



Photo credit: Dominique Faget/AFP/Getty Images

BEST PRACTICES IN SUPPLY CHAIN PREPAREDNESS FOR PUBLIC HEALTH EMERGENCIES

Technical Report

USAID | Global Health Supply Chain – Technical Assistance Multi Award IDIQ
(GHSC - TA) Contract No. AID OAA I 15 00030
Francophone Task Order Contract No. AID OAA TO 17 00006

DISCLAIMER. This publication was produced for review by the United States Agency for International Development. It was prepared by Chemonics International Inc. and McKinsey & Company.

TABLE OF CONTENTS

List of acronyms	2
Executive summary	3
1. Landscape assessment.....	6
1A Stakeholder Assessment.....	7
1B Hazard Assessment.....	10
1C Current State Emergency Supply Chain Capability Assessment	13
2. Governance, financing, and personnel.....	16
2A Organizational Structure and Designation of Authorities.....	17
2B Financing of Emergency Supply Chain.....	20
2C Personnel Training and Readiness.....	23
3. Emergency protocols.....	26
3A Trigger Definition.....	27
3B Separation of Emergency and Routine Supply Chain.....	28
3C Emergency Supply Chain Protocol.....	30
4. Emergency procurement and supply chain.....	32
4A Commodity Planning.....	33
4B Quantity Forecasting.....	35
4C Procurement and Sourcing of Emergency Health Commodities.....	37
4D Stockpiling.....	39
4E Emergency Response Warehousing and Storage	41
4F Transport.....	43
4G Waste management.....	45
4H Logistics Management Information System.....	47
Bibliography	49
Experts consulted.....	52

LIST OF ACRONYMS

ACCEL	Academic Consortium Combating Ebola in Liberia
CDC	Centers for Disease Control and Prevention
CMS	Central Medical Stores
EOC	Emergency Operations Center
ERP	Emergency Preparedness and Response Plan
ERW	Ebola Response Workers
ESC	Emergency Supply Chain
FAO	Food and Agricultural Organization
JEE	Joint External Evaluation
IHR	International Health Regulations
LCA	Logistics Capacity Assessment
LMIS	Logistics Management Information System
LMU	Logistics Management Unit
LWSC	Liberia Water and Sewer Corporation
MOH	Ministry of Health
MSF	Doctors Without Borders (Médecins Sans Frontières)
NERC	National Ebola Response Center
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OCV	Oral Cholera Vaccine
OPALS	Operational Planning Application for Logistics and Supply
PEPFAR	President's Emergency Plan for AIDS Relief
PIP	Pandemic Influenza Preparedness Framework
PPE	Personal Protective Equipment
PSCN	Pandemic Supply Chain Network
SKU	Stock-Keeping Unit
SOP	Standard operating procedure
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNISDR	United Nations Office of Disaster Risk Reduction
UNHRD	United Nations Humanitarian Response Depots
UNICEF	United Nations Children's Fund
WBPEF2	World Bank Pandemic Emergency Financing Facility
WFP	World Food Programme
WHO	World Health Organization
WTO	World Trade Organization



EXECUTIVE SUMMARY

When it comes to emergency supply chain management, a little preparedness will go a long way. Investing relatively small amounts of time and resources up-front to reach a minimum level of preparedness can significantly improve outcomes for vulnerable populations when an epidemic occurs, minimizing the impact on people and infrastructure. The same set of supply chain preparedness activities are applicable across most infectious threats and many resources are available to help countries prepare.

This document compiles best practices in emergency supply chain preparedness so that countries can respond rapidly and effectively to epidemic and pandemic threats. Such a response requires a well-functioning supply chain. However, the inherent unpredictability of an emergency poses particular challenges for the supply chain – visibility into both demand and supply is limited, and involvement of multiple stakeholders requires significant coordination. Investment in preparedness combats these challenges by planning for a range of possible scenarios and outlining stakeholder roles to mitigate the impact of these “unknowns”.

We take a country-centric approach to emergency preparedness, focusing on what governments themselves can do to strengthen their capacity to respond to public health emergencies. Other organizations, such as the Pandemic Supply Chain Network, have already done significant work on ways the international community (including private sector) can collaborate on emergency preparedness. This document complements those ongoing efforts by outlining the country’s own role in preparedness efforts. This intended audience of this document includes both international organizations (donors and NGOs) and developing country governments and public health practitioners. A closely related publication is the country-facing Emergency Supply Chain Playbook, which translates the lessons from this document into a package of action-oriented user guides, management tools, templates, and job aids suitable for in-country use for emergency supply chain preparedness and response. The relevant sections of this Playbook are

referenced under the “Resources” section of each chapter in this document.

The supply chain fits into a broader topic of emergency preparedness planning. Each country should have its own comprehensive emergency preparedness and response plan, which includes critical elements such as surveillance. The emergency supply chain recommendations in this document are intended to be part of a broader emergency preparedness agenda at the country level.

These recommendations are based on a One Health approach to emergencies that complements the all-hazards approach that some partners have adopted. One Health is an approach that takes a holistic view of human, animal, and environmental factors in disease preparedness and response. This document focuses specifically on supply chain preparedness for a set of infectious diseases and zoonotic hazards that developing countries commonly face. However, almost all of the practices in this document are also applicable to non-zoonotic infectious hazards and many are relevant to non-infectious disease emergencies.

Many existing resources are available to aid preparedness efforts. Local and international stakeholders have developed a number of materials to support emergency supply chain preparedness and response. These include sophisticated tools and guidance covering steps that require deep technical expertise. The gap that remains for most countries is to adapt and apply these tools to their own settings. For most countries, this will require a sustained initial effort by a small team, followed by lighter-touch annual updates in subsequent years. Activities can be summarized across three themes:

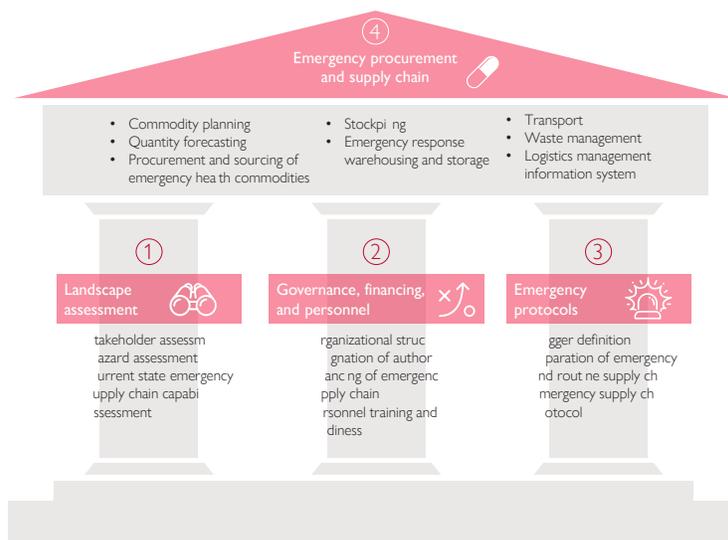
- **Clarifying governance of the emergency supply chain.** Clearly identifying who has authority and accountability for the emergency supply chain overall and the key sub-components within it will help countries mobilize rapidly and effectively in the event of a disease outbreak. In addition, identifying potential partners across each of the emergency supply chain components and opening consistent channels of

communication will further bolster countries' ability to respond to emergencies

- **Identifying disease threats and needed commodities.** Developing an initial understanding of a country's specific threats and potential resources to leverage in an emergency is essential to preparedness because of variation in country contexts across multiple dimensions (hazards, geography, existing capacity). These dimensions inform countries' decisions on how they design their emergency supply chain. Understanding disease threats will also allow countries to identify the types and quantities of commodities that should be stocked in the emergency supply chain in the event of an emergency, as well as deciding whether to stockpile some of these commodities in advance
- **Planning storage, transport, and logistics in the event of an emergency.** In the event of an outbreak, containing the threat is greatly aided by simple advance planning steps such as identifying potential storage sites and logistics providers

This document is organized into four sections: (1) Landscape Assessment; (2) Governance, Financing, and Personnel; (3) Emergency Protocols; and (4) Emergency Procurement and Supply Chain. Each section is further divided into individual chapters covering recommendations for discrete topics. These recommendations are not intended to be exhaustive; rather, they represent an effort to synthesize the significant amount of existing literature on each topic into a core set of implementable best practices. Each chapter also includes a case study highlighting an instance that illustrates some element of the recommendations, and many chapters also identify a set of common pitfalls to be avoided.

KEY COMPONENTS OF EMERGENCY SUPPLY CHAIN MANAGEMENT AND PREPAREDNESS



The best practices in this document were gathered from review of existing literature in the fields of supply chain management and emergency response, as well as interviews with interdisciplinary experts. Experts consulted for this study include staff from leading international organizations (e.g., WHO, UNICEF, WFP), public health and supply chain staff in developing countries, non-governmental organization, and private sector partners. A full list of sources and experts consulted can be found in the document's bibliography.



1. LANDSCAPE ASSESSMENT

1A | STAKEHOLDER ASSESSMENT

Map the local and international players in a country's emergency supply chain (ESC) to understand their roles, responsibilities, and capacities in an emergency.

Definition

A stakeholder assessment is a thorough mapping of all local and international organizations that could play a role in a country's ESC in the event of an outbreak. The assessment should not only identify the stakeholders but also determine their capacity to provide supply chain support, and what their roles could be.

Why this is important

Understanding the roles played by different stakeholders ahead of time will enable the strongest response from Day 1 of an emergency, with clear, coordinated involvement from all stakeholders. An accurate identification of the capabilities that each stakeholder will bring to the emergency supply chain enables coordination and planning ahead of time. This will reveal overlaps and gaps in capacity, which the country and its partners can then plan to bridge ahead of an actual outbreak.

Mapping

Every organization that could be a stakeholder in a country's emergency supply chain should be "mapped" ahead of time. Mapping involves listing the names of relevant organizations and individuals, contact information, roles and responsibilities, and geographic location. The mapping should include the following types of institutions:

- National and local governments
- Emergency operations centers
- Local authorities and communities

- Military
- Multi-national organizations (e.g., WHO)
- International and local NGOs
- Functional sectors (e.g., Logistics Cluster)
- Private sector organizations (e.g., local businesses, international businesses with in-country operations)
- Universities and centers of excellence

The ESC team, or in its absence the Ministry of Health (MoH), should list the organizations that fall under each of these categories to develop a sense of which sectors will play major roles. The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) provides a good starting point for locating this information, as it supervises different programmatic and technical clusters and can help countries understand the overall stakeholder landscape by sector. The Logistics Cluster's Logistics Capacity Assessments ("LCAs"; to be addressed in greater detail under "Current state capacity assessment") also list relevant stakeholders, along with the logistical capabilities that each provides.¹ Countries should supplement these sources with their own research, however, as country contexts change rapidly.

It is important to identify specific focal person(s) within each of the stakeholder organizations with whom the country will discuss supply chain logistics and capabilities. Some of these organizations (likely the international organizations, NGOs, and functional sectors) will have a local director of supply chain or logistics.²

Role identification

Once the ESC or MoH has identified relevant stakeholders, they should determine what roles these stakeholders typically play to design appropriate coordination structures, as well as to understand the organizations' impact on their ESC capacity.

1 Pandemic Supply Chain Network Project: "Project Report" (2017)

2 Pandemic Supply Chain Network Project: "Project Report" (2017)

The country's government, and likely its MoH in particular, will play the lead role as much as possible, shaping the ESC response organization, developing regulations, coordinating across other actors, and leading on communications. The typical groups of actors are:

- **Local authorities and communities**, which support the policies and communications developed by central structures
- **Coordinating mechanisms**, such as Logistics Clusters or Logistics Management Units (LMUs), which hold meetings across local and international actors
- **International organizations**, which provide technical programmatic activates, along with tactical logistics, operational, commodity, and funding support
- **Local NGOs**, which have varying roles depending on the community, but generally serve to support activities in specific communities and build trust
- **Private sector organizations**, which provide both physical assets, goods, and services as well as potential collaboration in preparedness in response planning³

The ESC team should look to past emergencies to better understand the roles that each stakeholder plays in specific contexts. Though there are typical sectoral roles in ESCs, the degree of each sector's influence, as well as the roles of specific organizations within each sector, vary by country and by emergency. Past emergencies provide useful information on past behavior that can help countries develop realistic expectations for roles that each partner will play in the supply chain.

Understanding what elements of coordination worked well and what worked poorly between stakeholders in the ESC is an important input for countries to establish appropriate organizational structures and partner coordination mechanisms for the future. An examination of past partner responses also helps countries plan for ESC pre-

paredness trainings. Identifying which stakeholders performed well along the value chain shows who can lead certain parts of preparedness exercises.

Not only will past disaster response case studies show which organizations participated in supply chain response, but also provide information on partner timelines. Information on historical response time by partner (e.g., time required to mobilize commodities from United Nations Humanitarian Response Depots (UNHRD) regional stockpile to point of service) will provide an important input to plan resupply and identify bottlenecks to simplify, such as customs protocols.

The ESC team can use existing assessments as starting points to identify the historical roles stakeholders have played. LCAs include a country-specific section on humanitarian background, which outlines past emergencies and historical responses.⁴ International organizations with in-country missions (e.g., WHO) that were involved in previous outbreaks will provide useful case studies on operations in previous outbreaks as well that illustrate how partners have coordinated in past emergencies.⁵

Partner capacity assessment

Understanding the capacity that each partner brings to the ESC is essential to identifying gaps that a country should fill ahead of an emergency. Stakeholders will have different capacities based on the country environment. These capacities range from physical capacity such as warehouses and supplies to informal capabilities such as community trust.

Ministries involved in public health emergencies, such as the ministries of Health, Livestock, and Agriculture, should work with their point people in partner organizations to assess each partner's material capacity, as well as technical expertise, across the following dimensions:

3 Pandemic Supply Chain Network. "Downstream Logistics in Pandemics," Logistics Cluster (2017).

4 Logistics Cluster Website: <http://dlca.logcluster.org/display/public/DLCA/LCA+Homepage>

5 World Health Organization. "Joint External Evaluation Tool," (2016).

- Personnel
- Stockpiled commodities
- Warehousing and storage space
- Cold chain capacity
- Transport
- Funds ⁶

Sometimes capacity can come from innovative sources, so countries should think outside the box – e.g., private sector businesses that deal with food refrigeration could serve as backup cold chain storage capacity in an emergency.

