DOWNSTREAM LOGISTICS IN PANDEMICS

LOGISTICS CLUSTER

Foreword

This guideline has been produced for the Logistics Cluster by the Pandemic Supply Chain Network, a public-private partnership formed in the wake of the 2014–15 Ebola outbreak in West Africa to support supply chain logistics in humanitarian responses to major public health emergencies in developing countries.

It is aimed at humanitarian logisticians and Logistics Cluster staff, and consists of two parts. The first addresses emergency preparedness for pandemic response. The second provides guidance for logistics planners and responders deployed to a medical emergency.

The authors are indebted to the many humanitarian, academic and private organizations whose work has informed this guideline. Particular credit is due to Médecins Sans Frontières, the World Health Organization and the World Food Programme.

The Pandemic Supply Chain Network, 2017

www.pandemicsupplychain.org

Contents

Part 1: Pandemic preparedness

1. Introduction

This document has been prepared for:

- humanitarian logistics managers (at HQs and in the field) responsible for preparedness in the operations of their respective organizations; and
- Logistics Cluster staff responsible for helping countries prepare for pandemics.

Pandemics require swift, multi-faceted responses. The aim of medical intervention is to care for patients and contain the disease outbreak. The aim of the logistics response is to enable and support the medical intervention.

As with all natural disasters, there is no business as usual: infrastructure, services and supply chains are disrupted, and local staff and subcontractors' staff may be severely depleted. Movement restrictions, essential to disease containment, add another layer of complexity. So, too, does the fact that staff must be protected from a highly infectious disease.

Given these factors, pandemic preparedness and response is best anchored in the humanitarian cluster system. This view was supported by Inter-Agency Standing Committee (IASC) Principals who, in late 2016, ratified a Level 3 (L3) activation protocol specifically for large-scale infectious disease outbreaks. While the protocol recognizes that both IASC and non-IASC actors will contribute to L3 responses; core responsibilities are reserved for WHO's Director-General of WHO, OCHA's Emergency Relief Coordinator, and IASC Principals.[1]

[1] For more information on the IASC's L3 activation protocol for large-scale infectious disease events and the IASC Principals, please see: https://interagencystandingcommittee.org/system/files/final_-iasc_system-wide_level_3_activation_for_infectious_disease_events_-_iasc_principals.doc, and https://interagencystandingcommittee.org/principals

Pandemic preparedness is not an end in itself; rather, it is a process intended to enhance emergency response capability. One of its most important purposes is to cultivate a shared understanding of risks and their likely impact on an operating environment.

An important development in this respect is the World Health Organization's Joint External Evaluation Tool.[2] Introduced in 2016, it is a mechanism to assess and measure a country's capacity to prevent, detect, and rapidly respond to public health threats. It is designed to ensure transparency and mutual accountability among International Health Regulations implementers,[3] and by scoring countries on a range of common indicators it provides a formal framework and strong motivation for improving preparedness. Crucially, Joint External Evaluations (JEEs) will be repeated every five years to ensure that progress is made.

Results published so far indicate that for the foreseeable future, international assistance will still be necessary when fast-moving pandemics occur. Therefore, there is scope for organizations to combine their own preparedness efforts with support for JEE follow-up actions in at-risk countries.

Whether at organizational or national level, it is important to note that detailed emergency response planning should only be undertaken if a risk is almost certain and is well defined. In other cases, mainstreaming a minimum level of emergency preparedness is more effective.

Achieving the necessary level of emergency preparedness is not a one-off, stand-alone activity. Over time, countries' risk profiles and humanitarian situations change; so, too, do organizations' operational capabilities, partnerships, and

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[2] World Health Organization (2016) *Joint External Evaluation Tool: International Health Regulations (2005)*. Geneva, WHO. Online at: http://apps.who.int/iris/handle/10665/204368

[3] World Health Organization (2005) *International Health Regulations (2005)*. 3rd edition. Geneva, WHO. Online at: http://www.who.int/ihr/en/.

relationships with national governments. Contingency plans for emergency response must adapt accordingly.

It is important, therefore, to acknowledge that pandemic preparedness requires a long-term commitment of both financial and human resources. Institutional knowledge, skills and supply chains must be maintained and kept up-to-date. All actors likely to be involved should work together to enhance collective preparedness. Collaboration and coordination are key.

2. Platform approach

Downstream logistics for pandemic preparedness and response is best organized through a platform approach. Supply chain preparedness for countries vulnerable to disease outbreaks should involve contributions from all sectors of society:

- The **national government** is the natural leader for communication and coordination efforts. It should put in place the necessary legislation, policies and resources for preparedness, capacity development and anticipated response efforts across all sectors.

- The various **functional sectors** (e.g. health and transport) are expected to provide essential operations and services during a major disease outbreak to mitigate health, economic and social impacts.

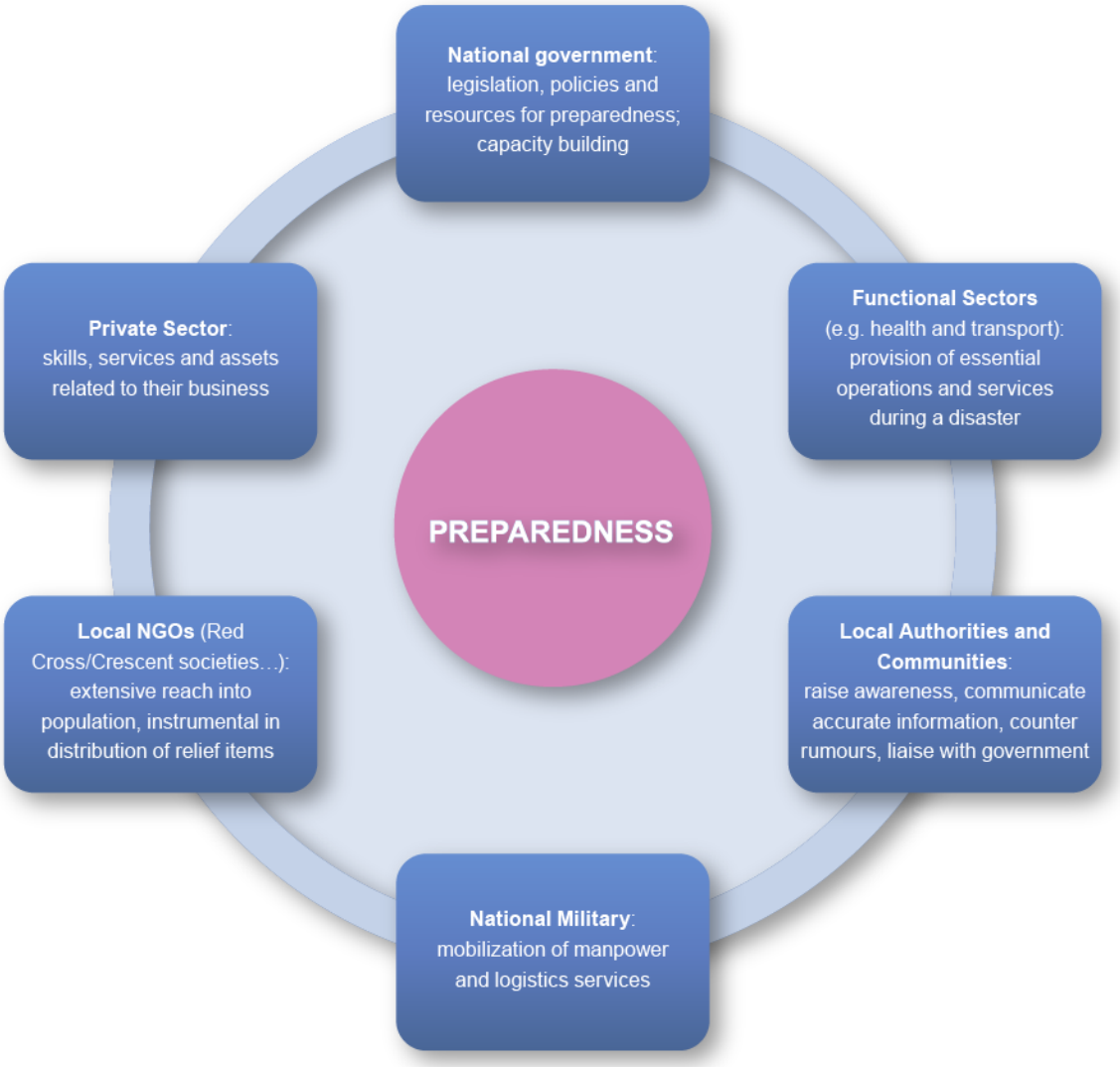
- **Local authorities and community organizations** may be well-placed to raise awareness, communicate accurate information, counter rumours, provide needed services and liaise with the government during an emergency.

- **National militaries**, with their human resources and their capability to mobilize significant transport, handling, storage and other logistics services, often play a crucial role in the initial response to disasters.

- **Local NGOs, Red Cross/Crescent societies**, and even academic/research institutions, can be critical to effective emergency response due to their extensive reach into the population. In the context of the supply chain they may play an important role in emergency needs assessments, and are usually instrumental in the distribution of relief items to affected populations.

- The **private sector** may play an important role by contributing skills, services and assets.

Figure 1. Stakeholders' responsibilities in pandemic supply chain preparedness



3. Assessment

3.1 Joint External Evaluation

The International Health Regulations (IHR), which are coordinated by WHO, represent an agreement between 196 countries for the purposes of achieving global health security. They include all public health emergencies of international concern (PHEIC), including those caused by infectious diseases, chemical agents, radioactive materials and contaminated food. Their objective is "to prevent, protect against, control and provide a public health response to the international spread of disease".

In 2015, WHO introduced a formal mechanism called the Joint External Evaluation Tool to assess and measure countries' status and progress in achieving targets related to the IHR. In doing so, it established a level playing field for all countries to work towards adequate preparedness, and an opportunity for much greater openness and cooperation in achieving global health security.

For the purposes of pandemic preparedness in downstream logistics, JEE assessments provide a snapshot of some of the strengths and weaknesses in countries' provisions for pandemic response. Although this first round of JEEs focuses almost entirely on medical and scientific aspects of preparedness and response, a few indicators do concern logistics, and it is recommended that logistics managers and Logistics Cluster staff pay close attention to country reports as they are published.[4]

[4] The Centers for Disease Control publish a map of completed and planned JEEs at: https://www.cdc.gov/globalhealth/healthprotection/fieldupdates/winter-2017/joint-external-evaluation.html. To access JEE reports for individual countries, go to WHO's IRIS website at http://apps.who.int/iris/ and search for "Joint External Evaluation of IHR Core Capacities".

3.2 Where there is no Joint External Evaluation

3.2.1 Risks and vulnerabilities

Risk assessment allows an organization to consider the extent to which potential events would have an impact on achievement of objectives.

Annex P-1, at the end of this part of the document, provides more information on how to assess events from two perspectives — likelihood and impact — using a combination of qualitative and quantitative methods.

The exact timing of a disaster cannot be predicted. Therefore, for the purposes of risk assessment for pandemic preparedness, impact is the more important of the two perspectives.

The objective of risk assessment is to obtain a thorough understanding of the most likely risks and vulnerabilities, by geographic area and population groups to which preparedness might be oriented.

Before an organization can formulate minimum preparedness and emergency readiness actions, it must understand the likely impact of the disaster on both its internal environment — programmes, processes, staff and assets — and its external environment — partners, and the affected country's population, infrastructure and health services.

With that information to hand, checklists of minimum preparedness actions and emergency readiness actions can be drawn up and used as described in Annex P-2.

Note that risk assessments should be repeated periodically to reflect changes in at-risk countries' circumstances — for better or worse.

3.2.2 National preparedness plans and capacities

It is important to know what groundwork has been done already on pandemic preparedness by governments and other bodies in at-risk countries.

It will be necessary to find out about the following in relation to pandemic preparedness and response capacity in each country:

- the National Disaster Preparedness Plan;
- the government structure, especially the Ministry of Health (MoH) and the unit dealing with disaster management; and
- the likely roles and capacities of local NGOs, community-based organizations, commercial enterprises and academic/research institutions.

Specifically:

- Does the MoH have an emergency preparedness plan?
- Which section of the MoH is responsible for dealing with emergencies and infectious diseases with epidemic potential?
- Is there a health information/epidemiology service?
- Are there laboratories capable of identifying or confirming the presence of infectious diseases with epidemic potential?
- What are the national health protocols, particularly for infectious diseases with epidemic potential?
- What are the exceptional regulations for relief consignments being imported for an emergency?

3.2.3 Baseline health and related logistics infrastructure and services

The better the medical and health conditions in a country, the more capable of coping a population will be.

A population's capacity to absorb the effects of a health disaster may be deduced from the country or region's levels of medical and health provision under normal circumstances. It is important, therefore, to factor baseline levels into risk assessments, and to consider in which ways and to what extent a major outbreak would impact on those existing health services and associated supply chains, including key infrastructure, services and capacities.

Where there is no JEE, it is useful to undertake a preliminary **mini medical logistics assessment**, along similar lines to an LCA but with a health focus.

For detailed, current information, consult with the national ministry of health, local Red Cross and Red Crescent societies, and humanitarian organizations such as Médecins Sans Frontières, UNHCR, UNICEF and the World Health Organization.

At minimum, the assessment should obtain information on the following topics.

Health facilities

Description of the health facilities available — number, locations and conditions of:

- hospitals;
- clinics;
- dispensaries.

Medical supplies

- Local drug supply system:

  - centralized or decentralized;
  - government- or privately-controlled;
  - resilience to crises;
  - stockpiles.

- Local drug production:
  - level of quality;
  - possible disruption by crisis;

Cold chain capacity

- Central cold chain storage capacity (taking into account vaccines and other pharmaceuticals already stored).
- Electricity autonomy of the central store.
- Temperature monitoring in the store and during transport.
- Transport capacity for vaccine shipment from the National central cold room to sub-national and district cold stores
- Passive cold chain **storage** capacity (i.e. capacity to store vaccines locally in refrigerators).
- Passive cold chain **transport** capacity (i.e. capacity to carry vaccines by hand).
- Active cold chain capacity (i.e. capacity to transport vaccines for several hours with ice packs and freezers).

In the event of a health emergency, information and contacts gathered will provide a useful starting point for more detailed assessment.

Customs

During a pandemic response, organizations need to import vast quantities of medical supplies, including pharmaceuticals into the affected country. Some logistics operations may also need to transport potentially biohazardous pathology samples from hospitals to laboratories in other countries.

Both activities are strictly regulated, and as a preparedness measure it is essential to establish contact with the customs authorities to learn their procedures and requirements.

Contact will also enable organizations to try to negotiate special conditions, such as tax exemptions or priority processing of humanitarian supplies that would come into force in the event of a health emergency.

Any agreements should be backed by signed documents to avoid the need for renegotiation if high-level customs officials are assigned to new posts.

Logistics Capacity Assessments

The Logistics Cluster uses Logistics Capacity Assessments (LCAs). These are online at: http://dlca.logcluster.org/display/public/DLCA/LCA+Homepage and could serve as a key source of information for risk assessment.

For each country surveyed, the LCA describes the national logistical infrastructure. It identifies:

- the levels and status of government;
- levels of foreign and private investment;
- issues that have positive and negative impacts on infrastructure at the national level; and

any national construction or improvement projects (either underway or planned), the expected completion dates, and the expected impacts on the logistical infrastructure.

The LCA also describes the quality and availability of services and supplies in the country, identifying:

- specific sectors supported by the government;
- specific sectors supported by private companies;
- development in particular geographic areas and service sectors; and
- any general supply issues (current or historical).

3.3 Critical weaknesses

JEE reports (if they exist) and risk assessments (outlined in 3.1, above, and Annex P-1) will provide insight as to whether there are any critical weaknesses in a country's health supply chain that will need to be overcome in the event of a pandemic.

Based on these findings, and as appropriate, use a tailored simulation exercise to develop a systematic and prioritized listing of weaknesses. For each weakness, define and describe the likely impact on the effectiveness of the supply chain.

Of particular importance are possible logistics bottlenecks, such as: infrastructure at sea ports and/or airports being inadequate to cope with surges in activity; insufficient storage facilities; not enough transport capacity; and inadequate customs facilities, etc.

The epidemic itself will have an impact on the availability of transport. For example, there might be enough trucks available in the country but the number of available truck drivers may be significantly reduced by sickness or quarantine rules.

3.4 Health supply chain improvement

Pandemic preparedness offers opportunities to improve health supply chains. An example would be supporting follow-up action to JEEs, where they exist. But that is by no means the only avenue to explore: many potential improvements would benefit all emergency supply chains, not just those concerned with health care.

To determine practical options, map the deficiencies in the supply chain against possible interventions. The following, general activities are a starting point.

3.4.1 Engagement

In a pandemic situation, the individual impact of each organization will be very limited. Success will depend on everybody being on board:

- government entities;
- the military;
- non-state entities;
- the private sector; and
- civil society.

To encourage and optimize their engagement, pandemic preparedness needs to be transparent and coordinated. To that end, it is necessary to:

- define the added value for all parties;
- clearly define the objectives of the engagement and the responsibilities of each party;
- integrate insights of all parties into the decisions; and
- build trust.

3.4.2 Capacity building

When a fast-moving pandemic occurs, people, systems and supplies must be ready to respond immediately. Every day spent plugging capacity gaps could mean more lives lost, and so those gaps must be identified and addressed in advance.

Ensuring that skills, structures, processes and procedures are in place

Capacity building should focus on training and technical assistance in:

- Emergency logistics
- Commodity tracking and supply chain management
- Port operations and cargo handling
- Surface transport contracting and clearing/forwarding
- Fleet operations and workshop management
- Warehouse management
- Flight dispatch and flight operational management.

It should include the following activities:

- **Human resource development** — the process of equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively.

- **Organizational development** — the improvement of management structures, processes and procedures within organizations, and the management of relationships between different organizations and sectors (public, private and community).

- **Institutional and legal framework development** — the process of making legal and regulatory changes to enable organizations, institutions and agencies, at all levels and in all sectors, to enhance their capacities.

Reducing bottlenecks

It may be that important bottlenecks, identified during risk assessment, could be eliminated or reduced through investment in equipment or infrastructure. Bottlenecks determine the throughput of a supply chain. If the capacity of a bottleneck in a supply chain improves, the throughput will increase.

Determining where bottlenecks occur requires supply chain visibility. Gaining visibility into the supply chain processes requires capturing data from end to end.

Three important and interrelated attributes should be considered in managing supply chain bottlenecks:

1. Supply chain knowledge — a thorough understanding of the "as is" condition of the supply chain, as well as the general status of external global, market and environmental influences.

2. Real-time supply chain intelligence gathering, information sharing and coordinated response.

3. Supply chain visibility — knowing how much inventory is available, where it is located and the level of demand.

Enhancing efficiency

The following improvements might require little or no investment:

- Establish stand-by supply agreements with reliable local suppliers of key relief items.

- Make small improvements in storage facilities.
- Establish transport arrangements.
- Use UNHRD or a similar network to strategically pre-position supplies.[5]

Pre-positioning emergency supplies

Pandemic emergency preparedness requires the right supplies to be in place in case an outbreak occurs. Swift response is best achieved using kits developed for the purpose.

This concept is discussed in detail in Part 2 of this document, particularly Annex R-5. Briefly, though, the advantage of kits is that they are stocked in advance; all materials in them have been selected, tested and are ready for use; and the cost, weight and size of specific kits are known.

There is no need for each organization to pre-position all critical kits around the world. Many humanitarian agencies have emergency preparedness projects as part of their regular programs, and most of these projects include strategic pre-positioning of critical items. Humanitarian procurement centres also have these critical kits in stock for rapid deployment.

[5] The United Nations Humanitarian Response Depots (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). For more information, please see: http://unhrd.org/.

Annexes: Preparedness

These annexes are adapted from WFP's *Emergency Preparedness and Response Package*.

Annex P-1. Risk assessment

Risk is the possibility that an event will occur that will affect the achievement of an organization's objectives and mandate. Risk Assessment should be the first component of an agency's Emergency Preparedness Plan. It could be structured into three steps:

1. Step one: risk identification
2. Step two: risk ranking
3. Step three: risk illustration

1.1 Step one: risk identification

Risks can be defined within three major categories: contextual, programmatic and institutional.

- **Contextual risk**, for example: movement restrictions; behavioural responses of the affected population to the pandemic; state failure; or conflict or another humanitarian crisis (whether pre-existing or coincidental) — factors that an agency is affected by, but over which it has very little control.
- **Programmatic risk**: risk of not reaching the program's objective or of potentially causing harm to others — for instance, pipeline breaks that prevent critical supplies reaching medical responders and patients; or an oversight or mistake that exposes people to a risk of infection.
- **Institutional risk**: risks with significant implications for an agency, such as unreliability of services (including IT), security issues (including confidentiality and data security), reputational loss, and financial losses

through corruption. These can affect an agency as an institution, and could compromise their ability to reach people in need.

This document focuses on mitigating the effects of contextual risks that impact on ongoing operations or give rise to a need to launch new ones. These contextual risks can be divided into the following types:

1. Natural hazards, including the pandemic itself, and others such as earthquakes, and extreme seasonal weather events that cause floods, landslides or droughts;

2. Armed conflict and civil unrest;

3. Restrictive government legislation, such as export and import bans;

4. Drastic changes in the socio-economic environment, such as a surge in prices of essential goods and medical supplies; and

5. Terrorism and crime.

When risks have been identified, it is important to be as specific as possible when describing them so that they can be monitored. If, for example, the possibility of conflict has been identified as a risk then the description of this risk must clearly note who the potential belligerents are, in which part of the country they could clash, and what main factors underlie the risk of violence.

1.2 Step two: risk ranking

Once the most prominent risks have been identified, each of them should be rated on a scale of 1 to 5 for **potential impact** and **likelihood** of occurrence.

The following table provides guidance as to how to assess impact and likelihood, and how to rate the level of seriousness.

Table 1. Rating impact and likelihood

Impact	Likelihood
Negligible (1) The organization is still able to carry out its operations, with almost no delays/losses. Heightened assistance needs can be addressed through minimal investment in ongoing operations. National response capabilities and those of in-country stakeholders are high. Minimal impact on staff and assets.	**Very unlikely (1)** The event has a remote chance of arising – up to a 20% chance within the current year – and/or has occurred very infrequently, if ever, in the past.
Minor (2) The organization is still able to carry out its operations, though with some delays/losses. Heightened assistance needs can be addressed through minor investment in ongoing operations. National response capabilities and those of in-country stakeholders are fairly high. Minor impact on staff and assets.	**Unlikely (2)** The event has a low chance of arising — between a 20 and 40% chance within the current year — or has occurred a couple of times in the past.
Moderate (3) Program delivery may be hampered. Additional resources and activities within ongoing operations will be required to attend to system disruptions and heightened humanitarian needs. National response capabilities and those of in-country stakeholders are medium. Some impact on staff and assets.	**Moderately likely (3)** The event has a possible chance of arising — between a 40 and 60% chance within the current year – or has occurred a few times in the past.
Severe (4) Program delivery will be significantly hampered. Substantial additional resources and activities within ongoing operations will be required to attend to system disruptions and heightened humanitarian needs. National response capabilities and those of in-country stakeholders are low. Considerable impact on staff and assets.	**Likely (4)** The event has a probable chance of arising — between a 60 and 80% chance within the current year — or has occurred a several times in the past.
Critical (5) The organization's activities could be blocked. The event may require a massive response from the organization. National response capabilities and those of in-country stakeholders are extremely low. Critical impact on staff and assets.	**Very likely (5)** The event has a significant chance of arising — over 80% chance within the current year — or has occurred a frequently in the past.

For each risk, a **seriousness rating** is then calculated by multiplying the figure for impact by the figure for likelihood:

impact rating × likelihood rating = seriousness rating

Each risk is then grouped by type of contextual risk (natural hazards, armed conflict, and so on). Adding together the seriousness ratings for all the risks within a group, then dividing the result by the number of entries in that group, produces an average seriousness rating for that type of contextual risk. For example:

Type of risk	**Risk**	**Seriousness rating**
Natural hazards	Pandemic: 5 × 5 =	25
	Earthquake: 3 × 1 =	3
Total =	25 + 3 =	**28**
Average seriousness rating for natural hazards =	28 ÷ 2 risks =	**14**

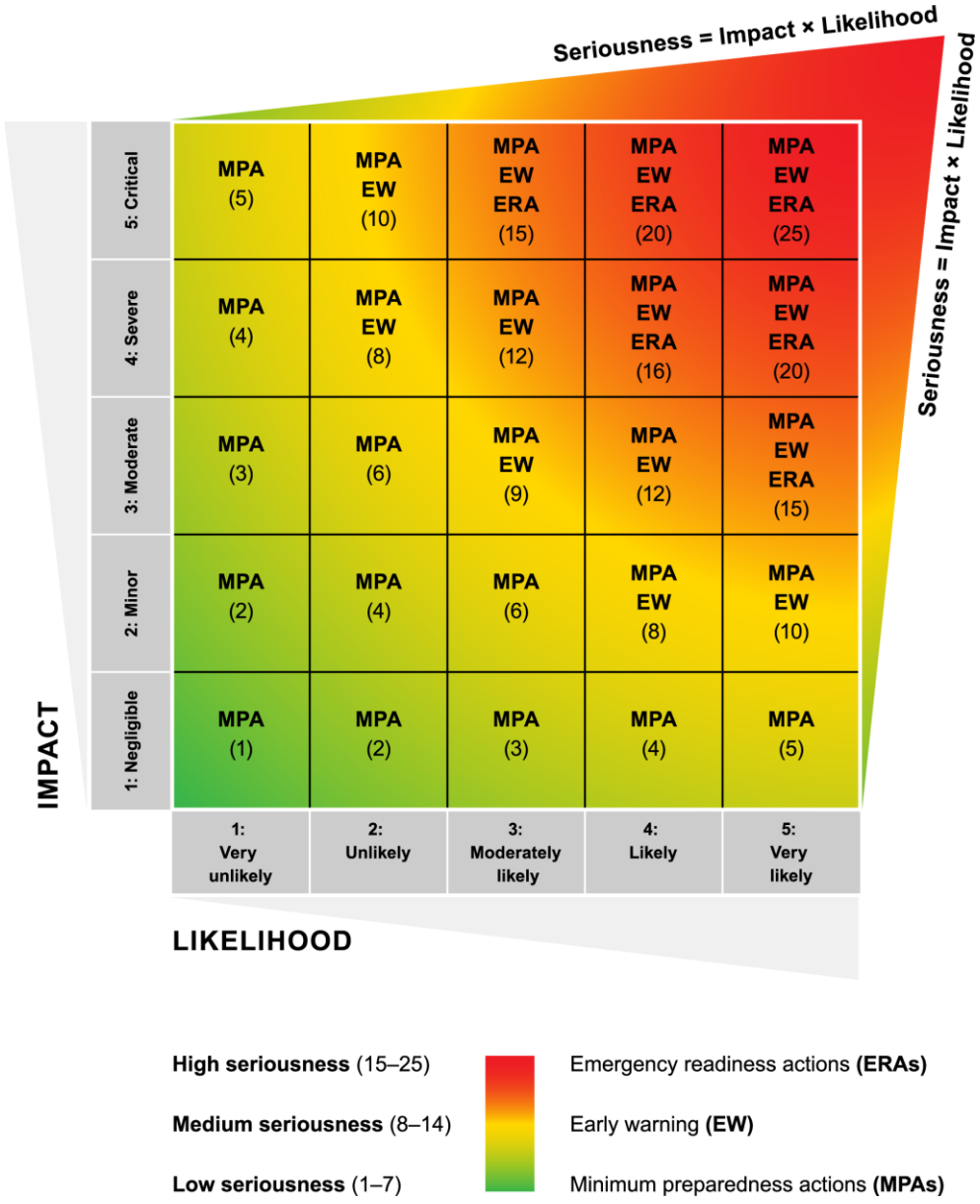
The resulting figure for average serious rating for each group of contextual risks can then be assigned a ranking of low, medium of high:

- **Low:** average score of 1-7
- **Medium:** average score of 8-14
- **High:** average score of 15-25

1.3 Step three: risk illustration

Once contextual risks have been ranked, illustrating them on a **risk graph** will help visualize the risk profile. The graph will draw attention to those risks whose seriousness levels rank in the medium and high ranges, and require mitigating actions beyond minimum preparedness actions.

Figure 2. Risk graph format



Annex P-2. Emergency preparedness checklists

To help structure emergency preparedness and readiness activities, checklists should be drawn up of minimum preparedness and emergency readiness actions.

Each checklist should cover pandemic supply chain and logistics, as well as business continuity, contingency planning, IT disaster recovery and security management in pandemic contexts.

Each checklist has a specific function at a specific point during the evolution of a risk; thus, the checklists are not to be adopted simultaneously.

Table 2. Emergency preparedness and readiness checklists

Type of checklist	Timeframe for adoption
Minimum preparedness actions (MPAs)	As part of the organization's annual plan of action
Emergency readiness actions (ERAs), including CONOPS	As a specific risk becomes imminent that will have a medium or high impact on the organization's operations

2.1 Minimum preparedness actions (MPAs)

The checklist of minimum preparedness actions is the first one that must be implemented to mainstream a minimum level of emergency preparedness throughout all functional areas of an organization. MPAs are based on a multi-hazard approach and are general preparations, not detailed ones for a specific outbreak.

2.2 Emergency Readiness Actions (ERAs)

The checklist of emergency readiness actions will be acted upon when a risk becomes imminent or when it is likely that the Inter-Agency Standing Committee (IASC) will activate a Level 3 response to a large-scale infectious disease outbreak.[6] Emergency readiness actions are activities that will bring relevant parts of the organization to an advanced level of readiness to respond to a specific risk.

Unlike the MPAs, the ERAs are geared towards a specific crisis. They build on the MPAs already in place and include a set of questions and concrete actions that will enable the organization to augment its emergency response capability and to develop a Concept of Operations (CONOPS).

[6] Definitions of the five criteria, analysis of which will be used to determine whether an L3 response is necessary, are listed in Annex A of IASC's *Level 3 (L3) Activation Procedures for Infectious Disease Events* is at: https://interagencystandingcommittee.org/principals/documents-public/final-iasc-system-wide-level-3-l3-activation-procedures-infectious

Part 2: Pandemic response

1. Introduction

This guideline has been developed for humanitarian logisticians who are deployed in response to a disease outbreak, and for Logistics Cluster staff who are new to working in the context of a medical intervention.

The purpose of this document is to provide guidance for developing a logistics plan for pandemic response, and to emphasize the importance of planning in disaster reduction efforts.

Several guidelines have already been produced by humanitarian NGOs and UN organizations. This one is not intended to replace them; rather, it draws on those resources, offering a brief compilation of key information for each step of an outbreak response deployment.

It addresses five core themes:

- The distinctive features of medical interventions;
- How to access essential data related to an outbreak;
- What information can be provided by a Logistics Capacity Assessment;
- How to identify logistics gaps and bottlenecks; and
- What should be included in a logistics operational plan.

It also aims to create awareness of the bigger picture of a pandemic intervention. As with all emergency responses, time is of the essence. Pandemic responses, however, are unique in that one of their primary objectives is to contain the spread of a fast-moving contagious disease. While each logistician is accountable to their own organization, the overall response is a tapestry of inputs by individual specialist organizations. Coordination, communication, and collaboration are essential — both to achieving the purposes of the intervention and to ensuring responders' safety.

There is a commonly-held notion that when a disaster strikes, transport and other arrangements can be improvised depending on circumstances in the field. This does not apply in pandemic response. Movement by land, sea and air is severely restricted due to infection control measures, and normal infrastructure and services may be brought to a virtual standstill. Logistics activities must be planned: preparation is fundamental to a smooth operation.

This guideline's structure is based on the process of a mission, and its content is presented as a series of tips from a logistician with pandemic response experience to others who are new to it.

