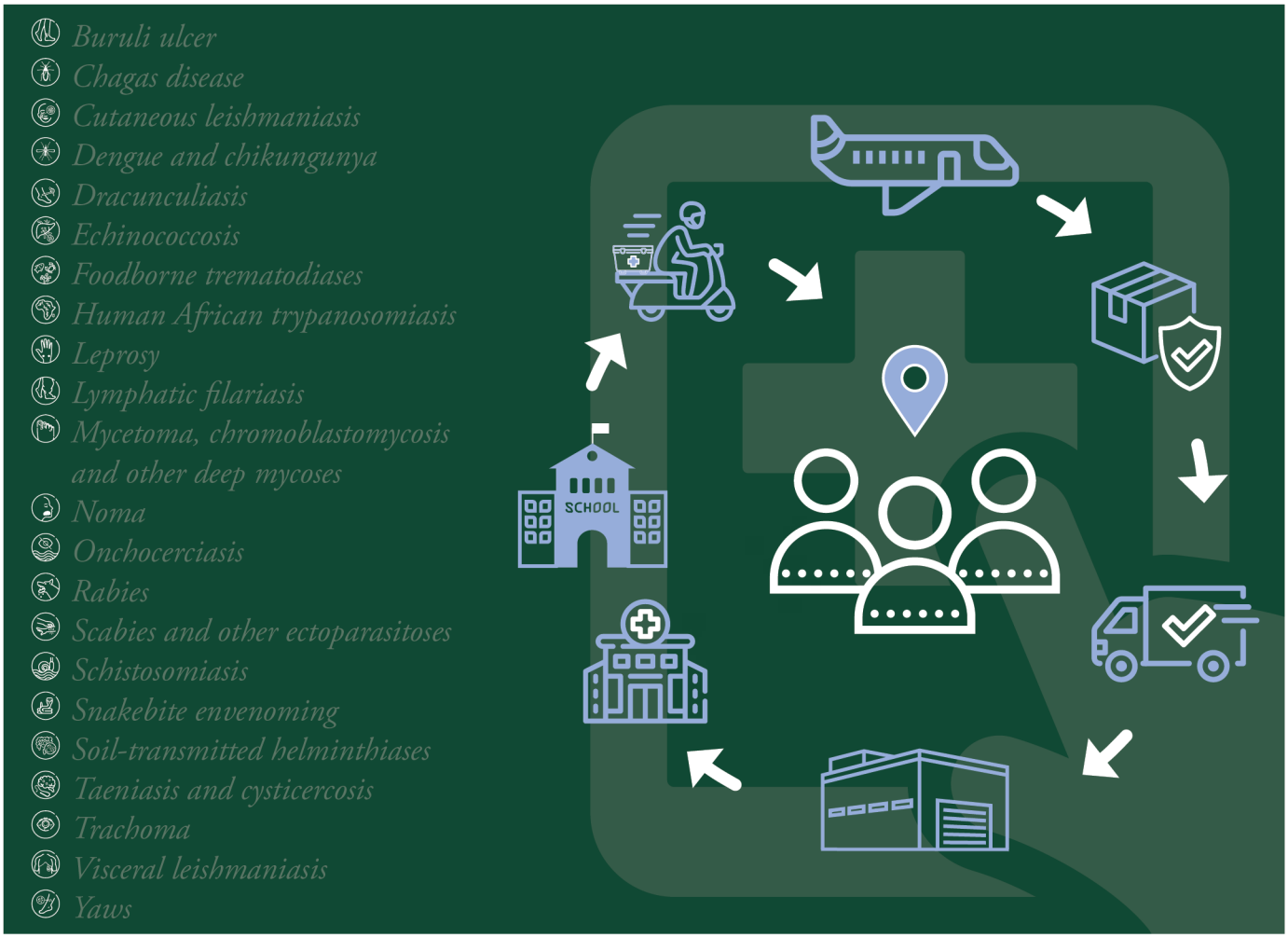

Routine health information system and health facility and community data for neglected tropical diseases

Last-mile logistics information system for medicines and health products

World Health Organization

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Contents

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Abbreviations

DHIS2	District Health Information Software (version 2)
eLMIS	electronic Logistics Management Information System
ERP	enterprise resource planning
FEFO	first expired/first out
GS1	Global Health Standards
HMIS	health management information system
JAP	Joint Application Package
JRF	Joint Reporting Form
JRSM	Joint Request for Select PC Medicines
KPI	key performance indicator
LMIS	Logistics Management Information System
MDA	mass drug administration
NTD	neglected tropical disease
PC	preventive chemotherapy
SOP	standard operating procedure
WHO	World Health Organization

Glossary

The definitions given below apply to the terms used in this document. They may have different meanings in other contexts.