It is important to note partners' capacity by geographic presence, as resources may vary across regions.

Process

The ESC team should refresh this stakeholder assessment on an annual basis or more frequently if possible, as part of their routine ESC maintenance processes. They should ensure that the list of organizations and point people for each organization remains current, and that when there is staff turnover (both at the government and at the partner organization), they reestablish contact with the newest stakeholders as soon as possible. This way, all stakeholders will be integrated into the ESC coordination mechanism, and countries can ensure their participation in trainings and simulations, such as table-top exercises to practice the execution of a country's Emergency Preparedness and Response Plan.



CASE STUDY –
THE PHILIPPINES

The Philippines' effort to identify and coordinate with partners shows the powerful role that stakeholder assessment plays in emergency response. During Typhoon Haiyan in 2013, private sector recovery efforts were helpful – companies with local presence served as first responders, donors, logistical aids, and in some cases, technical experts. But these efforts were uncoordinated, intermittent, and largely separate from government recovery initiatives. However, the Filipino government recognized the important role private sector could play in augmenting response efforts. After the crisis ended, the Philippines proactively worked to engage the private sector to contribute to future ESC, setting up partner coordination mechanisms to ensure a coordinated response. The government now holds a monthly multi-sectoral meeting among national and international key stakeholders such as government agencies, NGOs, and private sector-led organizations to prepare for potential emergencies. These meetings, which include representatives for hundreds of groups, address coordination issues and policy discussions, and promote an inclusive, synchronized approach toward disaster management. By identifying relevant stakeholders and focusing on areas where collaboration is beneficial, the country can better understand the capabilities at its disposal, and how it can leverage those tools to improve operations ahead of future emergencies.⁷

⁶ Pandemic Supply Chain Network Project: "Project Report" (2017)

⁷ Mercado et. al. "Advances in Civil-Military Coordination in Catastrophes: How the Philippines Turned Lessons Learned from Super Typhoon Haiyan (Yolanda) Into Best Practices for Disaster Preparedness and Response," Center for Excellence in Disaster Management (2015); Brown, Serena. "The Private Sector: Stepping Up," Humanitarian Practice Network (2015).

Potential pitfalls to avoid

- Letting stakeholder contact lists get out of date
- Overestimating partner capacity and failing to plan for a gap
- Not fully incorporating private sector interest and capacity by not acknowledging them as stakeholders in assessment process

1B | HAZARD ASSESSMENT

Identify the range of potential threats facing the country and prioritize them for preparedness efforts based on the potential severity and likelihood of each

Definition

Hazard assessments build out the range of potential threats facing the country and prioritize them for preparedness efforts based on the potential severity and likelihood of each. For hazards that countries identify as priorities, they should identify the hazard-specific variables that have implications on the ESC planning process (e.g., likely geographic spread and commodities required) and establish routine monitoring protocols.

Why this is important

Hazard assessment is essential to ESC preparedness, as it provides most of the inputs required for emergency planning across the value chain. Through a hazard assessment, a country will understand the range of scenarios it should prepare for, as well as the likelihood of each of those scenarios. When planning for epidemics and pandemics, the hazard assessment should consider all possible disease outbreak scenarios, assess their relative likelihood, and develop a threat profile for each potential disease. Nearly all logistics planning flows from an understanding of what the threat profiles for a country's specific diseases are.

Knowing the diseases themselves enable commodity forecasting by dictating which commodities are necessary, and knowing potential outbreak targets provide estimates on what quantity could be required. This forecasting, in turn, has implications on storage and transport needs (e.g., cold chain capacity). Diseases' threat profiles also prescribe considerations for waste management. Understanding the likelihood of different outbreaks helps countries calculate the risks to mitigate when putting in place preventative measures, which they can weigh against the potential costs of putting those measures in place.

Risk identification and prioritization

The Ministry of Health, in partnership with Ministries of Livestock and Agriculture, should identify and prioritize the diseases they are susceptible to and use that list to guide their ESC planning activities. A country's starting position should be that it is at risk of all the Integrated Disease Surveillance and Response (IDSR) list of priority diseases and zoonotic diseases. Countries can prioritize their risks by drawing from existing exercises and resources. Existing exercises include the CDC One Health Disease Prioritization workshop, the WHO's list of priority pathogens, and any other locally relevant prioritization exercises.⁸ The responsible ministries covering infectious diseases and zoonoses should hold workshops that gather these medical experts to check whether there are additional diseases to add as potential threats (e.g., emerging diseases not yet codified into IDSR).

Those responsible for planning the risk assessment can leverage the WHO's Risk Assessment Framework, which provides a useful methodology to identify the potential risk posed by each disease. The framework identifies impact and likelihood as the primary axes on which to map diseases. A disease's impact depends on its transmission (how infectious and contagious it is), as well as its virulence (how severe the disease caused by it is), and the effect it would have on a country's infrastructure (healthcare facilities, workers, etc.).⁹

8 CDC: "One Health Zoonotic Disease Prioritization Workshop" (2016); World Health Organization: "Blueprint Priority Diseases," (2017)

9 World Health Organization, "Rapid Risk Assessment of Acute Public Health Events," (2012); World Health Organization: "Emergency Response Framework," (2017)

Risk depends on the likelihood of a disease as well. Countries should leverage in-country expertise, as well as expert third parties and international partners, to determine the likelihood of these diseases. Factors such as local conditions, historical outbreaks, and neighboring countries' susceptibility all impact the likelihood of a given disease.

Once countries have assessed the likelihood and impact for each priority disease, they will be able to plot diseases on a matrix to develop a prioritized list for monitoring and ESC planning.

The ESC team should refresh this hazard assessment on a regular basis, as disease threats evolve over time. After an initial hazard assessment is complete, updating the hazards list in subsequent years will require significantly less time and resources.

Some governments may choose to employ an all-hazards approach to supply chain preparedness, through which they would plan for natural and humanitarian emergencies using the same systems and processes as for infectious threats. However, the scope of this document includes only supply chain preparedness for infectious threats.

Regardless, the ministries tasked with emergency preparedness and response should ensure they are proactively taking a holistic approach to not just assessing risk but actively managing it. This includes conducting numerous risk assessments for given situations, linking them to operational capacity and supply chain risk management.

Key elements for planning

When a country has prioritized which diseases they ought to plan for from an ESC perspective, they should develop detailed threat profiles for the highest-priority diseases. The Ministry of Health and other responsible ministries should work with epidemiologists, who are experts in mapping disease outbreak and evolution, in building these

detailed profiles. Some elements of the threat profile are especially important inputs to the ESC planning process, such as:¹⁰

- **Transmission mode:** How the disease travels from host to host, which will have an impact on the type of personal protective equipment (PPE) required, security precautions for emergency supply chain operations, and waste management protocols
- **Expected rate of disease spread (based on reproductive number and average generation length):** Will have implications for quantity forecasting and resupply planning of commodities
- **Geographic and demographic patterns:** Where outbreaks are most likely to begin (based on ecological, climactic, vector, human, or other factors within the country), and most likely patterns of spread, which will determine which areas the supply chain must target, and therefore will have implications for warehousing and storage locations and transport route mapping. Demographic information will provide guidance on which populations are most vulnerable, so countries can calculate low and high estimates of populations at risk for each disease to guide commodity forecasting.

Surveillance capabilities

The Ministry of Health will need to monitor the priority diseases they identify during their risk mapping. This will require basic surveillance capabilities for monitoring, such as collection mechanisms and laboratories for testing samples. Since many published frameworks already address this topic extensively, this document does not detail best practices in surveillance, noting only that surveillance systems should be optimized to provide timely information on all threats prioritized through the supply chain planning process.

10 World Health Organization, "Rapid Risk Assessment of Acute Public Health Events," (2012); World Health Organization: "Emergency Response Framework," (2017); Pandemic Supply Chain Network. "Downstream Logistics in Pandemics," Logistics Cluster (2017).



CASE STUDY – KENYA



Kenya's approach to hazard assessment illustrates how understanding risk and prioritizing among hazards can support emergency supply chains. In recent years, the Kenyan government has worked with international and local stakeholders – including government ministries and departments, development partners, civil society organizations, local leaders, and community representatives – to produce comprehensive national hazard assessments. These reports have recorded past incidents of disaster by category and scale to quantify which challenges are most pressing. Moreover, Kenya has developed plans for action in concert with the UN's Hyogo Framework for Action, identifying key resiliency goals and tracking core indicators to measure its progress. Thus far, the government and WHO have identified inadequate financing and poor utilization of existing supply chains as critical weak points in disaster preparedness. The government has also prioritized addressing high-risk environmental factors, such as lack of access to clean water, and certain high-risk diseases, such as HIV and influenza. Kenya's hazard assessment is not comprehensive; the country could benefit from further risk prioritization and improving surveillance capabilities. But the government's overall approach to hazard assessment provides a framework that it can use to prioritize its investments in supply chain capabilities toward where they have the highest impact.¹¹

Potential pitfalls to avoid

- Failing to consider the full breadth of diseases (including zoonotic diseases) as threats
- Not linking the output of the risk prioritization exercise to a monitoring and surveillance system
- Not refreshing the assessment on a routine basis to ensure threats accurately reflect the current context

Resources

- The ESC Preparedness Playbook discusses how to conduct a hazard assessment in the “Triggers” section and provides logistics checklists and worksheets to support execution
- Governments can request the CDC's One Health Zoonotic Disease Prioritization Workshop support to help identify the top 5 zoonotic diseases they are at risk for by reaching out to onehealth@cdc.gov and working with their CDC country offices.
- For countries that have completed the Joint External Evaluation (covered in more detail in the following chapter), reference the mapping of International Health Regulations (IHR) relevant hazards and priority risks as a starting point.¹²
- Reference the WHO Emergency Risk Framework to map diseases based on impact and likelihood. According to WHO Emergency Risk Framework, all member states should have surveillance systems that detect outbreaks of infectious diseases as a result of the IHR's emphasis on strengthening these capabilities.¹³

11 Kenya Ministry of Devolution and Planning, “National Progress Report on the Implementation on the Hyogo Framework for Action,” World Health Organization (2015).

12 World Health Organization, “Joint External Evaluation Tool,” (2016); International Health Regulations website: http://www.who.int/topics/international_health_regulations/en/

13 World Health Organization: “Emergency Response Framework,” (2017)

1C | CURRENT STATE EMERGENCY SUPPLY CHAIN CAPABILITY ASSESSMENT

Assess the current state of emergency supply chain preparedness to understand baseline capacity and identify potential pain points

Definition

An emergency supply chain capability assessment will provide a country with an understanding of its “starting point” in terms of both emergency preparedness and emergency supply chain capabilities.

Why this is important

If a government understands its current state of ESC preparedness, it will be able to identify both strengths to leverage and weaknesses to bolster in its emergency supply chain. With this knowledge, it will be able to better prioritize its own investments of resources and efforts, and understand where it should seek to leverage partner capacity when possible.

Preparedness efforts

The ESC team (likely within the Ministry of Health) should understand what initiatives they have already put in place for emergency preparedness across all areas, from surveillance and monitoring to overall supply chain and logistics capacity-building. The most efficient way to review existing preparedness efforts is to leverage assessments that have already been conducted on these efforts, to avoid rework and identify the areas that do require additional focus and investment.

The Joint External Evaluation (JEE) is a framework that the WHO introduced to assess a country's progress toward International Health Regulations

standards on emergency preparedness. It assesses “country capacity to prevent, detect, and rapidly respond to public health threats.”¹⁴ The JEE covers several areas relevant to emergency supply chain preparedness, which countries who have completed the assessment should use to assess their starting point:

- Procedures and regulations governing sending, receiving, and distributing medical countermeasures for emergencies
- Resources dedicated toward the logistics of medical countermeasures
- Thoroughness of a country's pandemic plan's consideration of medical countermeasures
- Cold chain capacity for vaccine delivery

However, the JEE and other types of existing assessments focus primarily on medical and scientific elements of preparedness, rather than logistical and supply chain elements. Organizations are hopeful that future versions of the JEE may incorporate additional logistics-specific components into their assessment of country preparedness.

The governmental team conducting the ESC preparedness capacity assessment should ask itself several high-level questions to understand its degree of emergency supply chain preparedness, such as:

- Does a national disaster preparedness plan exist, and does it consider logistics?
- Are surveillance capabilities linked to logistics and response plans??
- Are there roles and structures identified in the plan to govern the emergency supply chain?
- Are initial protocols to govern the emergency supply chain drafted?
- Has any planning on type, quantity, and source of commodities occurred, and are any of those commodities stockpiled?

Supply chain capabilities

The ESC team requires an end-to-end understanding not only of its planned supply chain activities for emergency preparedness, but of its routine supply chain capabilities, as the latter impacts a country's

14 World Health Organization, “Joint External Evaluation Tool,” (2016)

ability to implement the former. Again, countries should leverage existing assessments where possible to identify any potential pain points. One existing assessment is the Logistics Capacity Assessment (LCA), which assesses tactical elements of infrastructure and services that impact the supply chain's ability to function in an emergency. Any pain points identified here should be accounted for and planned for in the emergency preparedness plan. Generally, LCAs focus on infrastructure, suppliers, services, and landscape, with particular attention on any shortcomings that might complicate logistics planning in an emergency. A detailed overview of each section of the LCA can be found in both the PSCN's Downstream Logistics Guide and the Logistics Cluster's website.¹⁵

For some countries, LCAs either do not exist or are out-of-date. As these assessments do not map the supply chain from end-to-end, the ESC team should undertake a high-level assessment to identify their supply chain's core competencies and look at past outbreak responses to identify emergency-specific capabilities. Some high-level questions to guide early understanding of the supply chain are:

- Is it centralized or decentralized?
- Is it government-run or privately controlled?
- How resilient has it been in the face of past crises (outbreaks or other disasters)?
- Are there shortages or stockpiles?

