felt during a black swan event include initial stockouts and delays and ensuing supply-side bottlenecks. These will be discussed below.

### How Can Black Swan Events Affect Supply?

These events impact the supply side at both a manufacturing and distribution level. Initially, suppliers may struggle to distribute their goods due to these events wreaking havoc on distribution channels globally. As the crisis prolongs and buffer and safety stock of raw materials are depleted, the manufacturers themselves struggle to maintain order fill rates; supplies of finished products dwindle across the global supply chain until raw material delivery can resume. Difficulty in finding alternate sources and suppliers generally correlates to the duration of the event as well, and as sources diminish, lead times increase as suppliers scramble for alternatives.

### A. Transportation Reductions/ Restrictions Can Cause a Distribution Shock and Lead to Delays and Stockouts

One of the initial supply-side disruptions in the current black swan event (COVID-19 pandemic) was the severe impact to air travel and the ensuing freight logjams. By early March 2020, 10% of all flights were cancelled. In April, over 80% were cancelled.[9] As roughly half of air cargo is transported in passenger jets, freight rates increased as routes continued to be cut. Reduced flights initially created a bottleneck of delayed shipments. In response, some freight forwarders began running more cargo-only flights rather than hybrid passenger-cargo flights, but this still resulted in price increases and further delays. As flight routes were extremely limited, to ensure pharmaceutical availability, some supply chains were forced to charter private jets as an interim solution at a high cost.

**PRE-DISRUPTION CHARACTERISTICS**

- **Orders fulfilled** at acceptable and expected rates
- **Carrier pickups scheduled** according to routine lead times
- **Local carriers available** for last-mile distribution
- **Warehouses equipped** to hold sufficient stock and buffer stock
- **Emergency orders** are rare

[8] https://www.who.int/immunization/programmes_systems/supply_chain/en/

[9] https://www.aislelabs.com/blog/2020/03/27/how-airports-globally-are-responding-to-coronavirus-updated-frequently

### GHSC-PSM LESSONS LEARNED

COVID-19 did demonstrate that some of **the best practices we were using are adaptable** in the context of pandemics. **Reducing the size of shipments** and **using ocean freight** were two of the best practices that helped keep goods moving and minimized disruptions to the supply chain. In the end, our work incorporating better practices to streamline the global supply chain passed the test of a pandemic.

Similarly, shipping lanes were also impacted as demand for luxury goods fell, and quarantines and health considerations (e.g., the safety of ship crews and the potential for them to transmit illness from one country to another) caused delays. Due to uncertainty of shipments, freight companies changed scheduling patterns.[10] When shipping previously scheduled orders, ships were sailing with reduced volume, leading to higher costs, since the costs to operate a ship are only marginally affected by the amount of cargo. Eventually, many freight companies kept ships from sailing until they were full, causing long delays. It then became almost impossible to accurately forecast arrival dates to final port destination. This then delayed customs clearance, caused bottlenecks at the port and increased fees.

Black swan events can also impact ground transportation. During the 2015 Nepal earthquake, landslides blocked major roads and isolated villages. At the height of the 2014 Ebola outbreak, overland trucks in West Africa were often stuck at borders, which were intermittently closed throughout the epidemic.[11] In the COVID-19 pandemic, Zambia has been impacted by neighboring South Africa's restrictions. Some overland border posts were restricted, and drivers were asked to quarantine.

Even in-country, black swan events can delay or reduce transportation from the central-level down to individual service delivery points (SDPs) or health clinics. During the earthquake in Haiti (details below), ports were clogged and backlogged. At central-level warehouses and distribution centers commodities clogged picking lanes and shelves, which delayed outbound orders to facilities. During the Ebola outbreak, some logistics companies had an increased load of shipments, while nearly 50% of drivers refused to show up to work due to safety concerns.[12] Further, the supply of drivers, fuel and warehouse space can impact in-country distribution.