- Chapter 2 is a short briefing on terms and concepts used in infectious disease outbreaks, and on their relevance to logisticians. Note that Annex R-3 will help you ensure you're physically prepared to be deployed.
- Chapter 3 introduces Logistics Capacity Assessments (LCAs).
- Chapter 4 explains how to obtain data on the outbreak, and introduces tools that help quantify supplies.
- Chapter 5 gives tips on updating LCAs and gearing them to a health crisis.
- Chapter 6 focuses on identifying logistics gaps and bottlenecks.
- Chapter 7 is a guide to defining a concept of operations (CONOPS).
- Chapter 8 will help you turn a CONOPS into a Logistics Action Plan.
- Chapter 9 offers guidance on building logistics infrastructure.
- Chapter 10 covers creating a staff team.
- Chapter 11 focuses on managing supply chain information.
- Chapter 12 covers waste disposal.
- Chapter 13 is a checklist to help you prioritize your actions in the first few days of an outbreak response.

2. Pre-departure briefing

With thanks to the Centers for Disease Control, Microbiology Online, the University of Ottawa and the World Health Organization.

2.1 Key terms for infectious disease outbreaks

Medical terminology is baffling to most people, including logisticians. However, it is important to familiarize yourself with a few basic terms and expressions because they will be critical to your work and to communicating with medical responders. If you understand the language of infectious diseases and the principles of medical response, you will better understand operational priorities and the ways in which an intervention might evolve over time.

An **infectious disease**, also known as a 'transmissible', 'communicable' or 'contagious' disease, is an illness resulting from an infection that passes directly or indirectly from one individual to another. A **host** is an individual infected by that disease. A **host species** is a species (e.g. humans) affected by that infection.

Infectious diseases are caused by micro-organisms that enter the body, multiply, and damage and/or alter the function of infected cells. Micro-organisms that cause disease are called **pathogens**.

Pathogens include **bacteria**, **parasites** and **fungi**, which are cellular organisms. These are self-contained organisms that require a specific environment, e.g. the infected host's body, to reproduce. Pathogens also include **viruses** and **retroviruses**, which are non-cellular organisms that cannot reproduce independently. Instead, they hijack the functions of the host's cells in order to replicate.

A pathogen that infects one host species may **mutate** and become capable of infecting and spreading within another. Pathogens that are transmitted from other animals to humans are described as being **zoonotic**.

Occasionally, the incidence of an infectious disease in a community rises above the expected level. An **epidemic** is a temporary, widespread outbreak of a disease that either would not normally be present in the affected population, or would not occur often. Examples include the 2002-2003 SARS epidemic in China, and the 2014-2015 Ebola epidemic in West Africa.

An **outbreak** is essentially the same as an epidemic, and the terms are often used interchangeably. However, the word 'outbreak' may also be used when the geographic area in which people (or other animals) are affected is relatively small. An outbreak may lead to a broader epidemic if, for example, an infected person from one community travels to another community and infects people there, triggering another outbreak — or, by extension, several, linked outbreaks.

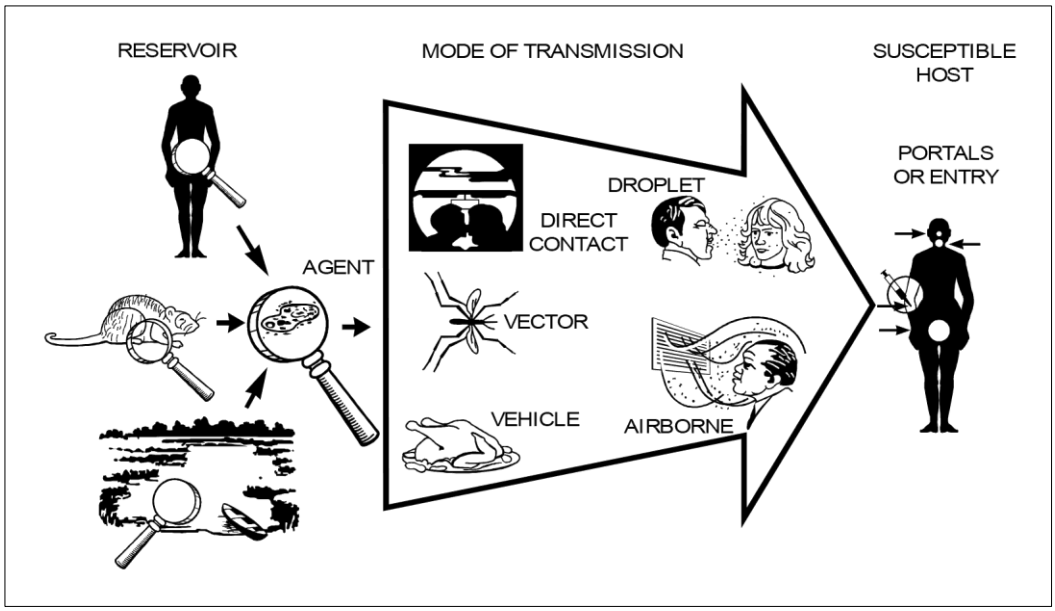
Similarly, an epidemic may expand across national or continental boundaries. A **pandemic** is an epidemic that has spread over several countries or continents, usually affecting a large number of people. Examples include the ongoing HIV pandemic, which was first reported in 1981, and the 2009 H1N1 flu pandemic. (The word derives from the Greek words 'pan' [all] and 'demos' [people].)

Epidemic diseases and **pandemic diseases** are infectious diseases to which populations have low levels of pre-existing immunity or no immunity at all. If a population has never previously encountered the pathogen then it will not have developed an immune response tailored to fighting it. Members of that population will therefore be susceptible to both infection and, potentially, very serious illness, and the disease may spread widely.

Yet, even when a pathogen emerges and potential hosts are susceptible, infection is not inevitable. A third ingredient is necessary: an **environment** that brings the infectious agent and host together.

A **chain of infection** requires the pathogen to: leave the host; survive for a period while it is being conveyed to another, susceptible individual; then enter and infect the recipient. The route from which it leaves is known as a **portal of exit**; and the route by which it enters is known as a **portal of entry**. In the case of flu, the portal of exit could be the nose or mouth (when a host sneezes) or the rectum (when they defecate); the portal of entry would be the recipient's nose or mouth. A **mode of transmission** is a means by which the pathogen is conveyed from the host to the recipient.

Figure 1. Chain of transmission



Source: Dicker, R.C. (1992) Principles of Epidemiology, 2nd Edition, p.45. Atlanta, U.S. Department of Health and Human Services, Centers for Disease Control.

An **attack rate** (also known as 'incidence proportion') is defined as the proportion of people who become ill after exposure to a specific pathogen.

In the case of a severe disease that spreads easily and rapidly, one of the main objectives of pandemic response is to contain the spread of infection. **Containment** usually depends primarily on **quarantining** infected individuals and those who have come into contact with them, and imposing a ***cordon sanitaire***, i.e. travel restrictions in and out of the affected area. For logistics purposes this is very

significant as those restrictions affect ports, airports, all types of transport providers, and access to communities in need of medical and humanitarian assistance.

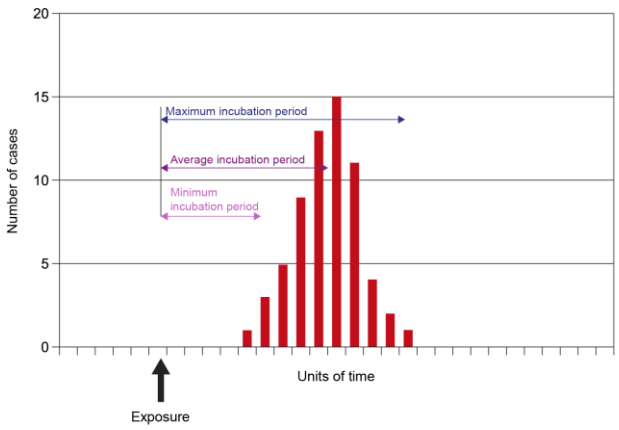
2.2 Data visualization in outbreaks

An **epidemic curve**, or **epi curve**, is a graph describing the **progression** of an outbreak over time. The x-axis depicts units of time — these units are chosen depending on the incubation period of the disease. The y-axis depicts the number of new cases, and these numbers are plotted against the units of time by date (or hour) of onset.

Different kinds of outbreaks produce characteristically different types of epi curves. It is important to understand what they mean because they are important planning tools for logisticians as well as medics.

The simplest epi curve relates to a **point source outbreak**. An example would be an illness stemming from a single contaminated food product. Provided that the source, or point, of exposure does not persist then the epidemic will be self-limiting. Cases arise, peak and then resolve within the disease's maximum incubation period.

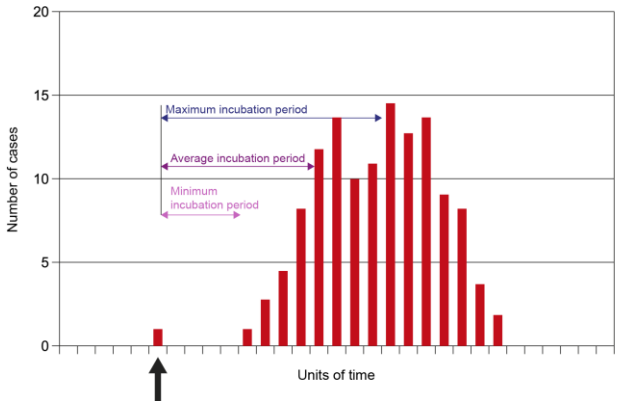
Figure 2. Epi curve of a point source outbreak with no propagation



Source: University of Ottawa. Society, the Individual, and Medicine. Epidemic Curves. *Online at: https://www.med.uottawa.ca/sim/data/Public_Health_Epidemic_Curves_e.htm*

Epidemics involving human-to-human transmission produce more complex epi curves. In these, the **index case** (i.e. the point source) is the initial host of the infection. But those who catch the infection from index case may also transmit it to others (**secondary transmission**). Consequently, the epidemic will extend beyond the maximum incubation period. However, if infection control measures are implemented successfully then the epidemic will have a **limited spread**.

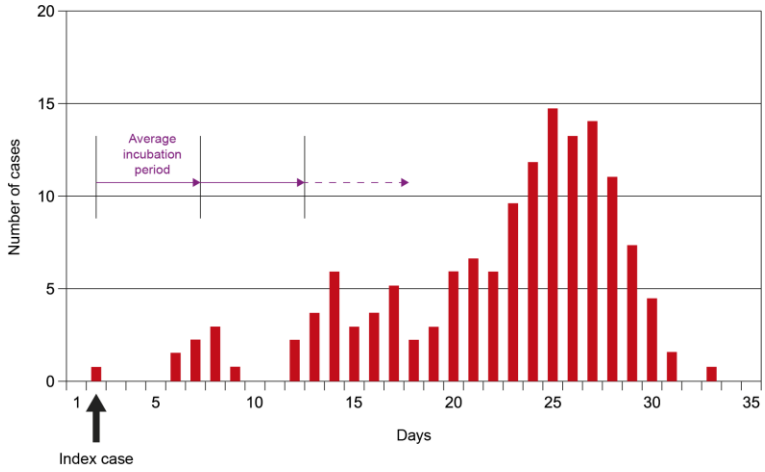
Figure 3. Epi curve of a point source outbreak with index case and limited spread



Source: University of Ottawa, op. cit.

An epidemic that extends beyond secondary transmission — with secondary hosts infecting others, and so on, is called a disseminated outbreak with **propagated spread**. It will continue until something happens to break the chains of infection that have radiated from the index case. For example, the epidemic may end because only a limited number of people are susceptible to the infection. Usually, though, the chain is broken by intervention, be it vaccination or quarantine, or by addressing the means of transmission (e.g. preventing the use of a water source contaminated with sewage from people with cholera).

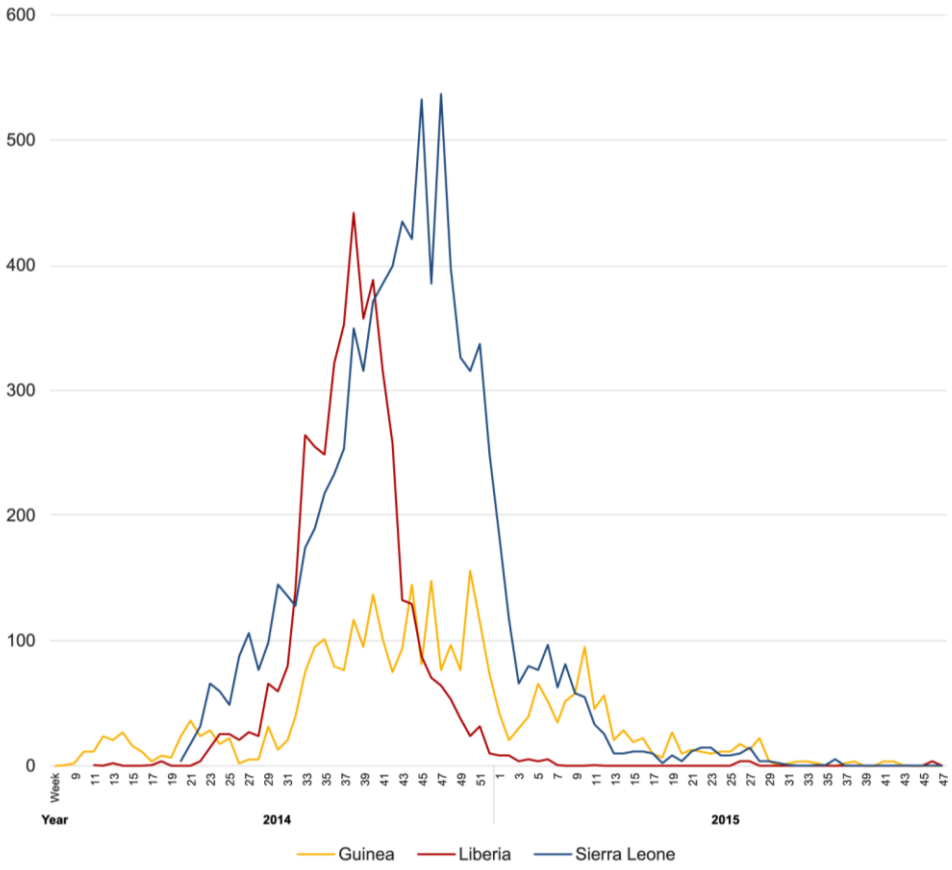
Figure 4. Epi curve of a disseminated outbreak originating from an index case with propagated spread



Source: University of Ottawa, op. cit.

The type of epidemic most likely to trigger a Level 3 emergency is a disseminated outbreak originating from an index case with propagated spread. The Ebola outbreak in West Africa was an example of this kind of outbreak, and the following graph shows the progression of that epidemic in the three most-affected countries.

Figure 5. The Ebola outbreak in West Africa 2014-2015: confirmed new cases in Guinea, Liberia and Sierra Leone by week, reporting weeks 8, 2014 to 48, 2015



Figures for Guinea and Sierra Leone for weeks 8–37, 2014 are from patient databases. From week 38, 2014 onwards, they are from WHO sitreps. Figures for Liberia are all from WHO sitreps. Only confirmed cases are shown: Guinea N = 3,297; Liberia N = 4,375; Sierra Leone N = 8,916. Total N = 16,588. This snapshot of the outbreak covers the period from 17 February 2014 to 29 November 2015. Source: WHO (2016) *Ebola data and statistics: countries with intense transmission*. Online at: http://apps.who.int/gho/data/node.ebola-sitrep

2.3 Essential knowledge for planning

To be able to effectively plan any response to an outbreak of an infectious disease (outbreak, epidemic or pandemic), it is important to know:

- The transmission mode of the infectious disease;
- The minimum and maximum incubation period for the disease;

- The epi curve, and what can be inferred from it with respect to the current status of the epidemic — i.e. whether the number of new cases is increasing, plateauing or decreasing;
- The evolution of the epi curve, specifically the number and relative size of epidemic peaks over time: this helps in planning whether to scale operations up or down; and
- The likely geographic spread of the disease: epidemiological data on local outbreaks within a larger epidemic or pandemic can also be used for mapping and forecasting, and thus for response planning.

So that you can do your job, you must have a basic understanding of the nature of the outbreak and its likely evolution.
You should get this information from a medical counterpart involved in the medical intervention.

For more, in-depth information on some of the topics covered in this section, please see Annex R-1.

3. Existing Logistics Capacity Assessments

With thanks to the Logistics Cluster and the World Food Programme.

Before departure, you should gather as much information as possible on the country to which you're going to be deployed.

The Logistics Cluster has prepared Logistics Capacity Assessments (LCAs) for more than 80 developing countries, some 60 percent of which are especially vulnerable to pandemic disease outbreaks because they have very little formal healthcare coverage.

LCAs can be found on the Logistics Cluster website at:
http://dlca.logcluster.org/display/public/DLCA/LCA+Homepage

They contain the following information.

3.1 Country profile

- Humanitarian background: disasters, conflicts and migration history; potential calamities and seasonal effects on infrastructure, etc.; in-country emergency response capacity; and contact information for government ministries and other emergency response agencies.

- National regulatory departments: governmental or other organizations¬ responsible for regulatory activities, such as taxes; control and quality assurance (e.g. of fuel, food and medical products); pre-shipment inspection; and regional regulatory frameworks (e.g. trade agreements).

- Customs information: regular procedures to clear goods, emergency procedures, duties and tax exemption information, etc.

3.2 Logistics infrastructure

This section of an LCA describes the national logistical infrastructure. It identifies levels and statuses of government, foreign and private investment. It describes issues that impact infrastructure at the national level. Finally, it highlights any relevant national projects, either planned or in progress; expected completion dates; and the impact the projects are expected to have on the internal logistical infrastructure.

There are sub-sections on specific types of transport infrastructure and capacity. These also include details of any planned or ongoing enhancement programmes, and their potential impact on the network. There is also a sub-section on storage facilities.

- **Ports**: this outlines the country's port network and offers details on individual ports.

  For each port, there is an overview of its location and a list of contacts. Key companies are described, and their contacts listed. Detailed information is provided on port performance, and it includes: cargo handling, in metric tons with separate container volume; channel draft and other limitations on vessel size; port congestion; prioritization of humanitarian cargo; major limitations and bottlenecks; and average waiting time between arrival and berthing.

  Other information includes: discharge rates and terminal handling charges; berthing specifications; general cargo handling berths; port handling equipment; container facilities; customs guidance; terminal information; stevedoring; the port's hinterland; and port security.

  Please also see: http://www.maritime-database.com/.

- **Aviation**: this covers the state of the aviation sector in the country. It identifies the supervising authority and private management companies; describes the overall national capacity, noting any significant constraints;

and lists any local carriers, along with their contact details. It also explains procedures for registration of foreign registered aircraft.

Each airport is listed, along with information about its facilities, including runways, helicopter pads, storage, infrastructure, security, and aviation services. Passenger and cargo performance indicators are also provided. Operating charges are listed for its cargo terminal, and for navigation and fuel services. Airbridge charges, royalties, and non-objection fees are also covered.

Please also see: http://www.azfreight.com/ and http://worldaerodata.com/.

- **Road network**: this gives an overview of roads coverage and capacity. It also identifies any national challenges, obstacles and bottlenecks; and any issues regarding maintenance and maintenance projects. It provides a distance matrix, and information on road security, weighbridges, axle load limits, and road class and surface conditions. Land border crossings are described in terms of: location; facilities; any obstacles or challenges commonly faced when crossing; hours of operation; daily capacity; and customs clearance.

- **Railway**: this describes the status and capacity of the national railway network and the network's role in the national transport framework. It highlights reliability issues, and known bottlenecks or other constraints. It provides a travel time matrix; and information on railway companies and consortia, and key routes and stations.

- **Waterways**: this covers the use of internal waterways for the transport of goods and people. It provides details of current usage, capacity, bottlenecks, and any issues which affect utilization.

  It also describes: the status of private transport companies and their capacity to move cargo and passengers along the waterways; the level of competition;

and any issues which have arisen in the past such as security and/or safety issues. A travel time matrix is provided, along with information on key routes and inland ports.

- **Storage**: this gives an overview of storage facilities around the country, and includes information on access, capacity, and key bottlenecks or constraints. It describes the national storage infrastructure and commercial storage, giving an indication of the ease of locating reliable facilities.

  It also covers:

  – storage used by humanitarian organizations (self-managed or outsourced, Red Cross/Crescent network);

  – public sector storage (agencies which support disaster/emergency response for the country, types of items they have in storage, and the ability for the humanitarian community to access such items if required); and

  – cold chain options in the country (medicine/vaccine storage options, and cold chain production capacity).

3.3 Services and supply

This section describes the quality and availability of services and supplies in the country; government or private company support of specific sectors; service sector development; and general supply issues (current or historical).

- **Fuel**: this outlines fuel provision in the country. It covers supply and storage; sources, whether government distributors or private companies; details of suppliers; and supply issues (current or historical).

It explains whether fuel is produced internally and/or imported, and lists the locations from which most of the fuel arrives. It covers the provision of diesel, petrol and Jet A1; fuel pricing; seasonal variations; fuel transportation; and standards, quality and testing.

For more details on fuel prices around the world, please see: http://www.mytravelcost.com/petrol-prices/ .

- **Transporters**: this describes the road transport market in the country. It details the number of operators, both large- and small-scale; the level of sophistication; issues with unions; and radius of operation. It gives an indication of current capacity; and of the sector's ability to meet domestic needs, and its ability to meet the influx of demand from the humanitarian community. It also highlights foreign operator restrictions.

- **Manual labour**: this gives an overview of the use of manual labour in the country, key national legislation, the role of unions, cost incentives and common areas of work. It also covers the relative availability of manual labour, and any common issues faced by organizations.

- **Telecommunications**: this describes the current telecommunications infrastructure, the level of control by the government, the number of private companies involved, and the level of competition. It provides information on: restrictions/procedures concerning the registration of SIM cards and mobile numbers; the availability of data plans and telephone services; existing humanitarian telecoms systems; and telecommunication regulations.

- **Additional suppliers**: this gives a high-level overview of commercially available key commodities used in humanitarian operations and programming at the national/district levels, and may include indications of main trading partners for import/export of these commodities. Key areas to

look at are: potable water and water pumps, pipes and tanks; tents, office furniture and computer/IT equipment; and medical supplies.

- **Additional services**: this describes the availability and level of capacity for other services that might be required by a humanitarian organization, and identifies any key gaps or issues in the marketplace. It covers: accommodation, power supply, financial services, clearing and forwarding agents, handling equipment, postal and courier services, printing and publishing, taxi companies, vehicle rental, and hazardous and non-hazardous waste management and disposal services.

3.4 Contact list

LCAs give contact lists for:

- Government
- Humanitarian agencies
- Laboratory and quality testing companies
- Port and waterway companies
- Airport companies
- Storage companies
- Fuel providers
- Transport companies
- Railway companies
- Suppliers
- Companies offering additional services.

4. Outbreak data

With thanks to the Centers for Disease Control, HealthMap, the Logistics Cluster, ReliefWeb and the World Health Organization.

4.1 The need for a flexible supply chain

In an outbreak, epidemic or pandemic, the supply chain for medical intervention must adapt to three variables:

- the **number of patients**;
- the **location of clusters of infection**; and
- the **treatment protocol**.

All three will change over time, and will be the subject of much speculation.

The number of patients will change, usually day by day. New infections and patient numbers will increase until containment measures are in place and compliance is consistently high. As shown in Figures 4 and 5 in the previous chapter, the number of new cases can fluctuate markedly, even within an upward or downward trend. Especially in a disease with a relatively long incubation period, the decisive turning point is unlikely to be clear until quite some time afterwards.

Unless movement restrictions are put in place and rigorously enforced, it is almost inevitable that people who have been infected but are not yet ill will unintentionally spread the disease to different locations. Modern transportation and global connectivity have greatly increased the speed at which epidemics and pandemics can develop. (The role of air transport in spreading contagious diseases is vividly illustrated in animations of simulated outbreaks by the Brockmann Lab at Humboldt University, Berlin, online at: http://rocs.hu-berlin.de/clips/index.html).

Even if you are working in only one affected country, be prepared for clusters of infection cropping up in different locations. Be realistic about your organization's capacity, and, with that in mind, build in as much flexibility as possible to cope with changes in geographic spread.

Treatment protocols are liable to change. In the case of a new disease or disease variant, initially there will be no vaccine and no targeted antimicrobial; the focus will be on providing those already infected with supportive care, and preventing new infections. Even if a vaccine or drug is successfully developed, production of enough doses for inoculation/treatment will likely take months. Once a new vaccine and/or drug is ready to be rolled out, the supply chain will change abruptly.

The impact of the interaction of these variables on the supply chain can be dramatic: the volume of goods required by medics can double or triple within just a few days. The nature of the goods may also require sudden changes: for example, vaccines require temperature-controlled transportation and storage (cold chain).

As a logistician, you will have to be alert both to the evolution of the outbreak and to the changing needs of medical colleagues.

You are not expected to become an expert on epidemics, but you will need to communicate closely with medical actors and the body coordinating the outbreak response.

4.2 Tailoring planning to the disease

Your first step will be to find out which infectious disease is responsible for the outbreak and how it is transmitted. You will need to know this for your own protection and to understand what the medical intervention will require.

For planning purposes, your primary source of information will need to be an epidemiologist. Mapping outbreaks and monitoring the evolution of a disease is their core competency.

Let's take a cholera outbreak in a refugee camp as an example.

Cholera is a bacterial disease, usually transmitted indirectly through water or food contaminated with the excreta of infected people. The attack rate varies, depending on the environment in which people are living, their baseline health status, and the availability of and access to WASH facilities.

- In open settings, the attack rate might be 0.2 percent;
- in rural communities of 5,000 people or less, it might be 2 percent;
- in refugee camps, with high-risk populations (because of malnutrition), it is likely to be 5–8 percent.

Thus, in a refugee camp of 10,000 people, a cholera outbreak will probably affect between 500 and 800 people.

Because the incubation period is very short (2 hours to 5 days), the number of cases can rise extremely quickly. The main feature of the disease is very severe diarrhoea that, untreated, can cause catastrophic dehydration and electrolyte loss that may kill a person within hours.

Care includes coping with the huge amount of infected fluids excreted by the patient, and treatment requires intensive oral or intravenous rehydration therapy. Moderately and severely ill patients will also need antibiotics. The hospitalization time per patient to recover from cholera is between 3 and 8 days.

Equipped with this information you will understand why a simple dispensary or small clinic, as is typically found in a refugee camp, cannot deal with such an outbreak.

Larger facilities with more space and more staff will be needed. They will need to be equipped with appropriate medical supplies, including fluids, antibiotics and cholera beds, and facilities for safe disposal of infected waste, including sewage. Logistics operations in support of medical actors will be key to saving lives and preventing new infections.

4.3 Mapping the outbreak

As a logistician, there are several pieces of information related to outbreak mapping that you should look for.

The first is the location (or locations) of the outbreak. Where will the medical intervention take place? You will have to make sure that you have a functional supply line to these locations. This will involve carefully chosen centralized and decentralized storage points, and a transport network to connect entry points to the storage points and on to medical responders in the field.

The second is the infection rate at each location. Where the infection rate is high, your supply line will be more stressed and you will need more storage capacity there than in places where there is less demand. Remember, though, that change is inevitable, and your storage must be sufficiently flexible to adapt to the evolving situation on the ground.

The third is where the outbreak is likely to spread. Look at populated areas and the surrounding roads, waterways and rail network. Which are the main travel routes? Where are people likely to congregate in large numbers — for instance, are there any well-known marketplaces? Where do the people who gather in these places come from? Are the people locals, or do some come from further afield or abroad?

You will also need to take into consideration the geography of the affected area: the terrain, vegetation, land use, waterbodies, climate, settlements, and transport networks. For an infectious disease to spread, its carriers must be able to move about and infect others. Thus, some geographic features may impede the spread of the disease. Where animal vectors are concerned, factor in their environmental niches and territorial ranges. And, in the case of waterborne pathogens, look at the locations of settlements and camps in relation to river catchments; also consider seasonal climatic factors and their influence on water bodies.

If the epidemiologists you're working with cannot provide all the information you need, you will find many resources online. These include the following organizations. Links are given in footnotes beneath the descriptions that follow.

- WHO
- CDC
- Reliefweb
- Logistics Cluster
- HealthMap

World Health Organization (WHO)

WHO's website (http://www.who.int/) carries a huge amount of data related to global health and ongoing outbreaks.

Type the name of the disease into the search bar, and the first entry in the search results will be a fact sheet and index page for that disease. On the destination page, follow links to in-depth information such as maps and medical data.[7]

The Data tab in the menu bar will take you to a section called 'Global Health Observatory Data' (http://www.who.int/gho/countries/en/). Within this there is an index of countries from which you can navigate to each country's health data and statistics. The information shown here is compiled by WHO and partners in close consultation with Member States. These pages also include descriptive and analytical summaries of health indicators.

WHO also publishes a theme-based map gallery that includes maps of former outbreaks (http://www.who.int/gho/map_gallery/en/).

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7 See also WHO's fact sheets for the media at: http://www.who.int/mediacentre/factsheets/en/.

WHO has also been working on a software tool called OPALS (Operations Planning Application for Logistics and Supply), which will provide estimates of demand for critical items based on the predicted spread of a disease. OPALS is described in detail in the ***Quantifying critical supplies section***, below. Logisticians responding to a public health emergency will benefit from the tool's guidance on the volumes of critical items required and when they will be needed.

As explained in Part 1 of this guideline, WHO publishes Joint External Evaluation (JEE) reports on countries' preparedness and response capacities for major health emergencies. Where available, these reports may provide useful insights in relation to the outbreak you're responding to. To access the reports, enter "Joint External Evaluation of IHR Core Capacities" into the search field at http://apps.who.int/iris/.

Centers for Disease Control (CDC)

The Centers for Disease Control and Prevention (http://www.cdc.gov) is a branch of the American Public Health Service. Type the disease's name into the search bar and you will be taken to a fact sheet containing maps and medical data.

ReliefWeb

ReliefWeb (http://www.reliefweb.int/) is a specialized digital service of the United Nations Office for the Coordination of Humanitarian Affairs (OCHA). ReliefWeb provides reports (e.g. analysis, appeals, assessments and situation reports); data (assessment and financial data); and maps (original maps, situation snapshots and other infographics). The maps are available at: http://reliefweb.int/location-maps and http://reliefweb.int/maps.

Logistics Cluster

The Logistics Cluster (http://www.logcluster.org/) is a mechanism responsible for coordination, information management, and, where necessary, logistics service

provision to ensure effective and efficient logistics response within humanitarian emergency operations. Its website provides country maps for each intervention, as well as other information related to ongoing operations.

HealthMap

HealthMap (http://www.healthmap.org/en) is the brainchild of a team of researchers, epidemiologists and software developers. Its automated systems monitor information from reliable online sources about emerging diseases, and filter, organize and visualize it in nine languages. Its constantly updated maps deliver a unified and comprehensive view of the current global state of infectious diseases in humans and other animals, and aid the early detection of global public health threats.