Active pharmaceutical ingredient	Any substance or mixture of substances intended to be used in the manufacture of a pharmaceutical dosage form and that, when used in the production of a drug, becomes an active ingredient of that drug. Such substances are intended to furnish pharmacological activity or other direct effect in the diagnosis, cure, mitigation, treatment or prevention of disease, or to affect the structure and function of the body.
Average monthly consumption	A measure of how much product is usually or on average consumed or dispensed during the course of a month. It is calculated per product at each distribution point (health facility, intermediate or central level). Monthly consumption can be collated with data from daily use records, bin or stock cards or drug registers and is calculated from average consumption over a period (e.g. 6 months). The period during which a stock-out was experienced can be taken into account by deducting the number of stock-out days from the denominator.
Batch	A defined quantity of pharmaceutical products processed in a single process or series of processes by manufacturer so that it is expected to be homogeneous.
Batch number	A distinctive combination of numbers and/or letters which uniquely identifies a batch, for example, on the labels, its batch records and corresponding certificates of analysis.
Electronic logistics management information system (eLMIS)	An electronic system that tracks products' location and movements, the rate of consumption/use, stock levels throughout the system, risks of stock-outs or expiry, temperature excursions for cold chain equipment, asset functionality for cold chain or diagnostic equipment and operational performance at all levels of the supply chain.
Expiry date	The date given on the individual container (usually on the label) of a pharmaceutical product up to and including the date on which the product is expected to remain within specifications, if stored correctly. It is established for each batch by adding the shelf-life to the date of manufacture.
First expiry, first out (FEFO)	A distribution procedure that ensures that the stock with the earliest expiry date is distributed and/or used before an identical stock item with a later expiry date is distributed and/or used.
Forecasting	Planning demand beyond the procurement period at national level on the basis of various assumptions, such as actual and estimated needs, consumption data from previous MDAs, available stock on hand, the capacity of the health system, plans for scaling-up treatment coverage and the allocated funds.
Global Standards 1 (GS1)	Standards are globally recognized frameworks that help businesses uniquely identify, capture and share information about products, locations and assets. They enable efficient supply chain management, ensuring accurate data exchange across industries.

Key performance indicators	A core indicator list consists of a limited set of key indicators. The core indicator list focuses data analysis on the most important indicators needed on a regular basis to monitor logistic activities and inform decisions at various levels of the health system to address potential supply chain disruptions. Establishment of the core indicator list should be a collaborative process involving multiple programmes and stakeholders. The list should be reassessed periodically to ensure that it reflects current global standards and country priorities.
Labelling	Process of identifying a pharmaceutical product including the following information, as appropriate: name of the product; active ingredient(s), type and amount; batch number; expiry date; special storage conditions or handling precautions; directions for use, warnings and precautions; names and addresses of the manufacturer and/or the supplier.
Logistics management information system (LMIS)	A system of records and reports – whether paper-based or electronic – used to aggregate, analyse, validate and display data from all levels of the supply chain system that can be used to make logistics decisions and manage the supply chain.
Opening balance	Stock on hand at the beginning of a defined time.
Shelf-life	The period of time during which a pharmaceutical product, if stored correctly, is expected to comply with the specification as determined by stability studies on a number of batches of the product. The shelf-life is used to establish the expiry date of each batch.
Stock-out	Any time when, at a defined moment in a given inventory, a needed medicine product is not in stock, and orders or prescriptions cannot be filled.
Storage	The storing of pharmaceutical products up to the point of use.

1. Introduction

1.1 Scope of this guidance

This document on logistics management information systems (LMIS) was developed to address the increasing need for harmonization and standardization of core indicators for managing medicines and health products for neglected tropical diseases (NTDs) at country level (i.e. for last-mile logistics). It thereby responds to requests from Members States, pharmaceutical groups, financial donors and implementing partners for guidance from the World Health Organization (WHO) for a transparent, standardized reporting mechanism and key indicators for in-country logistics. More importantly, this document will also guide the last-mile logistics process and is relevant for the health workforce working at different levels of national health information systems. It can be adapted and used for any health products depending on the needs of the country or health programmes.