### B. Government Policies and Restrictions Can Further Exacerbate International Supply Chains

Stay-at-home orders and other in-country travel restrictions can prevent supplies from reaching the last mile within countries. National governments may enact export restrictions on certain goods they deem essential. Initially, these policies can be an attempt to mitigate risk of supply chain shortages for their own populations. However, these supply constraints can force importing countries to seek alternative suppliers with alternate active pharmaceutical ingredient sources, many of whom may have limited capacity.

A fundamental restriction may be available financial resources. With the black swan event consuming resources intended for current healthcare supplies and distribution infrastructure, allocation of available funds must be prioritized until additional funding can be secured.

### C. Uncoordinated Efforts Can Exacerbate Bottlenecks

The 2010 Haiti earthquake is an example of a regional black swan event in which transportation became a bottleneck due to an over-supply and lack of coordinated shipping and customs clearance. Immediately following the earthquake, shipping lanes became clogged. Resources and labor were diverted to sorting through goods and coordinating new logistics operations, reducing capacity of individuals to assist elsewhere. The capital, Port-au-Prince, subsequently became clogged with in-bound goods with no planned end destination. The President's Emergency Plan for AIDS Relief (PEPFAR) supply chain was able to recover relatively quickly in Haiti because of the coordinated effort of seven international and national organizations. Within four weeks, the program resumed almost normal operations.

The 2015 Nepal earthquake saw a marked improvement in the transportation response, in-part due to prior disaster risk-reduction planning efforts, which included establishing a humanitarian staging area in

### LIMITED TRANSPORTATION IN NIGERIA FROM COVID-19

- By late March, **airports were closed**, and increased shipments by sea extended the lead times, further exacerbated by port closures.
- **Securing approval** for the release of family planning commodities from the central warehouse was **delayed**.
- **3PL (third party logistics) operators'** – essentially private courier, warehousing and distribution providers – movements were also **restricted**.

[10] https://www.joc.com/maritime-news/container-lines/coronavirus-creating-unprecedented-container-shipping-disruption_20200221.html
[11] https://www.bsigroup.com/globalassets/localfiles/aaa/Whitepaper%20Ebola_10.14_7.pdf
[12] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7150125

Kathmandu to assist and coordinate a UN logistics cluster.[13]

In the early stages of the COVID-19 crisis, when international travel lanes were starting to shut down, the USAID Global Health Supply Chain Program-Procurement and Supply Management (GHSC-PSM) project recommended that countries prepare for both international and in-country shut-downs by moving most products out of warehouses and redistributing stock to SDPs at the last mile in geographic areas most in need, even if this meant short-term over-stocking SDPs, since products in warehouses cannot serve patient needs. However, if demand has also been disrupted, then this response can result in unwarranted resupply quantities, distributed, potentially, to the wrong geographic areas. Where there is no supply disruption, demand disruptions are more easily identified (inventory is growing/not reducing), but when supply is also disrupted, other measures will be needed to identify if demand is disrupted.

**Where there is no supply disruption, demand disruptions are more easily identified (inventory is growing/not reducing), but when supply is also disrupted, other identification measures will be needed if demand is disrupted.**

GHSC-PSM also recommended re-organizing storerooms to prepare for any influx of emergency aid, including potential use of shipping containers (and reefers, or refrigerated shipping containers, that require external power) as short-term storage to preserve product quality.[14]

A procurement manager's ability to find products can also be affected by the procurement regulations of exporting countries. They may restrict exports, reverting to protectionist and inward-looking practices. As COVID-19 reached pandemic status, some exporting countries began restricting exports of personal protective equipment, respiratory-related pharmaceuticals, sanitation products and even foodstuffs. Over 80 countries introduced export restrictions between January and May 2020.[15] Improved global coordination can reduce these reactionary restrictions, but ultimately restrictions will not go away entirely until a state feels secure enough to reopen its own economy.