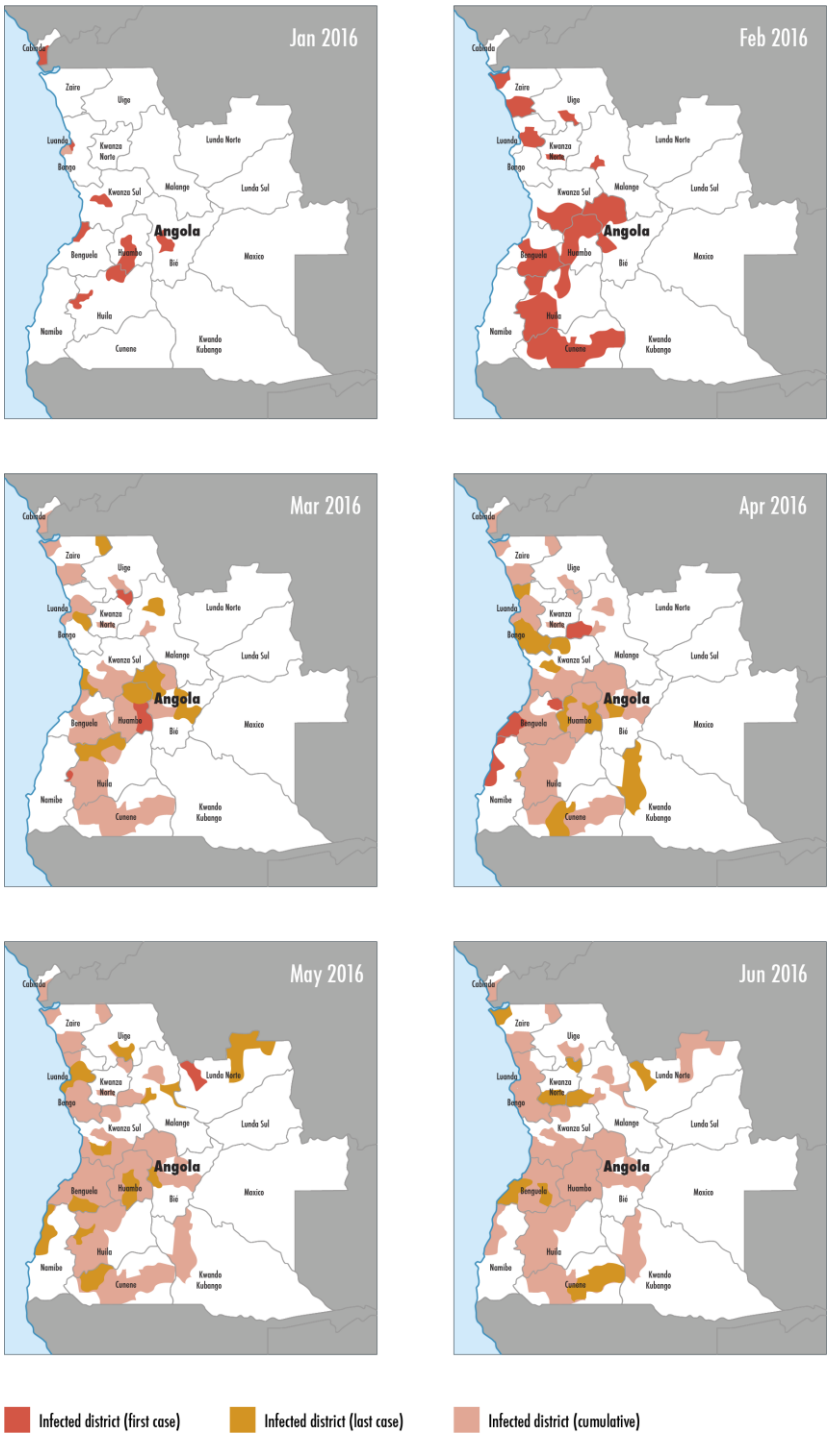
A mobile version of the HealthMap website, called Outbreaks Near Me, is available for iOS and Android at: http://www.healthmap.org/mobile.

4.4 Examples of outbreak maps

Between December 2015 and December 2016 Angola was affected by a severe outbreak of yellow fever, a viral disease that is transmitted by mosquito bites and is potentially fatal. National borders mean nothing to mosquitoes or viruses: in March 2016, the outbreak spread to the Democratic Republic of the Congo, where it eventually ended in February 2017. Thousands of cases were suspected; 965 were confirmed. Vaccination campaigns reached over 30 million people in the two countries.

The following sketch maps, based on a series published by WHO, show a 6-month snapshot the progression of the yellow fever epidemic in Angola in 2016. Maps like these would help guide the establishment of a network of logistics hubs and forward logistics bases (FLBs).

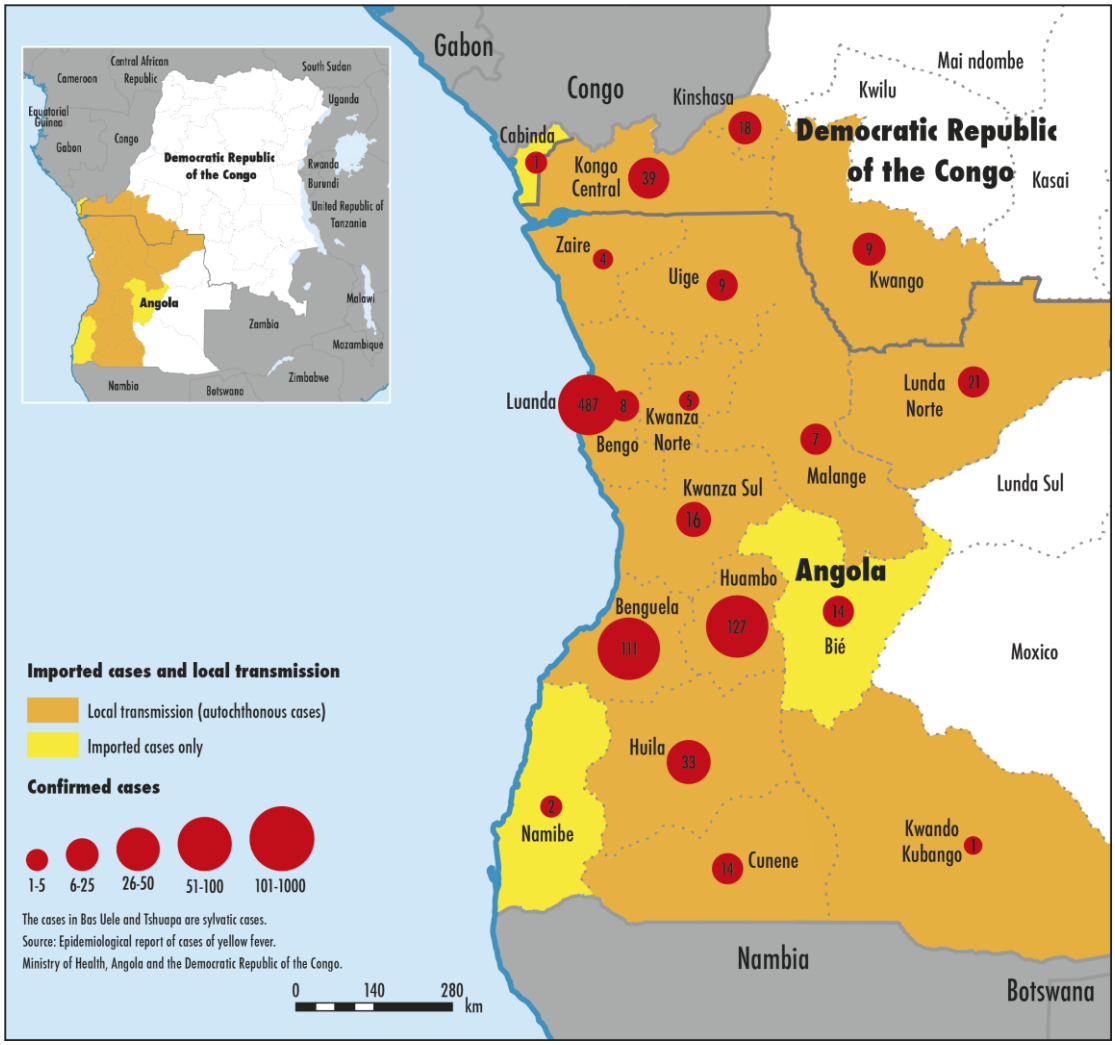
Figure 6. Geographic evolution of the yellow fever epidemic in Angola — monthly snapshots between January and June 2016



Based on WHO maps online at: http://www.who.int/emergencies/yellow-fever/maps/en/.

The full extent of the epidemic in the two countries is shown in the following map.

Figure 7. Distribution of confirmed yellow fever cases in Angola and the Democratic Republic of the Congo in mid-June 2016



Data as of 17 June 2016 for Angola and 21 June 2016 for the Democratic Republic of the Congo. Based on WHO maps online at: http://www.who.int/emergencies/yellow-fever/maps/en/.

While you're looking at these maps, perhaps take time also to read about the disease, using the following resources. In particular, look at maps illustrating population density, transport networks, waterbodies, and vegetation in the countries, and consider how you might use the information for planning a logistics response.

WHO's factsheet on yellow fever is at: http://www.who.int/mediacentre/factsheets/fs100/en/.

Infection Landscapes is a website devoted to landscape epidemiology: the study of interrelationships between infectious diseases and physical and social landscapes. (http://www.infectionlandscapes.org/2011/07/yellow-fever.html)

NASA's Socioeconomic Data and Applications Center publishes a large collection of population density maps. (http://sedac.ciesin.columbia.edu/data/set/grump-v1-population-density/maps?facets=region:africa)

The **Logistics Cluster** publishes detailed maps of Central Africa. These include logistics-related information for Angola (http://www.logcluster.org/countries/AGO), and an LCA for the Democratic Republic of the Congo (http://dlca.logcluster.org/display/public/DLCA/Democratic+Republic+of+Congo).

The British Geological Survey's Africa Ground Water Atlas includes, for each country, maps of surface water, climate, rainfall and land cover (http://earthwise.bgs.ac.uk/index.php/Hydrogeology_by_country).

4.5 Quantifying needs for critical supplies

When an outbreak occurs, it will be medical partners who define the medical intervention strategy. Their strategy will, in turn, define the supply needs of the operation.

Epidemiologists will analyse many variables, including: the type of disease, attack rate, demography, transmission mode, geography, chosen medical intervention strategy, healthcare worker experience level, and the capacity of the affected country's or countries' health services. They will then develop theoretical scenarios of the outbreak that will inform forecasts and decisions on, for example, how many patients to expect, what precautions are needed for health workers, what type of medical facilities are required, and how to transport patients.

WHO criteria and likely response scenarios have been used to specify and quantify a list of critical items for pandemic responses (Annex R-2). Based on the chosen medical intervention strategy, the medical partners will define which items should be ordered from this list.

Logistics officers should know and understand the medical intervention strategy. The ultimate purpose of the logistics strategy is to enable and support the medical response.

WHO's **OPALS** software is an important tool for logisticians: it helps estimate the overall demand for critical items based on epidemiological models of the predicted disease spread. The software uses disease and population parameters (e.g. population density, attack rate, and hospitalization needs) and treatment protocols to produce an estimate of the quantity (including weight and volume) of the critical items required to respond throughout an outbreak.

If you do not have access to OPALS, the table of critical items in Annex R-2 will help you. Please note that the list is revised periodically. An up-to-date version that includes more detailed specifications and ISO numbers is maintained by the Pandemic Supply Chain Network in coordination with WHO.[8]

You will need to be particularly aware of issues that may cause pipeline breaks. These include manufacturers' and suppliers' lead times, and potential bottlenecks, particularly in transport and warehousing.

Procurement can be very difficult during a pandemic. Expect global surges in demand for many of the critical items, and be aware that the supply chain will come under a lot of stress.

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[8] The Pandemic Supply Chain Network can be contacted via its website: http://www.pandemicsupplychain.org/.

In a large epidemic or a pandemic, huge volumes of critical items are used. For instance: during a pandemic disease outbreak the average demand for gloves per month would be around seven hundred 20-foot containers. And that is only one item. These volumes have serious implications for upstream and downstream logistics.

The critical items identified by WHO are not the only items needed for an intervention. Other, more general medical supplies and equipment will also be necessary. So, too, will be logistics equipment, such as vehicles, ITC, office equipment, and water and power supplies (see Annexes R-5 and R-6).

5. Logistics Capacity Assessments

With thanks to the Logistics Cluster, Médecins Sans Frontières and the World Food Programme.

As explained in Chapter 3, Logistics Capacity Assessments (LCAs), published by the Logistics Cluster, are a good starting point for gathering information relevant to your work.

5.1 Updating LCA information

If there is an LCA for the country you'll be working in, you will need to check that its information is up-to-date, and you will need to find out what has changed due to the outbreak. To obtain current information, do one of the following:

- If you are external to WFP or the Logistics Cluster, contact lca.global@wfp.org.
- If you are internal to WFP, contact the Head of Logistics of the country concerned and include lca.global@wfp.org in copy.
- For countries where WFP is not present, contact the regional WFP office with lca.global@wfp.org in copy.

5.2 Rapid Logistics Capacity Assessment Tool

If no LCA exists, you will have to carry out a rapid logistics assessment on your own.

The Logistics Cluster has developed a comprehensive tool for logistics assessment in emergency situations: the **Rapid Logistics Capacity Assessment Tool**, which is available at http://www.logcluster.org/rapid-assessment-toolkit.

The tool is designed for use by logisticians from NGOs, UN agencies and other organizations working on the ground during an emergency response situation, particularly during the assessment phase of the logistics operation and the implementation phase of logistics activities.

It consists of a series of checklists that cover 12 themes: airports, ports, railways, waterways, road networks, warehousing, local supply, fuel, customs, truck transporters, freight forwarding agents, and telecommunications.

Each checklist is divided into four parts:

1. Where can I find information?

2. Who should I contact? What should I ask?

3. A list of useful tips

4. A list of essential logistics actions to be organized

5.3 Local availability of resources

Often, at least some of the necessary supplies can be found either locally or not far from the emergency zone. Part of the rapid logistics assessment, then, must be to identify whether such resources exist, and, if so, where they are located. Three potential sources should be investigated:

- commercial suppliers from whom goods could be purchased;

- public resources; and

- private resources that can be used in relief efforts.

This applies to resources for the affected population as well as those required by relief organizations.

5.4 Factors affecting relief efforts

Many factors may hinder relief efforts in complex emergencies. For example, national authorities may restrict humanitarian operations and supplies. They might ban foreign-based relief organizations from entering the disaster or conflict area, or from entering the country itself. Or, they might put forward religious, political, or health reasons for preventing the arrival of a specific product.

Conversely, some governments are very accommodating, facilitating the efforts of relief organizations and the arrival of humanitarian assistance into the country or into the area where operations are underway. Examples include offering priority treatment at customs, lowering or eliminating tariffs and taxes, and/or making government facilities available to humanitarian operations.

Whether negative or positive, such measures must be included in your assessment, or appended to an existing LCA. They will affect the supply chain and the movement of relief teams. Restrictions may have to be circumvented, while favourable measures should be maximized.

Any other factors that might affect the availability, transport and distribution of supplies should also be recorded to assist in decision making. They might include: weather forecasts; seasonal practicalities; other events related to the event causing the emergency; and safety and security considerations that must be taken into account for the movement and positioning of supplies.

5.5 Mini medical logistics assessment

Standard LCAs are designed for conventional humanitarian logistics. You will therefore need to gather additional information that is specific to the medical operation.

A full medical assessment would require an experienced mixed team of epidemiologists, and medical, logistics and WASH specialists, etc.

Nonetheless, it is possible to conduct a mini medical logistics assessment that will help you identify logistics gaps and bottlenecks. The following list will guide your enquiries. A good source of information would be WHO as they would probably be involved in the full medical assessment.

- **Climatic, seasonal and environmental factors** that may influence or alter the disease pattern.

- Description of the **health facilities available**: number, locations and conditions of:
  - hospitals;
  - clinics;
  - dispensaries.

- **Medical supplies**
  - Local drug supply system:
    - centralized or decentralized;
    - government- or privately-controlled;
    - effect of crisis on drug supply;
    - estimated continuity of supplies and future shortages;
    - stockpiles.

- Local drug production:
  - level of quality;
  - disruption by crisis.

- **Vaccination campaign**
  - Medical surveillance:
    - Communication means for data transmission and management (mobile phones, computers, other mobile devices, and specific software for data entry, validation and analysis).
    - Transport and logistics support for active case finding.
    - Transport and logistics support for safe specimen shipment.
    - Local or regional suppliers for reagents and consumables.
  - Cold chain capacity:
    - National cold chain management coordination.
    - Central cold chain storage capacity (taking into account other vaccines already stored).
    - Electrical autonomy of the central store.
    - Temperature monitoring in storage and during transport.
    - Transport capacity for vaccine shipment from the national central cold room to sub-national and district cold stores.
    - Passive cold chain **storage** capacity (i.e. capacity to store vaccine locally in refrigerators).
    - Passive cold chain **transport** capacity (i.e. capacity to carry vaccines by hand).

    - Active cold chain capacity (i.e. capacity to produce ice pack with freezers to transport vaccines for several hours).

- **Transport and logistics**
    - National logistic coordination.
    - SOPs for customs clearance for vaccines and injection materials.
    - Vaccine delivery from peripheral store to vaccination points.
    - Adequacy of means for the transport of vaccination teams.
    - Adequacy of means for the transport of equipment to the vaccination point.
    - Details of the plan for clinical waste management (collection and destruction).
    - Incineration/burying capacity at the level assessed (vaccination site/health centre/central level).

6. Logistics gaps and bottlenecks

All of the critical items needed for a pandemic intervention will have to be transported from around the world to the operation locations. Bringing them into the country and getting them to where they are needed in the field is likely to be challenging.

Seaports and airports may be closed due to a national cordon sanitaire or local quarantine restrictions. Even if ports and airports are open to medical and humanitarian cargo, potential logistics bottlenecks include: infrastructure that is inadequate for handling such large volumes; inadequate customs facilities; lack of storage facilities; and lack of refrigeration required for cold chain storage.

Transport capacity may be much reduced. For instance: even where trucks are plentiful, drivers may be in short supply — either because many are sick or because quarantine rules prevent them from going to work.

With so many potential constraints to implementation, you will need to plan your actions and strategy very carefully.

6.1 Ports and border crossings

Let's start with the points of entry: seaports, airports and border crossings by road.

For each of these, you will need:

- an analysis of the actual situation;
- a plan for possible upgrades of these facilities (equipment, infrastructure and staff, etc.); and
- back-up plans in case some of these entry points are closed.

6.2 Storage and transport

You will, at all times, need to know the storage and transport capacities at your disposal, and have a plan for how to scale up these capacities. Be aware, though, that scale-up has its limits: there is no point in building enormous structures that would be impossible to manage.

You will need to carefully plan where to set up your staging areas, main hubs, forward logistics bases (FLBs), and satellite warehouses (SWs).

Where you situate them will depend, in part, on the geographic distribution of the outbreak, and on infection control restrictions at points of entry. It may be necessary, for example, to site your staging areas/consolidation hubs outside the affected country.

Other considerations will include: the availability of suitable warehouse facilities (and/or sites for mobile storage units [MSUs]); the country's logistics infrastructure; and the capacities of national ports, airports and haulage providers.

In other words:

- Can you access (or build) enough suitable storage space in the right locations?
- Is your proposed network of staging areas, hubs, FLBs and SWs accessible from points of entry and by functioning transport services?
- Will your proposed network be able to provide the swift and flexible response required by medical colleagues in the field?

Having consulted medical partners on which and how many of the critical items are needed, you will have calculated the expected volume of goods using WHO's OPALS tool or the table of critical items in Annex R-2.

With that information in mind, you will then need to analyse whether each of the following can cope with these volumes, and whether cold chain requirements (if any) can be met:

- the logistics infrastructure present in the country;
- the national transport fleets;
- seaports;
- airports; and
- the national road system.
- The following chapters — 7. CONOPS, and 8. Logistics Action Plan — will help you carry out this analysis.

6.3 Cold chain

Medical partners will also advise you as to which medical items require temperature controlled (cold chain) storage and transport. Note that cold chain applies to the products' entire journey from manufacturer to patient. In general, pharmaceutical products are stored in dry, well-ventilated areas at temperatures of 15–25°C or, depending on climatic conditions, up to 30°C. Vaccines, however, must be stored at temperatures between +2°C and +8°C. Some vaccines require even colder storage temperatures, between -15 °C and -25 °C.

7. CONOPS

With thanks to the Logistics Cluster and the World Food Programme.

The Concept of Operations (CONOPS) is an important document used by the Logistics Cluster and other organizations in an intervention. You will find a completed example in Annex R-4.

The purpose of a CONOPS is to describe a proposal for an operation in non-technical language so that all stakeholders can understand the details of the operation, its objectives, and how it will be carried out.

Since the purpose of an operation is to achieve a set of outcomes, the document will describe how resources and capacities will be harnessed to achieve them. It will also detail hurdles that might be encountered. It is a dynamic document, and will need to be updated as the situation on the ground evolves.

Other agencies might have similar documents with different titles (e.g. 'Project Document', 'Service Portfolio', or 'Project Concept').

7.1 CONOPS structure

In the case of logistics operations in support of medical response, the CONOPS should contain the following four sections:

1. Background
2. Logistics gaps and bottlenecks
3. Objectives
4. Planned activities

Background

The Background section should give a broad overview of the situation, and should focus on:

- the type of disease and the transmission mode;
- the number of people affected;
- how many deaths have occurred due to the outbreak; and
- the location of the outbreak (where clusters are, and whether those locations are urban or rural, etc.).

Logistics gaps and bottlenecks

The Logistics gaps and bottlenecks section should focus on the most critical constraints affecting the response to the outbreak. Themes will include:

- logistics infrastructure in support of the medical operations (including cold chain);
- disruption in logistics services;
- limitations of transport and storage capacity; and
- challenges in health supply chain management.

Objectives

The Objectives section should describe the outcomes your organization envisions, plans and commits to achieve through the activities that make up the operation.

Planned activities

The Planned activities section will be the most extensive section in the CONOPS. It will detail and explain all intended activities.

The most common activities will be coordination, information management and logistics services. In this context, logistics services typically consist of: warehousing; transport by road, air and water; loan of equipment; and technical logistics services such as engineering support.

7.2 Updating the CONOPS

A CONOPS is a live document. As the situation unfolds and further assessment results become available, activities will be adapted and revised. New activities may be added if the humanitarian community requests additional logistics common services.

These and other changes, such as facts and figures relating to the outbreak, will need to be documented in updates to the CONOPS. Up-to-date copies will need to be circulated to all stakeholders.

8. Logistics Action Plan

Different humanitarian agencies have different mandates, objectives and modus operandi; therefore, in an emergency each agency will need to draw up its own Logistics Action Plan according to its role in the response.

Although there is no one-size-fits-all Logistics Action Plan, this chapter covers the basics and offers some tips.

8.1 Planning hubs

The information you have gathered for the CONOPS (or equivalent document) will act as the foundation of the Logistics Action Plan.

Consider mapping:

- Entry points into the country
- Seaports and airports
- Road and rail border crossings
- Road map
- River map (if water transport is used)
- Existing logistics hubs and their capacity
- Location(s) of the outbreak
- The expected spread of the outbreak.

This information should give you a pretty good idea of where to install staging areas, logistics hubs and satellite warehouses.

If the location and size of one of the entry points into the country suit your requirements then you might install your main hub there. But consider that the fewer entry points there are, the more likely they are to get congested. It may therefore be better to have your main hub close to the entry point but far enough away to not suffer from its traffic/congestion.

The airport that will serve as the main aviation entry point into the country will likely become the first bottleneck in your downstream supply chain. It would be wise to install a couple of MSUs in that airport.

The country's capital is another place that might quickly become congested: most national coordinating bodies will be located there, and most humanitarian actors will pass through.

When setting up a network of logistics hubs, the most important consideration is the national transport network: you will need to ensure that you will have fast and easy access from the point/s of entry to the hubs, and onwards to the affected areas.

When planning each hub, you will need to ensure that your transport requirements are realistic in view of the transport network's capacity. Remember that the network may well be affected by quarantine restrictions and manpower shortages, if not now then at some stage in the outbreak.

Analyze the locations at which the Ministry of Health keeps decentralized stocks. If these locations fit your criteria, you can use them as a starting point for your network of logistics hubs.

It is not absolutely necessary to have a logistics hub within an area affected by the outbreak. As long as you have easy and quick access to the affected area, you might consider having the hub outside it. One of the advantages of this strategy is that it reduces the risk of having to freeze the hub if the affected area is placed in quarantine.

8.2 Procuring relief items

The three most important principles of humanitarian logistics procurement are:

- **transparency** — all phases in the procurement process must be fair and accurately documented;
- **accountability** — organizations are accountable to donors who may require that certain rules are followed when using funds they have provided; and
- **efficiency and cost effectiveness** — goods and services should be procured according to the 'Six Rights', i.e. they should be procured from the right, most cost-effective source; at the right price; be of the right quality and in the right quantity; and delivered on time to the right places.

The principles and their importance come from three key facts:

- the resources utilised are usually funded by donors;
- transparency contributes to the establishment of sound and reliable business relations with suppliers; and
- efficiency and cost effectiveness have a direct impact on operations and, ultimately, on beneficiaries.

The procurement function must guard against and mitigate risk, understand the market, build relationships with suppliers, meet needs in a timely manner, and constantly monitor performance to improve service provision. An organization must therefore have clearly defined policies that are well understood.[9]

[9] The Logistics Cluster's *Logistics Operational Guide on Procurement*, on which part of this section is based, is online at: http://dlca.logcluster.org/display/LOG/Procurement?src=search.

Each organization will have its own procurement guidelines and rules that use their own templates and protocols. Some organizations will differentiate the procurement of goods and the procurement of services, and may even have a separate procurement departments — one for goods, one for services. There is no fundamental difference between the two, provided that the three principles of humanitarian logistics procurement are respected.

Procurement staff may be unfamiliar with the medical supplies they will need to source and may be confused by the many varieties listed in suppliers' catalogues. To help them procure the right ones, a detailed, up-to-date list of the critical pandemic relief items in Annex R-2 is maintained by the Pandemic Supply Chain Network.

Coordinated approach

It is essential that procurement units are aware that in a pandemic there will be immense stress on the supply chain. The quantities needed are huge, and some of the items are supplied by only a few companies. To compound matters, some unaffected countries will start stockpiling in preparation for the spread of the disease to their country.

For these reasons, there should be an international, coordinated approach to the supply of critical items in a pandemic, including defining the specifications, quantities, priorities and timeline for the supply chain. The Pandemic Supply Chain Network, which was set up after the 2014–16 Ebola outbreak, has developed a **Supply Chain Information Platform**, which should be supported and used by actors involved in pandemic response.

Sourcing supplies

Pre-existing Long-Term Agreements (LTAs) with suppliers will be the best option in case of an outbreak. However, even an LTA is not an absolute guarantee of availability in a health crisis. Demand will exceed supply and alternatives will need to be found — hence the importance of an international, coordinated approach.

Supplies for emergency response come from a variety of sources. Disaster relief organizations acquire them directly, receive them as donations from the national and international community, or get them as loans.

It is likely that all of these procurement methods will come into play during the course of the emergency. Each has its advantages and disadvantages, but due to the urgency inherent in emergency response, the humanitarian community is seldom in a position to choose the most appropriate one. Nonetheless, whenever possible, sourcing decisions should be based on technical criteria and on an unbiased assessment of the needs of the affected population.

Purchasing supplies

Purchasing can be done locally or externally. If a choice is available, certain considerations should be kept in mind.

- **Local purchasing**. The merits of local purchasing depend on several criteria, such as: local availability of the products needed; the quality and quantity of available products; and how urgently those items are needed. In all cases, a cost/benefit analysis must be conducted, and it must address the key question of quality. This may require technical advice.

- **Bulk purchases**. Buying large quantities of a certain product may adversely affect the local market. This is because it can upset the equilibrium of supply and demand, and artificially raise prices. Conversely, sensitive local purchasing can promote the economic recovery of the affected region.

- **Storage**. Since space limitations are common when storing emergency supplies, it is sometimes possible to negotiate with local vendors so that the purchased goods can remain in their warehouses until needed by the end users.

- **External purchases**. Often, certain items cannot be sourced locally in sufficient quantities; their availability may be unpredictable; and/or there

may be quality issues. In these cases, procurement from abroad or from another part of the country is an option, provided that delivery times are acceptable.

Borrowing services and supplies

Some people, organizations and private firms lend equipment, services or expertise during an emergency. Although many of these loans are spontaneous, it is important to identify potential lenders before disaster strikes and, if possible, establish agreements for these services during the planning stage.

Checking specifications

A pandemic intervention will be an inter-agency operation. It is important to remember that different organizations have different equipment set-ups. For example: some use 220V generators, others use 110V. Similarly, some organizations' water pumps need 2-inch piping while others need 3-inch. Don't take anything for granted: always ask for specifications.

8.3 Receiving international shipments

Customs procedures and shipping papers

It cannot be overstated: the planning stage of logistics activities requires careful preparations. Crucial aspects must be coordinated in advance, and preliminary agreements should be reached with the relevant authorities.

Humanitarian organizations' relationships with customs authorities are based on trust and, ideally, that needs to be established before an emergency. During an emergency, many organizations and individuals will attempt to obtain preferential treatment regarding their imports, and access to customs and other authorities might become more restricted.

If your organization is new to the country, you will need to start from scratch: establishing contact with customs authorities; familiarizing yourself with their procedures and requirements; and, if possible, negotiating special conditions such as tax exemptions or priority processing of humanitarian supplies.

If your organization is already present in the affected country, but in another humanitarian capacity, then you will need to determine what the customs procedures and requirements are for importing medical supplies. You may need to negotiate new agreements with your customs contacts regarding the critical items you plan to import.

In both cases, contact with customs and other authorities must be made during the planning stage. If agreements are made then they should be formalized with signed documents. This will help avoid the need to renegotiate if, in future, new customs officials come into post.

When emergency supplies arrive from abroad, it is generally more convenient to hire a customs agency to handle all the formalities. However, this is not always possible. Therefore, it is important to know that in order to clear goods through customs, all international shipments must include, at minimum, the following documents:

- **Pro forma invoice**. This is to indicate that the goods are not part of a commercial transaction. They are itemized, along with harmonized tariff codes and unit values, but payment terms are specified as: “FREE, value for customs purposes only”.

- **Bill of lading** or **Waybill**. This is a legal document, issued by the carrier to the consignor, confirming that the carrier has received the shipment for transportation. It is signed by both parties; and, at the destination, it will be signed by the recipient to confirm that the goods have been delivered. The document describes the shipment in terms of its contents, the number of packages, volume, weight, and any other useful information. It includes details of all three parties: the consignor, the carrier and the receiver. Bills of

lading (B/L) apply to maritime transport; waybills refer to both land and air transport.

- **Manifest**. This document shows the type of products sent, their point of origin and their destination. It is for the use of customs officials in the country receiving the goods.

- **Packing list**. Even if this is not required, ideally, the shipment should include a list identifying the contents of the load, package by package.

Normally, the shipper sends these documents to the receiver once the supplies have been handed over to the carrier. If this has not happened, you should request that the documents be sent as soon as possible so that the necessary arrangements can be made at the destination.

Be aware that, depending on the nature of the goods, additional paperwork may be needed. For medicines, you will also need:

- Certificate of Analysis (CoA)
- Certificate of Pharmaceutical Product (CPP)
- Certificate of Origin (CoO).

Try to negotiate in advance with customs a reduction in the amount of documentation required, and secure an agreement as to exactly which documents they will need.

International commercial terms (Incoterms®)

Incoterms® are a set of 11 internationally recognized terms and accompanying rules, developed by the International Chamber of Commerce, that are used in contracts for the international purchase, sale and transport of goods.

The terms, or three-letter abbreviations thereof, are used to specify conditions applying to transactions, and the responsibilities of the seller and buyer (or the carrier and consignee) regarding costs and insurance risks, the place of delivery, and so on.

When acquiring or shipping products abroad, it is important to have a clear idea of which Incoterms® apply to the transaction and what they mean.

The current version of the rules is Incoterms® 2010. (A new edition is due in 2020.) A summary is online at: https://iccwbo.org/resources-for-business/incoterms-rules/incoterms-rules-2010/. However, you are strongly advised to read the full version, which is available for a small fee in a variety of formats and languages from https://iccwbo.org/.

Four of the most commonly-used Incoterms® are:

- CIF (Cost, Insurance and Freight)
- CIP (Carriage and Insurance Paid To)
- FCA (Free Carrier)
- FOB (Free On Board)

These are all explained at the link above.

Here are some examples as to how CIF, CIP and FOB might be used in a Bill of lading or Waybill: 'CIF to Puerto Caldera'; 'CIP to J. M. Córdova International Airport, Medellín'; 'FOB to Puerto Armuellez'. In each case, the Incoterm® stipulates a point at which purchased goods will be considered to have been delivered to the buyer. At that point, all risks and responsibilities transfer to the buyer.

8.4 Storage during transport

It is difficult to estimate storage capacity requirements even if the number of pallets to be stored, the total weight and the volume are all known. Other variables that must also be taken into account, include:

- weight, volume and number of pallets;
- palletized or not-palletized cargo;
- pallet short side handling or long side handling;
- pallet size;
- material handling equipment;
- aisle space;
- warehouse dimensions;
- block stacking or racking;
- load bearing capacity per square meter;
- product shape and size;
- load on the pallet; and
- maximum stacking height of goods.

Let's refresh some basic figures that might help us in this exercise. They will serve as a baseline for the calculations.

Containers

The two most commonly used containers for shipping humanitarian goods are the 20′ container (TEU: Twenty-foot Equivalent Unit) and the 40′ container (FEU: Forty-foot Equivalent Unit).