The donation of NTD medicines and health products by pharmaceutical companies is the backbone of NTD programmes. However, the supply chain management of these health products is challenged in many ways, including lack of timely supply chain data visibility, transparency, consistency and traceability; poor planning of medicines distribution; poor monitoring of medication batches; poor monitoring of stock on hand at district and sub-district levels; and wastage of medicines. As a result, in most situations, countries are unable to calculate the remaining balance of medicines following mass drug administration (MDA) campaign distribution. For example, in many endemic countries, poor forecasting has led to excess stock of praziquantel while simultaneously running out of albendazole during school-based deworming campaigns.

In response, WHO has implemented the Joint Application Package process, which enable countries to accurately request the quantities of medicines needed for their interventions, utilize them efficiently and report on their use in a timely manner. This approach helps minimize wastage and expiry of requested medicines. However, for the process to work, countries need to have in place a functional LMIS and the capacity to effectively manage it. The LMIS needs to have standard logistics key performance indicators; thus, supporting countries with effective guidance is critical and would contribute to improving efficiency in supply chain management. If countries implement good last-mile LMISs as outlined in this document, the information generated will help to complete the important information required for the Joint Application Package forms, such as outstanding stock balances, expiry status and wastage situations. The standard logistics key performance indicators outlined in this document can be used when countries develop their LMIS tools for the last-mile logistics or when integrating them into their existing system. The key performance indicators are intended as a set of essential, simple metrics for monitoring the distribution of NTD medicines.

1.2 Objectives

This document provides guidance on standard key performance indicators and their analysis, interpretation, frequency of collection and source, as well as data quality issues. It describes use of logistics data on health products for NTDs that are collected in health facilities or during outreach activities/community-based interventions. By the end of this document, readers should be able to:

- understand the importance of NTD logistics data and interpretation of key indicators for NTD medicines and health product logistics;
- monitor the performance of key NTD supply chain activities through the use of medicine and health product logistics indicators, either at the institutional or community/school level;
- assess data quality and understand its implications when interpreting data;
- use NTD logistics data in decision-making at all levels;
- identify data elements and use key performance indicators when developing new or integrating into existing eLMIS or health information system tools;
- understand the essential data needed to manage a supply chain;
- understand the use of LMIS data;
- master the use of the tools and processes that enable end-to-end visibility of data; and
- apply digital technology to improve LMIS.

1.3 Target audience

This document is intended for health workforces working with national health information systems at all levels of the health system including:

- health workers, pharmacists and logistics personnel at health facilities and districts who are managing NTD medicines and health products, and therefore involved in first-mile data collection and reporting at the peripheral level;
- ministry of health decision-makers, programme managers, logistics officers and data managers working in NTD programmes;
- health data managers and data clerks working with the national health information system or LMIS at subnational and/or health facility levels;
- staff of partner organizations supporting NTD programmes, who are supporting the strengthening of NTD health product logistics management information systems; and
- personnel working at research institutes involved with non-routine assessments and/or improvement of NTD control activities and specifically with the analysis of NTD programme and health product data.

1.4 Approach to development

This guidance was developed using a template provided by the WHO Division of Data, Analytics and Delivery for Impact. Its technical content was carefully crafted in alignment with the standard supply chain management modules adapted specifically to the management of NTD medicines and health products at country level. Input was provided by international logistic partners such as JSI Inc., international nongovernmental organizations such as Sightsavers, the Clinton Health Access Initiative and the Task Force for Global Health, as well as WHO regional advisers and disease focal points in the Global Neglected Tropical Diseases Programme. A dedicated drafting team comprising WHO technical officers and supply

chain experts at global, regional and country levels contributed to the writing and initial reviews. To ensure technical accuracy and relevance, external supply chain professionals and selected national programme managers from various countries conducted comprehensive reviews of the document.

1.5 Declarations of interest

Contributing disease experts external to WHO submitted signed disclosures of declarations of competing interests, academic or scientific activities, which were reviewed. No conflicts of interest were identified.