### IMPACT ON FAMILY PLANNING

**COVID-19 and the impact on international procurement of contraceptives is estimated to have reduced the amount of couple years of protection from 2019 to 2020 from 12.6 million to just 2.3 million.**

### D. Engaging in Single-Source Supplier Relationships Can Increase Risk and Costs

Many supply chains currently focus on reducing suppliers due to strategic partnerships and other incentives which can result in lower costs.[16] However, black swan events show that these cost savings often erode during periods of restricted supply, and pitfalls of a reduced number of suppliers become apparent. If the lack of alternative suppliers is an issue, supply-side disruptions will be felt almost immediately.

## Recovery Stage

To determine outlets for black swan supply chain recovery, we analyzed the largest factors of the above supply-side black swan effects. In finding common variables, we can better propose recovery options and mitigation for future events for all supply and distribution planners.

### A. Defining the Disruption(s)

Understanding the type of supply disruption is vital, as these disruptions can vary impacts along the supply chain (***Figure 8***). For example, if there is a logistical bottleneck along a route, finding alternate suppliers would do little to resolve the situation. As supply disruptions can be different across products, it is helpful to categorize into product groups, or critical products within a group, to better view the problems and solutions. It is important for supply chain managers to pinpoint the disruption along the supply side so they can fully understand the shocks. Often, more than one type may apply; however, supply chain managers must prioritize the issues and respond accordingly, resolving each disruption until stability is restored.

Working groups and committees set up to define the disruption and possible paths to recovery should pay attention to where exactly the shocks are felt the most.

### FIGURE 8. SUPPLY DISRUPTIONS

**Categorize Supply Disruptions**

- **Pre-Supplier Level**
  - Raw material shortage
- **Supplier Level**
  - Demand spikes
  - Labor shortage
  - Plant closure
- **Delivery and Distribution Level**
  - Policy-driven
  - Bottlenecks
  - Transportation shortage

[13] Cook, Alistair & Shrestha, Maxim & Htet, Zin. (2016). International Response to 2015 Nepal Earthquake: Lessons and Observations. 10.13140/RG.2.2.35305.90722.

[14] For more information, see https://www.ghsupplychain.org/sites/default/files/2020-06/COVID_guidance_Preparing_for_whats_next.pdf and https://www.ghsupplychain.org/sites/default/files/2020-04/Tips_for_optimizing_storage.pdf.

[15] https://crsreports.congress.gov/product/pdf/IF/IF11551#:~:text=As%20of%20May%201%2C%20at,products%2C%20and%20other%20medical%20goods.

[16] http://teme2.junis.ni.ac.rs/index.php/TEME/article/viewFile/1011/400.

**FIGURE 9. SUPPLY RECOVERY**

**Categorize Supply Disruptions**

- **Pre-Supplier Level**
  - – Raw material shortage
- **Supplier Level**
  - – Demand spikes
  - – Labor shortage
  - – Plant closure
- **Delivery and Distribution Level**
  - – Policy-driven
  - – Bottlenecks
  - – Transportation shortage

**Adjust Forecasts for Anticipated Duration**

- **Alternate Suppliers**
- **Alternative Products**
- **Public-Private Partnerships**
  - – Available products
  - – Trusted suppliers
  - – Distribution channels

If at ports of entry, this could be a logistics and transportation scenario. If shocks are felt during the ordering process, it is likely a manufacturing or supplier sourcing situation.

### B. Analyze Path to Recovery

Supply chain stakeholders need to be aware that supply-side shocks during black swan events often follow demand or policy-level impacts. Analyzing the paths to recovery and resiliency depends on being able to successfully pinpoint where along the supply chain these impacts affect supply the greatest. Any analysis must include demand planners and policy experts, as demand and policy areas will inevitably impact supply.

Supply chain managers must truly understand their suppliers and capabilities when analyzing recovery paths (***Figure 9***). For example, an increase in suppliers or substitute products will likely need to be retracted once the black swan event dissipates. Actions must be flexible and adaptable for a potential return to normal. Recovery is not complete if the proposed solution creates over-supply following the event. Policy decisions can impact the supply side, and recovery planners must be aware that national and international decisions will impact supply. It is important to analyze not only the paths themselves, but the potential regulatory and political variables at play when supply expands/contracts during a black swan event. Equally important is an assessment of available funds, as a funding constraint will mandate prioritization of all recovery options.