Table 1. Dimensions and capacities of typical 20′ and 40′ containers

		20′ container		40′ container	
		Imperial	Metric	Imperial	Metric
External dimensions:	Width	8′ 0″	2.438 m	8′ 0″	2.438 m
	Length	19′ 10 ½″	6.058 m	40′ 0″	12.192 m
	Height	8′ 6″	2.591 m	8′ 6″	2.591 m
Internal dimensions:	Width	7′ 8 $^{19}/_{32}$″	2.352 m	7′ 8 $^{19}/_{32}$″	2.352 m
	Length	19′ 3″	5.867 m	39′ 5 $^{45}/_{64}$″	12.032 m
	Height	7′ 9 $^{57}/_{64}$″	2.385 m	7′ 9 $^{57}/_{64}$″	2.385 m
Door aperture:	Width	7′ 8 ⅛″	2.340 m	7′ 8 ⅛″	2.340 m
	Height	7′ 5 ¾″	2.280 m	7′ 5 ¾″	2.280 m
Internal volume		1,162 ft³	32.91 m³	2,383 ft³	67.49 m³
Maximum gross weight		66,139 lb	30,000 kg	66,139 lb	30,000 kg
Empty (‘tare’) weight		4,850 lb	2,200 kg	8,380 lb	3,801 kg
Net load		61,289 lb	27,800 kg	57,759 lb	26,199 kg

Note that these are representative figures only. Dimensions and capacities vary according to manufacturer and the materials from which containers are made.

Pallets

The two most commonly used pallets are:

- European pallet (EUR pallet): 0.8 × 1.2 m
- American pallet (also called “standard” or “industrial” pallet): 1 × 1.2 m

Other pallet sizes include:

- Asian pallet: 1.1 × 1.1 m
- Australian pallet: 1.165 × 1.165 m

How many pallets fit in a container?

In a **20-foot container** (TEU), you can fit:

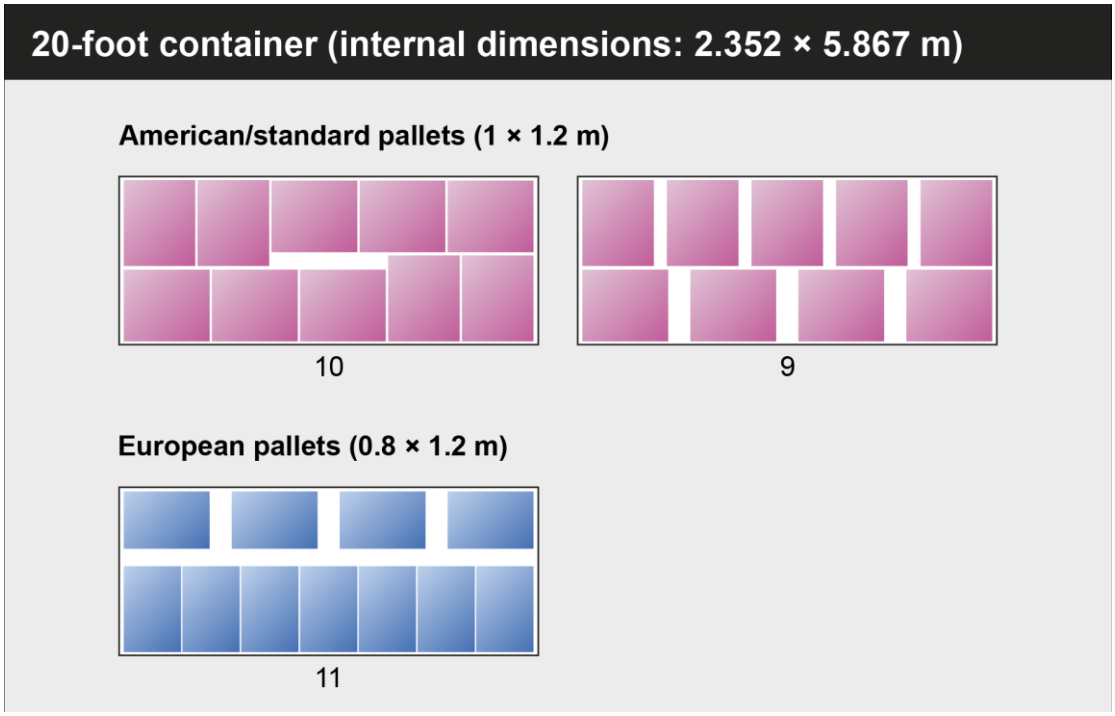
- 9-10 standard pallets, or
- 11 EUR pallets

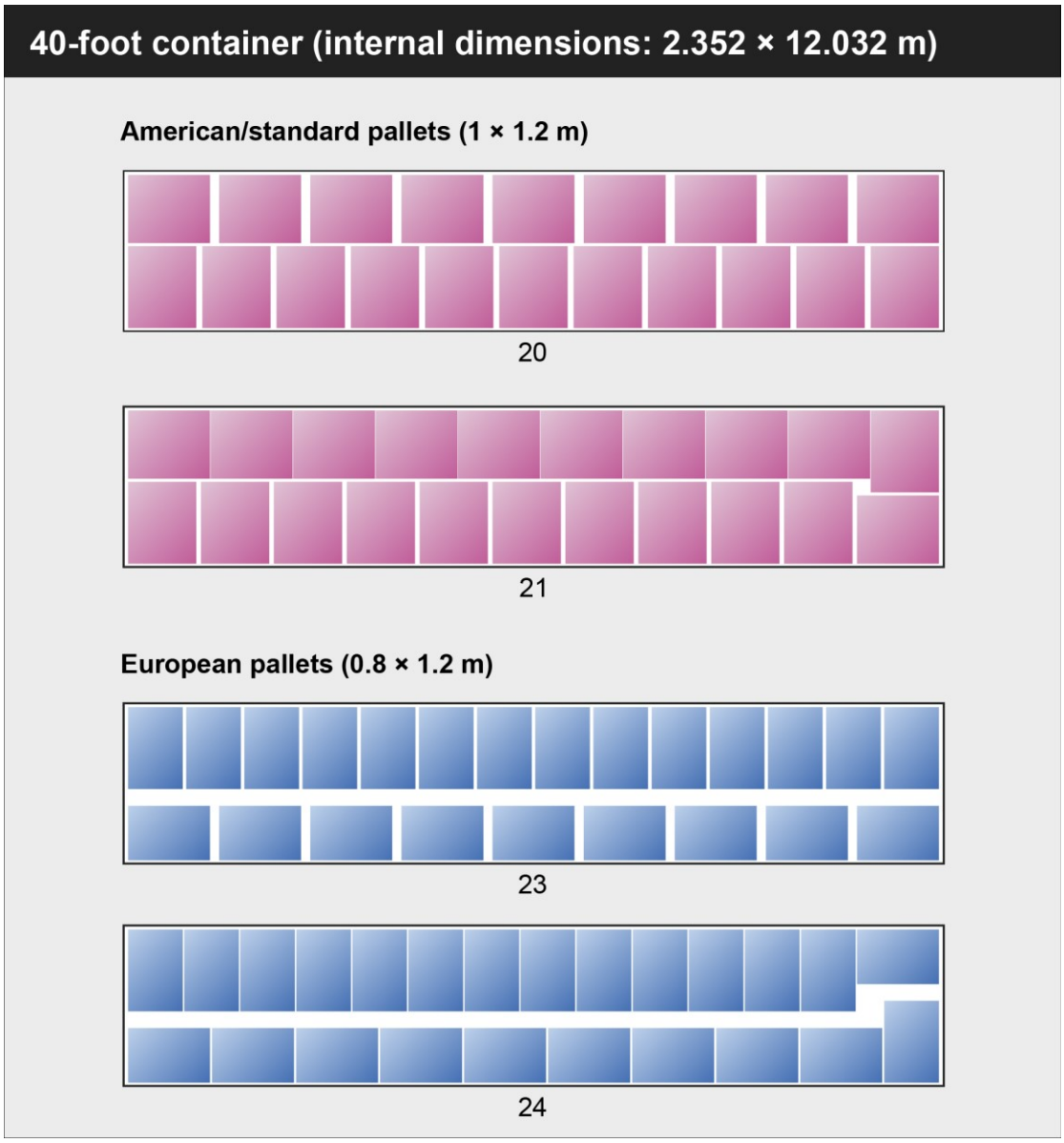
In a **40-foot container** (FEU), you can fit:

- 20-21 standard pallets, or
- 23-24 EUR pallets

The following scale drawings show the configurations that will maximize use of floor space.

Figure 8. Containers: American and European pallet configurations




40-foot container (internal dimensions: 2.352 × 12.032 m)
American/standard pallets (1 × 1.2 m)
20
21
European pallets (0.8 × 1.2 m)
23
24

Trucks

Curtainsider loaded with pallets. Source: Topai/Shutterstock.com

The internal dimensions of a curtainside trailer are as follows:

- width: 2.48 m (8′ 1.6″)
- length: 13.6 m (44′ 7.43″).

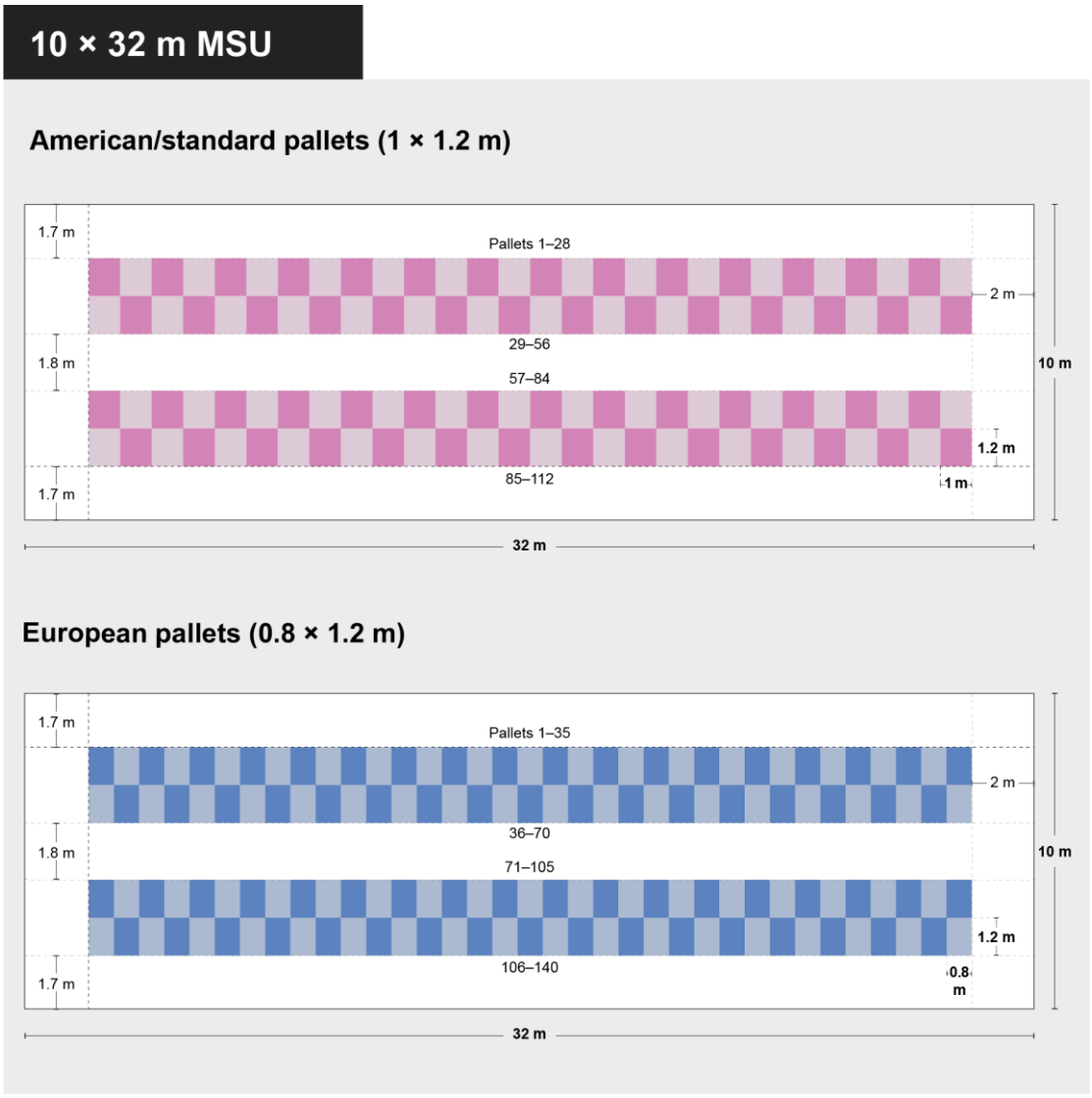
This trailer's floor space can accommodate 33 EUR pallets or 26 American/standard pallets.

MSUs used by Logistics Cluster

Let us now try to estimate how many pallets we can fit into a standard MSU used by WFP. The MSU measures 10 × 32 m (32′ 9.7″ × 104′ 11.8″). Again, our calculations will be based on floor space, and how many single pallets, or stacks of pallets, can be fitted across that floor space.

- For easy removal of the pallets, and easy access for stock rotation, we need at least three spacious aisles. One possible configuration, shown below, gives us space for 112 American/standard pallets (or 140 EUR pallets).

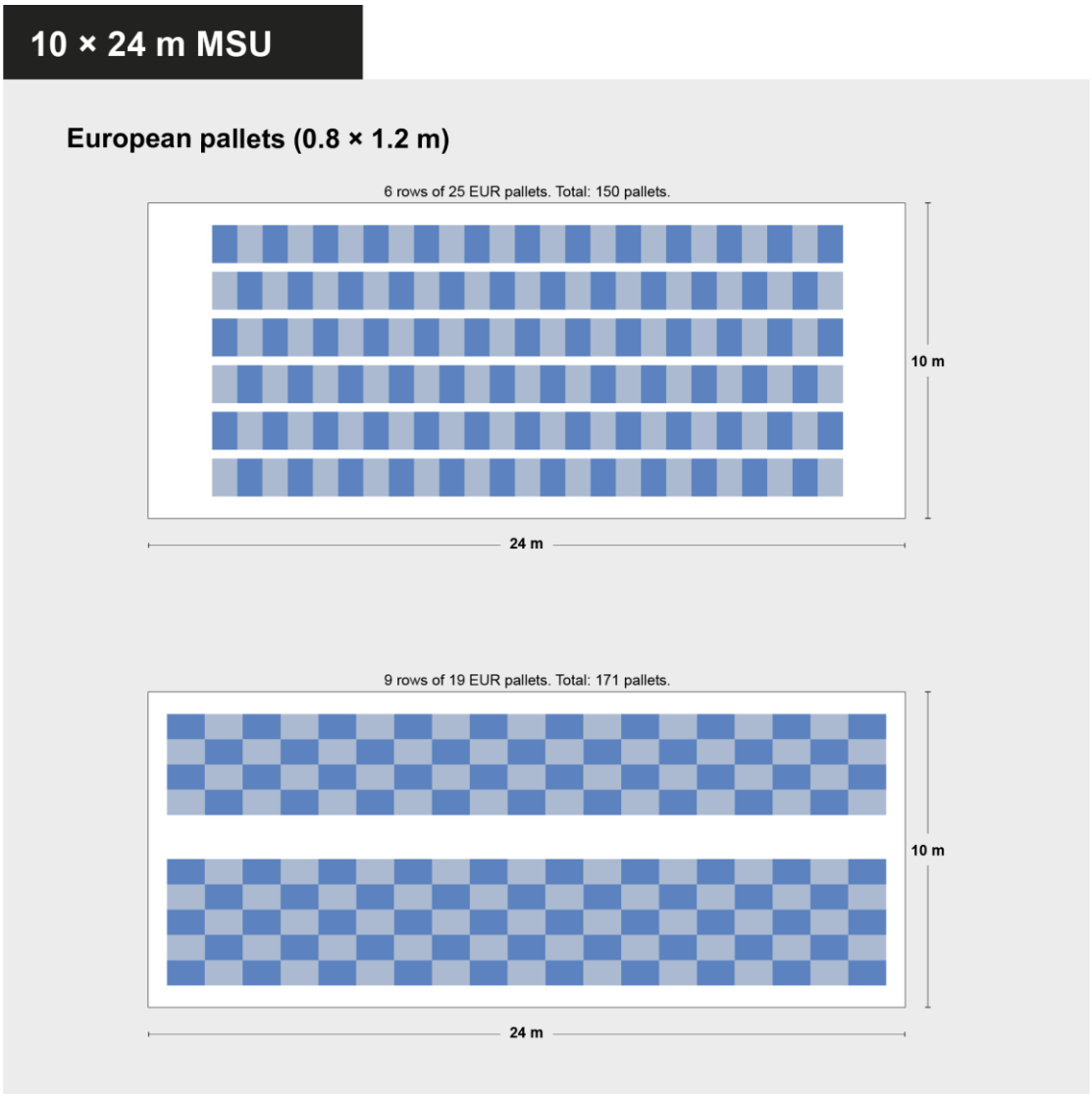
Figure 9. Standard 10 × 32 m MSU: American and European pallet configurations



Based on the number of pallets, we could fit the contents of about 10 TEU containers or 5 FEUs into this MSU. Cargo that arrives non-palletized cannot just be stored on the ground. Goods should be put on pallets, so the same calculation could be used.

MSU length is variable by sections of 4m, so you may encounter smaller-than-standard MSUs. If space is constrained, we can reduce easy access to the goods on the pallets. Let's consider options for an MSU with a floor space of 10 × 24 m (32′ 9.7″ × 78′ 8.88″). As the diagrams below illustrate, despite the smaller size, careful configuration allows space for 150 or even 171 EUR pallets. Clearly, the lack of access would make these arrangements far from ideal, especially if the goods are heavy or cumbersome, or if they have short shelf-lives and stocks need to be rotated.

Figure 10. 10 × 24 m MSU: European pallet configurations



8.5 Storing medical products

With thanks to Médecins Sans Frontières and the World Health Organization

Temperature control

Some critical items will need temperature-controlled transport and storage for the entire journey from the product manufacturer to the patient. In general, pharmaceutical products are stored in dry, well-ventilated areas at temperatures of 15–25 °C. Depending on climatic conditions, some may be stored at up to 30 °C.

All vaccines can be stored at positive temperatures (between +2 °C and +8 °C). Some vaccines can be stored at negative temperatures (between –15 °C and –25 °C).

UNHRD engineers and WFP have developed the Temperature Control Unit (TCU). The TCU is an advanced Rubb Hall designed specifically to store heat-sensitive items. It is fully powered by roof-mounted solar panels connected to an external control unit. If needed, a diesel backup generator can be activated.

Temperature control is achieved in TCUs through a combination of insulation and refrigeration. An inner liner for the entire Rubb Hall serves as an insulator. The interior is then divided into three sections, each of which is individually refrigerated to below 25 °C. This cellular approach helps maintain temperature control during stock movement, and it will minimize losses if refrigeration fails in any of the sections.

For detailed information about cold chain requirements, please see WHO's publication *The Vaccine Cold Chain*, which is online at:
http://www.who.int/immunization/documents/IIP2015_Module2.pdf

Protection, stock control and disposal

In general, medical products are not stored in a mixed warehouse with other products. It is essential to protect them not only from heat but also from anything

that might contaminate or degrade them, e.g. extraneous odours, pests, damp and intense light, etc. They must also be protected from tampering and theft. The storage of some medicines (such as psychotropics and narcotics) is subject to stringent legal regulations. In some countries, storage of medical products must be supervised by qualified pharmacists.

Remember that most medical products — both drugs and consumables — have expiry dates. If the product is not used before the expiry date, you will have to properly dispose it. Destruction of expired drugs is a complex process, with specific requirements for each type. You should coordinate with the Ministry of Health on legal and practical aspects so that disposal is carried out safely.

8.6 Warehousing of relief items

Remember that a warehouse is not a public place! It is a restricted area only accessible by authorized personnel. Also keep in mind that a bonded warehouse is a highly regulated environment with very strict legal rules that must be followed. To store certain products, e.g. pharmaceuticals, you will need specific licenses from the ministry responsible for their regulation.

Estimating storage needs and capacity

Your warehousing needs will depend on the type and quantity of supplies you expect to store. However, in emergency operations it is hard to foresee how many packages or bundles will come in, since many of the items sent are unsolicited. It is best to choose the largest possible space, even if at first the quantity of supplies does not require it.

Storage space is three-dimensional; it has width, height and depth. To determine the useful capacity of a site, some basic variables must be known:

- **Gross space**. This is the internal floor space. Measured in square metres, it is calculated by multiplying the width of the space by the length.

- **Gross cubic metres.** This is the entire interior space of the building. Measured in cubic metres, it is calculated by multiplying the width by the depth by the height of the building.

- **Structural loss**. This is interior space that is "wasted" because it is occupied by pillars, columns, dividing walls, bathrooms and any other structural component.

- **Support space**. This is space that will be needed for offices, the storage of warehousing equipment such as forklifts, and the operations area (classification, packing, etc.).

- **Net square metres**. This is the actual storage space. To obtain this figure, subtract from the gross space the structural loss, the support space and any other area that cannot be used for storage.

- **Net cubic metres**. This is the three-dimensional, gross cubic metre space minus the structural loss and overhead obstructions (lamps, pipes and beams, etc.).

You will need to keep in mind that different supplies have different storage volume requirements. The following table lists a variety of supplies and estimates the space needed to store one metric ton of each of them.

Table 2. Supplies and their different storage space requirements, per ton

Type of supply	Space required (m3)
Grains (rice, corn), flour, sugar in sacks	2
Powdered milk in sacks or boxes	3
Pharmaceuticals	3
Vegetable oil in cylinders or tins	1.5 to 2
Blankets in compressed packages (approx. 700)	4 to 5
Loose blankets	8 to 10
Clothes	7 to 10
Tents (approx. 25 family tents)	4 to 5
Kitchen utensils (between 35 and 40 boxes)	4 to 5

Special storage needs

Some relief items require special attention in terms of the type and security of the storage area. For example:

- Medical supplies and drug shipments can contain a large number of small, highly-valued and, often, restricted items. Many of the items will have a limited shelf-life. A secure area and judicious attention to expiry dates are required.

- Antibiotics and vaccines may require temperature-controlled cold storage arrangements, with sufficient capacity, a reliable power source, and a back-up power source.

- Safety protocols must be strictly implemented when storing and handling combustible items. Hazardous products such as fuels, compressed gases, insecticides, medical alcohols, ether and other flammable, toxic or corrosive substances must be stored separately, preferably in a cool, secure shed in the compound away from the main warehouse.

- Inventory management techniques should be implemented, both to prevent wasteful surpluses and to ensure proper stock rotation so that costly stocks are not wasted due to expiry. Procedures for controlling, preserving and releasing medical supplies and drugs should be established in consultation with medical experts.

Equipment and material required in the warehouse

To ensure that the warehouse functions properly, some basic equipment and materials are required. This equipment might include:

- a computer system with pre-installed software, such as a spreadsheet or stock control application, to record and keep track of supplies and their movements;
- forms and cards to control stocks, inflows and outflows of products;
- basic stationery, calculators and other office supplies;
- a metal filing cabinet with a lock;
- a first aid cabinet, and fire extinguishers that are ABC ratings-compliant;
- an electric generator with its own maintenance material;
- refrigeration equipment;
- shelves and pallets on which to stack products;
- tools for opening and closing crates and boxes;
- adhesive tape for packaging;

- scales, metric measuring tape and ladders;
- cleaning products and materials;
- wheelbarrows, hydraulic loading and moving equipment;
- safety gear for workers; and
- weights and measures conversion tables.

8.7 Transporting relief items

Transport is the link in the logistics chain that makes it possible for emergency humanitarian assistance to reach its destination. The challenge lies in making sure that supplies arrive where they are needed, when they are needed, and in good condition so that they are fit for purpose.

When designing an emergency supply transport strategy, it is not enough to consider in the abstract the best means of transport or the resources needed to mobilize supplies from A to B. Plans must be feasible; and flexibility is essential: alternative means, methods, and routes should be considered as a matter of course.

Getting emergency supplies from their point of origin to their eventual destination involves the combined use of air, land and/or water transport. Each means of transport has its pros and cons, with cost, capacity and speed being the main considerations.

Decisions on which type of transport to use should be based on:

- **Needs on the ground**. How urgently are the supplies needed? What type of supplies are being shipped? How large and heavy is the shipment going to be? What is the destination? What distances must be travelled?

- **Feasibility**. What means of transport are available? How much do they cost? How much can we afford? How hard is it to reach the intended destination, given the weather and the state of available routes?

The ideal form of transportation may not be available; and, even if it is, it may be too expensive, or conditions in the field may rule out its use. Determining what is needed is only the start of the planning process: you must also ensure that transport plans are affordable and practicable, and that you have contingencies in place.

Non-commercial or free transport, sometimes offered by other organizations or voluntary groups, reduces the cost of an operation. In general, however, the owners of the transport do not assume responsibility for the safety of the goods. It makes sense to use such transport only if you can take special security measures to protect the load.

Commercial carriers should always be the first option to explore. Businesses need to make a profit, but sometimes special rates can be negotiated for humanitarian supplies. You should bear in mind not only the price but also the reliability, safety, speed and quality of the firm. Since a service contract is a commercial transaction, you are entitled to demand that even the smallest contractual details are fulfilled.

You will need to ensure that the contract specifies any special handling requirements for the shipment (and that the contractor can fulfil them), and you should carefully review what is included in the fare (e.g. loading and offloading, the driver's fees, and so on).

Sometimes, shared services are available. WFP leads the Logistics Cluster and manages both the global network of United Nations Humanitarian Response Depots (UNHRD) and the United Nations Humanitarian Air Service (UNHAS). In some contexts, they provide common services for land transport, warehousing and air transport services.

8.8 Managing air operations

With thanks to WFP Aviation and the United Nations Humanitarian Air Service.

An organization may need to charter one or more aeroplanes to deliver the supplies. At times, there may be so many consignments arriving by air that it will be necessary to create a plan to coordinate aircraft landings, reception, and offloading of the supplies at the airport or landing strip. These tasks require a great deal of preparation. One person should be assigned to handle this work specifically, preferably someone with logistics experience.

Charter flights' routes and departure times are not timetabled like ordinary commercial flights. Instead, they determined by the customer in coordination with the airline company.

In some cases, government aircraft will collaborate with the relief effort. Those from air divisions of the armed forces will be marked as such, and if conflict is ongoing in the area affected by the medical emergency it will be necessary to consider whether using military planes will impact negatively on either the beneficiary population or your organization's reputation for neutrality.

Regardless of the carrier, some basic measures should be taken to make optimal use of air transport:

- The landing site should ideally be an airport, or at least an airstrip, but this is not always possible. If there is no airport, a good place for landing must be identified and used. The length and width of the improvised airstrip depends on the type of plane that must land and take off from the site. Ground conditions should be checked, and repairs or changes must be made to the strip to ensure safe landings.

- All available information about the characteristics of the landing site must be conveyed to those in charge of the aircraft. Details about the runway should include its location; length, width and orientation; and the material with

which it is paved. Available services, such as lighting and refuelling capabilities, should also be conveyed, as should safety information and local weather reports.

- When using an airport or landing strip, it is important to coordinate with the authorities in charge of the facilities to: determine what working areas are available, secure access to them, and obtain all information necessary to manage the operation successfully.

- All formalities required for landing must be negotiated with local officials in advance. You should establish what kinds of equipment and support will be needed for landing and offloading the supplies. You should also ascertain whether it will be possible to refuel at the site — aeroplane fuel and pumping equipment may not be available

- The date and estimated time of arrival must be defined clearly in advance. To prevent confusion between a.m. and p.m., it is more convenient to use a 24-hour cycle, so that 1 a.m. is denoted as 01:00 hours, and 1 p.m. is 13:00 hours. For flights coming in from a different time zone, it is essential to establish whether the arrival time is stated in local time.

- The person in charge of the operation (or the deputy) must be at the landing site at least one hour before arrival to check conditions on the ground and remove any obstacles that may affect the safety of the landing. Such obstacles might be people, livestock or objects on the runway.

- It is vitally important to establish a coordination centre where flight schedules and routes are defined each day. The centre must be manned, at the very least, by the person responsible for air operations, a pilot or representative of the airline, and the person in charge of coordinating the relief operation.

In the case of shared services, much of this work will be taken care of by the provider. UNHAS's services can be accessed directly by contacting UNHAS, or through the Logistics Cluster.[10]

8.9 Provider of last resort

With thanks to the Inter-Agency Standing Committee (IASC) and OCHA

The concept of 'provider of last resort'[11] is critical to the cluster approach. It represents cluster leads' commitment to do their utmost to ensure an adequate and appropriate response. It is necessarily circumscribed by some basic preconditions that affect any framework for humanitarian action, namely: unimpeded access, security and availability of funding.

Where there are critical gaps in humanitarian response, it is the responsibility of cluster leads to call on all relevant humanitarian partners to address them. If this fails then, depending on the urgency, the cluster lead as the 'provider of last resort' may need to commit itself to filling the gap.

If, however, funds are not available, the cluster lead cannot be expected to implement these activities. Instead it should continue to work with the Humanitarian Coordinator and donors to mobilize the necessary resources.

Where the cluster lead, the Humanitarian Coordinator and the Humanitarian Country Team are unable to gain access to a particular location, or where security constraints limit the activities of humanitarian actors, the provider of last resort will

[10] For more information about UNHAS, please see: https://www.wfp.org/logistics/aviation/unhas-current-operations.

[11] IASC's *Operational Guidance on the Concept of 'Provider of Last Resort'* is online at: https://www.humanitarianresponse.info/en/system/files/documents/files/IASC Guidance on Provider of Last Resort.pdf

still be expected to continue advocacy efforts and to explain the constraints to stakeholders.

For cross-cutting areas such as Protection, Early Recovery and Camp Coordination, the concept of 'provider of last resort' is applied in a different way.

In all cases, however, cluster leads are responsible for ensuring that wherever there are significant gaps in the humanitarian response they continue advocacy efforts and explain the constraints to stakeholders.

In the case of emergency shelter, the commitments of the International Federation of Red Cross and Red Crescent Societies (IFRC) are described in a Memorandum of Understanding between IFRC and OCHA. IFRC has not committed to being 'provider of last resort' nor is it accountable to any part of the UN system. It will, however, do its utmost to ensure an adequate and appropriate response as far as the network's capacities, resources, as well as the access and security situation allow.

8.10 Transporting biological samples

With thanks to the World Health Organization.

You might be asked to transport biological samples (usually of blood) to a laboratory. Laws on the transport of biological substances are strict and change rapidly. They must be adhered to; otherwise, the samples may be blocked at border crossings or rejected by the laboratory. Anything that prevents the samples from being analysed will also prevent diagnosis and appropriate treatment of the corresponding patients.

Samples are considered "dangerous substances", and their transport is subject to very strict regulations based on the *UN Recommendations on the Transport of*

Dangerous Goods.[12] The International Air Transport Association (IATA) has incorporated these recommendations in its Dangerous Goods Regulations to which all airlines, including express carriers like DHL, are subject. These regulations are updated annually.

WHO publishes *Guidance on Regulations for the Transport of Infectious Substances*. Please always check for the latest edition on WHO's website.[13]

UN classifications and shipping names for infectious substances

Dangerous goods are assigned UN numbers and proper shipping names according to their hazard classification and their composition. Proper shipping names are used to clearly identify the dangerous article or substance. Infectious substances are classified in Division 6.2 and are assigned to UN 2814, UN 2900, UN 3291 or UN 3373, as appropriate. Infectious substances are divided into the following categories:

- **Category A**: an infectious substance which is transported in a form that, when exposure to it occurs, is capable of causing permanent disability, life-threatening or fatal disease in otherwise healthy humans or animals.
  - The proper shipping name for UN 2814 is "INFECTIOUS SUBSTANCE, AFFECTING HUMANS".
  - The proper shipping name for UN 2900 is "INFECTIOUS SUBSTANCE, AFFECTING ANIMALS only".

[12] The *UN Recommendations on the Transport of Dangerous Goods* are online at: https://www.unece.org/?id=3598

[13] WHO's *Guidance on Regulations for the Transport of Infectious Substances* is online at: http://www.who.int/ihr/publications/who_hse_ihr_2015.2/en/.