The Logistics Cluster has developed a tool for quick logistics assessment in emergency situations: the Rapid Logistics Capacity Assessment Tool, which countries can leverage.¹⁶

Most governments have conducted more detailed assessments covering some or all of the following topics: forecasting and quantification, procurement, storage and inventory management, governance and capabilities, financing, and LMIS & data management. This existing data should be reviewed and deepened or refreshed in areas relevant to the emergency supply chain. In addition, countries should understand the current state of healthcare

infrastructure as well, such as:

- Types and numbers of healthcare facilities
- Local drug production, quality, and vulnerability
- Vaccination campaigns
- Clinical waste management collection and destruction capabilities

Looking at past emergencies can be especially useful for governments to understand both the resilience of their country's supply chain and potential breakage points. Countries may be more susceptible to some emergencies rather than others (e.g., floods), and will have developed specialized methods of leveraging supply chain capabilities to answer those emergencies, such as alternative means of transport. The ESC team can identify and build on these points of strength to improve their supply chain's responsiveness to future outbreaks. If some aspects of the supply chain broke down in past emergencies, countries should identify those bottlenecks or pain points as the priority capabilities they should invest in. For example, if in a past outbreak a country experienced significant vaccine wastage from a lack of adequate cold chain capabilities, the country should either prioritize investment in cold chain capabilities or identify local partners who can bolster that portion of the supply chain and plan the most efficient ways to partner with them.

¹⁵ Pandemic Supply Chain Network. "Downstream Logistics in Pandemics," Logistics Cluster (2017).

¹⁶ *ibid*

Potential pitfalls to avoid:

- Failure to adequately learn from prior outbreaks in identifying strengths and weaknesses in the emergency supply chain
- Assuming that routine supply chain capabilities will be sufficient to implement emergency supply chain plans in the event of an emergency
- Creation of “double work” by failure to sufficiently leverage existing assessment, or not linking existing assessments to action plans

Resources

- For countries that have completed the Joint External Evaluation, reference the “Preparedness” and “Medical Countermeasures and Personnel Deployment” chapters¹⁷
- For countries with up-to-date Logistics Capacity Assessments, they should use these LCAs as a means to review tactical elements of infrastructure and services¹⁸
- For countries without an updated LCA, they can utilize the Rapid LCA toolkit.¹⁹

17 World Health Organization. “Joint External Evaluation Tool,” (2016).

18 Pandemic Supply Chain Network. “Downstream Logistics in Pandemics,” Logistics Cluster (2017); Logistics Cluster Website: <http://dlca.logcluster.org/display/public/DLCA/LCA+Homepage>

19 Logistics Cluster Website: <http://www.logcluster.org/rapid-assessment-toolkit>



2. GOVERNANCE, FINANCING, AND PERSONNEL

2A | ORGANIZATIONAL STRUCTURE AND DESIGNATION OF AUTHORITIES

Clearly define roles and responsibilities for developing and maintaining an emergency supply chain, and establish how key stakeholders will interact during an emergency

Definition

Emergency supply chain organizational structure and designation of authorities means defining who is responsible for developing and maintaining an emergency supply chain, both between emergencies and in times of crisis. A clear organizational structure will also streamline the interaction between different Ministries, the Emergency Operations Centers, and relevant partners.

Why this component is important

A clearly defined organizational structure for an emergency supply chain is essential to ensure effective execution in a high-intensity, time-critical situation. Predetermined plans allotting responsibility for supply chain decisions enable the emergency structure to be operationalized immediately. Predefined roles simplify coordination in complex, multidimensional emergency environments. The range of stakeholders involved – governments, partner NGOs, and donors – creates a risk overlapping roles or gaps in responsibilities. Clarifying who owns decisions and how decision-makers will interact limits leadership voids or competing mandates. This ensures that the supply chain can get the maximum value from different resources that stakeholders bring to bear.

Key organizational roles and supply chain partners

There are two key aspects of organizational design needed for emergency preparedness: (1) the designation of a single national emergency supply chain lead and a clear chain of command for mobilization of emergency supply chain resources, and (2) the identification of all relevant partners that could be mobilized toward emergency response.

National emergency supply chain lead for health and Ministry of Health organizational structure for emergency supply chains

A single position should be designated as the government's lead responsible for the emergency supply chain in the event of an epidemic. Appointing one lead role minimizes confusion by providing a single point of contact for coordination across a range of both internal governmental functions and external partners. The key considerations in selecting the lead are:

- Technical background to understand logistics of supply chain function
- Strong leadership and coordination skills since he/she will have to work closely with logistics operators from different entities
- Solid working relationships with health centers and connections with distributor networks, as there will not be time in the midst of surge capacity to build these relationships from scratch

The degree of separation between the emergency and the routine supply chain will vary based on context (covered more in “Separation protocol”), but each should have its own designated lead. The emergency supply chain lead should be able to request additional resources from the routine supply chain during an emergency.

The emergency supply chain lead will need a team (“ESC Team”) to support them, with technical expertise on forecasting, procurement, storage, transport, and human and animal medicine. This team should be interdisciplinary to ensure a One Health approach (e.g., should include individuals from Ministries of Livestock/Agriculture). Each member

of the ESC team should be responsible not only for the initial implementation of preparedness, but the ongoing maintenance of all preparedness-related activities.

The emergency supply chain should have a reporting structure extending from the national to local levels. The central government should designate a lead at each of these levels of government (i.e., national, regional/state/province, and district). The same skills as above should be sought for emergency supply chain focal points at each level of the supply chain. The role may be filled by a “roster”, (e.g., responsibility rotates across individuals based on a calendar), but the roster must be filled by specific names.

The emergency supply chain lead for health should report in to the logistics lead of the national Emergency Operations Center (EOC). If an EOC is already in place in a country, then this reporting relationship should be in place permanently. If EOCs are only stood up in the event of an outbreak, then the reporting mechanism should be documented in a country’s Emergency Response Protocols.²⁰ Clearly outlining the interaction between the lead and the EOC is especially important since during an outbreak, the EOC will be the lead’s link to the broader emergency response efforts, including coordinating with such entities as the military, infrastructure officials, communications staff, international organizations, and private sector.

Relevant partners and designation of points of contact

The MoH should map the full set of partners such as international organizations, NGOs, and key private sector organizations (e.g., major businesses with significant supply chain networks) that could be mobilized in the event of an emergency. A clear organizational structure identifying the roles and points of contact at each organization helps to

ensure that all stakeholders are able to effectively contribute to the planning and response in an emergency.

The MoH should use the inputs from their stakeholder mapping to determine how best to coordinate the multiple partners involved in the emergency supply chain. Understanding the roles played by different actors will help identify the best organizational structure and partner coordination mechanisms to put in place ahead of an emergency (*Refer to stakeholder mapping section*).²¹

Each contributing organization, whether public sector, private sector, or international organization, should designate an emergency supply chain point of contact at the national level and for each sub-national and local hub. In the event of an emergency, this will be essential to understanding on-the-ground supply and demand of needed commodities. Where local authority is less clearly defined, the lead should interact with local partners such as local NGOs, which can be an important source of early-on needs assessment and distribution support in affected communities.²² These individuals will work closely with the national emergency supply chain lead to ensure a single, coordinated emergency supply chain effort.

Codification and performance management

In order to ensure that all needed roles are properly defined and filled, countries should maintain a status tracker covering the status of filled and vacant positions and which staff have been trained in emergency preparedness. For some positions, an official authorization may be required from the Minister of Health to formally create and staff new positions in ESC. The MoH and other ministries involved in ESC should also establish a roster monitoring which staff are responsible for mapping of partners and identification of leads and for ensuring that training is conducted.

20 World Health Organization, “Framework for a Public Health Emergency Operations Centre,” (2015); World Health Organization, “A Systematic Review of Public Health Emergency Operations Centres (EOC),” (2013).

21 World Health Organization, “Emergency Response Framework,” (2017).

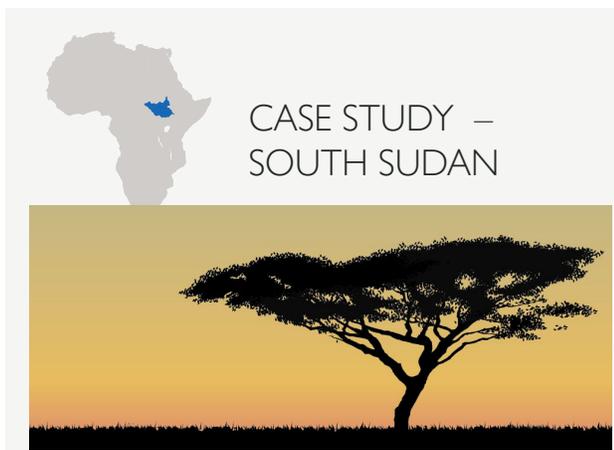
22 Pandemic Supply Chain Network Project: “Project Report” (2017), pg 71

Pitfalls to avoid

- Some common pitfalls that countries have encountered in the past include
- Not designating a specific individual in a clear enough manner, so that in the time of crisis, there is ambiguity over who owns authority
- Designating an individual but then undermining their authority when an epidemic begins
- Designating an individual who lacks the operational skills to obtain the necessary level of respect from those they must interact with, both internally and externally (e.g., with EOC and partner organizations)
- Maintaining non-emergency reporting lines (e.g., emergency supply chain lead from Ministry of Health continues to report to head of national supply chain rather than to the EOC)

Resources

- The ESC Playbook contains a chapter on “Governance and organizational structure” that provides guidance on how to develop an ESC team, map stakeholders, and set up trainings, with a suite of supporting tools, templates, and training materials



CASE STUDY –
SOUTH SUDAN

The successful prevention of the spread of cholera in South Sudan through the use of Oral Cholera Vaccine (OCV) reflects how clear organizational structure and authority support effective containment of an outbreak. Due to conditions in Protection of Civilian (PoC) sites and internally displaced persons (IDP) camps, the Ministry of Health (MoH) of South Sudan, WHO, and other partners prepared in advance for the possibility of a cholera outbreak. Two elements of governance played an important role in ensuring success when the disease hit – predetermined organizational structures and strong leadership. Preexisting coordination structures (e.g., the UN Health Cluster) were put in place ahead of the possible emergency, which allowed the agencies to operationalize their structure. While authority was clearly vested in one director and agency, international agencies were able to collaborate within the cluster system to efficiently vaccinate a quarter million South Sudanese, preventing the spread of an outbreak. The MoH and WHO played strong leadership roles, which minimized confusion across the diverse agencies and actors contributing to the supply chain process. Clear direction from these expert actors enabled even those partner agencies that were not medically focused and lacked OCV experience to contribute effectively as part of a broader coordinated response effort. South Sudan’s success has important implications for future emergency responses – if the right structures and leaders are in place, then it is possible that a broader range of actors with diverse field experience can successfully contribute to future emergency response efforts.²³

23 Abubakar et al. “The First Use of the Global Oral Cholera Vaccine Emergency Stockpile: Lessons from South Sudan,” PLOS Journal of Medicine (2015)

2B | FINANCING OF EMERGENCY SUPPLY CHAIN

Determine how the ongoing maintenance and response functions of the emergency supply chain will be financed

Definition

ESC financing entails identifying the funding amounts needed on an ongoing basis to maintain requisite levels of emergency preparedness, as well as funding amounts needed for response in the event of an emergency. Governments should also define the sources of these funds and the procedures to access and disburse them.

Why this component is important

Setting a clear budget for ESC maintenance allows governments the financial resources to prepare for emergency situations, and identifying sources of and procedures to access response funding in advance of emergencies allows them to move quickly to contain and hopefully stop outbreaks. Though allocating funds towards preparedness can be very difficult for countries to do, it has tremendous impact on the efficacy of response: a UNICEF/WFP study found that all preparedness investments examined saved significant time and/or funds in the event of an outbreak, and 64% of investments saved both.²⁴

Budgeting

The Ministries of Health and Finance should maintain two categories of budgets: the **preparedness ESC budget** and the **response reserve fund**. The preparedness ESC budget covers the cost of maintaining an ongoing level of emergency preparedness, while the response reserve fund covers the costs of responding to an epidemic.

Preparedness ESC budget

The budgeting of ESC inventory and preparedness costs should be incorporated into the routine supply chain budgeting process, since the costs are ongoing/annual. The preparedness ESC budget should include funds for:

- Expenses for warehouses designated for emergency storage
- Payroll and administrative costs for emergency-specific staff
- Inventory management of emergency supplies (e.g., cost of rotating out old stock) for any national stockpiles
- Routine preparedness training

These costs should be included in the routine supply chain's strategic planning, product forecasting, allocation, and procurement processes. This budget planning should take place on an adhered-to calendar basis. The resulting budget for ongoing emergency supply chain maintenance should be derived from the priorities outlined in the country's Emergency Preparedness and Response Plan (ERP).

Response reserve fund

The budget needed for response should be calculated as an incremental cost to the preparedness ESC budget. This incremental cost should be calculated as a weekly budget for operating an emergency supply chain across the entire country. A rough rule of thumb is that when an epidemic is geographically restricted, the country can proportionally adjust the budget (e.g., if it covers one-quarter of the country's population, it will cost approximately one-quarter of the calculated amount).

The size of the response reserve fund should be based on the country's risk assessment of likely threats, commodity planning, and quantity forecasting exercises. While an estimate can be made ahead of time based on commodity forecasting and logistics requirements assumptions for each potential threat, the estimate must be revisited when an

24 Meerkatt et al. "UNICEF/WFP Return on Investment for Emergency Preparedness Study," (2015)

actual outbreak occurs. The main drivers of cost are typically:

- Types and quantities of commodities necessary (based on commodity list required for the set of hazards the country faces)
- Transport required to move predicted volume. Note that transportation costs often spike during emergencies
- Capabilities required to store predicted volume (e.g., cold chain)
- Incremental staff needed to manage supply chain (e.g., district store leads, additional cold chain officers to travel with commodities)

This budget should be revisited annually and updated with the latest surveillance data informing which threats are most likely, as well as the latest assumptions on inflation and population growth.

Sources of funds

The preparedness ESC budget and response reserve fund will likely require multiple funding mechanisms (national funds, international funds, or donor funds). For example, in some countries, national budgets support ongoing preparedness, whereas emergency response funds are provided by international organizations and donors.

Since the costs of ongoing emergency preparedness are predictable and will show relatively little variation from year-to-year, the country should either dedicate a portion of its resources toward this on an annual basis, or work with partners to fund this maintenance annually.

For the response reserve fund, the Ministry of Finance should clearly identify where the funds will come from in the event of an emergency. A government's funding plan should have a first-level component for a smaller or early-stage events and a larger source of funds in the event of an epidemic. The first-level funding component is especially critical because delays in disbursing funds at the

beginning of an emergency could result in the hazard becoming more severe and potentially miss the opportunity to stop the threat before it becomes an epidemic.