### C. Scenario Planning With Stakeholders

After analyzing recovery paths, supply and distribution planners, managers, procurement specialists and, ideally, policymakers and other stakeholders must come together to define and detail various recovery scenarios.

— **Role-Play the Best Paths for Recovery**

Based on the prior analysis of recovery options, supply chain managers should have an idea of the largest factors impacting the supply side during black swan events. Informed by past events, recommendations and recovery plans from similar settings, supply chain planners and managers can apply these experiences and understand how to plot the best recovery path. By product group, the planning team guides the stakeholders through the top recommended paths to recovery, including the means to evaluate the impacts of each option.

For example, to re-stock warehouses in the short-term, supply chain managers may need to re-balance supplies across warehouses and SDPs, with a longer-term option to add additional procurement options, such as building a partnership with a private-sector firm. They should provide methods for comparing alternatives, such as cost to implement, consumption of fixed or non-replenishable resources (warehousing, service delivery, cold storage), and patient service-levels expected.

— **Plan Recovery Actions With Stakeholders**

Stakeholders are presented the recommended path(s) to recovery to evaluate the impact on the overall supply chain and how supplies can meet the expected demands. Where there are shortfalls in service levels to patients, stakeholders will want to understand if there were better alternatives. Perhaps an option was dismissed that delivered better patient service levels, but an additional cost to procure from the private sector was too steep. Stakeholders could be presented a cost/benefit analysis where options were dismissed only to find they can commit to finding additional funds, making it a viable path to recovery.

Once this team selects an appropriate path, it should identify the actions that must be taken to implement the path to recovery. The actions are broken into specific tasks that can be tracked to completion, and the results can be evaluated using the same criteria that was used to evaluate the path: cost to implement, use of resources and service levels delivered to patients.

*Cyclone Idai devastated Mozambique and significantly disrupted public health supply chains and deliveries of health commodities. PHOTO CREDIT: Mickaël Bréard | USAID GHSC-PSM*

— **Evaluate, Discuss, and Identify Risks**
The expected impacts to the supply chain can range anywhere from least negative impact to full recovery. Regardless of the expected impact, stakeholders should identify the risks associated with the recovery path and how these can be anticipated and mitigated. For example, if the recovery path is an initial redistribution to areas most in need, followed by a planned resupply from a private-sector partnership, risks of transportation availability, available funding or even change in government policy could impact the effectiveness of the planned recovery path. It's important to identify all potential risks, and then prepare to track the planned actions and associated risks to monitor the recovery path.

### D. Execute the Recovery Strategy

Stakeholders have agreed on the most appropriate path to recovery and have established the actions and tasks, the risks and the expected outcomes. Mobilizing the supply chain to execute the recovery strategy likely involves multiple parties that need to collaborate and share priorities so that all actions can be taken and consistently measured for expected outcomes. Most critical is the measure of patient-level service. Measuring available supply and actual demand

**NEW NORMAL AFTER COVID-19**

**Some long-lasting effects following COVID-19 recovery measures may include increased registration processing, especially with essential health commodities.**

monthly or quarterly may not be sufficient to determine if the recovery is progressing as planned.

To effectively monitor the progress of the supply recovery, gather real-time supply chain data wherever available, and use this as a first measure of how the recovery path is progressing. If real-time supply and demand data is only available from central stores, planning these locations independently can provide immediate insight into how supplies are changing. Planning the entire supply chain is the ideal, but at the least, prepare to monitor the critical product groups and key products. For each recovery strategy, ensure that all planned actions can be reported in near-real time, and then monitor these to identify missed targets and potential risk-triggers.

Once again, it becomes imperative to contextualize the data so that stakeholders can readily compare demand with supply to better understand supply chain imbalances. When root causes are identified, the recovery strategy should identify the actions that can be taken to mitigate the disruption (***Figure 10***).