2. LMIS informatics for NTD programmes

2.1 Core function

The logistics management information system, or LMIS, is essential for the efficient operation of health supply chains, offering timely and accurate data to support both daily management and strategic decision-making. LMIS includes physical and digital records and reports used by supply chain workers and managers to collect, organize, present and utilize logistics data across all levels of the system. Supply chains typically begin with basic manual forms and reports, which evolve into digital tools for capturing, reporting, analysing, visualizing and presenting supply chain data.

LMIS provides critical information on stock status, consumption rates, expiry dates and operational performance metrics. These data empower supply chain officers to make informed decisions about tracking expiries, issuing commodities, forecasting demand, and replenishing health facilities and warehouses. These actions help ensure efficient distribution and minimize wastage. Furthermore, an effective LMIS enhances communication among stakeholders, ensuring everyone has access to necessary information for effective supply chain management. A standardized set of core indicators is essential for maintaining consistency and comparability across the system.

Effective supply chains rely on end-to-end visibility, where the right data, of the right quality, reach the right people at the right time and place, enabling informed decisions and prompt actions. This effectiveness depends on a balanced combination of skilled personnel, efficient processes and appropriate technology. Skilled individuals must be capable of recording, analysing, managing and utilizing supply chain data at every level.

Technological advancements are transforming health supply chain management. Traditional paper-based LMIS are being replaced by digital applications that are accessible via cell phones, tablets and computers, often linked to central databases and online dashboards. These digital tools provide supply chain managers with easy access to data and insights. The introduction of an electronic LMIS (eLMIS) further enhances LMIS capabilities by improving data collection, analysis and dissemination.

eLMIS enables real-time monitoring of health product utilization rates, stock levels and potential risks such as stock-outs or expiring products. This system not only boosts operational efficiency but also informs strategic planning by optimizing supply chain design and processes. Additionally, eLMIS enhances workforce management and supports risk management and performance monitoring, enabling timely interventions that improve the overall effectiveness and cost-efficiency of the health supply chain. WHO recommends promoting traceability especially from central storage to last mile through usage of solutions like GS1 (Global Standards 1) barcoding and serialization and with dashboards to track key performance indicators.

2.2 Health management versus logistics management information systems

Healthcare workers are overburdened with data collection, and managers can be overwhelmed by too much data. Hence, unless data are to be used routinely to inform supply chain decisions and to enable operational or strategic actions, they should not be collected in a LMIS. Collecting data for managing a supply chain is a separate activity from collecting data about patients and health services; that is what a

health management information system (HMIS) collects. HMIS and LMIS have key differences, as listed in Table 1.

Table 1. HMIS and LMIS differences

	HMIS	LMIS
What data are collected?	Data about patients' health conditions or health services rendered.	Data about commodities (i.e. quantities issued, dispensed, used, received, lost, stolen, damaged, ordered, etc.).
Who collects the data?	Health care workers	Warehouse users
How frequently are data collected?	Data are collected and recorded daily, and usually compiled and reported monthly or quarterly.	Data are collected and recorded daily, and usually compiled and reported monthly, bi-monthly or quarterly. Online systems may enable access to real-time or near real-time data.
How are data used to make decisions?	Data are analysed periodically to determine disease patterns, monitor programme objectives, and plan resources (funding, health workers, facility infrastructure, etc.).	Data are analysed daily to assess stock status. Data are analysed and used regularly to determine resupply or order quantities, monitor supply plans, and monitor supply chain status and performance. Data are used periodically to plan or adjust forecasts.

LMIS: logistics management information system; HMIS: health management information system.
Source: The supply chain managers handbook: a practical guide to the management of health commodities (1).

2.3 Interoperability with other systems

Interoperability between LMIS and HMIS ensures that logistics data, such as stock levels, are directly correlated with disease burden, improving resource allocation efficiency. The effectiveness of an eLMIS is greatly enhanced by its ability to integrate with other national health information systems. This interoperability is essential for creating a comprehensive view of the health supply chain. By connecting with systems that manage disease caseloads, diagnostic information, population distribution and health facility data, the eLMIS provides more accurate insights for informed decision-making.

Integrating the NTD eLMIS with the broader supply chain and health information system infrastructure offers significant benefits, including in-depth analysis, streamlined workflows and improved visibility of logistics information. Key integrations involve connections with master facility registers to ensure consistent facility coding and links with HMISs for comparing service data with product utilization. Further guidance is provided in the *WHO toolkit for routine health information systems data (2)*.