In an epidemic, both international and national financing will likely be necessary. International organizations have set up emergency response funds (e.g., WB PEF2, WHO contingency fund).²⁵ It is important to be aware of these funds ahead of time, and know how the country will access them when the emergency triggers are activated. A government could also set up its own rapid response fund, or a country-specific public-private donor partnership that could be specifically used to fund the supply chain in an emergency. Multiple different players could pay into the fund, which would then be managed by the emergency supply chain lead in an emergency to operate the emergency supply chain. The mix of funding sources will vary by country, but every country should clearly identify which funding sources will be used in the event of an emergency.

It is important to note that these sources of emergency funds are not always distinct from one another, nor are they always sufficient. Alternative funding mechanisms are currently being explored, such as bonds tapping into capital markets, insurance products, and third-party financing.

Fund release processes

Governments should develop expedited processes and protocols for release of funds ahead of time. The key considerations are to ensure efficiency in accessing funds during an emergency and maintaining proper documentation for credibility and future planning.

Some traditional invoicing practices may be too time-intensive for emergency situations, so the MoH should work with suppliers ahead of time to establish expedited invoicing process. One way

25 World Health Organization, "Emergency Response Framework" (2017); World Health Organization Contingency Fund website: http://www.who.int/about/who_reform/emergency-capacities/contingency-fund/en/; World Bank Website: <http://www.worldbank.org/en/topic/pandemics/brief/pandemic-emergency-financing-facility>



CASE STUDY – SIERRA LEONE



Sierra Leone's response to the Ebola epidemic demonstrates the importance of proper documentation in emergency supply chain financing. In the early phases of Sierra Leone's Ebola epidemic, fund utilization was not documented and spending could not be accounted for. Inadequate control of financial resources diminished public trust and inhibited proper supply chain management. However, in later phases of the response, the National Ebola Response Center (NERC) developed an effective system of financing and documenting the payment of Ebola Response Workers (ERWs). They used mobile phones to transfer salaries to ERWs, which not only increased transaction speed, but also allowed the NERC to track payments. The NERC, with UNDP support, collected the names of the beneficiaries, contracted with mobile phone service providers to execute cash transfers, and worked with vendors to provide the actual cash to beneficiaries. The NERC recorded these cash transactions online, and included them in their published financial report. Sierra Leone's move toward proper documentation thereby enabled rapid dispensation of funds while ensuring that the funds were appropriately documented. These two elements together – enhanced liquidity and appropriately dispensed funds – preserved public trust at a time when community support was essential to the emergency response effort.²⁶

this could work is to have suppliers keep logs on a preapproved template as proof of activities and invoice the government against these activities on a weekly basis.

Independent verification will be helpful to make sure that deliveries are actually occurring as they are being reported. This verification will build a record of all emergency spend that should be used not only in donor reporting, but also as an input to the incremental emergency supply chain budgeting process that occurs every three years.

It may be beneficial to provide up-front payments to suppliers when a pandemic emergency is triggered. Suppliers will likely have to pull vehicles from routine business and ramp up hiring to fulfill surge capacity, and having capital on hand ensures that suppliers are sufficiently liquid to do so.

The MoH, as well as other ministries involved in emergency preparedness and response from a One Health approach (e.g., Ministries of Livestock and Agriculture), should collaborate to create an expedited process to input and update suppliers in the master vendor file rapidly, since the MoH/EOC will likely have to contract with additional suppliers to meet surge capacity. The national ESC lead should have enhanced authority to approve additional expenses and suppliers, but these instances should be documented clearly.²⁷

26 National Ebola Response Center. "Lessons From the Response to the Ebola Virus Disease Outbreak in Sierra Leone, May 2014–November 2015: Summary Report," (2015).

27 World Health Organization, "Emergency Response Framework" (2017).

Pitfalls to avoid

- Some common pitfalls that countries have encountered in the past include:
- Lack of funds in early phases of emergency, which will prevent the purchasing of supplies necessary to stop the outbreak before it spreads
- Reallocation of ring-fenced funds to other priorities
- Inefficient fund-release policies that stall response efforts

Resources

- The ESC Playbook contains a chapter on “Financing” that provides guidance on how to calculate and allocate ESC preparedness and response budgets. It also lists out multiple examples of existing funding mechanisms and some initial guidance on how to access them in the event of an outbreak

2C | PERSONNEL TRAINING AND READINESS

Develop trainings and simulations to prepare staff for emergency response, and ensure staff are consistently trained on them

Definition

Personnel training and readiness refers to activities for key staff and stakeholders involved in emergency preparedness to increase their understanding of ESC operations and build capabilities. Simulations involve real-time training exercises for ESC stakeholders to identify weaknesses and areas for improvements.

Why this is important

Effective emergency response depends on having capable, well-trained staff and partners that understand how to respond to a crisis. Since emergency response efforts are different from routine procedures, it is important to make sure staff have the capabilities and knowledge to properly support ESC functions ahead of time. Personnel training programs and other readiness initiatives (e.g., simulations) help staff develop the right skills to fulfill their roles and support effective emergency responses.

Training programs

Governments should use training and readiness programs as an integral component of their ERPs. Training programs are one of the most high-impact activities a government can support, when there is no crisis at hand. By developing expertise and understanding among staff and partners, training programs lay the groundwork for a successful disaster response. Governments can use these initiatives to invest in human resource capabilities across the supply chain.

An effective emergency preparedness training program should possess the following characteristics:

- The training program should cover existing plans and all ESC protocols
- Training should exist at the national, regional, and district level to facilitate readiness at all levels of government
- Trainings should be held on a routine basis for all departments involved in emergency supply chain, such as MoH, Ministry of Agriculture, Ministry of Livestock, or other government agencies, and with external parties involved in emergency response, including partners, NGOs, and medical suppliers. Other stakeholders that may need training include civil society organizations, local leaders, and community representatives

The officials responsible for designing and leading training should ensure that such programs are up to date. Programs should therefore be updated in tandem with preparedness plans (usually on a 3-year basis), or in light of new information that is relevant to emergency response. Program directors should also seek out best practices and partners to make training programs responsive to stakeholders' needs.

Simulations

Realistic simulations based on the country's ESC are useful for two reasons: (1) for identifying pain points in a response plan, and (2) to provide training on preparedness and response for in-country staff.²⁸ Because simulations provide an opportunity to test a response plan in real time, they often reveal valuable information about supply chain processes and uncover potential weaknesses. In addition, since outbreaks are infrequent and country staff involved in the ESC spend most of their time in nonemergency jobs, simulations provide valuable opportunities for country staff to practice skills and decision-making needed for emergency situations.

To maximize the effectiveness of simulations, drills should involve individuals from all levels of government and representatives from all partners that would be involved in responding to an emergency. Simulations should mirror realistic conditions as much as possible. Exercises can be targeted to test individual aspects of the supply chain response process, but officials should strive to undertake comprehensive simulations when possible.

Incorporating lessons learned

Officials should design personnel training programs to incorporate feedback from prior crises, staff, and stakeholders. To ensure programs are effective, they should incorporate information from both pre-emergency training scenarios and post-emergency assessments.

Pre-emergency: Results from the drills, simulations, and training programs will inform current state capacity assessments. Instructors should be careful to record areas of confusion and identify areas for improvement in training programs. Simulations should be used by country officials to identify which weaknesses may impact the effectiveness of its supply chain in an emergency. Results from simulations should be used to supplement training programs. Areas of particular weakness should be regularly drilled and tested.

Post-emergency: After every emergency, governments and their partners should engage in a comprehensive debrief to identify areas for improvement. Officials should solicit feedback from diverse sources, including experts and individuals on the ground, in the form of an After-Action Review and the debriefing should take place with key individuals involved in the ESC response. It is critical that these debriefs identify "lessons learned" which must then be used to update the Emergency Preparedness and Response Plans. Training programs and drills should be updated also to reinforce the ERP.

Tracking

As listed in "ESC Protocols" chapter, it is important to track whether all individuals involved in ESC have been trained. Officials should also record the date in which an individual last received training so as to ensure that members of the supply chain are kept up to date on new procedures and practices.

28 Pandemic Supply Chain Network. "Project Report," (2017). pg 76

Pitfalls to avoid

- Emphasis on training attendance rather than mastery of content
- Failure to capture lessons learned during outbreaks and use them to update plans and trainings
- Focus on “traditional” training formats (e.g., lecture) at the expense of more innovative and engaging formats

Resources

- The ESC Playbook chapter on “Governance and Organizational Structure” provides guidance on how to set up trainings on ESC P&R. It includes a modular set of materials to conduct trainings on ESC preparedness and response, including several customizable scenarios, a detailed facilitator guide to inform how trainings should be led, and a participant workbook for trainees.
- JEE’s “Medical countermeasures” chapter contains information on country trainings and simulations²⁹
- CDC’s Division of Strategic National Stockpile (DSNS) has conducted in-country Emergency Preparedness and Response simulations³⁰
- WHO “Simulation Exercise Manual” provides practical guidance on simulation exercise design and execution for public health emergencies in particular³¹



CASE STUDY –
NIGERIA

In the past decade, Nigeria has effectively leveraged personnel training to improve supply chain preparedness for influenza epidemic. After a small avian flu outbreak in 2007, the Nigerian government began testing its pandemic response plans in simulations on a semiannual basis. These simulations were conducted in 2007, 2009, and 2011; the latter exercise was the largest government exercise in the nation’s history. These training exercises, carried out jointly with the US Department of Defense, help educate healthcare professionals and ready staff in the case of an eventual outbreak. Observers say that the simulations effectively transmitted important information to healthcare professionals, key stakeholders, and the public, while allowing the government to proactively invest in improving logistical planning to ensure adequate emergency preparedness. Nigeria has kept the damage from influenza outbreaks low over the last decade, suggesting that the MoH’s simulations and training programs are working to improve ESC readiness.³²

29 World Health Organization. “Joint External Evaluation Tool,” (2016), pg 64

30 Center for Disease Control. “Preparing Global Responders,” (2017) <https://www.cdc.gov/phpr/stockpile/ghsastockpilesupport.htm>

31 World Health Organization. “WHO Simulation Exercise Manual,” (2017).

32 Sellwood, Chloe and Jonathan Van-Tam, Pandemic Influenza: Second Edition. (2013); Nigeria Ministry of Health: “National Pandemic Influenza Preparedness and Response Plan,” (2013).



3. EMERGENCY PROTOCOLS

3A | TRIGGER DEFINITION

Pre-establish protocols for what types of alerts trigger the activation of the ESC to reduce difficulties in decision-making

Definition

Trigger definition is the establishment of thresholds that “trigger” the activation of the ESC. The activation of the ESC means that a country will move from employing routine protocols to following its emergency protocols.

Why this is important

Trigger definition is particularly important because of the difficulties involved in both identifying and escalating disease-driven emergencies. Failure to identify and treat epidemics early on increases the risk of their escalation into full-blown epidemics. Given the risks of delayed action, and the potential for politics to enter the decision-making process, it is best to rely on a predefined set of criteria that trigger escalation.

Trigger criteria

Governments should pre-define, documented description of all triggers that will activate the use of ESC and logistics protocols. These triggers should cover at least all the threats that they prioritized for monitoring in their hazard assessment. Where possible, the triggers should be tied to specific, quantifiable benchmarks. Typical triggers are pre-defined numbers of suspected cases, confirmed cases, or even types of diseases themselves.

All triggers that require an emergency response should not only be predefined, but also be transparent and public to garner national trust. Defining apolitical triggers can be particularly challenging, but

is especially important to ensure that the emergency response process itself is apolitical, which encourages national and international cooperation and facilitates a swift response.

External triggers

National triggers should link to external emergency evaluation systems, such as the WHO's grading system. Country governments should establish how different grades correspond with the activation of their ESC protocols, with defined actions for the supply chain identified in the case of each grade. Linking to international definitions of emergencies facilitates collaboration and planning between the government and third-party stakeholders, as they operate under a consistent framework. For example, if a country activates its protocols in a consistent manner with the WHO, then its streamlined emergency customs protocols will already be in place to facilitate the import of WHO's essential commodities shipments. International organizations also offer support in assessing and grading potential emergencies, which countries should leverage when they are uncertain about the status of an outbreak (e.g., the Rapid Response Assessment from WHO).³³

Internal triggers

Governments may also choose to define their own internal triggers for ESC activation.. These could be local (e.g., a single case of a particular threat might trigger internal emergency) or global (e.g., declaration of influenza in nearby country). Country governments might choose to establish more proactive triggers than those identified by external countries if they wanted to prevent lag time from impeding the emergency response. Governments can also explore more innovative trigger models such as social media trends, big data assessments, probabilistic risk assessments, or progressive type systems.

33 World Health Organization. “Technical Guide to Rapid Assessment and Response,” (2003); World Health Organization, “Rapid Risk Assessment of Acute Public Health Events,” (2012).



CASE STUDY – DEMOCRATIC REPUBLIC OF THE CONGO



The Democratic Republic of the Congo's response to its 2017 Ebola outbreak demonstrates how clearly defined trigger mechanisms can facilitate an effective disaster response. Having dealt with Ebola outbreaks before, including in 2014 – officials, locals, and politicians agreed that a rapid response to any outbreak would be critical to preventing a similar outbreak within national borders. The confirmation of the first positive case of Ebola triggered an immediate response plan. The government notified international stakeholders in order to obtain capital and technical assistance. It also triggered the swift implementation of emergency protocols, putting into place an ESC and logistics protocols to cope with the disease. The response included rapid identification of individuals who may have been infected and treatment for those with the disease. Observers noted that the response was “fast, decisive, and coordinated,” cutting off the potential for the disease to spread. The DRC managed to end the outbreak in just 42 days; it resulted in only four deaths. Without a predefined, clear, and public trigger, the toll could have been much worse.³⁴

Potential pitfalls to avoid

- Failure to link national triggers to internationally-defined grading systems
- Slow triggering of emergency protocols due to desire to avoid the appearance of crisis and avoid impact on the economy

Resources

- The ESC Playbook chapter on “Triggers” provides guidance on trigger definition
- The WHO Emergency Response Framework details the WHO emergency grading process extensively.³⁵

3B | SEPARATION OF EMERGENCY AND ROUTINE SUPPLY CHAIN

Develop protocols for how the emergency and routine supply chains should interact

Definition

Separation of emergency and routine supply chains will allow a government to develop protocols for how these two supply chains should interact in the event of an emergency. Once the emergency protocol is triggered, the ESC should become as stand-alone as possible, and should be managed by a different individual than the routine supply chain.