### Next Steps: What Recovery Efforts Can Pose Enduring Solutions?

While these solutions cannot solve supply chain issues in the middle of a crisis instantaneously, they serve as recommendations for distribution planners and supply chain managers in the future to create a more resilient structure (***Figure 11***). These recommendations are:

— Create and maintain communication channels upstream through suppliers which can be further expanded during disruptions.

— Have multiple suppliers to minimize supply risks — this should not be viewed purely as a standalone expense.

— Increasing supply speed reduces risks to inventory by stemming supply disruptions and reducing overall volume of inventory at risk. This requires greater coordination by the supply chain team.

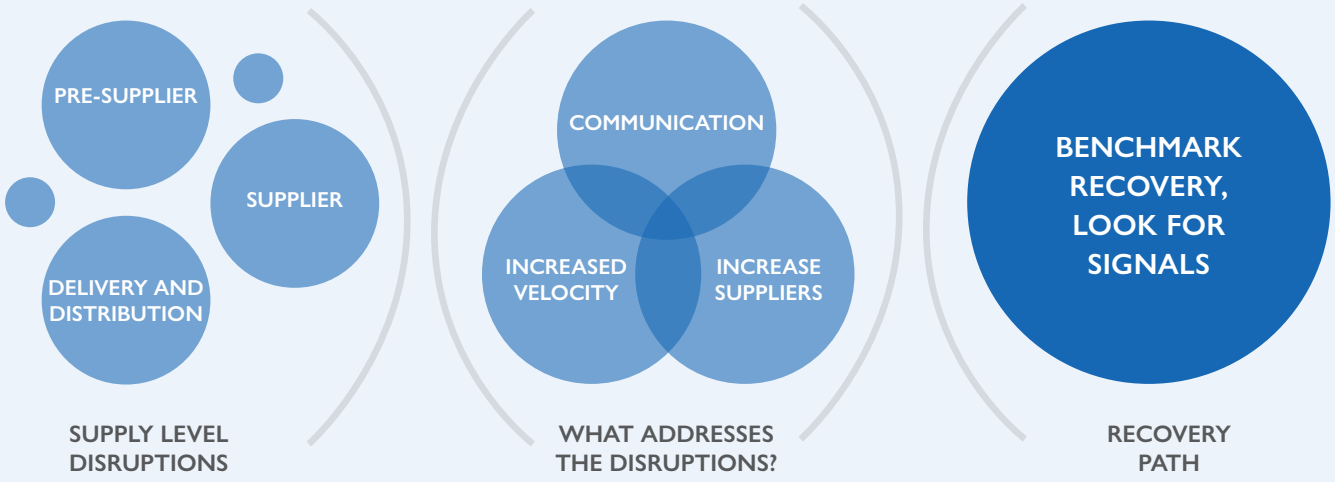
**FIGURE 10. CONTEXTUALIZING SUPPLY DATA**

**Compare**
supply and stock data with the current state of distribution channels prior to the crisis to pinpoint trends

**Identify**
potential shocks to the distribution channels, such as reduced supply channels, as well as export restrictions

**Verify**
and signal supply responses, such as seeking product substitutes or alternative suppliers to promote coordination across the supply chain network

**FIGURE 11. RE-PLANNING THE SUPPLY CHAIN**




For example, during the black swan event, you may have found alternative suppliers that offer a similar or higher quality product that may have only a small additional cost, but who may be able to deliver with a shorter lead time. It may make sense to procure a small percentage (e.g., 5-10% of need) from a higher cost but faster supplier as a way of maintaining a secondary supplier if the primary supplier experiences a delay or disruption. At the very least, procurement managers should maintain a list of suppliers that they can call when their primary supply fails.

Finally, over the long-term, smaller shipments help protect against a future black swan event — for those large shipments that were not received before transportation is cut off as happened during COVID-19, stockouts were more likely than if small amounts were continuing to enter. Smaller shipments are also easier to schedule and obtain cargo space for and are easier to move from ocean to air if required. By reducing inventory cycles and increasing ordering points, you are reducing the overall volumes of commodities at risk.