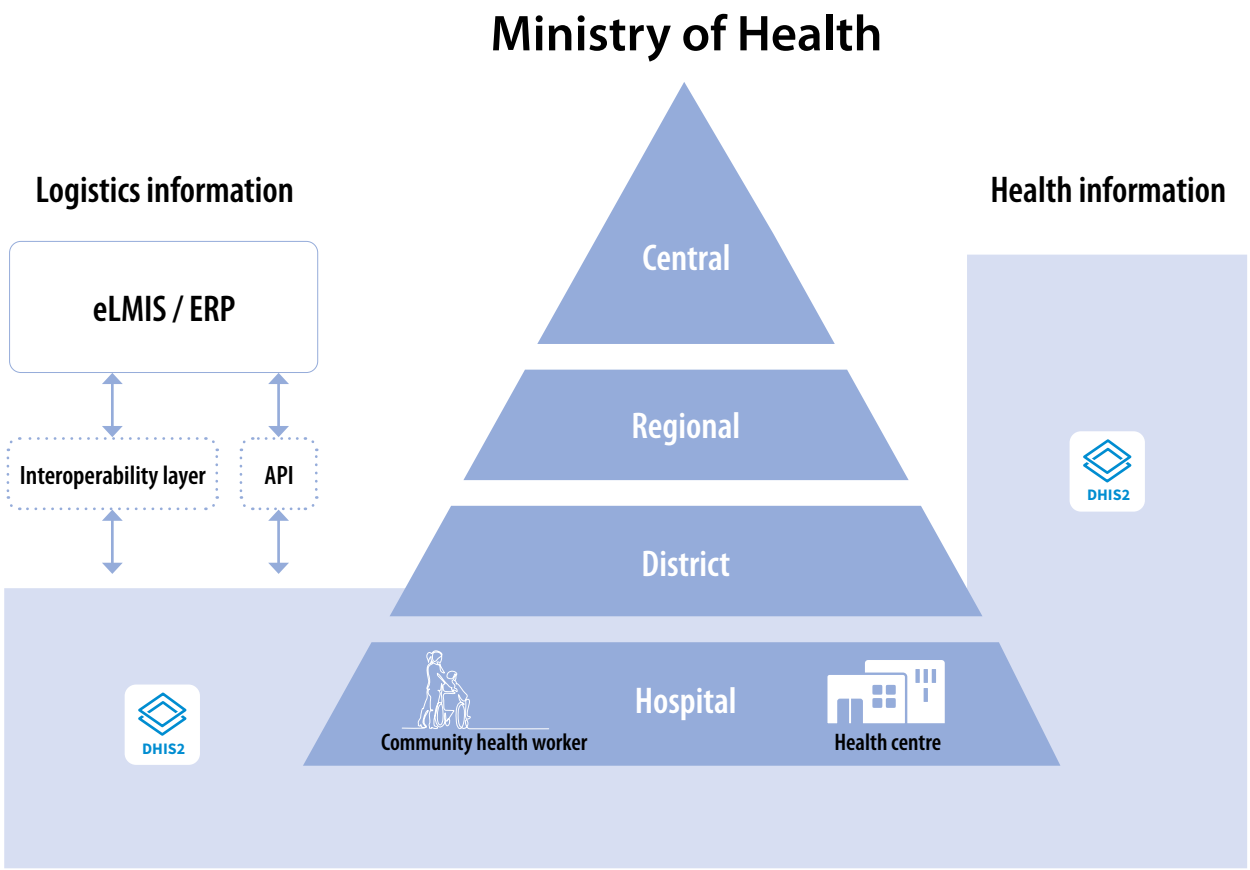
2.4 Challenges and best practices for harmonizing LMIS with HMIS

To ensure streamlined data flows and decision-making, it is essential to harmonize LMIS with HMIS databases and systems. The most consistently cited challenges from both HMIS and LMIS managers when discussing the topic of integrating the two systems related to organizational structure. In many countries, a distinct organizational separation exists between logistics and service delivery groups. The two groups operate independently from the national level all the way down to the service delivery level. As a result, very little data are shared, and coordination across organizational boundaries to begin planning an integration effort across systems is challenging. Another key challenge is related to the quality, timeliness and reporting rates of each system. If the data quality is suspect in either system and efforts have not been made to validate and improve the quality and timeliness of the data in each system separately, the value of linking the data decreases substantially.