Why this is important

By clearly establishing the separation of emergency and routine supply chains and defining their interaction, governments will be able to better prioritize the maintenance and functionality of the ESC in response to an emergency. This will enable the ESC to function as rapidly and effectively as possible in response to an outbreak. There is a concern that merging the emergency and the routine supply chains would lead to a reallocation of resources from the ESC to potentially undersupplied routine supply chains, which should be avoided.

34 Yong, Ed. “How the Democratic Republic of the Congo Beat Ebola in 42 Days.” *The Atlantic* (2017). CDC, “Ebola Outbreak Democratic Republic of the Congo 2017,” (2017).

35 World Health Organization, “Emergency Response Framework,” (2017)

Prioritization

Successful operation of the ESC in a crisis situation will rely on multiple levels of prioritization. During an outbreak, the functioning of the ESC should take priority over the functioning of the routine supply chain. This does not mean that the routine supply chain should cease to function in an emergency; to the contrary, wherever possible it should function as normal so that nonemergency health commodities remain in circulation. However, if an epidemic or disaster becomes acute enough, some of its resources may need to be diverted into the ESC. In fact, during the most severe outbreaks, the routine supply chain may need to be completely dedicated to emergency usage for a period of time.

In addition to the prioritization of the ESC over the routine supply chain, prioritization within the routine supply chain itself should occur during an outbreak. This way, if repurposing from the routine supply chain to the ESC must happen, lower-priority efforts can be diverted to support the ESC. In the case that a country has multiple parallel supply chains (e.g., vaccines, HIV commodities), the ESC team should establish an order of precedence on how assets from the non-emergency supply chains would be repurposed into the ESC (e.g., repurposed vaccine cold chains). In this way, the most important parts of the routine supply chain(s) can be preserved even while the ESC is being prioritized. Moreover, this partial preservation of the routine supply chain should seek to minimize wastage of nonemergency commodities wherever possible.

One preparedness-specific interaction between the emergency and routine supply chains will be the rotation of emergency stock into the routine supply chain. The protocols surrounding this will be further elaborated in the “Stockpile” chapter. Another point of interaction may be in the last mile, where in practice, the ESC may leverage aspects of routine supply chains.



CASE STUDY – HAITI



Haiti’s experience in dealing with a cholera outbreak in 2010 was unsuccessful in many respects. However, the government’s response shows how a nation can use routine supply chains to supplement an ESC without compromising the functioning of either. In the early stages of the cholera outbreak, the disease’s rapid spread caught authorities off-guard and outpaced the nation’s public health response. To compensate, Haiti tapped into the existing HIV commodities supply chain to facilitate the distribution of essential supplies. These efforts were supplemented with additional emergency funds from the CDC. MSPP and additional PEPFAR partners received \$14 million to expand treatment and prevention efforts. These funds helped ensure that the emergency supply chain did not jeopardize operation of the routine supply chain. PEPFAR clinicians received supplemental trainings to help with cholera treatment and prevention efforts. Importantly, PEPFAR continued to perform its normal duties with respect to HIV care. In this way, even though Haiti’s response to the outbreak was too slow to contain the disease, its experience demonstrates that well-defined coordination of emergency and existing supply chains can augment an emergency response effort.³⁶

Resources

- The ESC Playbook contains a customizable “Response Quick Guide” in which ESC teams can

36 Tappero, Jordan and Robert Tauxe. “Lessons Learned During the Public Health Response to the Cholera Epidemic in Haiti and the Dominican Republic.” Accessed via National Institute of Health (2011).

document their ESC protocols, including those on the separation between the routine and emergency supply chain

- CDC's Division of Strategic National Stockpile (DSNS) provides country governments with support in developing detailed Emergency Response Plan for Medical Countermeasures in which governments can document protocols³⁷

3C | EMERGENCY SUPPLY CHAIN PROTOCOL

Establish protocols to govern the ESC's readiness in between emergencies and to manage how the ESC will function in an emergency.

Definition

Protocols are rules that describe how processes should function under an emergency, and who should run those processes. They should be incorporated into a government's Emergency Preparedness and Response Plan.

Why this is important

The establishment of protocols in advance of an outbreak creates a clear set of guidelines that can be activated immediately once emergency status is triggered. When protocols are developed in advance, they can be employed in training stakeholders to ensure all partners are adequately prepared to perform their roles in the event of an outbreak.

Characteristics of effective ESC protocols

Effective ESC protocols should have delineated responsibilities for actors on every level. At every level of the ESC, protocols should clearly articulate the responsibilities of each type of individual

operator (e.g., district warehouse managers, health facility staff). Protocols should also be designed to ensure staff safety, as items being transported may be biohazardous. These protocols should cover of the following areas:

- Organizational structure and financing
- Commodity forecasting and quantification
- Stockpiling
- Procurement and sourcing
- Storage and warehousing
- Transport and customs
- Waste management
- Data visibility

Effective ESC protocols should be governed by “no-regrets principles” prioritize efficacy over resourcing concerns prioritizing agility and allowing for flexibility (e.g., rapid incorporation of new vendors). However, this flexibility should not come at the cost of appropriate documentation. Protocols should clearly identify which forms of documentation are essential for each stage of the emergency supply chain.³⁸

Customs protocols

Before an emergency occurs, countries should review and document customs protocols to speed the entrance of supplies through their borders once emergency status is triggered. Customs protocols will cover how goods pass through ports and airports in an expedited fashion (e.g., blanket duty waivers, temporary exemptions). In addition, countries should arrange for tax and duty exemptions for the transport of health emergency commodities into the country prior to an outbreak. These agreements are backed by signed documents where possible to prevent renegotiation.³⁹ Finally, governments should adopt the following external best practices where possible:

- OCHA, UNCTAD, and World Customs Organization/WTO have developed customs protocols that should be put in place upon declaration of an emergency. These should be deployed

37 Center for Disease Control. “Preparing Global Responders,” (2017) <https://www.cdc.gov/phpr/stockpile/ghsastockpilesupport.htm>

38 World Health Organization, “Emergency Response Framework,” (2017)

39 “Emergency Response Supply Chain Assessment,” Australian Council for International Development’s Humanitarian Reference Group (2007)

during pandemic responses to alleviate bottlenecks⁴⁰

- Customs IT systems have also been developed (ASYCUDA, ASYREC) to interact with existing customs IT systems and speed processes during an emergency⁴¹

Metrics

Countries should track indicators to monitor the current state of preparedness on an ongoing basis, as part of performance management of the ESC. A short list of helpful metrics should be established. In selecting metrics, countries should balance between minimizing additional work while also ensuring visibility into the current state of ESC preparedness. These include:

- Number of ESC roles filled out of total roles needed, with a roster of names
- Share of ESC operators trained in ESC protocols and frequency of simulation exercises
- Stockpile levels

Resources

- CDC's Division of Strategic National Stockpile (DSNS) provides country governments with support in developing detailed Emergency Response Plan for Medical Countermeasures in which governments can document protocols⁴²
- The ESC Playbook contains a customizable "Response Quick Guide" in which ESC teams can document their essential ESC protocols for emergency response across each element of the ESC (e.g., transport, waste management)
- WHO has a set of SOPs that should be activated within 24 hours of emergency grading outlined in its Emergency Response Framework⁴³
- The JEE assesses countries' plans to address regulatory concerns in the event of an emergency⁴⁴



CASE STUDY – NIGERIA

Nigeria's clear delineation of ESC protocols facilitated an effective response to a 2014 Ebola outbreak. Adopting infrastructure from its past responses to epidemics, Nigeria used its Polio Emergency Operations Centre and its experience and resources with prior epidemics as a springboard for an Ebola response. The EOC was divided into six functional units, each tasked with managing a separate part of the response plan. The agency bypassed routine bureaucracies to coordinate real-time responses to local officials and international stakeholders, allowing it to quickly build technical knowledge and distribute supplies. According to the World Bank, roles within the EOC were clearly defined, making it possible for leadership to hold individuals accountable for specific results. Team managers were granted a degree of autonomy with resource allocation and personnel management. The EOC also leveraged Nigeria's previous investments in front-line health workers and facilities to mobilize against the Ebola threat. In these ways, the existence of well-established ESC protocols as part of broader EOC protocols allowed Nigeria to quickly mobilize to fight the spread of Ebola.⁴⁵

40 Pandemic Supply Chain Network. "Project Report," (2017). Pg 75

41 Ibid. Pg 76

42 Center for Disease Control. "Preparing Global Responders," (2017) <https://www.cdc.gov/phpr/stockpile/ghsastockpilesupport.htm>

43 World Health Organization, "Emergency Response Framework," (2017). Pg 34

44 World Health Organization. "Joint External Evaluation Tool," (2016)

45 Odutolu, Ayodeji Oluwole. "Nigeria's Seven Lessons from Polio and Ebola Response," World Bank (2016)



4. EMERGENCY PROCUREMENT AND SUPPLY CHAIN

4A | COMMODITY PLANNING

Determine essential commodities to stockpile and procure based on potential epidemics

Definition

Commodity planning for potential epidemics refers to the identification of the types and specifications of commodities required to combat an outbreak.

Why this is important

A predetermined and specified list of commodities provides countries with critical information to plan across the supply chain. Compiling this can significantly slow down the early phase of a response, so developing an initial list is essential in increasing response efficacy. Creating a defined list enables countries to forecast needed quantities, identify suppliers and negotiate agreements, determine storage needs, plan for transport, and develop protocols on inventory management as well as waste disposal.

Types of commodities

Determining the types of commodities needed in the event of an outbreak is the first step in an effective commodity planning process. The ESC is responsible for several categories of supplies: medical and nonmedical consumables, PPE, pharmaceuticals or vaccines directly relevant to specific diseases, health facility infrastructure and equipment, and emergency response logistics equipment. The majority of supplies that countries will need during an emergency, such as PPE and emergency response equipment, will be consistent regardless of a country's hazard profile. Other specific items will vary based on the types of disease risks a country faces.

The ESC team can use hazard assessments as the first indicator of what types of commodities they should plan for, and hazard assessments may allow countries to “cross off” several commodities based on the absence of a particular disease threat. Once governments identify relevant threats, they should build on established resources to determine which specific commodities they need. Various organizations such as the PSCN, Food and Agricultural Organization (FAO), and WFP have already worked on identifying lists of commodities needed by disease type for the most common infectious diseases. ESC teams should leverage these existing lists by cross-referencing them against their own hazard assessments and working with experts to further specify any additional commodity needs⁴⁶

Commodity specifications

Specifications for emergency commodities should be identified ahead of time as much as possible to enable the most effective planning. If countries can identify technical specifications down to the SKU level by defining elements such as size, color, packaging, and shape, they will be able to identify suppliers accurately and put contracts in place before a crisis begins. This can be a labor-intensive process, and experts from organizations like the WHO and UNICEF should be involved in defining the commodity specifications early on. This ensures they reflect WHO standards to ease the procurement process and facilitate collaboration with international stakeholders.

Supply kits

The ESC may use pre-configured supply kits in the early phases of an emergency response to accelerate supply chain operations. These kits vary based on the response scenario, and are designed by professionals to be modular. However, several downfalls can come from the over-reliance on kits, such as a lack of proper forecasting and planning of specific needs, a lack of visibility and validation, and significant lead times when purchasing from popular basic aggregators. Potential use of these kits and their composition should both be accounted for in the commodity planning process

46 Pandemic Supply Chain Network. “Project Report,” (2017). Pg 119



CASE STUDY – BOTSWANA



Over the past decade, Botswana’s Ministry of Health has reformed its Central Medical Stores (CMS), a government agency responsible for supplying drugs and medical supplies, with the aim of promoting 97% commodity availability. Although not specifically focused on ESC, Botswana’s supply chain reform experience highlights the benefits of improved supply planning and management. The MoH’s reforms included transforming CMS into a semi-autonomous agency (parastatal). In concert with these efforts, the government released a strategic plan designed to estimate the country’s needs in different crisis situations. CMS categorized drugs into vital, essential, and nonessential items, specifying target procurement and storage rates for each category. Botswana also assessed methods to ensure that these drugs could be made available in different regions. Strategies included reassigning management responsibilities within CMS, revising performance indicators, and streamlining internal administrative practices. CMS also worked to refocus its procurements programs to minimize rates of drug expiry and work with partners to limit supply constraints. Though Botswana still faces challenges with respect to stock outs and supply chain management, the country’s commodity planning efforts have shown benefits. Commodity planning has helped promote widespread access to HIV/AIDS medicines, and the government has used

its vaccine stores to rapidly halt an outbreak of foot and mouth disease. These achievements reflect the important role that commodity planning can play in preparing for and addressing outbreak of a disease.⁴⁷

Prioritization

If resources are limited, governments will need to prioritize which commodities they purchase. This choice should be informed by several considerations:

- Risk level posed by absence of commodity
- Number of emergencies and scenarios that commodity can be used for
- Complexity of acquisition and management, e.g., sourcing, shelf life, cold chain requirements
- Relative cost
- Frequency of resupply necessary

Pitfalls to avoid:

- Insufficient planning of commodity specifications
- Oversight of basic commodities that may be essential during an emergency response
- Assumption that another stakeholder will be responsible for identification of commodities
- Lack of prioritization amongst commodities leading to shortages of important goods

Resources

- The ESC Playbook contains a “Commodity forecasting” section that contains guidance and tools on identification and quantification of commodities. It contains commodity lists for ~20 priority infectious diseases and zoonoses in the form of Disease Job Aids for ESC staff⁴⁸
- PSCN has created detailed commodities lists for several common diseases that WHO is in the process of refining⁴⁹

47 Thomson et al. “Central Medical Stores Botswana: 2010 – 2012 Strategic Plan,” USAID; Muzulu, Paidamoyo. “Botswana donates foot-and-mouth disease vaccines to Zim,” *Newsday* (2017); African Health Observatory. “Analytical summary – HIV/AIDS: Botswana,” World Health Organization (2017)

48 USAID. “Emergency Supply Chain Preparedness Playbook: Disease Job Aids,” (2018).

49 Pandemic Supply Chain Network. “Project Report,” (2017). Pg 119

4B | QUANTITY FORECASTING

Determine the quantity of essential commodities required in an emergency

Definition

Quantity forecasting is the process of calculating the quantities of key commodities that will be necessary to deliver care in the event of a public health emergency.