Overall, procurement managers should pay careful attention to the demand signals and the possibility of a new normal and avoid placing orders and distributing products that will result in the bullwhip effect. Regardless of what steps and paths are followed, the true ability to recover and lead the way to the new normal is communication, visibility and forward thinking both upstream and downstream of the suppliers.

### NEW NORMAL AFTER COVID-19

**In Nigeria, health commodity supply planning moved from quarterly to monthly to guard against future interruptions.**

06.
Demand & Supply Disruptions

PHOTO CREDIT: Bobby Neptune | USAID GHSC-PSM

# Demand and Supply Disruptions Require a Stepped-Up Approach to Recovery

**When both demand and supply are disrupted, a layered approach to the problem uses demand recovery strategies to drive appropriate resupply strategies.**

The fundamental steps are those described for mapping scenarios:

1. **Define the Disruption**
2. **Analyze the Path to Recovery**
3. **Plan Scenarios With Stakeholders**
4. **Execute the Recovery Strategy**

Then monitor the planned execution and re-plan, as needed, to remain aligned with changing conditions as the supply chain progresses to the new normal. For situations where both demand and supply are disrupted, it becomes even more important to adjust demand and calculate new supply requirements together.

## A General Approach to Both Supply-Side and Demand-Side Disruptions

Procurement and supply chain planning managers at all levels should consider disruptions up to and including black swan events. Conduct scenario mapping during the business as usual stage and think through both the response to a disruption and recovery options, not just reacting to the immediate disruption.

**More frequent planning is needed to balance demand and supply, particularly when demands are changing, and supplies must be continuously reprioritized.**

Advance planning for post-event recovery is key to creating resilient health systems which can weather black swan events.[17] The Emergency Supply Chain (ESC) playbook process was established through the Global Health Security Agenda to help countries plan, during the business as usual stage, for how they will react in the short term by mapping specific, most-likely scenarios involving black swan events. (See the Emergency Supply Chain Preparedness and Response resource page for more information). The general process is what appears below.

Supply disruptions have an immediate and visible impact on the supply chain; however, it is critical to understand if there is both demand and supply disruption for a given product or product family. Annual quantification may have been sufficient during the pre-disruption stage, but the demand disruption requires an updated demand forecast to better align available supplies to where they are most needed. More frequent planning is needed to balance demand and supply, particularly when demands are changing, and supplies must be continuously reprioritized (***Figure 12***).

Following the four steps of mapping scenarios, defining the disruption will identify those situations where both demand and supply have been disrupted, and drive the rest of the process.

1. **Define the Disruption**
   Determine the stakeholders and donors whose products are disrupted, which products are affected and where.

[17] Nuzzoet al. BMC Public Health (2019) 19:1310 https://doi.org/10.1186/s12889-019-7707-z.

## FIGURES 12. RE-PLANNING THE SUPPLY CHAIN

### Categorize Demand Disruptions

- Unavailability of supply
- Inability to visit facilities
- Reallocation of health workers
- Population displacement
- Discouraged or fearful population

### Adjust Forecasts for Anticipated Duration

- Patients return when supplies restored
- Patients return post-black swan
- Patients return when services restored
- Patients relocate due to shifting demands
- Patients return after awareness campaign

### Re-Plan the Supply Chain

- Assess time to sustain and recover
- Redistribute to balance supply/shifting demand
- Monitor process to eliminate bottlenecks
- Monitor supply impacts/ change demand assumption
- Develop public-private partnerships for a resilient supply chain

**Supply disruptions are evident, but the demand disruption requires intervention by the planner to adjust the forecast for the area and products affected.** Review any past or similar circumstances and any successful solutions that were chosen at the time. Define the scope of resources, especially the budget, needed to address the disruption.