- **Category B**: an infectious substance that does not meet the criteria for inclusion in Category A. Category B infectious substances are assigned to UN 3373.

  – The proper shipping name of UN 3373 is "BIOLOGICAL SUBSTANCE CATEGORY B".

Full details of packaging, labelling and documentation requirements please consult WHO's *Guidance on Regulations for the Transport of Infectious Substances*. The following paragraphs summarise some of the main requirements.

Labelling

All packages containing infectious substances must be correctly labelled.

They should be marked with the applicable UN number and proper shipping name. The word "liquid" or "solid" must be appended in lower case and in brackets after the proper shipping name. If the package contains Category A material then the name and contact details of the person responsible for the material must clearly marked on the packaging.

Packages containing Category A material must be labelled with the internationally recognized, diamond-shaped class 6.2 hazard label shown below. The labels must be at least 100 mm² on large parcels and at least 50 mm² on small ones.

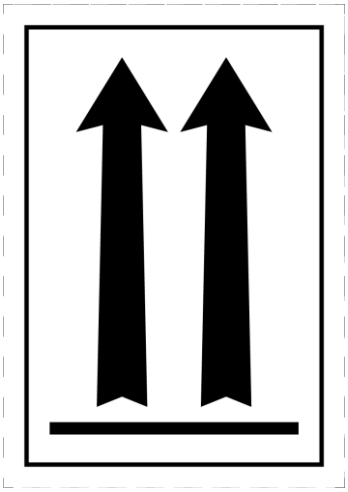
Figure 11. Labels: Class 6, Category A

Packages containing Category B substances must be labelled with a UN 3373 label. Again, these labels must be at least 100 mm² or 50 mm² on large or small packages, respectively.

Figure 12. Labels: UN 3373

If a package contains more than 50 ml (1.7 fl. oz) of material it must also be labelled with orientation arrows, with labels measuring at least 74 × 105 mm, and affixed to at least two opposite sides of the box.

Figure 13. Labels: orientation



Packages containing dry ice (UN 1845) must also be labelled “DRY ICE” next to a Class 9 miscellaneous dangerous goods warning label. The minimum size on large parcels is 100 mm², and on small ones it is 50 mm².

Figure 14. Labels: Class 9, miscellaneous dangerous goods

Please note: additional labels will be required for specific situations, e.g. if samples can be transported only by cargo aircraft. Always consult up-to-date guidelines well in advance so that you have all the necessary labelling materials to hand.

All necessary labels can be bought cheaply, in bulk, online. Those specifically relating to handling instructions can be bought directly from IATA at: http://www.iata.org/publications/store/Pages/dgr-handling-labels.aspx.

Packaging

All samples must be transported in approved triple packaging. The three layers are:

- **Primary receptacle**: a primary watertight, leak-proof receptacle containing the specimen. The receptacle is packaged with enough absorbent material to absorb all fluid in case of breakage or leakage.

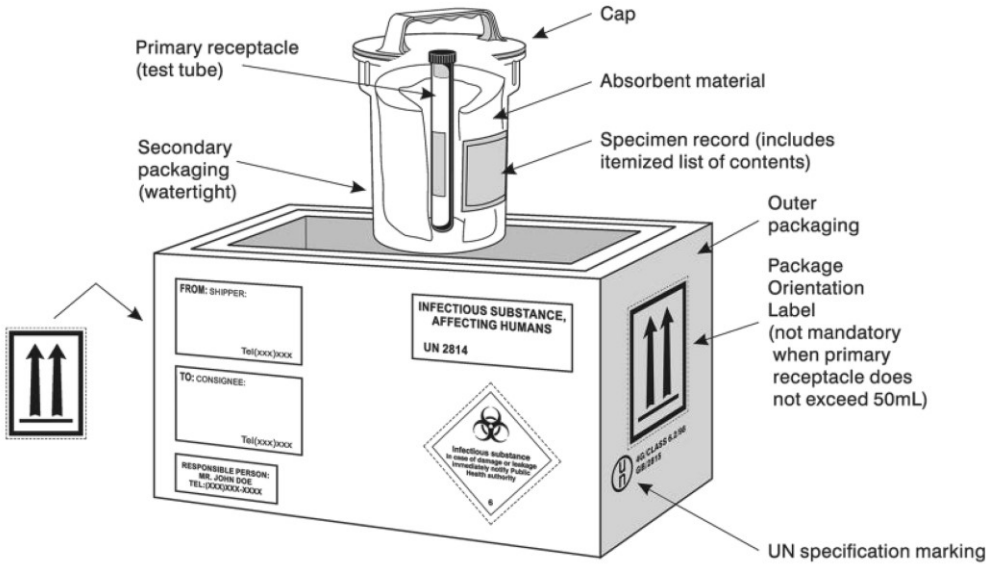
- **Secondary packaging**: a second durable, watertight, leak-proof packaging to enclose and protect the primary receptacle(s). Several cushioned primary

receptacles may be placed in one secondary packaging, but sufficient additional absorbent material shall be used to absorb all fluid in case of breakage or leakage.

- **Outer packaging**: secondary packaging is placed in the outer shipping packaging with suitable cushioning material. Outer packaging protects its contents from damage while in transit. The smallest overall external dimension allowed is 10 × 10 cm, but, in practice, the dimensions will be considerably greater so that packages can be labelled correctly.

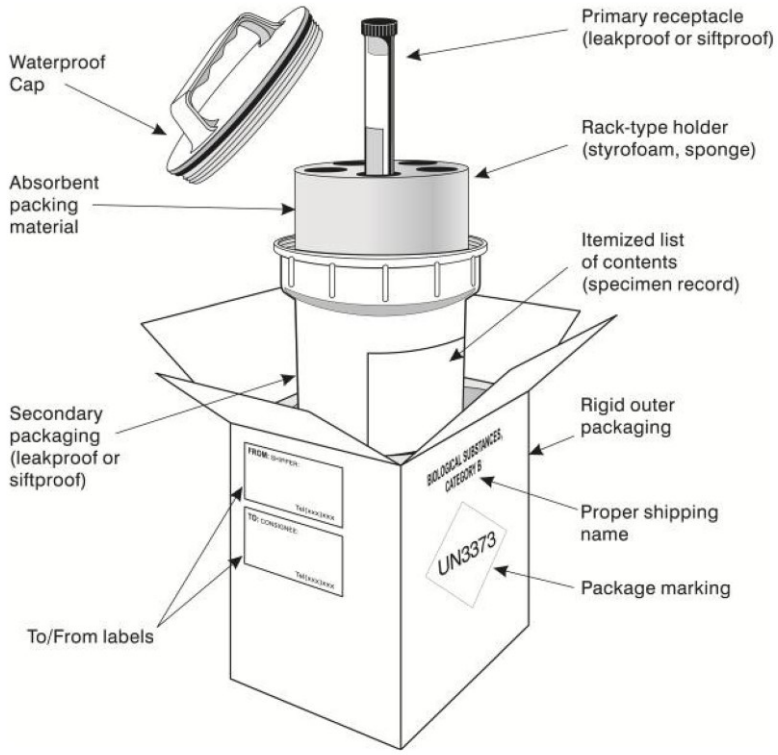
Pre-labelled, UN and IATA-compliant Category A and B packaging kits, and absorbents and cushioning materials can be bought online from several specialist packaging suppliers. Check to make sure that the products being sold meet the current WHO and IATA requirements and that the labelling designs are correct.

Figure 15. Example of triple packaging system for the packaging and labelling of Category A infectious substances



Source: IATA, Montreal, Canada.

Figure 16. Example of triple packaging system for the packaging and labelling of Category B infectious substances



Source: IATA, Montreal, Canada.

Each completed package must be correctly marked, labelled and accompanied by appropriate shipping documents. **Documentation must contain the biological name of the pathogen if known**. If is not known, but is suspected to be a Category A, UN 2814 or UN 2900-type pathogen, then the words "suspected Category A infectious substance" must be appended, in parenthesis, to the proper shipping name on the transport document. Whether known or unknown, the name of the pathogen is not shown on outer packaging.

8.11 Clearing customs

Depending on the extent of the emergency, the local authorities may declare a state of emergency and accept aid provided by the international community, initially in the form of relief consignments.

In these circumstances, authorities normally draft ad hoc, exceptional regulations for the import of emergency relief consignments. These regulations override standard ones, and remain in force for as long as the relief operations last. They must be incorporated into an SOP so that each humanitarian actor knows how to import its goods.

The customs clearance process is fundamentally about the control of goods. The customs officers can do this through the electronic or paper verification of documents to identify the cargo, and/or through physical inspection of the cargo.

There is a common misconception that exempted goods/materials are free from customs formalities. They are not. To comply with customs law, customs and the persons concerned must carry out all the relevant operations, just as they would with any other type of cargo. Every shipment must be documented, and in the case of exempted goods/material there is an additional requirement: the certification or proof of its status as exempted.

At the onset of an emergency there are ad hoc pieces of legislation, typically a decree issued by the relevant Minister's Office. These decrees might lack detailed instructions — in part, because few countries have customs protocols specifically for emergencies.

Only 14 countries have signed Annex J of Chapter 5 of the Revised Kyoto Convention (International Convention on the Simplification and Harmonization of Customs

Procedures).[14] Communally known as "Blank Waiver for Relief Consignments", the provisions of Annex J last only for a limited period of time, covering the relief assistance phase.

The decision to exempt goods imported into a territory for humanitarian purposes from the payment of duties and other taxes is entirely at the discretion of the country's authorities. Whether commodities or a specific donated item can be imported into a country without any taxes depends on the local government's decision about:

- the national humanitarian aid import policy;
- the goods qualified under that policy; and
- which actors should be granted tax-free status.

For reference:

1. The World Customs Organization (WCO) is an intergovernmental organization. Comprising of 174 member states, it deals with 98 percent of international trade.[15]

2. The Kyoto Convention, or International Convention on the Simplification and Harmonization of Customs Procedures, came into force in 1974 and is widely accepted.[16] It was last revised in 1999. Annex J, Chapter 5, specifically deals

[14] Annex J of Chapter 5 of the Revised Kyoto Convention is online at: http://www.wcoomd.org/en/topics/facilitation/instrument-and-tools/conventions/pf_revised_kyoto_conv/kyoto_new/spanj.aspx.

[15] WCO's website is at: http://www.wcoomd.org/.

[16] The Revised Kyoto Convention in its entirety is at: http://www.wcoomd.org/en/topics/facilitation/instrument-and-tools/conventions/pf_revised_kyoto_conv.aspx.

with relief consignments: it defines the definition of relief consignments; highlights three operational standards; and provides recommended practices.

3. Recognizing the need for standard customs agreement between the UN and a State/government, OCHA and WCO produced what is known as the 'OCHA Model Agreement'. The Model Agreement was approved by the Permanent Technical Committee in 1996. It outlines clear definitions and simple clauses, sets up a general collaboration framework and provides very practical and useful specific conditions relating to:

   - duties, taxes or levies;
   - free status;
   - paperwork simplification;
   - inbound and export;
   - process facilitation; and
   - pre-arrival clearance submission.

The Model Agreement is published online by OCHA in English, French, Spanish, Arabic and Russian.[17]

[17] The OCHA Model Agreement is online at: https://www.unocha.org/legacy/what-we-do/coordination-tools/logistics-support/customs-facilitation.

9. Building logistics infrastructure

With thanks to WFP Engineering.

During an emergency response, lack of adequate and secure infrastructure often slows down the deployment of a well-conceived logistics action plan. WFP Engineering and WFP Logistics identified a need for a package that provides contingency supplies and materials, and that will improve the efficiency of a pandemic response.

This chapter provides an overview of an infrastructure package that has been developed by WFP Engineering to ensure a rapid and efficient response to a pandemic emergency. Here, we shall focus on the items required to go "in a box" for a rapidly deployable, contained solution.

Four different installations have been designed for different size and functional requirements. The installations represent a typical hub-and-spoke network and are composed of staging areas, main hubs (largest), forward logistics bases, and satellite warehouses (smallest). The packages have been designed taking into consideration the following assumptions:

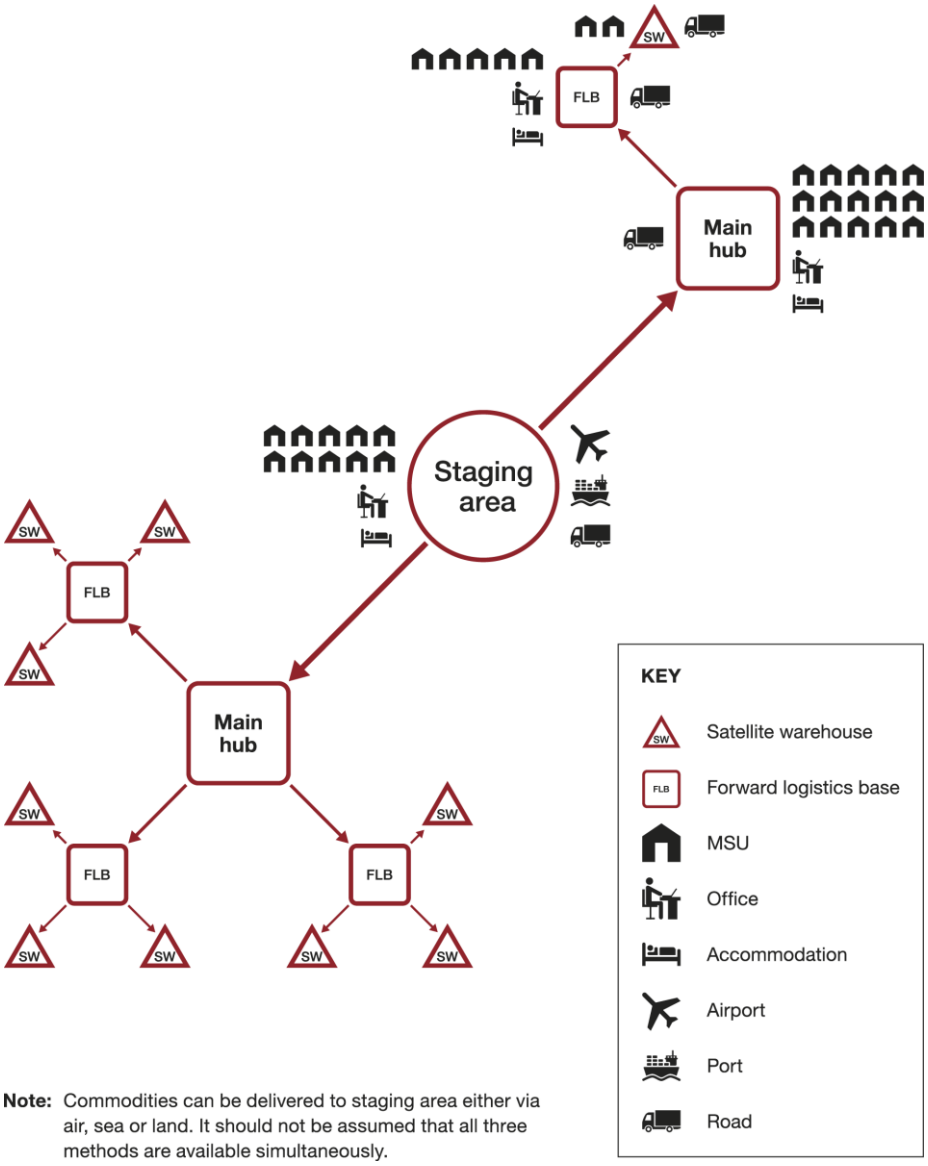
- the infrastructure design and items list is non-site specific;
- designs at all logistics hubs are modular so that infrastructure can be scaled up or down dependent upon the emergency, climate and geographical location, etc.;
- a primary deployed package will provide a temporary infrastructure solution until delivery of a secondary package (if required);
- the secondary package will be shipped by sea;

- the secondary package will provide a more medium-term infrastructure solution;
- both primary and secondary deployment packages have been designed so that the majority of items are 'plug and play', so as to minimize on-site civil works;
- items are sourced locally where possible;
- civil works are kept to a minimum so that there is less need for complex tenders during an emergency; and
- easy installation of all elements is desired so that non-specialized labour can be sourced locally.

Each logistics hub requires specific equipment and supplies to be packaged together to ensure a fast set up. These are listed by hub component in Annex R-6. WFP Engineering assume that each of the logistics installations will be accessible and connected to each other by road.

The diagram on the following page shows an example of downstream logistics hub-and-spoke network.

Figure 17. Example of a downstream logistics network



Source: WFP Engineering

9.1 Types of logistics infrastructure

The function of each type of hub is explained below. The actual size of each hub will depend on the emergency.

Staging area

At the onset of the emergency, the staging area is the first level of infrastructure to be established. Its purpose is to decongest main entry points to the affected areas, and ease the flow of aid to its target destination. The staging area is most commonly set up at seaports or airports where resources first arrive in country. Usually, resources do not remain at this hub for very long: once they have been sorted they are distributed to the main hub(s). A staging area configuration might consist of:

- 10 MSUs
- Office facility
- Accommodation for staff
- Facilities for partner organizations.

Main hub

The main hub is the largest of the logistics installations. A greater number of MSUs are installed here to accommodate a large quantity of commodities. This hub acts as the main distribution node in the network of hubs and spokes through which supplies are stockpiled for use in the field. It might consist of:

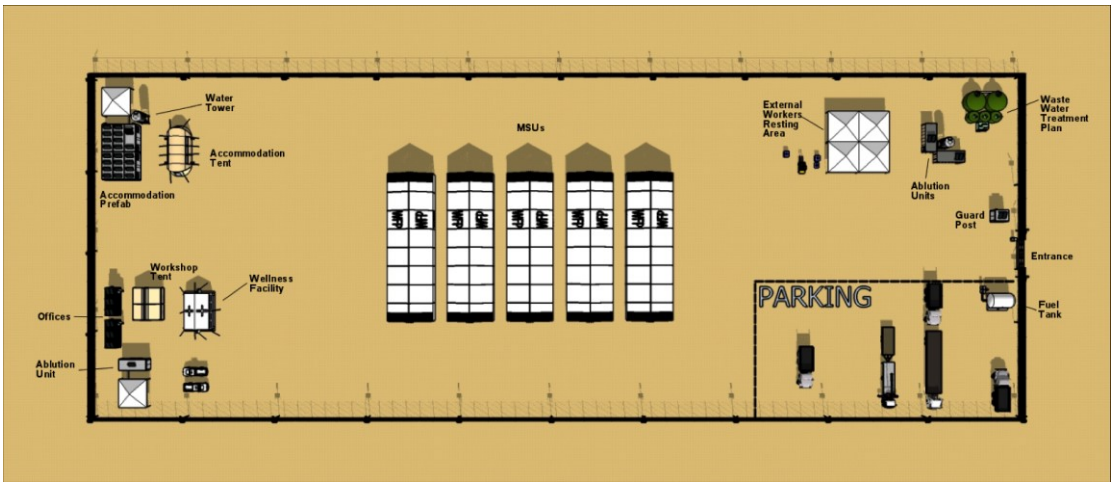
- 15 MSUs
- Office facility
- Accommodation for staff
- Facilities for partner organizations.

Forward logistics base

The forward logistics base (FLB) is the third level in the downstream supply chain, and it is third largest hub in terms of storage capacity. Like both the staging area and main hub, the FLB also provides office and accommodation facilities and facilities for external workers.

- 5 MSUs
- Office facility
- Accommodation for staff

Figure 18. Example of forward logistics base setup



Source: WFP Engineering

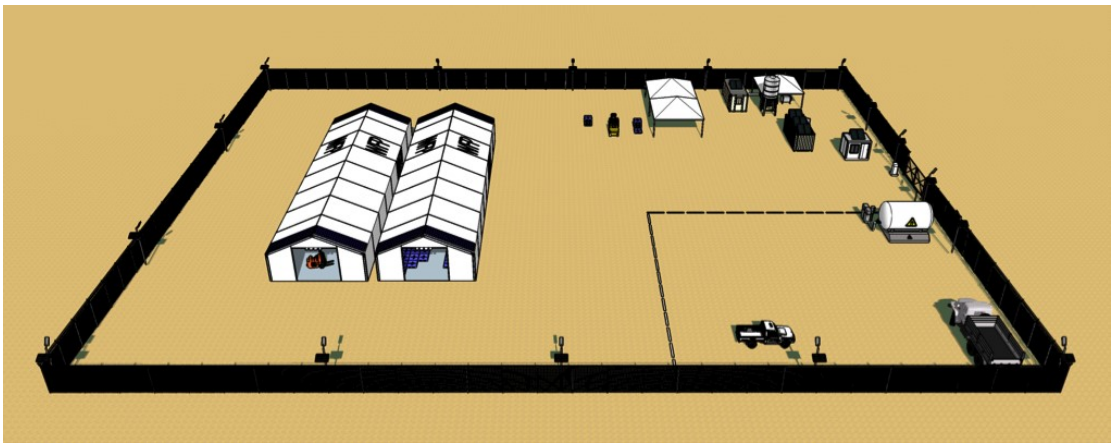
Satellite warehouse

The satellite warehouse is the smallest and last hub in the downstream supply chain and may only be required dependent upon the circumstance. This hub has no office or accommodation facilities and can only store a limited number of commodities; offices or accommodations can be added if required.

A satellite warehouse might consist only of:

- 2 MSUs

Figure 19. Example of satellite warehouse setup



Source: WFP Engineering

See Annex R-6 for a list of equipment needed to install these hubs. Please note, however, that the list is given as an example and is not exhaustive.

Construction

So that WFP Engineering's kits can be set up and mobilized quickly, the following aspects of construction should be taken into consideration.

- To minimize on-site civil works, all cabling and piping should be established above ground.
- A small amount of work related to procurement will be required once the site is identified.

- A site-specific design, contract for works, and oversight function will be essential once the site is identified.
- Basic materials should be sourced locally, as available.
- Machinery (where required) should be sourced locally.
- Labour to construct/assemble (where required) should be sourced locally.

9.2 Storage facilities

Mobile Storage Unit (MSU)

The Mobile Storage Unit is the main component of any emergency logistics hub. MSUs store and preserve resources, and provide protection from environmental elements. MSUs are deployed as part of WFP Engineering's primary package.

While the primary package is being shipped, the site's groundwork and drainage works should be prepared. Unspecialized local workers can install MSUs rapidly without the need for heavy machinery.

The size of MSU most commonly used by WFP is 10 × 32 m. Multiple units make up the storage component of the logistics infrastructure.

Modular flooring

Depending on site conditions, the use of modular/temporary flooring may remove the need to purchase gravel or concrete locally. Modular flooring also raises the floor level up by 50 mm, greatly reducing the amount of site drainage required.

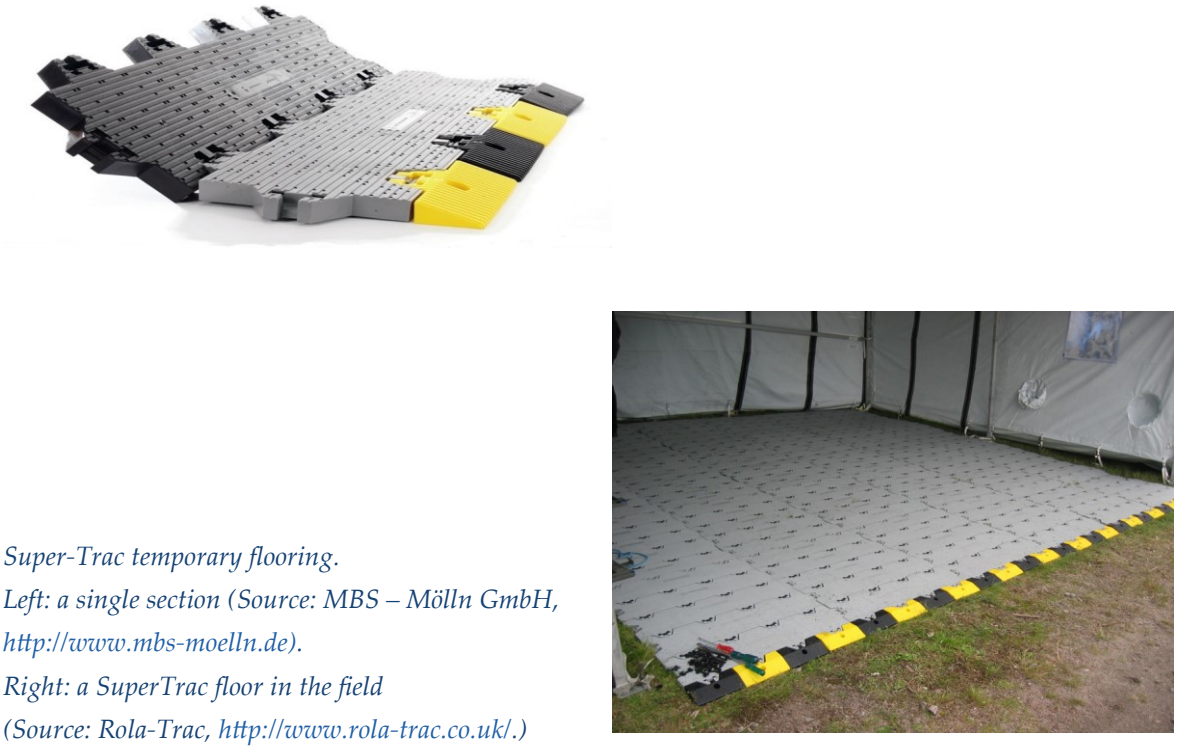
Modular/temporary flooring is installed using sections that, typically, measure 1,000 × 500mm. Individual panels are combined to provide a full floor system.

Several manufacturers produce temporary flooring suitable for humanitarian use in the field, and there are various specifications, with products manufactured for light loads (a pedestrian footpath) or for heavy loads (trucks or a forklift).

Modular flooring has several advantages, including:

- • ease of installation;
- • speed of installation (up to 70 m2 per hour);
- • ease of removal after demobilization; and
- • increased floor level (by 50 mm).

Figure 20. Example of modular flooring



Super-Trac temporary flooring.
Left: a single section (Source: MBS – Mölln GmbH, http://www.mbs-moelln.de).
Right: a SuperTrac floor in the field
(Source: Rola-Trac, http://www.rola-trac.co.uk/.)

10. Logistics staff

Logistics operations need logistics staff, and deploying staff for humanitarian operations requires its own logistics operation. Transport and mobilization, feeding, lodging and healthcare must all be taken into account in logistics planning. The teams on the ground should be as self-sufficient as possible, so as not to place an additional burden on the already strained resources of the affected population.

Logistics staffing involves putting together a team that encompasses a broad range of specialties. Many logisticians are generalists, and it may be that their mix of skills will be adequate for the operation. More likely, you will also need staff who specialize in, for example, warehousing, transport and customs. The team's operational effectiveness will depend on a good balance of skills, and your best bet is to bring in both generalists and specialists.

The logistics team will also need administrative and financial support to handle budgets and process invoices and payments. Other teams involved in the response may be able to supply these services; if not then the team will need to hire its own admin and finance personnel.

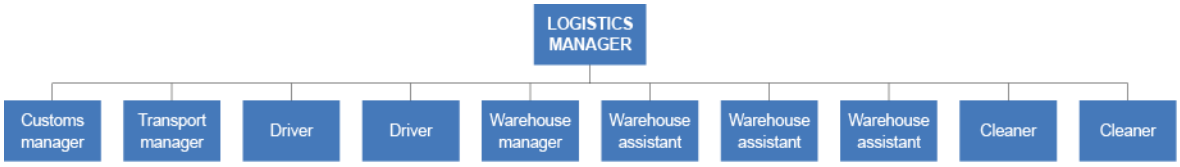
Staff for emergencies need to be trained in advance. That is why most the humanitarian agencies have regular emergency preparedness trainings. Many agencies also have standby rosters of trained, experienced individuals whom they can mobilize for emergency interventions.

10.1 Organizational chart

In an emergency, you will be faced with having to do numerous things at the same time, or at very short notice. You will need to think carefully about how you're going to manage your teams.

Having a horizontal organizational chart will not really help!

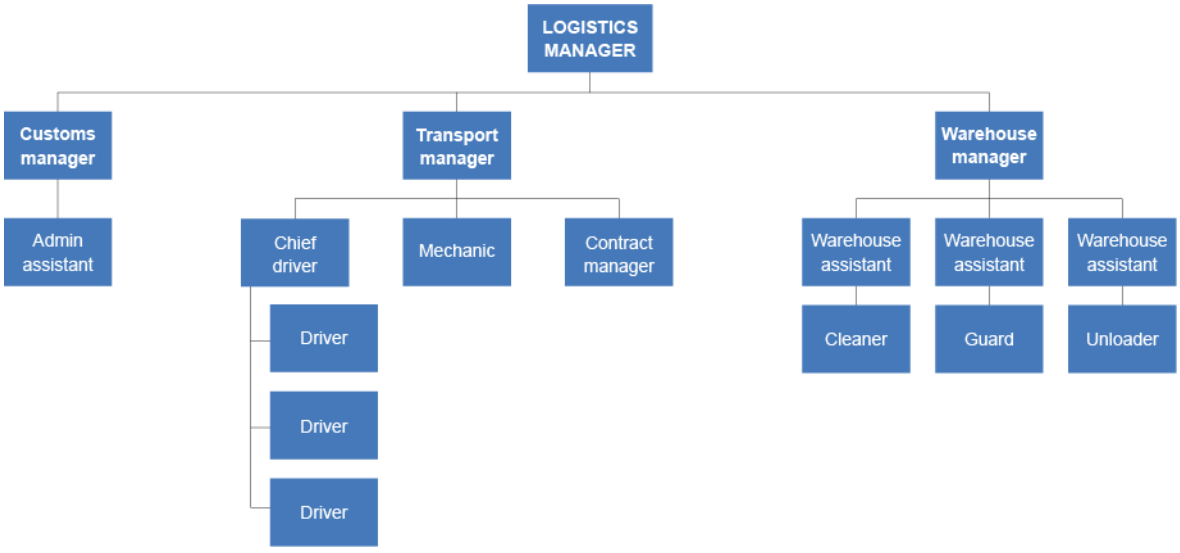
Figure 21. Horizontal organizational chart



In this set-up, each team member reports directly to you, and so you will spend all your time talking to and directing them. This arrangement might appear to give you more control; but, in fact, you will lose track of the overall picture because you will be distracted by team members' day-to-day problems and complaints. You have no one to delegate to.

To maintain a better view of the operation and spend less time managing people, you should aim for a pyramid-like organizational chart. If you group activities and tasks together then you can appoint managers for each group and delegate to them.

Figure 22. Pyramid organizational chart with layers of delegation



10.2 Transport services and fleet management

Operations in the field depend on transport services. The complexity of each activity will, in part, be determined by who or what needs to be transported. For example, transporting patients with infectious diseases, heat-sensitive medical products, and dangerous products all present their own challenges.

Other common complications include poor-quality roads, climate, and security risks in conflict zones. Road accidents can have grave consequences for passengers and other road users. Accidents or banditry may cause loss of consignments of medical supplies or laboratory samples, and seriously impact patient care.

Transport is therefore an important point of vulnerability for humanitarian operations, and day-to-day management of a fleet of vehicles poses major operational, security and financial challenges.

Fleet management should be organized in all places and at all times with respect for the following principles:

- **Ensuring the mobility of persons and goods**
  - The composition of a fleet should be tailored to the needs of the operation. Your objective is to provide the best transport services possible within the constraints on the ground, and the type, quality and number of vehicles should be chosen accordingly.

    You will also need to anticipate changes in activities and operational needs over time, and build flexibility into the fleet. The volume of passengers and packages, service frequency and distances will vary. So, too, will driving conditions (road passibility, security, weather and traffic, etc.).

  - The fleet should be standardized and homogenous. The acquisition of vehicles — whether through purchase, rental, borrowing or received as

donations — should be carefully planned and budgeted, and should proceed only after validation by the head office.