Why this is important

Shortages in key commodities can cripple an emergency response and limit a country's ability to slow the spread of disease, while over-purchasing wastes precious resources. By determining how much of certain goods they will need in a crisis, countries can lay the groundwork for an effective response and reduce supply shortages in the event of an outbreak. Quantity forecasting also allows countries to begin establishing supply agreements and logistics protocols in preparation for outbreaks.

Tools for quantity forecasting

The process of quantity forecasting is highly technical. It requires modeling specific commodity needs under different outbreak scenarios. Countries should leverage partner expertise and existing tools for supply estimates while they develop their own capacity. Working with experienced partners helps countries access sophisticated modeling tools and expertise that can help improve the accuracy of predictions.

Existing tools for quantity forecasting include:

- Operational Planning Application for Logistics and Supply (OPALS) is a tool developed by the WHO to help gauge quantities of critical items

- required for pandemic response. While OPALS was designed for H1N1, PSCN is working to expand the tool to forecast commodities for the ten diseases that its commodities list covers
- UNICEF's Emergency Supplies Calculator helps countries identify quantities required and costs during an epidemic based on several demographic factors, such as population at risk.
- PSCN's list provides maximum monthly quantities for each of its commodities list items⁵⁰

How to create quantity forecasts

Before a crisis emerges, countries should work to estimate overall likely demand for key commodities in the event of disease outbreaks. At the very least, the MoH should engage experts from WHO to develop a rough estimate of the consumption ratios by disease for each of the critical commodities identified (e.g., # number of units per 100 patients). Several critical considerations can affect the severity of an outbreak and a country's response needs. These include:

- Demographic data (e.g., number of children, population size)
- Geographic factors, including the fraction of the population living in urban vs. rural areas and the types of ecosystem present
- Timeframe of response, along with consumption patterns and continuity of demand
- Patterns from prior epidemics of likely pathogens
- Epidemiological behavior of pathogen

By entering data for each of these factors into a digital model, such as the ones listed above, countries can retrieve detailed estimates for both the quantity of supplies needed and their costs. These estimates will provide countries with baseline scenarios of their commodity needs in the event of an outbreak. In addition, countries can modify each of these assumptions to identify their needs under different outbreak scenarios. For instance, countries can identify how their quantity demands in an epidemic with an aggressive clinical course rate versus

50 Pandemic Supply Chain Network. "Project Report," (2017), pg 33; Pandemic Supply Chain Network website: <https://www.pandemicsupplychain.org/information-platform/>



CASE STUDY – GHANA



Ghana has effectively used quantity forecasting in preparation for numerous emergency situations. During the Ebola crisis, the Ghanaian government responded to the possibility of an outbreak by having the MoH assess the country's ability to respond to an epidemic. Using outbreak scenarios with different projections of how rapidly the disease could spread, the government undertook a comprehensive risk and vulnerability assessment. For each scenario, the government estimated its needs for drugs and non-drugs consumables, gaps in current stock levels, and procedures to distribute commodities to sites. As part of this effort, Ghana partnered with the WHO to conduct monitoring and supervisory visits to local health sites to review epidemic preparedness at the local level. The government also worked to identify potential sources of medical goods from both internal and external suppliers. Though Ghana never faced an outbreak of Ebola, it has been well-stocked with emergency supplies during outbreaks of cholera and yellow fever, reflecting the important role quantity forecasting plays in maintaining stable levels of essential commodities.⁵¹

a relatively mild one. By adjusting these assumptions in the model, countries will be able to create response plans for outbreaks of varying severity. When testing these scenarios, countries should place particular focus on diseases identified as high-

risk or high-likelihood in their hazard assessments. Countries should also create quantity forecasts that reflect all major feasible outbreak possibilities.

Factors to consider

Accurate quantity forecasts require a holistic understanding of crisis scenarios. Therefore, when testing different models, countries must pay particular attention to how their quantity demands might vary during different stages of the outbreak and across regions.

Regional variation: Commodity demands can vary significantly across subnational regions and delivery centers in the event of an outbreak. As such, countries must identify potential demand at both the national and regional level in their forecasts. In general, regional demand can be calculated as a population-weighted fraction of national demand. However, areas with different geographic and demographic characteristics may have significantly different challenges in the case of an outbreak. Therefore, national-level forecasters should consult with regional experts such as state- or provincial-level health officials to identify any factors that may affect local quantity needs. Countries should also project the maximum demand a given region could have in the event of a severe outbreak. Together, these subnational forecasts will provide countries vital context for their transport and logistical plans.

Stages of the crisis: Commodity demands will vary in different stages of a crisis. In the earlier stages of an outbreak, countries may opt to use greater quantities of pre-configured medical supply kits, whereas in later stages, demand may shift toward individual items. Therefore, countries need to account for both the number of kits needed at the outset of a crisis and the transition to a piecemeal ordering system. Countries should also plan for frequency of resupplies, which will depend on the doubling rate of the epidemic, and for the need to restock the stockpile after an emergency ends.⁵²

51 Ghana Ministry of Health: "National Preparedness and Response Plan for the Prevention and Control of Ebola Viral Disease," (2014); Ohene et al. "Assessment of the response to cholera outbreaks in two districts in Ghana," *Journal of Infectious Diseases of Poverty* (2016)

52 Expert interviews

Forecasting at the onset of an outbreak

Initial data to inform quantity forecasting should be gathered as part of the preparedness agenda to give countries a solid understanding of how they will quantify needs under different emergency scenarios. However, quantity forecasting for a specific outbreak must occur at the outset of an outbreak, as countries will use outbreak-specific data, such as location and size of an initial outbreak, to define their quantity forecasts. If the ESC team chooses to do so, it should utilize the above models and considerations to ensure accurate predictions.

Pitfalls to avoid

- Not applying “no-regrets principles” and instead prioritizing resources over preparation, leading to being undersupplied at the outbreak of an emergency
- Lack of forecasts for multiple outbreak scenarios
- Failure to account for how needs may change over the course of an outbreak

Resources

- The ESC Playbook contains a “Commodity forecasting” section that contains guidance and tools on identification and quantification of commodities
- Operational Planning Application for Logistics and Supply (OPALS)⁵³
- UNICEF’s Emergency Supplies Calculator⁵⁴

4C | PROCUREMENT AND SOURCING OF EMERGENCY HEALTH COMMODITIES

Identify suppliers that will be responsible for providing emergency commodities and determine their capacity to meet emergency needs

Definition

Procurement and sourcing involves obtaining essential commodities from local and international suppliers in preparation for and during an emergency response.

Why this is important

Bottlenecks for essential commodities can inhibit an emergency response even when other areas of the supply chain are functioning effectively. For each essential commodity, countries need to know not only how much they need, but also a clear sense of where they will source these commodities from. Countries should also have mechanisms in place to obtain those commodities so that a response can begin as soon as a crisis hits. This requires building and maintaining a list of potential suppliers and their capacity, and putting agreements in place with suppliers beforehand about exactly what they will provide during an outbreak.⁵⁵

Identifying sources of supplies

Countries should have a comprehensive list of potential sources for all essential commodities. First-line suppliers should be pre-identified, vetted, and contracted ahead of time to limit lead times. Suppliers should also be diversified to limit risks such as long production lead times or local factory shutdowns due to the spread of infection.

53 Pandemic Supply Chain Network: “Supplies,” <https://www.pandemicsupplychain.org/supplies/> (2017)

54 UNICEF: “Emergency Supply Calculator,” https://www.unicef.org/cholera/Chapter_10_UNICEF/14_Supply_calculator/WebCalculation.htm (2016)

55 Pandemic Supply Chain Network: “Project Report,” (2017), pg 37



CASE STUDY – LIBERIA



During the 2014 Ebola crisis, Liberia created and implemented new procurement and sourcing processes as part of the emergency response. Initial responses to the outbreak were focused on setting up Ebola treatment centers, and as a result, the ESC initially received inadequate attention. For instance, healthcare workers lacked access to proper PPE that could help ensure their own safety. To compensate, Liberia's government, in concert with the Academic Consortium Combating Ebola in Liberia (ACCEL), created new procurement and sourcing processes to improve drug and equipment availability. Local procurement was used when possible to create a rapid, cost-effective supply process. ACCEL worked with a local medical school to make the process auditable and ensure quality in line with the government's standards. International procurement and partnerships with NGOs also played a major role in the supply chain and allowed Liberia to leverage international suppliers to fulfill unmet needs. The Liberian government also established a streamlined process for customs clearance to expedite drug imports. When these steps were put into action, supply chain performance rapidly improved. The revamped Liberian supply chain procured and delivered more than 70 metric tons of supplies within a twelve-week period. Moreover, operational efficiencies from the new procurement process helped reduce transportation costs, and ACCEL used those savings to fund deliveries to previously unreachable hospitals. Though Liberia and ACCEL's efforts emerged in the midst of a

crisis, they demonstrate the importance of effective procurement and sourcing strategies for ESC management.⁵⁶

Local, regional, and national suppliers each can play a unique role in the procurement process:

- **Local suppliers:** Countries should build out an inventory of in-country sources to supply commodities in the short term. Local suppliers can provide rapid access to essential commodities, but can be susceptible to slowdowns because of a widespread epidemic. The Ministries of Health, along with any other national procurement functions, should develop quality standards and accreditation processes for working with local suppliers. They should also leverage technical experts and international organizations to ensure quality control through regular monitoring programs
- **Regional stockpiles:** Existing strategic reserves located in major regions (e.g., west Africa) can play a pivotal role in providing expensive and hard-to-access supplies during an emergency. Countries should work with regional suppliers (e.g., UNHRDs, WHO, FAO stockpiles) to determine which commodities could be sourced from each during an emergency response, but countries should plan with the expectation that they would not be able to rely on strategic reserves alone in the event of a multi-country outbreak
- **International sources:** Where possible, countries should work to establish standby agreements with global stakeholders and suppliers because they are less likely to experience downtime during an epidemic. Because organizations have diverse strengths and capacities, countries should aim to pre-determine the different roles organizations would play in a sourcing strategy (e.g., UNICEF procures pharmaceuticals, WFP procures logistical supplies)

56 Goentzel, Jarrod and Ian Heigh. "Supply Chains in Crisis," Inside Logistics (2015)

Procurement procedures

After identifying potential suppliers, the ESC team should put in place contracts and agreements with suppliers and plan the procurement process ahead of time. Because crises can affect many countries at once, procurement strategies should be designed to ensure that countries can meet their commodity needs in a time of high demand. Contracts should specify the procedures by which countries will receive the goods from their suppliers, identify potential risks, specify transport methods, and outline the amount of essential commodities they will receive from each supplier. This information will help countries avoid bottlenecks in procurement due to limited inventory during an emergency. The MoH and other relevant ministries should establish processes and protocols for regularly reviewing and updating the lists of their suppliers as well as their contracts and standby agreements with those suppliers. They should also update contracts to fit with changing needs and health priorities. In particular, the MoH should modify existing contracts to put in long-term agreements for surge capacity fulfillment where possible. Moreover, countries should contract new providers (after vetting and quality assurance) to meet additional capacity as necessary.⁵⁷

Potential pitfalls to avoid

- No quality assurance tests conducted for identified suppliers
- Reliance on regional and international stockpiling mechanisms without pre-established agreements in place
- Lack of diversification of sources leading to bottlenecks

Resources

- The ESC Playbook contains a “Procurement and sourcing” section that provides guidance and tools on obtaining essential commodities from suppliers, as well as a database in which to record suppliers and their potential capacity

- The LCAs provide a preliminary list of in-country suppliers with estimated capacity, though these must be updated and maintained regularly⁵⁸
- The UN Global Marketplace lists international and local suppliers⁵⁹

4D | STOCKPILING

Pre-purchase and store emergency supplies to have in reserve short term in the event of an emergency

Definition

Countries should have ready access to a critical quantity of essential commodities on hand for the initial period of an epidemic to enable an effective response before regular resupply is established. Earmarked regional stocks or virtual stocks, as well as national stockpiles, can provide ready access.

Why this is important

Effective stockpiling and stockpile management will strengthen countries’ capacity to handle emergencies by enabling an immediate response in the first phase of an emergency.

International versus national stockpiles

Commodities can be stockpiled either internationally (usually in a regional logistics hub such as Kenya for east Africa) or nationally. Appropriately managed national stockpiles reduce the need for cross-border imports of essential emergency commodities. However, international stockpiles can be more cost effective because they cover several countries and can be a stopgap if local capacity is not sufficient.

57 Pandemic Supply Chain Network. “Project Report,” (2017), pg 37-39

58 Logistics Cluster Website: <http://dlca.logcluster.org/display/public/DLCA/LCA+Homepage>

59 United Nations website: <https://www.ungm.org/>



CASE STUDY – MOZAMBIQUE



Mozambique's government has used stockpiling effectively to prepare for potential cholera epidemics. A consistent challenge in stockpiling medical goods is minimizing risk of loss while maintaining a stable supply of goods. Mozambique's government undertook a comprehensive analysis of records from neighboring countries to assess its needs with respect to cholera prevention and treatment. The Mozambique government took concrete steps to ensure that its stockpiles would remain well-supplied without wasting resources. In particular, assigning co-shared responsibility to the MoH and a separate agency helped promote sensible management of the drug stockpile. Because using goods from the stockpile required joint authorization from two agencies, Mozambique was able to ensure that goods were only used in response to an emergency, rather than to supplement routine medical supply chains. The system is not without flaws, as stock outs are still a common problem in certain areas of the country. But the use of dedicated, well-run stockpiles in planning for potential cholera epidemics helped to lay the groundwork for efficient ESC management.⁶⁰

The ESC function of a country should hold a working session with experts and partners to determine whether a regional or a national stockpile is most appropriate for the country context. Choosing what to stockpile locally requires understanding the cost of being short on a product versus the cost of being long (e.g., expired product, inventory holding). Considerations for international versus national stockpiling for each commodity are:

- Demand considerations: Likelihood of use, substitutability (e.g., can another product or method be used for the same effect?), consumption patterns, existing stock levels in routine supply chain
- Ability to manage inventory locally: Lifecycle, complexity of management, cold chain capability required, storage capacity available/affordable locally
- Ease of import: Ease of passing customs, risk level posed by travel time⁶¹

Locally-held stockpiles

If stockpiles are held locally, the commodities should be purchased and stored separately, and the country should develop a system for rotating supply through routine supply chain while regularly replenishing emergency stocks to prevent expiry. Best practice would be to pre-position stocks at strategic storage locations based on the geographic likelihood of key threats. This system should include both stock rotation and stock monitoring. Stock rotation should be done in a scheduled manner: the ESC should not be “raided” when the routine supply chain is stocked out, and needs to be preferentially in stock at all times. Stock monitoring should occur at regular intervals (at least quarterly) to avoid product expiry and misappropriation of commodities.⁶² Finally, protocols codifying inventory management and appropriate use of stockpiled supplies should be documented, shared, and followed in nonemergency situations.