**2. Analyze the Choices**

Examine the impacts of the adjusted forecast and where and when existing supplies run out. Make sure that any resupply orders that cannot be filled due to the supply disruption reflect accurate/updated delivery schedules so that the time to recover is accurately reflected in the supply plan. **Consider the alternatives of redistribution and prioritize where resupply orders should be distributed when available.** It may make sense to collect a limited amount of data about stocks on hand, available funding (including emergency funding) and supplier and in-country lead times. If this is not possible, a proxy for some information may be needed to develop a forecast of demand and a supply plan to meet the need from existing stock and future shipments.

**3. Plan Scenarios**

Work with stakeholders to evaluate the trade-offs for different response options. **There may be opportunity for redistribution of available supplies, or to expedite existing resupply orders, or procure new supplies from new sources.** Added costs associated with the recovery strategy should be assessed, and priorities established between different commodities and product families that also require intervention.

**4. Execute the Plan**

Select the appropriate recovery strategy with stakeholders. **Begin executing the plan, including any redistribution efforts, sourcing new supplies, or even partnering with the private sector.** Settling on the appropriate recovery strategy is based on current conditions, so frequently revisiting both demand and supply conditions is critical. As conditions change, repeat steps in the planning cycle as needed to adjust for the new conditions.

Repeat this process throughout the black swan event, with adjustments to demand and supply as needed, until the disruption is corrected. Spikes or troughs in demand signals will level out to the new normal demand picture once supplies are stabilized, or other factors affecting demands are addressed, such as regaining access to health facilities and healthcare providers.

Frequent planning is critical in the recovery from a black swan event. The annual quantification process is essential for budgeting and calculating long-term requirements, but the responsiveness and flexibility needed to maintain demand and supply balance requires continuous adjustments. The best practices in supply chain planning include a monthly demand planning cycle, at least, with a rolling 12-month forecast that reflects changing conditions. Measuring forecast demand to actual demand is central to planning the appropriate stocking levels throughout the supply chain to meet the likely demand. **Countries that follow this guideline to frequently plan will be better prepared for sudden changes in supply chain conditions and will have the right tools in place to tackle future black swan events.**

# 07.

In Summary

PHOTO CREDIT: Mickaël Bréard | USAID GHSC-PSM

## The Supply Chain Will Recover!

**History has taught us that supply chains do recover after black swan events. But how and how quickly? Organizations that have recovered the quickest have usually been able to respond and adapt more effectively than others by maintaining a strong focus on sustaining or improving their internal processes during and after the black swan event.**

Recovery happens when the supply chain is able to match supply with demand in a cost-effective way. This requires thinking through different scenarios for recovery and then planning for the most likely while being ready to adapt to any changes.

### New Normal

Recovery does not mean returning to pre-event "normal". Conditions have changed. For example:

- Changes in product preference may continue with many patients
- Shifts in populations can be long lasting
- New supply or distribution channels created to help with the crisis can continue
- New processes adopted to aid in the emergency could become the new standard operating procedure

These last two points are crucial to building a resilient supply chain. The black swan event likely exposed weaknesses, such as single sources of product and limited transportation carriers. If they are solved by identifying new suppliers, they should become part of a new supplier/partner network. If planning disciplines evolved with new access to data or new methods for modeling the data, these tools should become part of the new normal.