- Whenever possible, you should allocate the most reliable vehicles and the most experienced drivers to programmes experiencing the most difficult transport conditions (duration, security, traffic problems, etc.). Daily vehicle allocation should be organized according to fleet size. Management of allocation might be:
  - centralized, with vehicles dispatched daily to the various user groups;
  - decentralized, in the case of large transport volumes, with vehicles dedicated permanently to one or several departments; or
  - a combination of these systems.
- You should conduct a proactive analysis of the local market. For various reasons (unforeseen changes in transport requirements, or vehicle breakdowns, etc.) it may be necessary to rent vehicles to ensure the mobility of teams and materials. A rented vehicle should be subject to the same administrative and safety requirements as those purchased by the organization.

- **Ensuring safety during transport**
  - Preventive vehicle servicing involves testing, cleaning, servicing and repairing, and is essential to maintaining the functional reliability of the vehicles. When there is any doubt about a vehicle's reliability, the vehicle should be repaired as quickly as possible while alternative solutions are planned in case of prolonged immobilisation.
  - Vehicles should be fitted out with powerful communication equipment that enables centralized tracking of their movements in case of need (e.g. insecure conditions, or traffic difficulties, etc.). The level of vehicle

identification and the ability to report movements must meet the strategy of visibility and tracking of vehicles included in the security plan of the mission or project.

– When operating in an insecure context, transport management and staff should be familiar with the roads, and evacuation by road of teams should be done according to the contingency plan of the mission or project. Whenever possible, evacuation routes must be identified, tested and documented in advance (e.g. maps, road block positions, etc.).

– Vehicles and motorized equipment should be powered with tested and reliable fuel sources, the quality and quantity of which must ensure uninterrupted supply. Identifying diverse sources and establishing fuel reserves, if possible, will give fleet management a degree of independence from individual suppliers.

  Keeping sizeable fuel stores helps avoid shortages if supplies dry up, and it facilitates the processes of decanting and filtering which are often necessary. Handling, transport and storage of petroleum products (diesel, petrol and waste oil, etc.) must be done with the utmost care to protect facilities and their occupants from fire risk. Essential precautions include storing the products away from other buildings; limiting access; labelling products and stores clearly and accurately; and ensuring that stores are ventilated adequately and equipped with appropriate fire extinguishers.

– Whether expatriates or nationals, drivers of vehicles used by the organization should be competent and physically fit to drive. Each of them must have a valid driving licence; be familiar with traffic regulations, road signs and driving regulations; and know exactly how their vehicle reacts.

– The transport of passengers and goods should be carried out in accordance with the internal regulations included in the mission's

security plan (e.g. maximum number of passengers per vehicle). It must also comply with national and international transport legislation (e.g. ADR6 regulations for the transport of dangerous goods). The driver of a vehicle is responsible for the safety of persons and goods during the entire journey.

- **Managing the fleet efficiently**

  - Provided that rationalization does not impair the quality of operations, you should always aim to optimize the use of vehicles. One aspect of this is encouraging sharing among users. Cooperation will be necessary because rationalization will rely on users coordinating individual transport plans and ensuring that journeys are always relevant to the mission. The benefits are reduced transport costs and reduction of the largest ecological footprint of emergency response activities.

  - Management and performance data should be monitored, analyzed and reported regularly. Information should include fuel consumption, operating costs, the number of kilometres driven, frequency of immobilization, degree of use, and the number of accidents, etc.

  Managing a fleet of vehicles, therefore, includes the following activities:

  - defining a homogenous fleet depending on intervention needs and contexts;
  - identifying and negotiating in advance with suppliers of rented vehicles and fuel;
  - making vehicles operational and compliant with national transport regulations and your agency's internal safety procedures;
  - planning preventive vehicle maintenance using original spare parts;
  - identifying and tracking vehicles and their movements; and

– providing information for users, and training drivers in order to increase accountability when dealing with transport problems.

10.3 Workspace and accommodation

In the 1980s, Médecins Sans Frontières (MSF) developed a range of medical and logistics kits that offered the flexibility they needed to respond rapidly, and fully equipped, to a wide array of different medical emergencies.

Over time, they have developed a portfolio of some 50 ready-to-be despatched kits, each of which has a specific purpose and consists of items from a standardized stock list. Descriptions, cost, quantities and weights of all items are always known, making budgeting, shipping and replenishment much more straightforward. The kits can be combined to form whatever setup is needed, and they allow MSF to be up-and-running in the field within a few days.[18]

The kit system is a typical example of a 'push' supply chain. Supplies are distributed proactively according to centrally estimated need, and not reactively following a request.

Clearly, critical medical supplies are no use without people to implement the response, and responders need workspaces and accommodation. Several agencies, including WFP, have adopted and developed kitted systems for these purposes, and they are now a key component of emergency preparedness and rapid response.

Installing offices and accommodation in main cities may, if you're lucky, be relatively straightforward. In remote areas, however, it is a completely different

[18] For more information about MSF's development of kits please see "The Logistics Revolution" at: http://www.doctorswithoutborders.org/msf-experience.

ballgame. The best way to equip an operational logistics team is to create kits/modules for them to pick up before departure.

Setting up and equipping office space and accommodation involves a many items and skills. But don't assume that your organization must do everything by itself. This should be a coordinated effort, with different actors contributing skills so that everyone can achieve the same objective. For example, the Emergency Telecom Cluster (ETC) can help with all issues related to telecommunication; and the Logistics Cluster can help with storage and transportation. Some organizations or humanitarian procurement centres have pre-positioned stocks that are available for other humanitarian agencies. These are referred to as white stocks.

Here are some examples, based on kits developed by various organizations, of very useful non-medical kits that can be pre-positioned in case of emergencies (also see Annex R-5):

- Administration kit: stationery, agency identification and presentation supplies, standard administrative forms
- Survival kit: for a team of *x* people to survive in a self-sufficient way for *x* days in a temperate climatic condition
- Team life kit: rapid installation of an *x*-person team in a remote area
- Laptop kit
- Multifunction printer kit
- Radio communication kit (HF, VHF and UHF)[19]

[19] Despite technological developments, information access and communication remain very limited in many intervention zones. In the case of conflict zones, access is often interrupted or totally unavailable for strategic military reasons. An additional complication in conflict zones is that the exchange of information becomes more sensitive and, without elementary transmission precautions, staff can be put at risk and programmes may be interrupted.

- Satellite communication kit
- Mobile phone kit (e.g. double sim)
- Generator kit
- Logistics kit: set of basic logistic items[20]
- Power supply kit: 230/12/230 V.[21]

When setting up accommodation for teams, housing standards should be specified, paying special attention to the following:

- Minimum space allocated per person (floor area; cubic volume; a separate bed for each person)
- Supply of safe water in the workers' dwelling in such quantities as to provide for all personal and household uses
- Adequate sewage and garbage disposal systems
- Appropriate protection against heat, cold, damp, noise, fire, disease-carrying animals and insects
- Adequate sanitary and washing facilities, ventilation, cooking and storage facilities and natural and artificial lighting
- A minimum degree of privacy between individual persons and against undue disturbance by external factors

[20] Basic logistics items would include rope, shovels, adhesive tape, measuring tape, foldable chair and table, scissors and basic tools, etc.

[21] A power supply kit would include a battery, battery charger, extension cables, multi-plugs, a stabilizer and a converter, etc.

- Separate gender accommodation
- Adequate sanitary conveniences
- Common dining rooms, canteens, rest and recreation rooms and health facilities, where not otherwise available in the community
- Facilities to wash and dry clothes
- Basic cooking utensils, stove, microwaves and fridge
- Basic cutlery and crockery for the number of occupants
- Sheets and pillow slips
- Pillows, blankets
- Bath towels and tea towels.

Some interventions, particularly responses to highly contagious diseases, may require confined living quarters. These are based on infection control principles, and guarantee a safe haven where workers can relax. Setting them up involves creating a closed area where you control everyone and everything that comes in and goes out: housing staff, visitors, food, water and waste. Anything coming into this safe zone is decontaminated on entry. Housing staff are equipped with washing and cooking facilities, and they receive a work uniform that doesn't leave the compound. There are no deliveries inside the compound.

10.4 Warehouse staff

Managing supplies and their storage is complex, and requires a manager who can maintain an overview and direct staff effectively. Depending on the volume of stocks passing through the warehouse, the manager may need assistants. The key point,

though, is to prevent several people from having the same level of authority, since this causes confusion in the management of the supplies, making it hard to determine who is responsible when problems arise.

Warehouse operation also requires a team to maintain the facility and handle the supplies, e.g. offloading, loading, classification and moving items, etc.). These tasks are not highly specialized and can be done by relief personnel and local staff. However, staff must still receive basic training to do their job, and it is important that those trained are retained so that resources are not wasted.

It is also necessary to hire security personnel to guard the supplies and to control the arrival of unauthorized parties.

To ensure that everyone performs their jobs as intended, all staff members must receive a written job description with clear instructions about their functions and duties.

11. Supply chain information management, tracking and coordination

With thanks to the World Food Programme.

The International Organization of Standardization defines supply chain tracking as the "ability to trace the history, application or location" of an item.[22]

To track everything about an item would require a very complex and costly software system; therefore the "breadth, depth and precision" of what is tracked needs to be determined by each organization.

- Breadth refers to the amount of data collected;
- Depth is how far back and forward in the supply chain the item is tracked; and
- Precision is the degree of accuracy to which the movement of the item is recorded.

One of the main reasons for tracking the supply chain is improved supply chain management. It allows the supply chain's performance to be measured and improved, potentially revealing opportunities to reduce supply chain costs.

It also facilitates safety and quality control. The pharmaceutical and food industries are good examples of where tracking the supply chain is critical. Tracking provides an audit trail, which is a legal requirement. In the case of suspected or actual product contamination, the audit trail is used to identify the source, and enables product recalls or withdrawals.

[22] The International Organization of Standardization is at: http://www.iso.org/iso/home.

An information system for use in an emergency situation is made up of four elements:

- **tracking of beneficiaries' needs,** which is reconciled with donations;
- **procurement of supplies** required in the field of operations;
- **tracking of supplies** through the supply chain; and
- **reporting**.

It is often said that logistics is the most important element of a disaster relief project and that information systems are the single most important factor in determining the success of an emergency logistics operation. Effective emergency relief requires an information system that fully supports all aspects of the supply chain.

While emergency and non-emergency supply chains are largely based on the same principles, there are several important differences. The main ones are: infrastructure; unpredictability, due to the emergency; and, in some instances, ongoing conflict.

Most humanitarian emergencies occur in developing countries, which have less infrastructure than developed countries. If the emergency is caused by a natural disaster or conflict then, very often, much of the infrastructure that did exist will been damaged or destroyed. Major components of the country's transport infrastructure — ports, airports and roads — may be out of commission.

In emergency situations, it is hard to predict either demand for relief supplies or the duration of the relief effort. Forecasting the quantities and types of goods needed is difficult and is subject to change. Without knowing how long an emergency may persist, and particularly in the case of conflicts, it is not easy to determine the value of enhancing infrastructure in the supply chain.

Other differences between emergency and non-emergency supply chains are:

- the logisticians running emergency supply chains come from varied backgrounds and are usually not professional logisticians; and

- the goods in an emergency supply chain are more varied in type and size than in a commercial supply chain, and this adds to the complexity of handling and storage in warehouses.

Because of these differences, commercial tracking systems do not have all the necessary functionality for emergency supply chain management. For instance, most commercial systems assume that users will have constant network connectivity. But in humanitarian disasters, the region's communications infrastructure may have been damaged or destroyed, rendering such a system useless.

Humanitarian agencies, therefore, require information systems specifically designed for emergency relief.

Their users fall into two categories:

- staff working in the region of the emergency (field workers); or
- managers at the organization's headquarters.

These two types of users have very different needs from a tracking system. The field workers need the system to support their logistics processes for the day-to-day operation of emergency relief. Staff at headquarters need reports and financial data for planning and reporting to donors or management.

11.1 Relief Item Tracking Application (RITA)

In 2009, WFP launched the RITA project. Its objective was to develop a standard tool that, during emergency response operations, would support the tracking of transport and transit-storage logistics services provided by the Logistics Cluster to other humanitarian organizations. Until then, tracking had been done using locally implemented spreadsheets. The project centred around creating a centralized

database to replace them, allowing consistent, operation-wide accounting of cargo being handled by the Logistics Cluster on behalf of third parties.

RITA was designed to be flexible. It supports a variety of configurations and different implementation models, ensuring adaptability for a wide range of operational contexts.

It is built on a consignment-tracking principle. Commonly used by commercial couriers, consignment-based solutions allow for differentiation between cargo based on a specific request. Just as FedEx, DHL and UPS need to keep track of consignments for numerous clients, all over the world, the Logistics Cluster need to keep track of logistics services provided to multiple, independent organizations — simultaneously, and across a range of locations.

RITA was designed to be functional in emergency response contexts where urgent delivery of goods is a high priority, information is not readily available, and poor communication is common. Therefore, the information required to make a request is kept to a minimum, and is defined by what information is absolutely necessary to clearly describe and monitor the logistics service.

RITA has proved its worth in emergency response. Efforts are currently underway to develop a refined tracking tool that can be used in both pandemic response and other emergencies.

12. Waste Disposal

Wit thanks to Médecins Sans Frontières.

Safe disposal of medical waste is one of the main pillars of infection control, and is critical to pandemic containment.

The objective of medical waste management is to render all waste non-infectious and/or inaccessible. The specialists in this area are our WASH colleagues.

This chapter provides general information on medical waste management. You should also check WHO's Healthcare Waste Management website, and their factsheet on medical waste. [23],[24]

Be aware, however, that no amount of reading will turn you into a WASH specialist! Handling medical waste is extremely risky, and requires extensive training, protective clothing, proper equipment and disposal facilities, and medical support in case of accidents.

If you have to deal with medical waste, please consult WASH.

[23] WHO's Healthcare Waste Management site is at: https://www.healthcare-waste.org/basics/overview.

[24] WHO's fact sheet on medical waste is at: http://www.who.int/mediacentre/factsheets/fs253/en/.

12.1 Types of waste

Of all waste generated by healthcare activities, about 85 percent is general, non-hazardous waste that is comparable to domestic waste. The remaining 15 percent is considered hazardous material that may be infectious, toxic or radioactive.

Waste and by-products come from a range of materials. They include the following:

- **Infectious waste**: waste contaminated with blood and other bodily fluids (e.g. from discarded diagnostic samples); cultures and stocks of infectious agents from laboratory work, including autopsies; and discarded medical consumables and disposable medical devices that have been used on patients with infectious diseases.

- **Pathological waste**: human tissues, organs, fluids or body parts; and contaminated animal carcasses.

- **Sharps**: syringes, needles, and disposable scalpels and blades.

- **Chemicals**: solvents used for laboratory preparations; disinfectants; heavy metals contained in batteries and in medical devices (e.g. mercury in broken thermometers).

- **Pharmaceuticals**: expired, unused or contaminated drugs and vaccines.

- **Genotoxic waste**: highly hazardous, mutagenic, teratogenic or carcinogenic compounds, such as cytotoxic drugs used in cancer treatment, and their metabolites.

- Radioactive waste: products contaminated by radionuclides, including radioactive diagnostic material or radiotherapeutic materials.

- **Non-hazardous or general waste**: waste that does not pose any particular biological, chemical, radioactive or physical hazard.

Healthcare services in high income countries generate, on average, up to 0.5 kg of hazardous waste per bed per day. In low-income countries they generate, on average, 0.2 kg per day.

However, the latter figure may be misleading because in low income countries, hazardous and non-hazardous healthcare waste is often not separated. Waste that was previously non-hazardous may become hazardous through contamination. Assume, therefore, that all mixed healthcare waste is hazardous.

12.2 Providing appropriate toilet facilities, and disposing of excreta

1. Ratio of people per toilet

The recommended ratio is one toilet per 20 people. This should be used as a planning guideline.

2. Local technical and financial conditions

If there is sufficient and reliable piped water available and there is a connection to a sewer system or a functioning septic tank and drainage system, flush toilets may be appropriate, depending on the materials used for anal cleansing. In other situations, latrines (dry or pour flush types) are appropriate. Care must be taken when planning the location of latrines to avoid contaminating groundwater and the risk of flooding.

3. Social and cultural considerations

Toilets should be designed and equipped to respond to cultural identities (e.g. anal cleansing with water, cleansing with toilet paper, etc.).

In most cases, separate toilets are required for men and women, and separate toilets should be provided for staff and patients. They should be clearly marked to help users find them.

Special children's toilets should be provided where many children use the healthcare facility.

4. Accessibility of toilets

It is essential to consider the time and effort required to reach the toilets. In multi-story buildings, there should be toilets available on all floors, and routes used to reach toilets should be smooth and flat to enable easy access for people in wheelchairs.

Signs providing directions to toilets should be clearly displayed at a height that can be easily seen by both ambulatory patients and wheelchair users. Other types of signage, such as high contrast or tactile signs and audio cues, will assist people with visual or hearing impairment.

5. Designing toilets for people who are disabled or infirm

Patient toilets should be equipped to make them easy to use for people with disabilities, pregnant women, elderly people and people who are sick.

Note that a proportion of patients of all ages, particularly people with disabilities and those severely weakened by illness, may not be able to use a toilet. Instead, they may use continence aids, such as diapers, that need to be changed. For this they may need to lie down while a carer changes and cleanses them. Their health and safety and the carer's must be considered.

When designing toilet facilities for use by people with disabilities, ensure that the rooms or cubicles are:

- large and specifically designed and equipped for use by people with disabilities, including wheelchair users;
- spacious enough to allow the user to be assisted;
- equipped with a hygienic bench onto which the user can be easily transferred and positioned comfortably while they are changed and cleansed;
- equipped with soap, water and disposable towels (and lined, pedal-operated bins with lids) so that hands and soiled parts of the body can be washed and dried, and urine scalds and urinary tract infections can be prevented;
- fitted with an emergency call button so that the user or assistant can summon help; and
- closed so that they are private.

The Changing Places Consortium has developed a guideline for optimal design of toilet facilities for people with disabilities. Although this is geared towards public buildings in developed countries, the principles are universally relevant. Their guideline includes detailed scale drawings of floor plans that will help inform the design of equivalents in the field.[25]

If you are unsure as to how best to go about providing suitable facilities consult with humanitarian agencies specializing in assisting people with

[25] Changing Places Consortium's guideline on designing accessible toilet facilities is at: http://www.changing-places.org/LinkClick.aspx?fileticket=YEDKVYyX8TE=&tabid=38.

disabilities in emergency and development contexts. These include Handicap International and Mobility International USA.[26],[27]

Also, read guidelines and reports about accessibility in emergencies and the general requirements of people with disabilities, such as Handicap International's *Accessibility for All in an Emergency Context and Disability in Humanitarian Contexts* and their more recent study of *Disability in Humanitarian Contexts*.[28],[29]

6. Hygiene and safety concerns

Toilets should be designed, built and maintained so that they are hygienic and acceptable to use, and do not become centres for disease transmission. This includes measures to control fly and mosquito breeding, and putting in place a regular, monitored cleaning schedule.

To minimize the risk of violence, including sexual violence, toilets should be carefully located, and should be lockable from inside by the user (for protection from intruders). Toilets and their access routes should be well lit at night.

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[26] Handicap International are at: https://www.handicap-international.org.uk/.

[27] Mobility International are at: http://www.miusa.org/resource/tipsheet/humanitarian.

[28] Handicap International's 2009 guide *Accessibility for All in an Emergency Context and Disability in Humanitarian Contexts* is at: http://www.humanitarianlibrary.org/sites/default/files/2014/02/Guidelines-for-Accessibility-in-Emergencies-HI.pdf.

[29] Handicap International's 2015 study *Disability in Humanitarian Contexts: Views from Affected people and Field Organisations* is at http://www.un.org/disabilities/documents/WHS/Disability-in-humanitarian-contexts-HI.pdf.

7. Handwashing points

At exit points from all toilets, water points with soap and adequate drainage should be provided and their use should be encouraged.

8. Cleaning and maintenance

Toilet facilities should be cleaned whenever they are dirty, and at least twice every day, with a disinfectant used on all exposed surfaces and a brush to remove visible soiling. Strong disinfectants should not be used in large quantities, as this is unnecessary, expensive, potentially dangerous and may affect the biodegradation process. If no disinfectant is available, plain cold water should be used.

In specific contexts (e.g. isolation for cholera patients), a 2 percent active chlorine solution should be used to disinfect faeces or vomit. Usually the chlorine solution is already contained in the container that will receive the faeces or vomit from the patients in bed.

12.3 Disposing of waste water

1. Waste water drainage systems

There are two types of waste water for which drainage needs to be provided: grey water from washbasins, showers and sinks; and black water from flushing toilets. They should be removed in standard waste drainage systems to an off-site sewer or to an on-site disposal system.

Note that all open wastewater drainage systems should be covered, to avoid the risks of disease vector breeding and contamination from direct exposure.

Small quantities of infectious liquid waste (e.g. blood or body fluids) may be poured into sinks or toilets. Most pathogens are inactivated by a combination of time, dilution and the presence of disinfectants in the wastewater.

However, toxic waste (e.g. reagents from a laboratory) should be treated as healthcare waste. It must not be poured into sinks or toilets that drain into the wastewater system.

2. Prevention of environmental contamination

The most appropriate waste water disposal option is connecting the healthcare setting to a properly built and functioning sewer system, which is, in turn, connected to an adequate treatment plant.

If the sewer does not lead to a treatment facility, an on-site retention system with treatment will be necessary before wastewater is discharged.

In situations where waste water must be disposed of on site, the following guidelines apply.

- Grey water should be disposed of via soakaway pits or infiltration trenches. These should be equipped with grease traps which should be checked weekly and cleaned, if needed, to ensure the systems operate correctly. Pits or trenches should not overflow into the healthcare setting grounds or surroundings, nor should they create insect or rodent breeding sites.

- Black water should be disposed of in a septic tank, with the effluent discharged into a soakaway pit or infiltration trench.

- Grey and black water may be treated in the same septic tank and soakaway system, although this requires a larger septic tank than one used for black water alone.

- All systems that infiltrate wastewater into the ground should be sited so as to avoid contaminating groundwater. There should be at least 1.5 metres between the bottom of the infiltration system and the groundwater table (more in coarse sands, gravels and fissured formations), and the system should be at least 30 metres from any groundwater source.

- If the healthcare setting has a septic tank, the sludge from the tank should not be used for agricultural purposes. Instead, it should be buried following safe procedures.

3. Rainwater and surface run-off

Rainwater and surface run-off may be drained and disposed of separately if the system in place for wastewater cannot cope with additional water from sudden heavy rains or rainwater and surface run-off. In that case, it must be managed in a way that does not carry contamination from the healthcare setting to the outside surrounding. Correct, separate drainage of rainwater is particularly important for settings such as cholera treatment centres where there is a high prevalence of enteric pathogens that might be washed out of the isolation area into the local environment.

12.4 Disposing of healthcare waste

1. Segregation of waste

Healthcare workers should segregate waste into four categories, each of which should be stored, collected and disposed of separately. The four categories are:

- sharps waste (needles and scalpels, etc.), which may or may not be infectious;

- non-sharps infectious waste (anatomical waste, pathological waste, dressings, used syringes, and used single-use gloves, etc.);
- non-sharps non-infectious waste (paper and packaging, etc.); and
- hazardous waste (expired drugs, laboratory reagents, radioactive waste and insecticides, etc.).

2. Storage and collection

Suitable containers will need to be provided so that waste can be segregated at source and then safely collected and disposed of.

- Sharps should be placed immediately after use in yellow puncture-proof, covered safe sharps containers, which are regularly collected for disposal. Containers must not be filled above the line indicated on the label, and they must be sealed using the integrated safety lock prior to disposal.

Figure 23. Sharps bin

Sharps bins are colour-coded for separate disposal of different types of contaminant.

- Non-sharps infectious waste should be placed in yellow or red infectious waste bags or containers (15–40-litre capacity with lids). Bags should be collected and replaced after each intervention or twice daily. Containers should be emptied, cleaned and disinfected after each intervention or twice daily.

- Non-sharps non-infectious waste should be placed in black waste containers (20–60 litre capacity). The containers should be collected, emptied, cleaned and replaced daily; alternatively, plastic bags may be used as liners inside the containers.

For each of these three waste categories, it is recommended that waste containers are sited no more than 5 metres from the point of waste generation. Two sets should be provided for each location, for a minimum of three types of waste. On hospital wards, at least one set of waste containers should be provided per 20 beds.

- Hazardous waste should be collected and stored in appropriate and labelled containers placed in secure location. Radioactive waste should be stored in containers that prevent dispersion, behind lead shielding.

3. Treatment and disposal

- Sharps should be disposed of in a sharps pit. In small health centres or emergency structures, sharps pits may simply be buried drums; in other settings, they might be concrete-lined pits.

  For safety reasons, it is not advisable to use a decentralized facility to handle collection and off-site treatment and disposal. However, in urban situations this may be unavoidable due to lack of space.

- In small healthcare settings, non-sharps infectious waste should be buried in a pit fitted with a sealed cover and ventilation pipe for on-site

treatment. Alternatively, it should be high-temperature incinerated or steam sterilized either on-site or off-site.

Special arrangements may be needed to dispose of placentas according to local custom.

The preferred option for specific infectious waste (such as blood samples, plastic syringes and laboratory tests) is steam sterilization before disposal. This avoids environmental pollution from incineration. One autoclave should be dedicated for waste sterilization. The autoclave used for sterilizing medical devices within the laboratory must not be used for this purpose.

- Non-sharps non-infectious waste should be buried in a pit, a landfill site, or preferably recycled with non-food and non-medical items. If space is limited, non-sharps non-infectious waste should be incinerated. Ashes and residues should be buried in a pit.

- There are several kinds of hazardous waste and each requires specific treatment and disposal methods. These include encapsulation, sterilization, burial, incineration and long-term storage. Some waste, such as pharmaceutical waste, cannot be disposed of in low-cost settings and should be sent to a large centre for destruction or returned to the supplier. In all cases, national regulations should be followed.

4. Waste disposal zone

The waste disposal zone should be fenced off and should be located at least 30 metres from groundwater sources. It should have a water point with soap or detergent and disinfectant for hand-washing or to clean and disinfect containers, and it should have facilities for wastewater disposal into a soakaway system or sewer.

Where an incinerator is used, it should be located to allow effective operation with minimal local air pollution in the health centre, nearby housing and crops, and it should be large enough for extension if new pits or other facilities have to be built.

13. Logistician's checklist

With thanks to the World Food Programme.

Actions and decisions taken in the first phase of an emergency will lay the foundation for an effective emergency response. The following checklist describes essential activities that must be undertaken by logistics staff responding to an outbreak.[30]

The checklist also includes information gathering activities for which you need to liaise with other units in your or other organizations. Please note that the list is not exhaustive.

[30] This checklist is based on WFP's *Emergency Preparedness and Response Package* and WHO/PAHO's *Field Manual*.

Table 3. Checklist for logisticians responding to an outbreak

Timing	Task
Pre-departure	**Review existing LCAs** and logistics information for the country to which you are deploying; identify potential logistics bottlenecks and gaps.
	Establish contact with other key responders – e.g. UN agencies, humanitarian organizations, any in-country contacts.
	Review relevant **guidance** documents **on the disease**, e.g. from WHO and CDC.
	Review disease-specific information and **maps** of the **current outbreak** (where available).
Within first 72 hours	*Liaise with medical team* to obtain **current outbreak data**, and learn about the epidemiology of the disease and its transmission mode.
	Liaise with programme team to obtain information on **targeted number of beneficiaries** and **planned areas of intervention**.
	Liaise with financial team to determine the **budget available** for procurement and logistics.
	Liaise with security team to obtain information on the **security situation** and access to the intervention areas, including changes in security clearance requirements.
	Determine the **type and quantity of relief items** needed for both the initial weeks and subsequent months of this outbreak, guided by your *programme colleagues* as well as WHO OPALS estimates, where available.
	If **prioritization** of relief items is necessary, obtain guidance from the *medical team*.
	Work with procurement team to learn about potential **sources of supply** — commercial vendors and strategic reserves, etc. — in order to identify likely **up-stream supply routes** and most suitable staging areas.
	Assess the need for **air support**.

Timing	Task
	Draft **Logistics CONOPS** based on estimated supplies arriving in airports and ports, local sourcing, downstream supply route, handling, warehousing and transport options.
	Dispatch **logistics assessment** team(s) to assess logistics conditions in affected areas and relevant supply routes.
	Evaluate the possible impact of **quarantine regulations** on upcoming operations, and develop backup plans.
	Work with ICT team to ensure essential **ICT equipment** is available for use in logistics operations.
	Work with financial team to develop a plan if **local banks** are not functioning.
	Work with security team to identify **security measures** that may be required for the logistics operation, including contingency plans for evacuation/relocation.
	Establish contact with **customs officers**; review customs procedures for humanitarian goods.
	Participate in an **inter-agency logistics coordination** meeting (or cluster meeting, if activated) to: • review the logistics requirements; • share information on logistics gaps and bottlenecks; and • collaborate to ensure that logistics efforts of all intervening humanitarian organizations are coordinated.
	Mobilize and **contract** transport and storage arrangements.
	Mobilize **logistics support equipment** (MSU, prefabs, pallets…), and acquire fuel for transportation.
	Establish protocols and ensure capacities for sharing and managing **supply chain information.**

Annexes: Response

Annex R-1. More key terms used in infectious disease outbreaks

'*More* key terms,' did we hear you groan? We do understand that learning medical terminology is hard work. But, once you're familiar with these terms and concepts, you'll be much better equipped to communicate with medical colleagues — and that will make your job much easier.

1. The usual suspects

We'll start gently with some revision on the two most well-known types of microbe.

Bacteria

Bacteria are **single celled microbes**. Unlike the cells of other, more complex organisms, bacterial cells contain neither a nucleus nor membrane-bound organelles. Instead, their genetic information, i.e. their control centre, is contained in a **single loop of DNA**. Many bacterial cells also contain plasmids, which are additional circles of genetic material. While not usually essential to the bacterium's basic survival, plasmids often contain genes that give the bacterium some advantage over other bacteria. Plasmids may also carry antibiotic resistance genes.[31],[32]

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[31] Microbiology Online. Online at: http://microbiologyonline.org/about-microbiology/introducing-microbes/bacteria.

[32] Bennett, P. M. (2008). Plasmid encoded antibiotic resistance: acquisition and transfer of antibiotic resistance genes in bacteria. *British Journal of Pharmacology*, 153(Suppl 1), S347–S357. http://doi.org/10.1038/sj.bjp.070760

The human body contains ten times more bacterial cells than human ones: we give them nutrients and provide a conducive environment, and they help us in numerous ways, including warding off infection by other species or strains of bacteria. Within particular species of bacteria, some strains are extremely beneficial, while others may cause potentially deadly disease. *Escherichia coli* (*E. coli*) is a good example: benign strains that live in our gut are essential to our wellbeing; however, particular pathogenic strains can cause gastroenteritis and neonatal meningitis, and are responsible for about 90 percent all urinary tract infections.

Figure 24. *E. coli* bacteria

Illustration of a group of Escherichia coli (E. coli) *bacteria, based on electron micrographs. (Source: Centers for Disease Control/James Archer. Illustrators: Alissa Eckert and Jennifer Oosthuizen)*

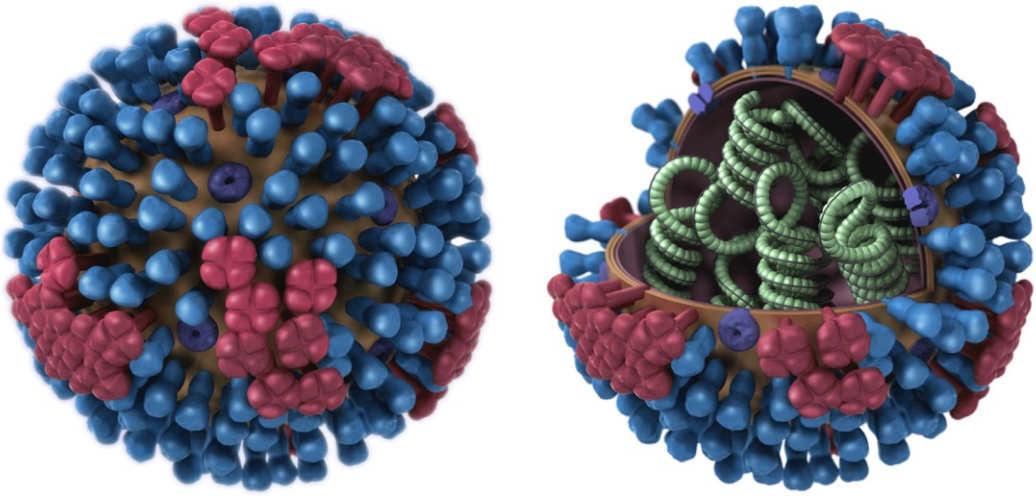
Viruses

Viruses are the smallest of all the microbes. They are said to be so small that 500 million rhinoviruses (which cause the common cold) could fit on to the head of a pin.