60 Wagenaar et al. “Stock-outs of essential health products in Mozambique-longitudinal analyses from 2011 to 2013,” *Journal of Tropical Medicine and International Health* (2014); expert interviews

61 Pandemic Supply Chain Network: “Project Report,” (2017), pg 46-51

62 Emergency Response Supply Chain Assessment,” Australian Council for International Development’s Humanitarian Reference Group (2007).

Pitfalls to avoid

- Poor visibility into stockpile stock levels and expiry dates
- Loose restrictions ring-fencing stockpiled commodities
- Failure to restock commodities after an outbreak

Resources

- The ESC Playbook contains a “Stockpiling” section that provides guidance on how to identify stockpiling needs and resources
- If countries have completed the JEE, they can reference the “Preparedness” section on mapping of national stockpiles to identify current capabilities and gaps⁶³
- The UNHRD are a global network of strategically located depots managed by WFP. Together, they form a preparedness tool that supports the strategic stockpiling efforts of the wider humanitarian community. UNHRD provide a range of services, including management of emergency relief stocks (pre-positioning, storage, and handling of emergency supplies and support equipment)⁶⁴

4E | EMERGENCY RESPONSE WAREHOUSING AND STORAGE

Prepare storage infrastructure to manage inventory of essential commodities during an epidemic

Definition

Preparing storage infrastructure to manage inventory involves mapping existing storage infrastructure and creating external partnerships prior to emergencies to build up extra capacity.

Why this is important

Effectively preparing storage infrastructure ensures that countries have sufficient warehousing to store the quantity and volume of essential commodities forecasted.

Positioning of warehousing and storage

The number of warehouses required in a country depends upon the quantity and volume of essential commodities, population distribution, physical characteristics, infrastructure quality, and particular threats faced. The ESC function should understand warehousing and storage specifications for each essential commodity (shelf life, temperature, volume, weight, demand) to inform how much total storage capacity they need, as well as what type of management is appropriate. The ESC team should review existing warehouse and storage facilities to understand current capacity available and clear out wasted capacity (e.g., space taken up by expired goods). Finally, warehousing and storage considerations for each emergency commodity should be codified into an inventory management section for the warehousing and storage protocols, and managers should be trained on them.

Building up external capacity

If capacity is not sufficient to store essential commodities between resupplies, the government should build or rent additional capacity. To do so, they should enter into negotiations and discussions with partner agencies and private sector actors on the cost and availability of potential storage facilities.⁶⁵ During these negotiations, countries should

63 World Health Organization. “Joint External Evaluation Tool,” (2016)

64 For more information, please see: <http://unhrd.org/>

65 “Emergency Response Supply Chain Assessment,” Australian Council for International Development’s Humanitarian Reference Group (2007)



CASE STUDY – EL SALVADOR



El Salvador's response to an earthquake in 2001 shows the important role that well-designed storage and warehousing plays in emergency response. El Salvador operates an integrated storage system in which medicines and supplies are primarily distributed from central warehouses to local storage areas and organizations. When the earthquake hit, the design of El Salvador's system allowed the country to access stored goods rapidly. El Salvador used an inventory tracking management system designed in partnership with the Pan American Health Organization to register goods coming in and out of government warehouses. The system kept track of existing stores and goods received from donors, storage capacity at the local level, and local inventory. Quick distribution, effective use of existing capacity, and access to an international airport also allowed El Salvador to quickly access and stock international aid in its central warehouses. Moreover, the accountability provided by the warehousing management system attracted positive press attention, which promoted public trust. El Salvador's storage system is not perfect: its costs could be lower and it occasionally suffers from stock outs. Nonetheless, in the case of the earthquake, effective management, accessibility, and sufficient capacity helped facilitate an accountable, streamlined emergency response.⁶⁶

keep in mind that certain commodities may require additional capacity or resources in terms of:

- Loading and unloading of supplies
- New equipment
- Warehouse labor
- Delivery site setup
- Security
- Temporary warehousing is another alternative for emergency response storage if owned, partner, and private sector capacity is insufficient. The ESC team can work with routine supply chain storage and warehousing staff to identify strategic locations where temporary storage could be set up (e.g., lots near airports/seaports, centrally located sites). These sites should be documented ahead of time.

Pitfalls to avoid

- Even if storage capacity exists before an emergency, staff may not be prepared for a scale-up⁶⁷

Resources

- The ESC Playbook contains a "Storage and warehousing" section that provides guidance on storage and warehousing, and provides tools and templates to support a warehousing and storage assessment
- Countries can reference the CDC Strategic National Stockpile guidelines to understand protocols around warehousing and storage⁶⁸
- The LCAs provide a preliminary list of in-country warehousing and storage with estimated capacity and guidance on sources of information⁶⁹

66 Tomasini, Rolando, and Luk N Van Wassenhove. "Coordinating Disaster Logistics after El Salvador's Earthquakes using SUMA's Humanitarian Supply Management System." *Harvard Business Review* (2003). Alliance for Health Logistics Systems. "Characterization of the Supply Chains for Medicines and Medical Supplies in Latin America." USAID (2015)

67 "Emergency Response Supply Chain Assessment," Australian Council for International Development's Humanitarian Reference Group (2007)

68 CDC Website: <https://www.cdc.gov/phpr/stockpile/index.htm>

69 Logistics Cluster Website: <http://dlca.logcluster.org/display/public/DLCA/LCA+Homepage>

4F | TRANSPORT

Determine how commodities will flow from stockpiles and storage facilities to service delivery points

Definition

Making a transport plan involves liaising with customs officials, identifying transporters, writing transport protocols, and mapping transport routes. Mapping transport routes should consider the existing transport infrastructure, the physical characteristics of the commodities transported (and any special constraints they require, such as cold chain), seasonality, and the locations of the country's stockpiles, warehouses, and service delivery points.

Why this is important

Effective transport plans enable countries to deliver vital emergency goods in a time-efficient manner. Proper planning is required for countries to dispatch needed commodities across a wide range of terrain inside their borders and to avoid wastage of commodities through improper handling during transport. Moving commodities down from the central level to the point of care can be very challenging, and early mapping and identification of transport mechanisms and routes can save valuable time in an emergency.

Liaising with customs officials

To prepare their transport operations, the ESC function should determine whether each commodity will come from within national borders or internationally. For imported commodities, the ESC should establish a point of contact within the national customs agency prior to an emergency to establish expedited processes and tariff-free treatment of emergency commodities (outlined in Section 3C of this document). This area has been a particular challenge in several recent epidemics.

Mapping transport routes and identifying transport options

For each threat, the ESC team should identify service delivery points close to where the threat is most likely to occur and in areas accessible to end users. In addition, countries should identify any commodity-specific considerations (e.g., cold chain required). Finally, countries should map out a range of potential options for likely service delivery points.

Building on the supplier list from the commodity forecasting step, the ESC team should understand the logistics capability of each potential commodity provider. For example, some suppliers are able to deliver products directly to the central medical store, whereas others require the use of third-party logistics companies to deliver products into the country. Properly documenting this information in advance of an emergency will allow countries to quickly understand lead times for ordering and resupply in the event of an emergency.⁷⁰

In addition, the ESC team should maintain an updated list of logistics providers for each region and/or district that could be mobilized in the event of an emergency. These include MoH vehicles, and should also include private sector options such as third-party distributors. In many countries, military vehicles could also be mobilized. The team should document the types of vehicles available and pre-vet all logistics providers for quality.

Where possible, countries should negotiate contracts for transportation that can be activated when an emergency response is triggered.⁷¹ Payment structures for transport vary: some organizations, such as the WFP, pay transporters based on weight, while others pay based on distance traveled.

70 Pandemic Supply Chain Network: "Project Report," (2017). pg 50

71 Pandemic Supply Chain Network: "Project Report," (2017). pg 71



CASE STUDY –
GUINEA

Guinea’s mass campaigns with a two-dose OCV demonstrate effective use of transportation planning in ESC management. The country’s vaccination efforts faced significant challenges, as the cholera epidemic affected a large, difficult-to-access area with a highly mobile population. Moreover, the campaign had little time to prepare and mobilize the public to respond to the outbreak. Yet effective transportation planning allowed Guinea to deliver high volumes of cold-chain vaccines in resource-limited settings. Vaccines were transported from a central supplier in India to the national airport, where they were then taken to district capitals in refrigerated trucks. From the capitals, vaccination teams used cars and boats to transport vaccines at an ambient temperature to final vaccination sites. These vaccination sites, chosen in concert with community leaders, were designed to be easily accessible and centrally located. Despite having to transport logistically difficult goods such as water, the design of the supply route meant that the government was able to effectively interface with at-risk populations. Guinea’s model also kept delivery costs low, at only \$1 per vaccine. Guinea’s model thereby shows that efficient use of transportation can improve the reach and efficacy of an ESC without raising costs.⁷²

Writing transport protocols

Governments should draft additional protocols to streamline and safeguard the transport process and the commodities transported. First, these protocols should specify procedures for handling receipt of each type of vehicle, especially noting where special machinery is required (e.g., forklifts). Second, these protocols should specify safe handling procedures to protect staff involved in transport and logistics. In addition, countries should create protocols to re-deploy regular SC transport or other MoH vehicles to be used when necessary in an emergency.⁷³

Transport planning at the time of an outbreak

Immediately after an emergency is triggered, the ESC team should make a transport plan to provide needed logistics to the site of the outbreak. Some key considerations in developing the plan include:

- This plan should ideally be **nimble and adaptive**, responding quickly to changing geographies as an outbreak begins or spreads from one area to another. Using the LCA in conjunction with local knowledge of transportation infrastructure will allow countries to pre-identify potential bottlenecks and to create new emergency transport routes
- This plan should **take into account frequency of resupply** depending upon the consumption patterns of the commodity in question. For example, certain emergency commodities are meant for one-time use (e.g., vaccine) whereas others represent a repeat need (e.g., medication or medical supplies). In addition, the frequency of distribution will be a function of the burn rate of supplies

A number of external considerations exist as well, including environmental, political, and demographic factors. Environmental conditions such as severe weather may restrict the viability of using certain routes in the transport plan. Political decisions such as travel bans add another dimension of complexity. Population movement or quarantines represent

72 Ciglenecki et al. “Feasibility of Mass Vaccination Campaign with Oral Cholera Vaccines in Response to an Outbreak in Guinea,” *PLOS Journal of Medicine* (2013)

73 Timoleon, Chaliamalias. “The Logistics Chain of Emergency Supplies in Disasters,” Athens University: School of Medicine (2012)

a third constraint, which should also be factored into the route planning.⁷⁴

Pitfalls to avoid

- Reliance on verbal rather than written contracts
- Assumption that suppliers will also act as distributors
- Not incorporating commodity-specific considerations (e.g., cold chain) into transport plan

Resources

- The ESC Playbook contains a “Transport and waste management” section that provides guidance on transportation
- UNHRD and WFP have developed downstream logistics kits ready for deployment within 24/48 hours, with ready-to-deploy logistics hub (has mobile storage, offices, generators, etc.), and WFP has developed designs and modules for how to build logistics bases⁷⁵
- The LCAs provide an overview of national infrastructure as well as transportation providers⁷⁶

4G | WASTE MANAGEMENT

Plan on how best to dispose of contaminated commodities during an epidemic

Definition

Waste management involves creating plans for the safe disposal of contaminated commodities during an epidemic. This involves establishing protocols to categorize contaminated commodities and outlining specific requirements for each type’s disposal.

Why this is important

Without effective sorting of waste, cross-contamination of nonhazardous waste could occur, increasing the quantity of waste that needs to be disposed of and increasing the risk of further infection.