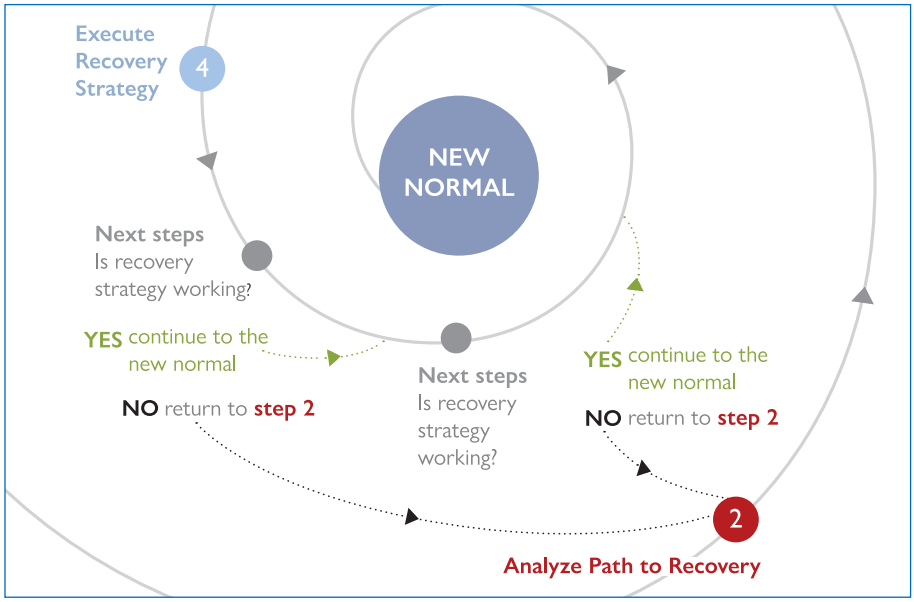
This guide has introduced a principle of more frequent planning cycles where demand is projected, adjusted and frequently assessed to prioritize and reprioritize supply plans. ***Figure 13*** illustrates this principle by showing that if a new strategy needs to be adjusted, planners should go back to Step 2 to reassess the path to recovery, make adjustments as needed and continue on to the path to the new normal. This will help to ensure the long-term resiliency of the supply chain.

Any planning process improvements that are created to navigate during a crisis are adopted because they are more sensitive and responsive to changes in supply and demand. If they are more costly to execute, the cost should be reduced where possible so that they can be adopted as part of the new supply chain processes.

Another critical dimension of the new normal is where public/private partnerships were developed to respond to the black swan event. These could have been one-off solutions to a particular crisis, or they could have been broader, such as a new distribution channel. In any event, these partnerships should be pursued as lasting ones, wherever excess capacity could be needed quickly or routinely. This will benefit both organizations and help limit exposure to future black swan events.

The field guide provides stakeholders with a process to think through their recovery strategy — not just internally within an organization but as part of the supply chain network. To then assist with this process, the guide has outlined insights and experience from historical events across the three major types of supply chain shocks: Demand shocks, supply shocks and when supply and demand shocks are combined.

## FIGURE 13. EXECUTING RECOVERY




The guide provides context to assist with assessment of supply chains and suggestions for how to respond and recover. These outlines aim to provide help by:

- **Focusing stakeholders on the top issues** potentially affecting the supply chain recovery and avoid distraction by misleading clues
- **Thinking broadly through different scenarios** and determining how the available data can be used to inform changes as the supply chain recovers
- **Generating "Plan A"** for recovery but then having a "Plan B," a "Plan C" and so on, enabling change as the environment changes
- **Reducing surprises** and being prepared for the likely outcomes

As the selected recovery strategies are being implemented, careful monitoring of the changing conditions in the supply chain will help indicate if the strategy is working, or if adjustments are needed. There can also be a case where "Plan A" is no longer viable, where "Plan B" or an alternative strategy must be developed and deployed. Thus, it is important that during execution, there is frequent feedback from supply chain monitoring and reporting to inform how the selected strategy is performing.

Lessons learned from GHSC-PSM management of the global supply chain show that a coordinated effort, with frequent and open communications across the extended supply chain, are key to resiliency. Key strategies learned to keep the supply chain moving forward during the COVID-19 pandemic included: quickly surveying the supplier network to understand links to China, where the virus originated, and the nature and extent of supply chain disruptions; proactively managing expected increases in transportation costs; and creating more analysis around geographic dependency.

The supply chain will recover. The most important aspect is ***how***. The success of a well thought out and communicated recovery strategy across all supply chain actors is not that recovery went perfectly as planned — that is just luck. As the environment changes, we can limit the disruption or take advantage of the changes to recover more quickly to establish a resilient supply chain in the new normal, and be ready for the next challenge, big or small.