Several non-negligible technical issues may also need to be addressed to successfully implement routine linkage of the two systems for reporting and analysis. The primary technical challenges that exist, regardless of the actual systems used for the HMIS and LMIS, involve ensuring that the data sets match up and can be reliably linked in a manner that allows for comparison and correlation of the data. Aggregation of data in each system may also not be consistent. If data are aggregated using different time frames or geographical groupings, then successfully linking and analysing the data is difficult.

WHO recommends the following actions for routinely linking HMIS and LMIS data: encourage communication across organizational boundaries, agree upon data standards and resolve data quality issues. Additionally, organizations creating or supporting HMIS or LMIS platforms should work to include import and export functionality, standard application programming interfaces and architecture supporting interoperability. Countries pursuing integrations should carefully consider their needs and capability to support the integrated systems. Integration requires significant time, cost and careful attention to the potential challenges in order to maximize its benefits *(3)* (Fig. 1).

Fig. 1. An interoperable platform that integrates into multiple eLMIS and ERP systems

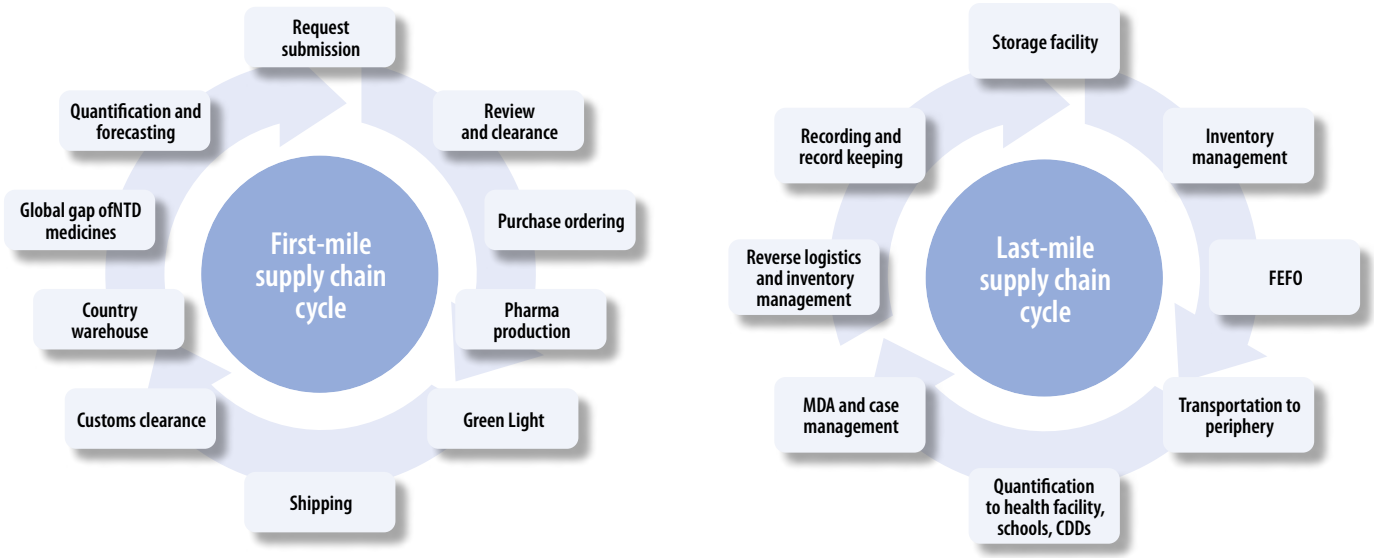


API: application programming interface; DHIS2: district health information system (version 2); eLMIS; electronic logistics management information system; ERP: enterprise resource planning.
Source: HISP Centre, University of Oslo.

3. First-mile and last-mile logistics for NTD medicines and health products

First-mile logistics refers to the initial stage of the supply chain process. It encompasses countries requesting medicine, followed by the movement of goods from a manufacturer or supplier to a distribution centre or warehouse. Last-mile logistics represents the final leg of the delivery journey. It involves transporting products from a distribution hub or warehouse to the end beneficiary of the product at health facility or community level (Fig. 2).

Fig. 2. First- and last-mile supply chain cycles



CDDs: community drug distributors; FEFO: first expiry, first out; MDA: mass drug administration.