Categorization of medical waste

The ESC should sort each of the commodities they use in a given emergency into one of several discrete categories, each requiring a different set of disposal practices. The appropriate type of transport and storage capacity will vary depending upon which category of commodity is being disposed of. Countries can then use this categorization to calculate the required resources for safe disposal. Once this calculation is complete, all personnel operators involved in waste disposal should be trained on the different category-specific protocols.⁷⁷

Procedural considerations

Countries should identify where supplies are being used (clearly demarcating them when toxic) and implement receptacles in these areas. The bulk of these receptacles will be at health facilities, but others might be at waste disposal sites or in warehouses. Where possible, countries should use existing waste management protocols from their routine supply chain. For special categories such as highly toxic waste (see below section), special containers should be provided. Disposal will vary depending on the type of waste (e.g., recycled, buried, incinerated, chemically treated), and countries should ensure proper facilities and transport for each type of disposal procedure.⁷⁸

74 Timoleon, Chaliamalias. “The Logistics Chain of Emergency Supplies in Disasters,” Athens University: School of Medicine (2012)

75 Pandemic Supply Chain Network: “Project Report,” (2017). pg 74

76 Logistics Cluster Website: <http://dlca.logcluster.org/display/public/DLCA/LCA+Homepage>

77 Pandemic Supply Chain Network. “Downstream Logistics in Pandemics,” Logistics Cluster (2017)

78 *ibid*



CASE STUDY – LIBERIA



Disposal of toxic and contaminated waste posed a critical challenge for Liberia during its recent Ebola crisis. The Liberian government was able to meet that challenge by partnering with UNICEF to develop comprehensive safety guidelines for waste disposal. The government and its partners worked to promote awareness of safe disposal methods, build technical capacity, and transport waste without jeopardizing sanitation workers' safety. In addition, a Liberian government agency (LWSC) was tasked with the process of desludging Ebola contaminated sewage in Monrovia. Among other responsibilities, the LWSC worked with communities to maintain direct supply of chlorine solutions and septic tanks. The government supplemented these efforts with multi-sectoral monitoring protocols, including members of the local and national ministries, and with engagement of civic leaders at the local level. The Liberian government's strategy prioritized dissemination of technical knowledge and awareness, while strategically allocating the tools needed to dispose of waste. Put together, these efforts ensured safe disposal of contaminated items and limited spread of the disease.⁷⁹

Categories of waste

Contaminated commodities can be divided into three categories:

- **Sharps waste** includes syringes, needles, scalpels, and other sharp objects, and thus proper disposal of sharps waste necessitates the use of special, puncture-proof containers. These specialized containers should be procured prior to an emergency, and their quantity should be proportional to the amount of sharps commodities the country requires
- **Non-sharp infectious waste** includes both pathological waste (human tissue and fluids) and infectious waste (such as medical devices) which has been contaminated by pathological waste. This category of contaminated waste should remain separate both from other categories of contaminated commodities, and from non-contaminated, non-infectious waste (e.g., cardboard boxes) and human waste. Keeping these separate reduces the possibility of further contamination, thereby lightening the load on the overall supply chain by minimizing the total amount of contaminated waste that must be transported⁸⁰
- **Highly toxic waste** includes genotoxic, carcinogenic, radioactive, and chemical waste, as well as unused or expired pharmaceuticals. Because of the increased level of severity of contamination, protocols enforcing stricter PPE should be codified and enforced, and special containers should be used to reduce exposure. This extra equipment, like the puncture-proof containers for sharps waste, must be procured prior and in proportional quantity to the projected amount of highly toxic waste⁸¹

79 Simen-Kapeu et al. "Strengthening health systems to restore and sustain child survival gains in the context of Ebola: Case studies from Liberia," UNICEF (2015)

80 This does not include human remains burial, which can be extremely challenging during an outbreak.

81 Pandemic Supply Chain Network. "Downstream Logistics in Pandemics," Logistics Cluster (2017). Pg 135

Cultural considerations

Countries should include the expertise of local authorities in the planning process to ensure that waste management procedures align with local cultural practices. Civic leaders and community leaders can also be helpful in communicating safe waste management procedures to affected communities during an outbreak.⁸²

Pitfalls to avoid

- Using improper waste disposal materials for sharps or toxic waste
- Mixing hazardous and nonhazardous waste at receptacle site
- Failure to incorporate regional cultural customs for waste management in disposal plan

Resources

- The ESC Playbook contains a “Transport and waste management” section that provides guidance on waste management

4H | LOGISTICS MANAGEMENT INFORMATION SYSTEM

Where possible, utilize Logistics Management Information Systems (LMIS) or other data systems for effective management of ESCs

Definition

When used well, LMISs track the correct and timely delivery of all elements of the supply chain and allow for data-driven decision-making about supply chain management. However, in developing countries with poorly functioning LMIS for routine supply chains, it may not make sense to rely on these systems for the ESC. In these situations, sim-

ple Excel-based trackers or clearly-defined paper-based systems may be more appropriate.

Why this is important

LMISs serve both as a check on the supply chain (to make sure the commodities are in fact reaching the projected destination in the quantity and frequency they were planned) and a tool to improve the supply chain (identifying gaps or inefficiencies). However, using LMISs with ESCs is not a widespread practice in developing countries, and its implementation should be considered in the context of broader ESC priorities.

System viability

Countries should evaluate the existing LMIS for their routine supply chain on its system viability. For a LMIS to be viable from a systems perspective, it must be **reliable** and **accessible**. An assessment of LMIS reliability should include both the reliability of the tool or software used and the reliability of the network. An assessment of LMIS accessibility should include data quality and accessibility. In addition, the LMIS should be user-friendly and easy to maintain and update.

Preparing an emergency LMIS

Countries should take the following steps to prepare an emergency LMIS:

- Countries should ensure that the LMIS tracks stock levels of at least a subset of all commodities from the emergency stockpile and from warehouses on the national, regional, and sub-regional level
- Countries should ensure that all emergency commodities suppliers and product specifications are preloaded into this system to allow for rapid ordering and tracking
- Countries should ensure that the lead time of the largest supplier for each commodity is preloaded into the LMIS so that the appropriate re-order timing and quantity can be calculated

82 Pandemic Supply Chain Network. “Downstream Logistics in Pandemics,” Logistics Cluster (2017). Pg 136



CASE STUDY – TANZANIA



LMIS improvements in Tanzania have improved the country's health care system and its readiness for emergency health situations. Over the past decade, Tanzania has partnered with international stakeholders and local care delivery organizations to implement widespread use of LMIS technology. As a result, data accuracy and access have improved, helping to promote well-informed decision making across the supply chain. These programs have also helped ensure that hospitals and caregivers have access to critical medical products. Stock outs have decreased by over 20%, and quality data is continuing to improve forecast accuracy rates. Tanzania's advancements in LMIS use have laid the groundwork for a response in the event of a health emergency. The country's efforts to create a fully integrated LMIS for all commodity groups has streamlined preparedness efforts and helps ensure proper access to necessary care in the event of an emergency.⁸³

- Countries should ensure that any extra stock pushed from national to regional or sub-regional warehouses in consultation with experts is noted in the LMIS
- All individuals involved in ESC management (including national, provincial, city, and country government officials) should be pre-trained on the LMIS
- Countries should define protocols on how to use the LMIS during an emergency (e.g., how often to update, persons responsible for tracking specific data). A two-tiered, weekly or bi-weekly system in which a national point person calls regional managers for stock levels and each regional point persons call sub-regional managers is best practice during an emergency

Resources

- The ESC Playbook contains a “Data visibility” section that provides guidance on inventory management and tracking systems

83 USAID: “Health Logistics in Tanzania: Timeline of Accomplishments for Supply Chain Interventions” (2016)

BIBLIOGRAPHY

- Abubakar et al. "The First Use of the Global Oral Cholera Vaccine Emergency Stockpile – Lessons from South Sudan," PLOS Journal of Medicine (2015). <http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1001901>
- African Health Observatory. "Analytical summary – HIV/AIDS: Botswana," World Health Organization (2017). http://www.aho.afro.who.int/profiles_information/index.php/Botswana:Analytical_summary_-_HIV/AIDS
- Alliance for Health Logistics Systems. "Characterization of the Supply Chains for Medicines and Medical Supplies in Latin America." USAID (2015). <http://apps.who.int/medicinedocs/documents/s22392en/s22392en.pdf>
- Brown, Serena. "The Private Sector: Stepping Up," Humanitarian Practice Network (2015). <http://odihpn.org/magazine/the-private-sector-stepping-up/>
- CDC, "Ebola Outbreak Democratic Republic of the Congo 2017." (2017). <http://www.who.int/emergencies/ebola-DRC-2017/en/>
- CDC: "One Health Zoonotic Disease Prioritization Workshop," (2016). <https://www.cdc.gov/onehealth/pdfs/zoonotic-disease-prioritization-workshop.pdf>
- Ciglonecki et al. "Feasibility of Mass Vaccination Campaign with Oral Cholera Vaccines in Response to an Outbreak in Guinea," PLOS Journal of Medicine (2013). <http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1001512>
- "Emergency Response Supply Chain Assessment," Australian Council for International Development's Humanitarian Reference Group (2007). http://www.pacificdisaster.net/pdnadmin/data/original/AC-FID_emergency_response.pdf
- Ghana Ministry of Health: "National Preparedness and Response Plan for the Prevention and Control of Ebola Viral Disease," (2014). <https://ebolacommunicationnetwork.org/wp-content/uploads/2014/09/Ghana-Ebola-National-Plan-Sep2014.pdf>
- Goentzel, Jarrod and Ian Heigh. "Supply Chains in Crisis," Inside Logistics (2015). https://ctl.mit.edu/sites/ctl.mit.edu/files/Supply%20Chains%20in%20Crisis%207_15.pdf
- Kenya Ministry of Devolution and Planning, "National Progress Report on the Implementation on the Hyogo Framework for Action," World Health Organization (2015). http://www.preventionweb.net/files/42432_KEN_NationalHFAprogress_2013-15.pdf
- Mercado et al. "Advances in Civil-Military Coordination in Catastrophes: How the Philippines Turned Lessons Learned from Super Typhoon Haiyan (Yolanda) Into Best Practices for Disaster Preparedness and Response," Center for Excellence in Disaster Management (2015). <https://www.cfedmha.org/LinkClick.aspx?fileticket=QEDCMIMtTc4%3D&portalid=0>

- Muzulu, Paidamoyo. "Botswana donates foot-and-mouth disease vaccines to Zim," *Newsday* (2017). <https://www.newsday.co.zw/2017/09/botswana-donates-fmd-vaccines-zim/>
- National Ebola Response Center. "Lessons From the Response to the Ebola Virus Disease Outbreak in Sierra Leone, May 2014-November 2015: Summary Report," (2015). <http://nerc.sl/sites/default/files/docs/EVD%20Lessons%20Learned%20Summary%20A5%20FINAL.pdf>
- Nigeria Ministry of Health: "National Pandemic Influenza Preparedness and Response Plan," (2013). http://www.ncdc.gov.ng/themes/common/docs/protocols/16_1490369515.pdf
- Odutolu, Ayodeji Oluwole. "Nigeria's Seven Lessons from Polio and Ebola Response," *World Bank* (2016). <http://blogs.worldbank.org/health/nigeria-s-seven-lessons-polio-and-ebola-response>
- Ohene et al. "Assessment of the response to cholera outbreaks in two districts in Ghana," *Journal of Infectious Diseases of Poverty* (2016). <https://idpjournal.biomedcentral.com/articles/10.1186/s40249-016-0192-z>
- Pandemic Supply Chain Network: "Downstream Logistics in Pandemics," *Logistics Cluster* (2017).
- Pandemic Supply Chain Network: "Project Report," Unpublished (2017).
- Sellwood, Chloe and Jonathan Van-Tam, *Pandemic Influenza: Second Edition*. CABI (2013).
- Siedner et al. "Strengthening the Detection of and Early Response to Public Health Emergencies: Lessons from the West African Ebola Epidemic," *PLOS Journal of Medicine* (2015).
- Simen-Kapeu et al. "Strengthening health systems to restore and sustain child survival gains in the context of Ebola: Case studies from Liberia," *UNICEF* (2015)
- USAID: "Health Logistics in Tanzania: Timeline of Accomplishments for Supply Chain Interventions" (2016). http://www.jsi.com/JSIInternet/Inc/Common/_download_pub.cfm?id=17395&lid=3
- Tappero, Jordan and Robert Tauxe. "Lessons Learned During the Public Health Response to the Cholera Epidemic in Haiti and the Dominican Republic." Accessed via National Institute of Health (2011). https://wwwnc.cdc.gov/eid/article/17/11/11-0827_article
- Thomson et al. "Central Medical Stores Botswana: 2010 – 2012 Strategic Plan," *USAID* (2010). http://pdf.usaid.gov/pdf_docs/PA00JZNW.pdf
- Timoleon, Chaliarnalias. "The Logistics Chain of Emergency Supplies in Disasters," *Athens University: School of Medicine* (2012).
- Tomasini, Rolando and Luk N Van Wassenhove. "Coordinating Disaster Logistics after El Salvador's Earthquakes using SUMA's Humanitarian Supply Management System." *Harvard Business Review* (2003).
- Wagenaar et al. "Stock-outs of essential health products in Mozambique-longitudinal analyses from 2011 to 2013," *Journal of Tropical Medicine and International Health* (2014). <https://www.ncbi.nlm.nih.gov/pubmed/24724617>

- World Health Organization, "A Systematic Review of Public Health Emergency Operations Centres (EOC)," (2013).
- World Health Organization. "Blueprint Priority Diseases," (2017). <http://www.who.int/blueprint/priority-diseases/en/>
- World Health Organization. "Ebola Preparedness and Response in Ghana," (2016). <http://apps.who.int/iris/bitstream/10665/254908/1/EbolaPreparedness-Ghana-eng.pdf>
- World Health Organization. "Emergency Response Framework," (2017). <http://www.who.int/hac/about/erf/en/>
- World Health Organization, "Framework for a Public Health Emergency Operations Centre," (2015).
- World Health Organization. "Joint External Evaluation Tool," (2016). http://apps.who.int/iris/bitstream/10665/204368/1/9789241510172_eng.pdf
- World Health Organization, "Rapid Risk Assessment of Acute Public Health Events," (2012). http://www.who.int/csr/resources/publications/HSE_GAR_ARO_2012_1/en/
- World Health Organization. "Technical Guide to Rapid Assessment and Response," (2003).
- Yong, Ed. "How the Democratic Republic of the Congo Beat Ebola in 42 Days." The Atlantic (2017). <https://www.theatlantic.com/science/archive/2017/07/how-the-democratic-republic-of-congo-beat-ebola-in-42-days/532590/>

EXPERTS CONSULTED

Organization

AL ANaid
Bill and Melinda Gates Foundation
CDC
CDC
FAO
GHSA
Harvard Humanitarian Initiative
IFRC
IMC
MIT
MSF
Liberia Public Procurement and Concessions Commission
OFDA
OFDA
OFDA
PSCN; Henry Schein
PSM
UNICEF
UNICEF
UNICEF
UNICEF
University of Minnesota
US Dept of Health & Human Services
US Dept of Health & Human Services
USAID
USAID
USAID
WEF
WFP
WFP
WFP
WFP
WHO

Name

Kathy Fulton
Prashant Yadav
Michael Ayers
Tom Jackson
Severin Loul
Olga Bassong
Dr. Stephanie Kayden
Amanda McClellan
John McGhie
Jarrod Goentzel
Stefaan Philips
James Dorbor Jallah
Linda Mobula
Robert Sepe
Giselle Zimmerman
Allison Neale
Scott Dubin
Stephane Arnaud
Carol Kungu
Jean Cedric Meeus
Benjamin Schreiber
Dr. Amy Kircher
Stephen Curren
Laura Wolf
Marilyn Crane
Lindsay Parish
Wendy Taylor
Ryan Morhard
Shilpa Anjali
Stephen Cahill
Konjit Kidane
Bruno Vandemuelebrocke
Michael Griffin