Viruses are not cells. They are made up of a core of genetic material, either DNA or RNA, that is surrounded a capsid, which is a protective coat, usually made of protein. Some have an additional outer coat called an envelope that may be covered in protein spikes or knobs.

Viruses are obligate parasites: in order to multiply, they must insert themselves into host cells and harness the cells' replication functions for their own ends. Outside the host cell they are harmless; once inside, most either damage or kill the cell, which is how they cause disease.[33],[34]

Figure 25. Representation of a generic influenza virus



Source: Centers for Disease Control and Prevention.

[33] Microbiology Online: http://microbiologyonline.org/about-microbiology/introducing-microbes/viruses.

[34] Gelderblom, H.R. (1996) Structure and Classification of Viruses. In: Baron, S. (Ed.) *Medical Microbiology. 4th Edition*. Chapter 41. Galveston (TX): University of Texas Medical Branch at Galveston. https://www.ncbi.nlm.nih.gov/books/NBK8174/.

2. Definitions

Infection

An infection is the invasion of and multiplication within an organism by microorganisms (such as bacteria, viruses, parasites and fungi) that are not normally present within that organism.[35]

Infectious disease

An infectious disease, also known as transmissible disease or communicable disease, is illness resulting from an infection. Infectious diseases are caused by pathogenic microorganisms, such as bacteria, viruses, parasites or fungi; the diseases can be spread, directly or indirectly, from one person to another. Zoonotic diseases are infectious diseases of non-human animals that can cause disease when transmitted to humans. (Similarly, some infectious diseases of humans can be transmitted to other animals.)[36]

Endemic disease

The baseline or endemic level of a disease is the level at which a particular disease is observed to be present in a community under normal circumstances. Note that this level is not global and it may change. For example, dengue, which is spread by mosquitos, was endemic in only 9 countries prior to 1970; now, it is endemic in more than 100 countries but is not present at all in others. Where it is not present, the baseline level is zero.

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35 MedicineNet.com: http://www.medicinenet.com/script/main/art.asp?articlekey=12923

36 WHO: http://www.who.int/topics/infectious_diseases/en/

Where a disease is endemic, in the absence of intervention — and assuming that the baseline level is not high enough to deplete the pool of susceptible persons — the disease may continue to occur at this level indefinitely. However, epidemics may occur, causing many more cases than expected. If a disease outbreak occurs in a community where the baseline level was zero, the people in that community will be especially vulnerable, having no immunity to the disease.[37],[38]

Outbreak / epidemic / pandemic

Occasionally, the amount of disease in a community rises above the expected level. Epidemic refers to an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area (e.g. the 2002-2003 SARS outbreak, and the 2014-2016 Ebola outbreak). Outbreak carries the same definition as epidemic, but is often used for a more limited geographic area. Pandemic refers to an epidemic that has spread over several countries or continents, usually affecting a large number of people (e.g. the 2009 H1N1 flu pandemic).[39]

3. Epidemic and pandemic diseases

WHO's Department of Pandemic and Epidemic Diseases (PED) promotes strategies and initiatives for priority emerging and re-emerging epidemic diseases.[40] Their work currently focuses on the following diseases:

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37 CDC. *Introduction to epidemiology: 1, 11, Epidemic Disease Occurrence*. Online at: http://www.cdc.gov/ophss/csels/dsepd/SS1978/Lesson1/Section11.html.

38 WHO (2017) *Dengue and severe dengue factsheet*. Online at: http://www.who.int/mediacentre/factsheets/fs117/en/.

39 CDC, ibid.

40 WHO Department of Pandemic and Epidemic Diseases: http://www.who.int/csr/disease/en/.

- **Airborne diseases**

  Influenza (seasonal, pandemic, avian), severe acute respiratory syndrome (SARS), Middle East respiratory syndrome coronavirus (MERS-CoV)

- **Airborne and salivary**

  Epidemic meningitis (meningococcal meningitis)

- **Vector-borne diseases**

  Yellow fever, Chikungunya, Zika fever, West Nile fever

- **Water-borne diseases**

  Cholera, Shigellosis, Typhoid fever

- **Rodent-borne diseases**

  Plague, Leptospirosis, Hantavirus, Lassa fever

- **Haemorrhagic fevers**

  Ebola virus disease, Marburg virus disease, Crimean-Congo haemorrhagic fever, Rift Valley fever

- **Other zoonotic diseases**

  Nipah virus infection, Hendra virus infection, human monkeypox

- **Eradicated, but the virus still exists as research samples**

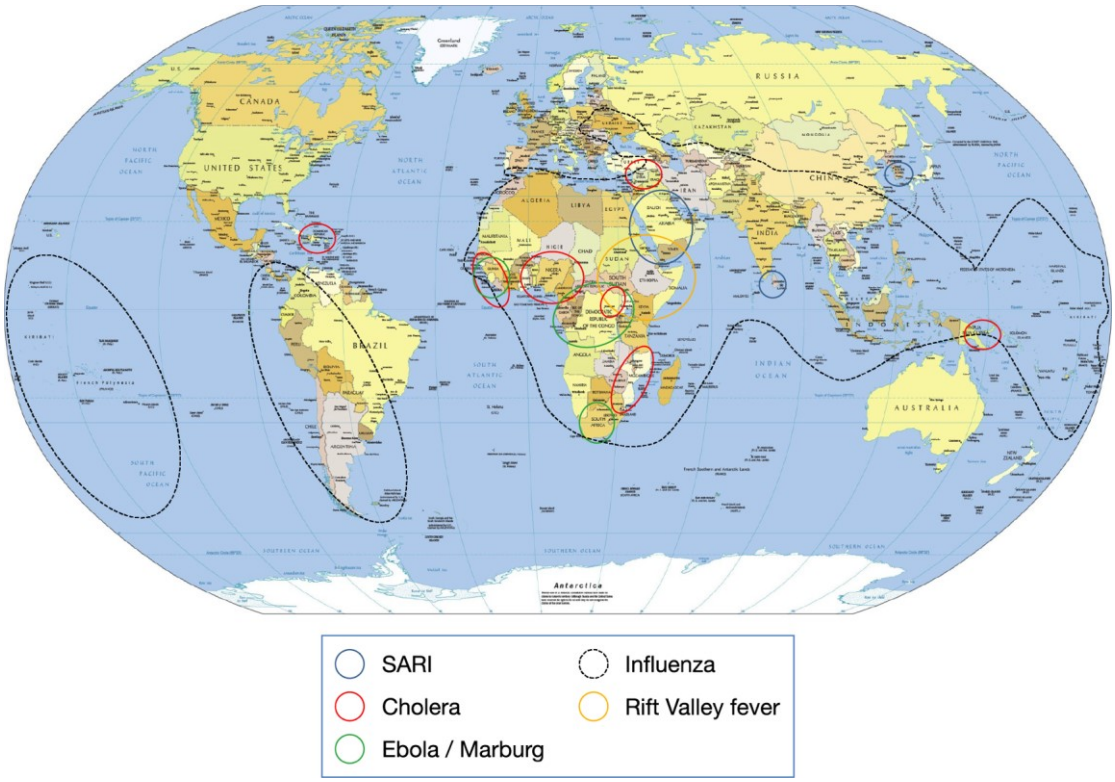
  Smallpox (variola major)

4. Epidemic/pandemic operational planning focus areas

Knowing about the characteristics and histories of existing pandemic diseases, particularly the risk factors for transmission, the locations of previous outbreaks and populations' current vulnerabilities, can be very useful to agencies potentially involved in future responses. It allows them to develop a more strategic approach at an organizational level to pandemic preparedness and response.

The following sketch map, from 2016, shows how such information might be visualized to inform planning.

Figure 26. Sketch map of operational planning focus areas for six diseases

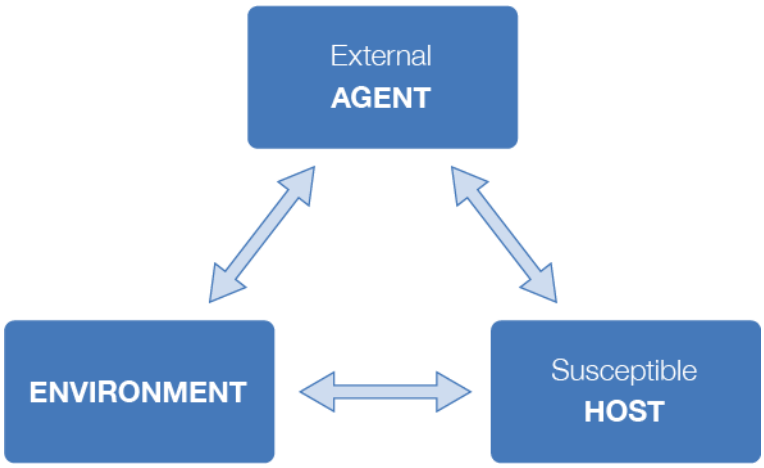


Source: WHO. Note: the map does not represent an exhaustive, accurate distribution of risks. Priority areas have been chosen based on vulnerable settings (IDPs, refugees), the Pandemic Influenza Preparedness (PIP) priority countries, and low immunity and vulnerability profiles. This attempt at mapping is made for logistics and stock planning purposes only. Not to be reprinted or redistributed.

5. Important variables in outbreaks

At its simplest, epidemic theory considers three variables.

Figure 27. The epidemiologic triad



The triad consists of an external **agent**, a susceptible **host** and an **environment** that brings the host and agent together. Different diseases require different balances and interactions of these three components.

Agent

The term agent refers to an infectious microorganism or pathogen: a virus, bacterium, parasite, or other microbe. Generally, the agent must be present for disease to occur; however, presence of that agent alone is not always sufficient to cause disease. A variety of factors influence whether exposure to an organism will result in disease, including the organism's pathogenicity (ability to cause disease), dose, and the host's immune response. An agent will not automatically cause an infection; however, it may do if conditions are favourable.

Host

A host is an organism (for our purposes, a human) that can be infected by the agent. A variety of factors intrinsic to the host can influence an individual's exposure, susceptibility, or response to a causative agent. Susceptibility to a specific agent will depend on one or more variable. Such variables may include, but are not limited to:

- Age, gender and/or occupation
- Vulnerable settings (IDPs, refugees)
- High risk groups (e.g. Zika — pregnant women)
- Immunity (cholera Haiti — prior to 2010, no cholera for 60 years)

Certain agents, such as the human immunodeficiency virus (HIV), create susceptibility in the host to other agents, i.e. opportunistic infections.

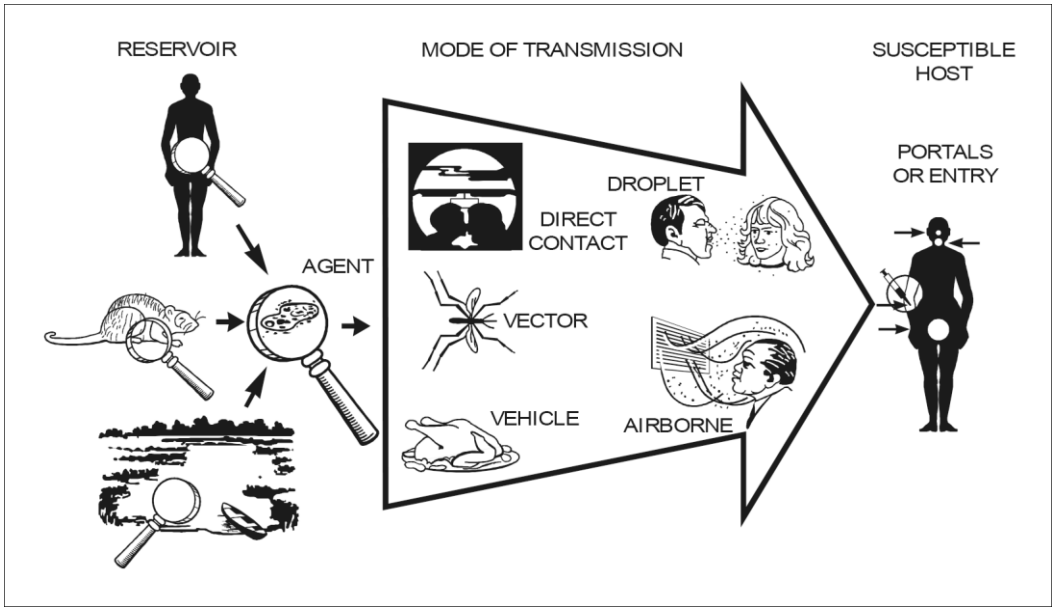
Environment

Environment refers to extrinsic factors that affect the agent and the opportunity for exposure. Environmental factors include: physical factors, such as geology and climate; biologic factors, such as insects that transmit the agent; and socio-economic factors, such as crowding, sanitation, and the availability of health services.

6. Chain of infection

Bearing in mind the epidemiologic triad model, let's revisit the diagram we looked at in Chapter 2 (Pre-departure briefing, Figure 1) and which is printed again below. Understanding the chain of infection is crucial to bringing infectious disease outbreaks under control. Containment of infectious diseases depends on breaking the chain, and your contribution as a logistician will be vital to that effort.

Figure 28. Chain of infection/transmission



Dicker, R.C. (1992) Principles of Epidemiology, 2nd Edition, *p.45. Atlanta, U.S. Department of Health and Human Services, Centers for Disease Control.*

An infectious agent may be transmitted from its natural reservoir to a susceptible host in different ways. There are different classifications for modes of transmission. Here is one classification:

- **Direct**
  - Direct contact
  - Droplet spread

- **Indirect**
  - Airborne
  - Vehicle borne
  - Vector borne (mechanical or biologic)

Direct transmission

In direct transmission, an infectious agent is transferred from a reservoir to a susceptible host by direct contact or droplet spread.

Direct contact

This refers to skin-to-skin contact, kissing, and sexual intercourse. Direct contact also refers to contact with soil or vegetation harbouring infectious organisms. For example, infectious mononucleosis ("kissing disease", "glandular fever") — which is caused by Epstein Barr virus — and gonorrhoea — caused by *Neisseria gonorrhoeae* bacteria — are spread by direct contact between people. Hookworm, caused by two species of parasitic roundworm, is spread by direct contact with contaminated soil.

Droplet spread

Droplet spread refers to spray with relatively large, short-range aerosols produced by sneezing, coughing, or even talking. Droplet spread is classified as direct because transmission is by direct spray over a few feet, before the droplets fall to the ground. Pertussis ("whooping cough"), caused by *Bordetella pertussis* bacteria, and meningococcal infection, caused by *Neisseria meningitides* bacteria, are examples of diseases transmitted from an infected host to a susceptible host by droplet spread.

Indirect transmission

Indirect transmission refers to the transfer to a host of an infectious agent from a reservoir. A reservoir may be particles of the infectious agent that have:

- been emitted from an infected host and become suspended in the air;
- settled on inanimate objects (vehicles of transmission); or
- been taken up by animate intermediaries (vectors) and then emitted.

Airborne

Airborne transmission occurs when infectious agents are carried by dust or droplet nuclei suspended in air. Airborne dust includes:

- Airborne dust includes: material that has settled on surfaces and become re-suspended by air currents; and infectious particles blown from the soil by the wind.

- Droplet nuclei are dried residue of less than 5 microns in size. In contrast to droplets that fall to the ground within a few feet, droplet nuclei may remain suspended in the air for long periods of time and may be blown over great distances. Measles, for example, has occurred in children who came into a physician's office after a child with measles had left, because the measles virus remained suspended in the air.

Vehicles

Vehicles that may indirectly transmit an infectious agent include food, water, biologic products (blood), and fomites (inanimate objects such as handkerchiefs, bedding, or surgical scalpels).

A vehicle may passively carry a pathogen — for instance, hepatitis A virus or *Vibrio cholerae* bacteria may be carried by food or water.

Alternatively, the vehicle may provide an environment in which the agent grows, multiplies, or produces toxin — as improperly canned foods provide an environment that supports production of botulinum toxin by *Clostridium botulinum* bacteria.

Vectors

Vectors such as mosquitoes, fleas, and ticks may carry an infectious agent through purely mechanical means or may support growth or changes in the agent.

Examples of mechanical transmission are flies carrying *Shigella* on their appendages and fleas carrying *Yersinia pestis*, the causative agent of plague, in their gut.

By contrast, in biologic transmission, the causative agent of malaria or guinea worm disease undergoes maturation in an intermediate host before it can be transmitted to humans.

7. Other terms used in outbreaks of infectious diseases

Mortality

Mortality rate means **death rate** in a specific population over a given time.

Various types of mortality rate are used — infant mortality rate, under-5 mortality rate, and so on. But the one that gives an early warning of an outbreak is **crude mortality rate** because it looks at an entire population. Calculated repeatedly over successive time periods, it identifies the baseline mortality rate for that population under normal circumstances, and if the death rate goes up, it will highlight the increase.

Crude mortality rate is calculated based on two numbers:

- the total number of deaths from all causes in a population during a given period; and

- the total size of the population in which those deaths occurred.

During an acute emergency, that period will be either a day or week. For ease of comparison, the result is expressed in the format "*x* deaths per 10,000 per day" (or "*x* deaths per 10,000 per week", if applicable).

The equation used is:

$$\left(\frac{Number\ of\ deaths}{Total\ population}\right) \times \left(\frac{10{,}000}{Number\ of\ days\ in\ the\ time\ period}\right) = x\ deaths\ per\ 10{,}000\ per\ day$$

A crude mortality rate higher than 1 per 10,000 people per day is considered by WHO to be an emergency.

Note that in all the equations given in this section, the figure of 10,000 may be scaled down or up to, say, 1,000 or 100,000, depending on the convention established by epidemiologists working on the outbreak. Just remember to substitute whichever figure you're using in both the equation and the result.

Morbidity

Morbidity refers to illness, and may be described in terms of:

- **incidence rate**, which is the number of **new cases of a disease** within a given period divided by the number of persons at risk for the disease, i.e.:

$$\left(\frac{Number\ of\ newly\ diagnosed\ cases\ of\ the\ disease}{Number\ of\ persons\ at\ risk\ for\ the\ disease}\right) \times \left(\frac{10{,}000}{Number\ of\ days\ in\ the\ time\ period}\right) = Incidence\ rate\ per\ 10{,}000\ persons\ at\ risk\ per\ day$$

- **prevalence**, which is a snapshot of the **total number of cases** of a disease within a population at a given time, i.e.:

$$\left(\frac{Total\ number\ of\ cases\ of\ the\ disease}{Total\ population}\right) \times 10{,}000$$
$$= Prevalence\ of\ the\ disease\ per\ 10{,}000\ persons$$

Attack rate

An attack rate, or incidence proportion, is defined as **the proportion of those who became ill after a specified exposure** to the infectious disease.

For example, in an outbreak of cholera with 50 cases among a population at risk of 2,500 persons, the attack rate of the disease is 50 ÷ 2,500 = 0.02, which may be expressed as 2 percent, or 20 per 1,000 persons.

Epidemic curve

An epidemic curve (epi curve) is a graph illustrating the **progression of an outbreak over time**. (See Chapter 2, Key terms for infectious disease outbreaks, where epi curves are discussed in detail.)

During an outbreak, an epidemiologist will study the patterns, causes and effects of the disease on the population. Based on observation and on knowledge of other epidemics, he or she will take an educated guess as to the likely course of the outbreak, and will try to identify the point the outbreak has reached. For example: can we expect patient numbers to rise or fall, and how long might the outbreak last? The epidemiologist's forecasts will help intervening actors to plan ahead.

8. Conclusion

To be able to effectively plan any intervention in an outbreak of an infectious disease (outbreak, epidemic or pandemic), it is important to know:

- The timing of the epi curve: where are we on that curve, what can we expect in the future (decline, status quo or increase of ill people);
- The evolution of the epi curve: is it an outbreak with 1 peak or several peaks (when to scale down the operations);
- The transmission mode of the infectious disease; and,
- Linked to the transmission mode, where geographically is the outbreak likely to expand.

So that you can do your job, you must have a basic understanding of the nature of the outbreak and its likely evolution.
You should get this information from a medical counterpart involved in the medical intervention.

9. Additional resources

For the brave or interested among you who would like to know more on these topics, there is an online introductory course from the Centers for Disease Control and Prevention (CDC) called *An Introduction to Applied Epidemiology and Biostatistics* at: http://www.cdc.gov/ophss/csels/dsepd/ss1978/index.html.

London School of Hygiene and Tropical Medicine has published an extensive web resource for non-medics that explains all the concepts and maths involved in epidemiology in conflict zones. It's called *The use of epidemiological tools in conflict-affected populations: open-access educational resources for policy-makers*, and is online at: http://conflict.lshtm.ac.uk/

The websites of the World Health Organization (http://www.who.int/en/) and the Centers for Disease Control and Prevention (http://www.cdc.gov/) are very good sources of information for any outbreak of any disease around the world.

If you still want more, here are some notes on the above-mentioned diseases.

Viral diseases

- **Crimean-Congo haemorrhagic fever (CCHF)** is caused by infection with *Nairovirus*, a tick-borne virus from the family *Bunyaviridae*.

- **Ebola virus disease (EVD)**, formerly known as Ebola haemorrhagic fever, is a severe, often fatal illness in humans. The virus is transmitted to people from wild animals and spreads in the human population through human-to-human transmission.

- **Hantavirus Pulmonary Syndrome (HPS)** occurs in the Americas, is caused by hantaviruses, and can be fatal. Hantaviruses occur worldwide and are transmitted by exposure to rodents' urine, faeces and saliva. They also cause a group of illnesses, collectively called **Haemorrhagic fever with renal syndrome (HFRS)**.

- **Influenza** (the flu) is a contagious respiratory disease caused by flu viruses. It is spread from person to person by coughing or sneezing. It can also be spread by touching contaminated surfaces.

- **Lassa fever** is an acute viral haemorrhagic illness of 2-21 days duration that occurs in West Africa. The Lassa virus is transmitted to humans via contact with food or household items contaminated with rodent urine or faeces.

- **Marburg virus disease** causes severe viral haemorrhagic fever in humans. *Rousettus aegypti*, fruit bats of the *Pteropodidae* family, are considered to be natural hosts of Marburg virus. The precise route of transmission is unknown; however, the most likely route is thought to be exposure to infected bat faeces or aerosols. Once a person is infected they can infect other people directly through close or direct contact.

- **Meningitis** is a disease caused by the inflammation of the protective membranes covering the brain and spinal cord known as the meninges. The inflammation is usually caused by an infection of the fluid surrounding the brain and spinal cord. Meningitis may develop in response to a number of causes, usually bacteria or viruses, but meningitis can also be caused by physical injury, cancer or certain drugs.

- **Monkeypox** is a rare disease that is caused by infection with monkeypox virus.

- **Rift Valley fever (RVF)** is a viral zoonosis that primarily affects animals but also has the capacity to infect humans. It is spread through mosquito bites. Infection can cause severe disease in both animals and humans. The disease also results in significant economic losses due to death and abortion among RVF-infected livestock.

- **Severe acute respiratory syndrome (SARS)** and **Middle East respiratory syndrome (MERS)** are respiratory illnesses, each caused by a virus from the coronavirus family. SARS is caused by SARS-associated coronavirus, and MERS is caused by MERS coronavirus.

- **Smallpox** is an acute contagious disease caused by the *variola* virus.

- The last naturally occurring case of smallpox occurred in 1977 and the disease was declared eradicated in 1980. Research samples of the virus remain in only two locations worldwide.

- Yellow fever, Chikungunya, Zika and West Nile fever are by different viruses, all of which are spread via mosquito bites.

Bacterial diseases

- **Cholera** is an acute diarrhoeal infection caused by ingestion of food or water contaminated with the bacterium *Vibrio cholerae*.

- **Leptospirosis** is a disease that affects humans and animals. Without treatment, Leptospirosis can lead to kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure, respiratory distress, and even death. It is caused by members of the *Leptospira* family of spirochaete bacteria.

- **Plague** is a disease that affects humans and other mammals. It is caused by the bacterium *Yersinia pestis*. In humans, the most common routes of infection are: bites from rodent fleas carrying the bacterium; or handling an animal infected with the bacterium.

- **Shigellosis** is an infectious disease caused by a group of bacteria called *Shigella*.

- **Typhoid fever** is a life-threatening illness caused by the bacterium *Salmonella Typhi*.

Annex R-2. List of critical pandemic relief items

The following list is correct as of July 2017; however, it is subject to change. The Pandemic Supply Chain Network, in coordination with WHO, maintains an up-to-date version on behalf of the humanitarian logistics community.

Table 4. Critical pandemic relief items

Categories and items		Unit of Measurement (UoM)	Weight per UoM (kg)	Volume per UoM (m^3)
	Personal Protective Equipment (PPE)			
1	Examination gloves	Each	0.00792	0.00004
2	Mask, surgical, flat rectangular with folds	Each	0.027	0.00036
3	Surgical N95 respirator	Each	0.02	0.00023
4	Coveralls, fluid-resistant, disposable, with elastic wrists, ankles and hood	Each	0.25	0.0017
5	Hood	Each	0.032	0.00043
6	Gown, disposable, with elastic wrists	Each	0.0688	0.00062
7	Gown, fluid resistant, disposable, with elastic wrists	Each	0.35	0.0025
8	Full face shield	Each	0.05	0.00069
9	Goggles	Each	0.1	0.001
10	Scrubs, tops/pants	Each	0.15	0.0012
11	Aprons, disposable	Each	0.18	0.00033
12	Aprons, heavy-duty, reusable	Each	0.31	0.0004
13	Gloves, heavy-duty	Pair	0.07	0.0003
14	Boots, rubber	Pair	1.04	0.0056
	Disinfection Consumables / Biohazardous Waste Management			
15	Alcohol-based hand rub	Each	0.2	0.00081
16	NaDCC granules (kg)	Kg	1.125	0.0021

Categories and items		Unit of Measurement (UoM)	Weight per UoM (kg)	Volume per UoM (m^3)
17	NaDCC tablets	Tablets	0.0002	0.0000001
18	Set: mask, gel and soap for targeted population — airborne diseases		0.264	0.00126
19	Set: hand gel and soap for targeted population — haemorrhagic fever		0.237	0.00090
20	Bag, disposable for biohazardous waste (PPE and clinical waste without sharps)	Each	0.0143	0.000019
21	Safety box / sharps container (must be labelled “Biohazard”)	Each	0.2752	0.00067
22	Body bags (suitable for burial or cremation)	Each	2.61233	0.00607
23	Incinerators for contaminated wastes	Each	1,225	6.897
	Vector Control			
24	Bed nets		0.4900	0.00190
25	Repellent (individual set)	Each	0.1	0.00024
	Drugs and Medical Consumables			
26	Infusion giving set	Each	0.191	0.00055
27	Syringe: 0.5 ml autodestruct (AD) and 5 ml reuse prevention (RUP)	Each	0.00623	0.00010
28	Antitoxin (BAT — Botulism Antitoxin Heptavalent)			
29	Essential drugs and consumables to support general health facilities *	Each	50	0.174
30	Infusion (Ringer’s lactate — litre)	Litres	1.1821	0.0025
31	Oral Rehydration Salts (ORS)	Litres	0.03138	0.00008
	Health Facilities Infrastructures and Equipment			
32	Essential hospital and medical equipment to support health facilities: Adjustable hospital beds, examination table, foldable stretcher, pulse oximeter, portable isometer, stethoscope, sphygmomanometer *			
33	Cholera beds	Each	17.50	0.04371
34	Medical triage/treatment/isolation facilities			
35	Mobile basic diagnostic X-ray system	Each	192	1.79525
36	Ambulance with air isolation system for transport of contagious patients *	Each	1,942	21.36

	Categories and items	Unit of Measurement (UoM)	Weight per UoM (kg)	Volume per UoM (m^3)
	Temperature-Controlled Supply Chain			
37	Refrigerated containers for cold chain purpose (immunization campaign)	Each	4,600	67.5
	Laboratory Test Equipment and Reagents			
38	ELISA and RT-PCR laboratory equipment and reagents	Each	100	0.4144
39	Packaging transport substance, class 6.2	Each	1	0.0671
40	Rapid diagnostic testing kit for malaria	Each	0.02	0.094
41	Rapid diagnostic test for dengue, chikungunya and Zika *	Each	0.025	0.197
42	Rapid diagnostic test kit for cholera	Each	0.016	0.1015
43	Rapid test for Zaire ebolavirus	Each	0.01	0.0000667
44	Sample collection tubes	Each	0.0045	0.0000519
45	Swabs for buccal sample collection	Each	0.0045	0.0000519
46	Swabs for nasal sample collection	Each	0.0045	0.0000519
	Medical Equipment			
47	Dialysis equipment	Each	100	0.315648
48	Infrared thermometer *	Each	0.485331	0.003873
49	Laryngoscope, adult, child set *	Each	1	0.0018
50	Neonatal/adult intensive-care ventilator *	Each	6.320	0.052
51	Oxygen concentrators *	Each	23	0.1205
52	Oxygen face mask with reservoir bag, disposable *	Each	0.1	0.04838
53	Pulse oximeter, portable *	Each	0.1	0.00221
54	Suction system *	Each	7.55	0.08611
	Water and Sanitation			
55	Water tank truck and/or water trailer for potable water	Each	6,000	68.4878
56	Chemicals: malathion, pyrethroid (Permethrin, Deltamethrin)	Kg	0.5	0.00189
57	Fogging machine	Each	12	0.136
58	Ultra-low volume sprayers	Each	4.2222	0.0624
59	Drinking water quality control module			

Categories and items		Unit of Measurement (UoM)	Weight per UoM (kg)	Volume per UoM (m^3)
60	Sprayer, hand, disinfectant, portable, small	Each	0.733	0.01
61	Sprayer, backpack	Each	4.2222	0.0624
62	Rodent repellent treatment			

** Technical descriptions to be fine-tuned and updated by WHO.*

Annex R-3. Deployment

If you're deployed for an operation linked to an infectious disease, you must think about your own health, and ensure that you're fit to work in such an environment. Here are some preparations you'll need to make, and a few non-health-related practical points.

Health check-ups

- **Medical**: have you had a medical check-up in the last 6 months?
- **Women's health**: do you need to attend for a routine cervical smear or breast check-up?
- **Men's health**: do you need to attend for abdominal aortic aneurism screening or a prostate check?
- **Dental**: have you had a dental check-up in the last 6 months?
- **Eyes**: have you had an eye examination in the last 6 months?

Essential preparations for your own safety

- **Blood group**: in case you need a transfusion, carry a card that clearly states your blood group. If you don't know what it is, ask your family doctor to run a test.

- **Vaccines:**
  - Make sure you've been given all the compulsory vaccinations;

- Check whether you need (and have been given) any other recommended vaccinations for your mission;
- If required, arrange to bring any vaccination updates with you to the mission; and
- Make sure your International Vaccination Certificate (Yellow Card) is in order.

- **Protection against malaria, if applicable**
  - Pack mosquito repellent, and make sure you pack long-sleeved shirts and trousers to wear in the evenings to protect yourself against mosquitoes.
  - Make sure you're prescribed and take antimalarial medication as instructed by your doctor. Antimalarial drugs need to be started before you travel so as to build up protection. Each drug requires a different build-up period — some, days; some, weeks — so double-check and don't leave it too late! Also, if you've never taken antimalarials before, your doctor will probably want you to take a short course in advance in case you experience adverse effects and need to be switched to a different drug.
  - Pack a mosquito bed net.

- **Personal pharmacy**

  Ensure you pack adequate stocks of anything you might need, such as:

  - Hygiene products you routinely use, or are likely to need;
  - Over-the-counter medicines you might need;

  - Your prescription medicines;
  - Cooling bags/cold water-activated travel wallets, if your medication is temperature sensitive;
  - Hand sanitizer;
  - Any other health-related supplies, or spare parts and equipment that you need to maintain or administer them.

- **People with pre-existing medical conditions, pregnant women, and persons leaving on their first mission**
  - Make sure you have a consultation with an Institute of Tropical Medicine, or with a hospital department specializing in infectious diseases.
  - If you have a pre-existing condition, make sure you wear a medical alert dog tag, or similar, with up-to-date information in case you're incapacitated during your mission and need treatment.
- **People with diabetes**

  For information about the medical documentation you'll need to take your treatment supplies on planes, and for a calculator to help you adjust insulin treatment when travelling across time zones, see Diabetes Travel at: http://www.diabetestravel.org. Another useful site is Diabetes UK at: https://www.diabetes.org.uk/travel.

Insurance and travel documentation

- **Health insurance**: ensure that you've received enough information. If you still have questions, ask for clarification.

- **Travel documents**: make sure that you have all the necessary travel documents, such as your passport, visa, invitation letter and your tickets, etc.

Other stuff

- If you really don't know what to expect and you're going to remote areas, these might be useful:
  - Water purifying tablets;
  - Simple eating utensils;
  - Clothing you're not attached to; and
  - An individual tent, groundsheet and sleeping mat.

Annex R-4. CONOPS example

With thanks to the World Food Programme

The following example of a logistics CONOPS document refers to the humanitarian crisis in Yemen. Please note that it pre-dates the cholera epidemic that began in 2016. For information about the subsequent health crisis, please see WHO's sitreps at: http://www.emro.who.int/yem/yemeninfocus/situation-reports.html. *Maps are at:* http://reliefweb.int/country/yem/thumb - content_top.

WFP logistics CONOPS: Yemen crisis

Background

On 22 February 2010, following a ceasefire agreement between the Government and Houthi tribes in the North, the Humanitarian Country Team (HCT) requested the activation of the Logistics Cluster in order to focus on improving the emergency preparedness and response, information sharing, strengthening coordination, and enhancing the humanitarian community's capacity to respond to the growing needs of vulnerable populations in the country.

Since April 2011, the security situation in Yemen has deteriorated substantially nationwide. Yemen has experienced widespread anti-government protests leading to a political stalemate. Parallel to the demonstrations, Yemen is facing an increasingly complex humanitarian crisis. Families displaced by the Sa'adah conflict in the North, and Abyan in the South, as well as refugees from the Horn of Africa, continue to rely on humanitarian assistance. The combined effects of the global food, fuel and financial crises have increased poverty in Yemen and have further exacerbated the vulnerability of a population which is already suffering from high rates of hunger and malnutrition.

Gaps and needs

Given the security situation and humanitarian crisis in Yemen, the scaling up of the humanitarian interventions identified the need to support the movement of life-saving humanitarian cargo from the capital Sana'a to the affected areas. While access to portions of Yemen remains difficult due to limited access to affected areas, pre-positioning of fuel in Haradh and Aden is needed before onward movement to affected regions; this is coupled with the government's inability to provide basic fuel services, due to rising oil prices and challenges faced in oil production.

There is also a need for coordination and information sharing between the various actors in order to mitigate any duplication of efforts and maximize the use of available logistics assets.

The objectives and planned activities

The Logistics Cluster activities aim to provide the humanitarian community with the logistics capabilities and coordination mechanisms to deliver life-saving relief assistance to the populations in Yemen's affected regions. Based on the initial logistics gaps and bottlenecks identified, the activities of the Logistics Cluster include:

1. Logistics Coordination and Information Management

- A Logistics Cluster Coordination cell for Yemen has been established in Sana'a with a dedicated Logistics Cluster Coordinator to facilitate the overall response strategy, including optimizing the use of logistics assets aiming to ensure an uninterrupted supply of life saving relief items to the affected population. The Logistics Cluster liaises closely with the other organizations; and facilitates regular Logistics Cluster meetings and publishes records of decisions taken on behalf of the Humanitarian Community.

- The Logistics Cluster also has an information management capacity, which includes GIS / mapping services, with the aim of coordinating logistics

operations and supporting decision making to improve the efficiency of the logistics response. Within this capacity, the Logistics Cluster consolidates information on the overall logistics situation from the humanitarian community and local authorities, identifying logistics gaps and bottlenecks.

- Additionally, the Logistics Cluster disseminates vital information through the Yemen operations page at: http://www.logcluster.org/ops/yem10a.

2. Logistics Cluster Services

- The Logistics Cluster provides fuel through implementation of the Service Level Agreement (SLA) mechanism to the humanitarian community in order to avoid fuel shortages and therefore avoid disruption of humanitarian activities in Yemen.

- The fuel distribution systems located in Sana'a, Aden and Haradh, where fuel will be stored and distributed to humanitarian organizations based on the SLA and the Pro-Forma Invoice (PFI).

- These services are not intended to replace the logistics capacities of the organizations but rather supplement them through the provision of common services. Furthermore, these services are not intended to compete with the commercial fuel market, but to fill identified gaps.

- The Logistics Cluster established three fuel storage facilities in WFP warehouse compounds: one in the capital, Sana'a, one in northern Yemen in Haradh, and one in southern Yemen, in Aden.

3. Airlift

- The Logistics Cluster is making available, to the Humanitarian Community, the use of airlifts from Sana'a to strategic areas within Yemen for the safe movement of staff and delivery of life-saving relief items.

- WFP / UNHAS air passenger service is available for the medical and security evacuation of the humanitarian aid workers.

- Four flights per month are scheduled from Sana'a to Sa'adah and Hodeidah.

This Concept of Operations is a living document and the activities will be adapted and revised as the situation unfolds and further assessment results become available, including the possible provision of additional logistics common services as required by the humanitarian community.

Annex R-5. Examples of kits to pre-position

Various items of logistics equipment

A set of basic logistics items, for coping with the numerous small problems encountered in the installation stage of a mission or of storage facilities. It might include: ropes, tarpaulin, jerrycans, water filter, tools, torches and spare batteries, multi-plug electrical cords, nails, screws, taps, drilling machine, padlocks, spray paint, paint brushes, tie wires, refuse bags, duct tape, gloves, overalls, boundary tape…

Generator kit

Compact diesel generator, intended for emergencies or a small office. Three different sizes are recommended:

- 3-4k VA (2,800 W);
- 5-6 kVA (4,800 W); and
- 7-8 kVA (6,000 W).

It is also handy to have a compact, transportable petrol generator, used for lighting, mobile installations, or low power devices; 800 VA should suffice for this use. As well as the generator itself, each kit should include: earth cable and pin, maintenance follow-up card, spare parts (filters and oil), jerrycan, funnel…

The following equations convert between kilovolt-amps (kVA) and watts (W):

- Watts = 1,000 × kilovolt-amps × power factor
- Kilovolt-amps = watts ÷ (1,000 × power factor)

For online electrical and engineering calculators, try http://www.rapidtables.com/.

Delivery kit for fuel, hand pump

Portable manual pump with hoses, nozzle and water separator filter designed to pump fuel from 200 L drums or tanks.

Basic tools

Basic tool set, essential in every mission/project for different logistical jobs. The kit includes hand tools (screwdrivers, pliers, hammers, chisels, saws…); gloves and other safety-wear; duct tape, measuring tape, padlocks, headlights, overalls…

Electrical distribution

Portable distributor box with circuit-breakers and fuses, and cable extension reels for a quick set up of electrical distribution in an isolated site. The kit should allow distribution of energy produced by a standard 5-6 kVA (4,800 W) generator with thermomagnetic circuit breakers.

Power supply system

Power supply system, composed of two main elements: battery charger/inverter and batteries, allowing different functions:

- Energy storage in the batteries
- 12 V DC power supply
- 230 V AC power supply
- UPS function: uninterrupted AC power supply, with large autonomy.

Team life kit

Kit allowing rapid installation of an 8-person team in a remote area:

- Basic furniture, folding or which can be dismantled (chairs, shelves, table…)
- Stove and cooking equipment (pots and pans, cooking utensils, buckets, water reservoir, stove, matches, water filter, flasks, cutlery, cleaning materials…)
- Bedding equipment (camping beds, sleeping bags, mosquito nets, survival blankets…)
- Lighting (torch lamps, spare batteries, storm lamps, rechargeable lanterns, multi-plug electrical cord…)
- Personal hygiene items (washing powder, soap, toothbrushes and toothpaste, toilet paper, towels…)
- Foodstuffs for 5 days (instant coffee and powdered juices, freeze dried bags of food, dried fruit, sardines, biscuits…)

It's best to compose the kit of 3 modules (bedding equipment, cooking equipment and food/hygiene for 5 days), which can be ordered separately or in different quantities according to the needs.

Office administration kit

Complete set of administration supplies intended for setting up a new office: stationery (with organization's logo and stamp, and an inkpad…), organization's identification and presentation supplies (flag, T-shirts, stickers…), and standard administrative forms (stock cards, waybills, order forms…), calculator, multi-plug extension cord…

Various kits of office equipment

The key message here is to think not only about the machine but also about all the accessories you'll need to run and use it, such as: multi-plug surge-protected electrical cords, ink cartridges, toners, keyboard, mouse, numeric pad, router, Internet cables, stabilizer… In the case of desktop computers, it would be wise to include a spare keyboard and mouse in case of coffee spills or other accidents.

- Laptop/desktop computer
- Printer
- Photocopier

Various kits of communication equipment

Again, as well as the main pieces of equipment, include accessories in the kit, such as: spare fuses, multi-plug electrical cords, connector clips, spare batteries, electrical wire…

- HF, base and mobile, including antennas
- VHF, base and mobile, including antennas
- UHF, base and mobile, including antennas
- Satellite communication, base and mobile.

Annex R-6. Equipment for setting up logistics hubs

With thanks to WFP Engineering

This annex is referred to in Chapter 9, Building logistics infrastructure. The following list is not exhaustive and is only an example.

Table 5. Equipment for setting up logistics hubs, by component

Item	Specification	Quantity			
		Staging Area	Main Hub	FLB	Satellite WH
MSU Warehouses					
MSU	32 m × 10 m	10	15	5	2
Flexible solar panel with battery	MSU mounted (to power indoor and outdoor lights) — power output to be defined	10	15	5	2
Interior LED lighting	Indoor — wattage to be defined	60	90	30	12
LED Security lights	MSU mounted (outdoor) — wattage to be defined	10	15	5	2
Cold storage unit	For storage of pharmaceuticals	2	3	1	1
Aluminium shelving system		10	15	5	2
Racks for pharmaceuticals		2	3	1	1
Flooring	Geotextile and tarpaulin				
Drainage pipes	Corrugated metal pipe (diameter 600–1,200 mm)				

Item	Specification	Quantity			
		Staging Area	Main Hub	FLB	Satellite WH
Offices					
Office (prefab)	Standard furnished	2	3	1	1
Office desk	With draws	4	6	2	2
Office chair		4	6	2	2
Small table for printer		2	3	1	1
Filing cabinet		2	3	1	1
Laptop		4	6	2	2
Printer		2	3	1	1
Keyboard and mouse		4	6	1	1
Air conditioning / heating unit		2	3	1	1
Multi-plug surge-protected extension lead		4	6	2	2
Solar panels with battery	Office mounted (to power indoor and outdoor lights) — power output to be defined	10	15	5	5
Interior LED lighting	Indoor — wattage to be defined	4	6	1	1
LED Security lights	Office mounted (outdoor) — wattage to be defined	2	3	1	1
Stationary kit	Assorted items	2	3	1	1
VSAT mobile kit		1	1	1	1
Coverage	The same as the MSU can be used				
Tent	Temporary	2	3	1	1

Item	Specification	Quantity			
		Staging Area	Main Hub	FLB	Satellite WH
Additional workspace					
Workspace office (prefab)	2 prefabs attached to create larger space	1	2	1	–
Air conditioning / heating unit		1	2	1	–
Meeting table	To seat 10	1	2	1	–
Meeting chair		10	20	10	–
Multi-plug surge-protected extension lead		2	4	2	–
Solar panels with battery	Office mounted (to power indoor and outdoor lights) - power output to be defined	1	2	1	–
Interior LED lighting	Indoor — wattage to be defined	1	2	1	–
LED Security lights	Office mounted (outdoor) — wattage to be defined	1	2	1	–
Spider telephone		1	2	1	–
VSAT mobile kit		1	1	1	–
Tent	Temporary	1	2	1	1
Accommodation					
Accommodation (prefab)	Numerous standard prefabs attached to sleep 8. Furnished, including: wardrobe, single bed, mattress, chair and table.	1	2	1	1
Wardrobe		8	16	8	8
Single bed		8	16	8	8

Item	Specification	Quantity			
		Staging Area	Main Hub	FLB	Satellite WH
Mattress		8	16	8	8
Chair		8	16	8	8
Table		8	16	8	8
Solar panels with battery	Accommodation mounted (to power indoor and outdoor lights) - power output to be defined	1	2	1	1
Interior LED lighting	Indoor — wattage to be defined	1	2	1	1
LED Security lights	Accommodation mounted (outdoor) — wattage to be defined	1	2	1	1
Air conditioning / heating unit		1	2	1	1
Solar boiler		1	2	1	1
Thermal solar panel		1	2	1	1
Tent	Temporary — to sleep 8	1	2	1	1
Sanitation					
Ablution unit	2 facilities	1	2	1	1
Solar panels with battery	Prefab mounted (to power indoor and outdoor lights) — power output to be defined	1	2	1	1
Interior LED lighting	Indoor — wattage to be defined	1	2	1	1
LED Security lights	Prefab mounted (outdoor) — wattage to be defined	1	2	1	1
Septic tank (water treatment units)	Size to be determined	2	4	2	2

Item	Specification	Quantity			
		Staging Area	Main Hub	FLB	Satellite WH
PVC conduits	Quantity to be determined				
Water tank	10,000 L	2	3	2	2
Portable ablution unit/tent	Temporary	1	2	1	1
Guard posts					
Prefab	1/2 standard-size prefab	1	1	1	1
Office desk	With drawers	1	1	1	1
Office chair		2	2	2	2
Laptop		1	1	1	1
Keyboard and Mouse		1	1	1	1
Multi-plug surge-protected extension lead		1	1	1	1
Air conditioning / heating unit					
Solar panels with battery	Prefab mounted (to power indoor and outdoor lights) — power output to be defined	1	1	1	1
Interior LED lighting	Indoor — wattage to be defined	1	1	1	1
LED Security lights	Prefab mounted (outdoor) — wattage to be defined	1	1	1	1
Control panel		1	1	1	1
Electrical					
Perimeter lighting	Solar with battery — one light to be installed every 20 m around perimeter fencing				

Item	Specification	Quantity			
		Staging Area	Main Hub	FLB	Satellite WH
Rubber insulated cables/electrical wiring					
Main electric panels					
All connections, switches and protection, etc.					
Distribution box/electrical kit	Panel complete with circuit breakers for incoming/outgoing connection				
Windsock, H-V panels					
Rotary fuel pump		1	1	1	1
Electrical fuel pump		1	1	1	–
Generator and housing	10 kVA — wheel mounted	1	1	1	1
Vehicles					
Fork lift (all-terrain)		2	2	1	1
Fork lift (all-terrain) - 2.5t-3.5MTMax. with triplex tower (4x4 — all terrain tyres)		–	1	–	–
Fork lift (for concrete) - 2.5MT. with triplex tower (4x2 — normal tyres for all concrete)		–	1	–	–

Item	Specification	Quantity			
		Staging Area	Main Hub	FLB	Satellite WH
Truck (all-terrain) — 8-10MT		1	2	1	1
Land Cruiser 79 Single Cabin		2	4	2	2
ATV 4x4		1	1	1	1
Miscellaneous					
Drone with GoPro		1	2	1	1
Security cameras	To be determined				
Geotextile	10,000 m2 each kit (10 × 50) or (10 × 100)	1	2	1	1
Fuel tank	Size = ?	1	1	1	1
Fuel Dispenser					
Fire extinguisher	To be determined				
Chain link perimeter fence with barbed wire (concertina)	Metres = ?				
Sliding security chain link gate		1	1	1	1
Boom gate		1	1	1	1
Tarpaulin	10m × 20m	30	50	20	10
Fuel drums		10	20	10	5
Plastic pallets	80 percent of MSU surface	1,500	2,000	500	200
Hand pallets		5	10	8	3
Trolleys		12	20	10	8

Item	Specification	Quantity			
		Staging Area	Main Hub	FLB	Satellite WH
Gazebo		2	4	2	2
ICT kit		1	1	1	1

Annex R-7. Emergency labels for packages containing medical samples

The following labels can be used as a stopgap if you run out of high-quality, commercially-produced labels.

Print the required page onto A4 white labels or paper at actual size, i.e. 100 percent, and follow WHO instructions as to their proper use. You will find all the necessary guidance in WHO's *Guidance on Regulations for the Transport of Infectious Substances*.[41] Remember to weather-proof any labels you print in the office — they won't be as robust as commercial ones.

[41] WHO's *Guidance on Regulations for the Transport of Infectious Substances* is online at: http://www.who.int/ihr/publications/who_hse_ihr_2015.2/en/.

CATEGORY A INFECTIOUS SUBSTANCE LABELS

Minimum size:

100 x 100 mm on large packages; 50 x 50 mm on small packages.

Number per package: 1.

Proper shipping name (UN 2814 or UN2900 label) must be displayed adjacent to the mark.

INFECTIOUS SUBSTANCE,
AFFECTING HUMANS
UN 2814

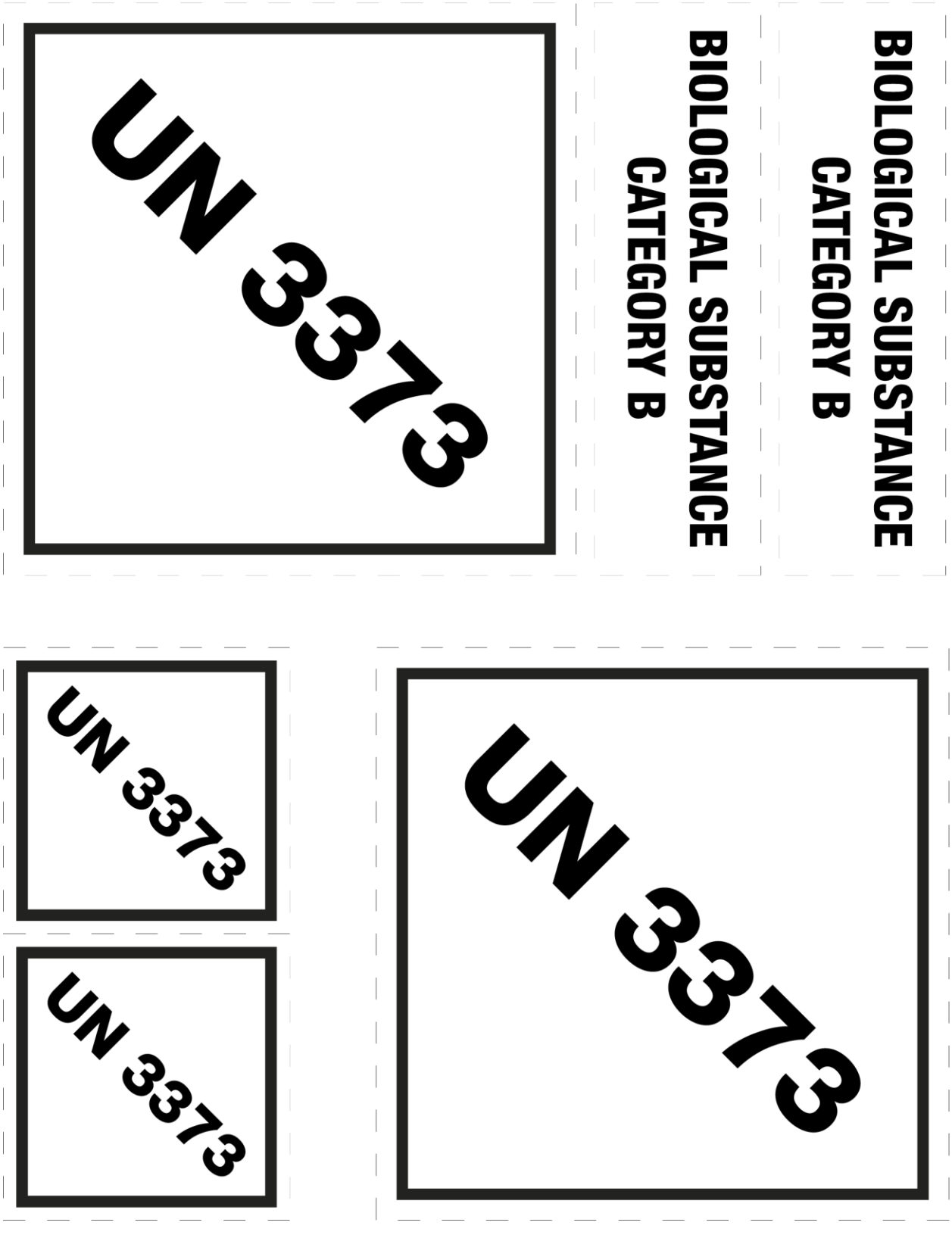
INFECTIOUS SUBSTANCE,
AFFECTING ANIMALS only
UN 2900

CATEGORY B INFECTIOUS SUBSTANCE LABELS

Minimum size: at least 5o x 50 mm.

Number per package: 1.

“BIOLOGICAL SUBSTANCE, CATEGORY B” must be displayed adjacent to the mark.



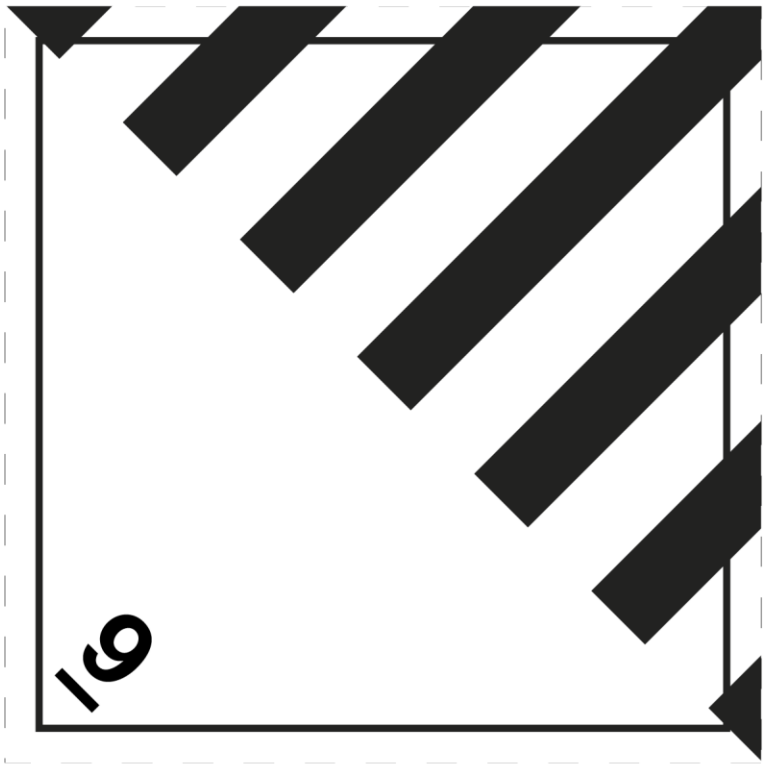
MISCELLANEOUS DANGEROUS SUBSTANCES LABELS

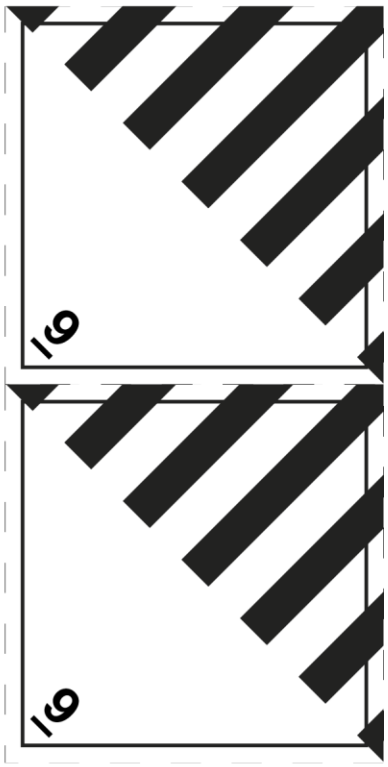
Minimum size:

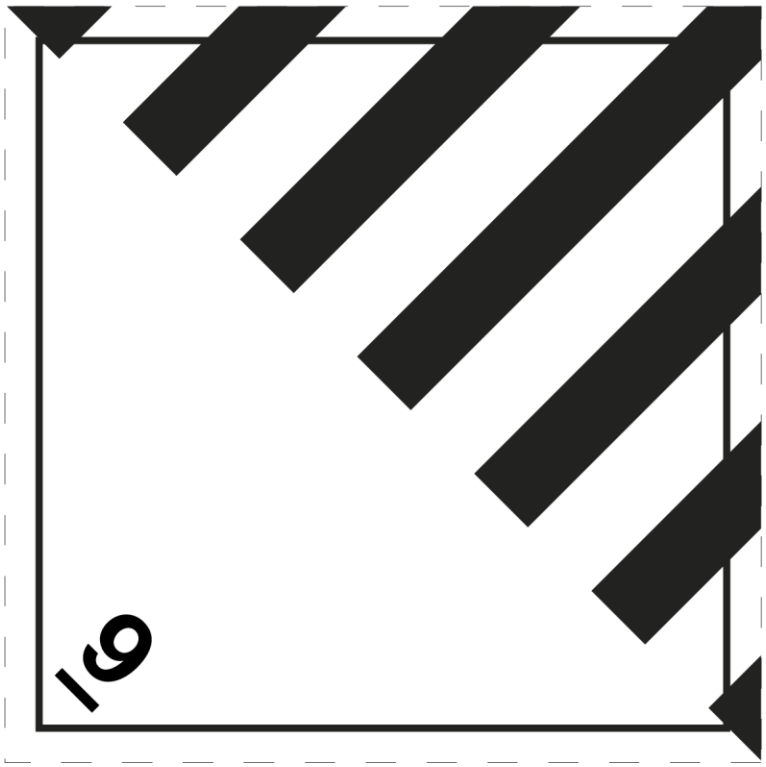
100 x 100 mm on large packages; 50 x 50 mm on small packages.

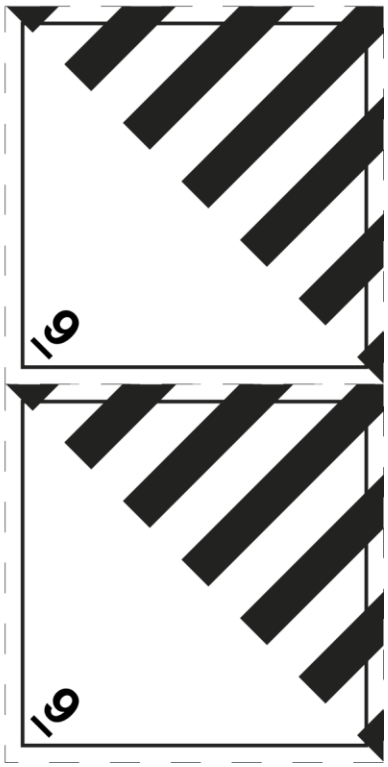
Number per package: 1.

For use when packages contain dry ice (i.e. carbon dioxide, solid [UN 1845]).





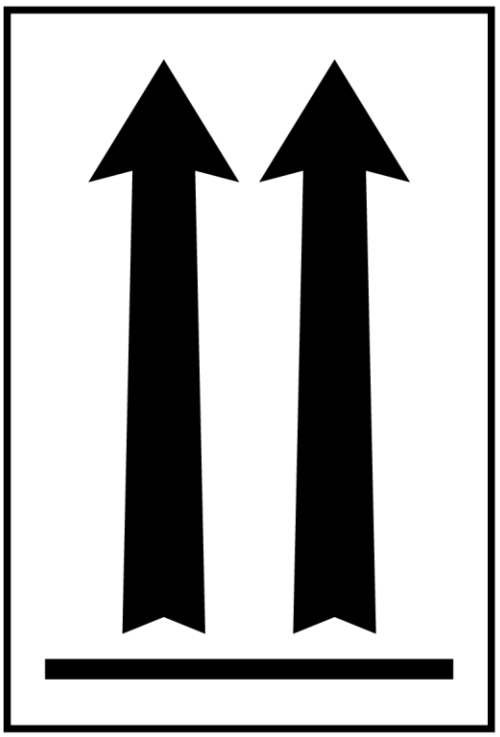




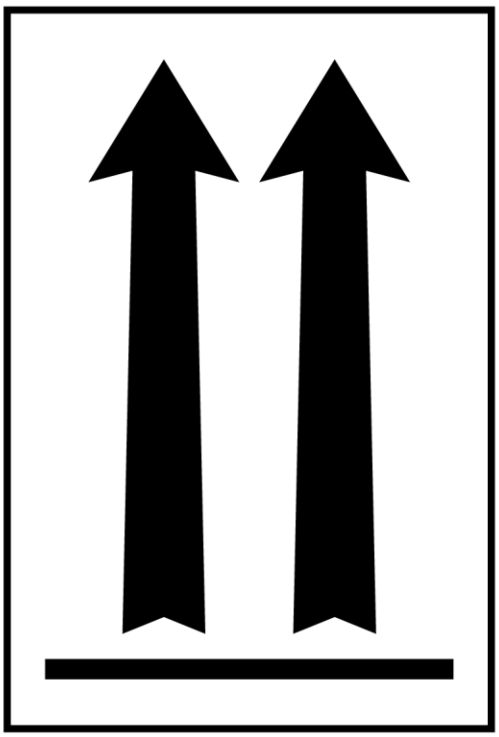
ORIENTATION LABELS

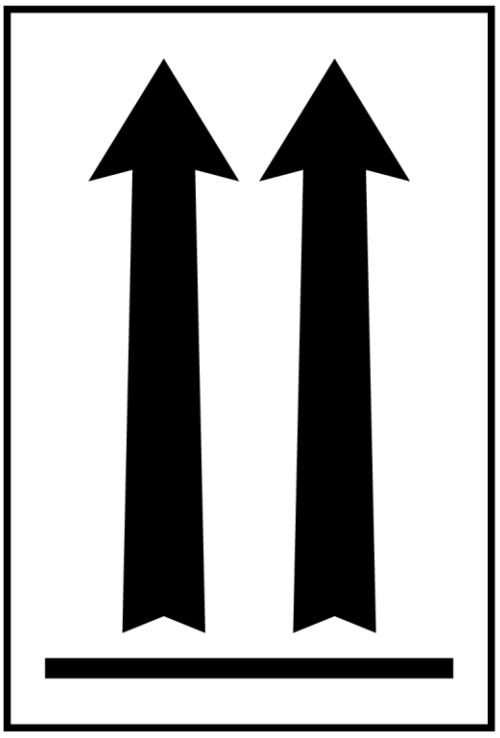
Minimum size: 74 x 105 mm. Number per package: 2 on opposite sides.
If necessary, add ‘This side up’ on the top cover of the package.

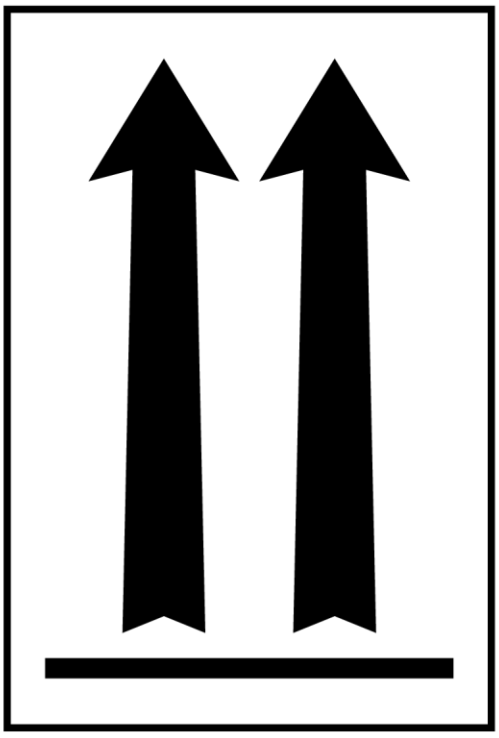
THIS SIDE UP



THIS SIDE UP







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