In practice, NTD medicine and health product supply chain logistics starts when a country quantifies its needs and then submits its medicine request to WHO until their requested medicine arrives in the ministry of health national warehouse. There are several steps in between these two events that will take around 10 months. Once the country has submitted its medicine request it will be reviewed by WHO and, if it meets the requirement, WHO will raise a purchase order to the pharmaceutical company where the medicine is going to be produced, packaged and prepared for shipment. Once the consignee gives the greenlight/ import permit to ship the product it will be shipped either by sea, road or air freight to the port of entry of the country requesting the product. This is followed by customs clearance and delivery to the warehouse designated by the ministry of health. This completes the first-mile logistics.

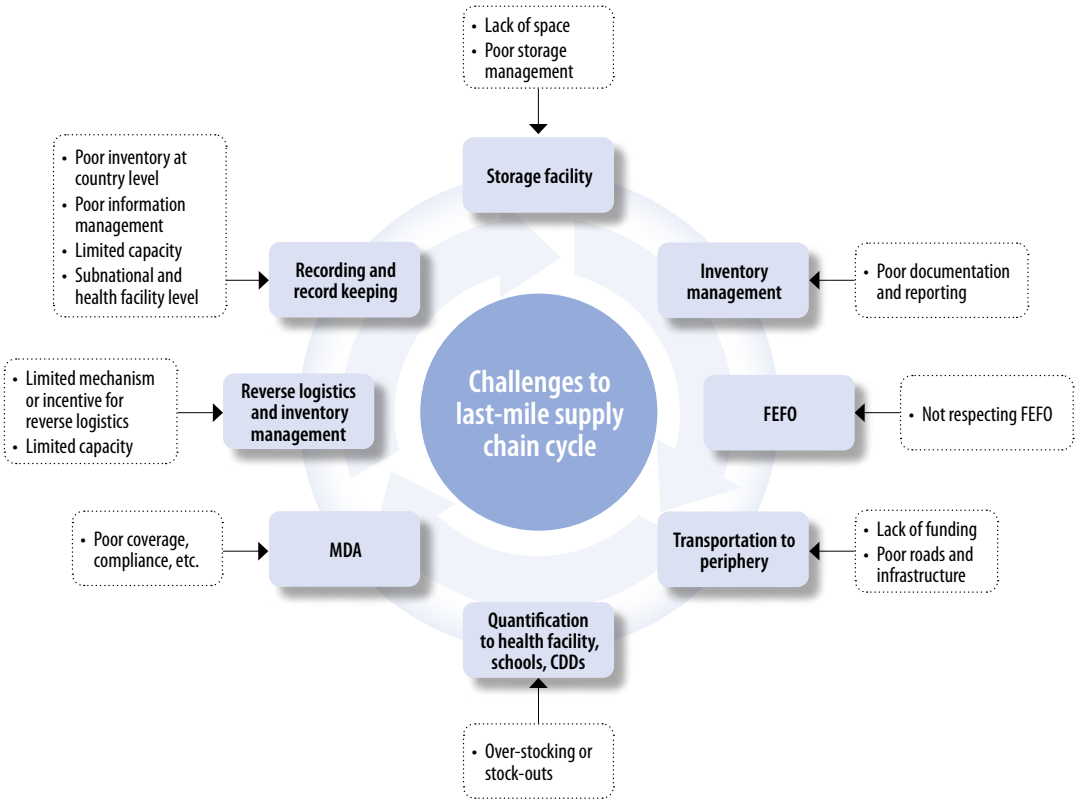
The second phase, which is called last-mile logistics, starts from the product being received to the ministry of health's national warehouse until it is distributed to beneficiaries at in the health facility or at community or school levels. This phase is completed once the medicine utilization is reported, and stock balances are reconciled including reverse logistics and reported back to WHO.

3.1 Last-mile logistics

Last mile is more than just a delivery. It is a crucial phase of the supply chain management for health services deliveries in order to develop and streamline effective NTD health products planning, management and distribution systems for NTD health products.

One of the many reasons why an eLMIS system should be implemented is that it will help to address issues with last-mile logistics, specifically quantification and forecasting, inventory management, documentation and reporting requirements (Fig. 3).

Fig. 3. Common challenges to the last-mile supply chain cycle



CDDs: community drug distributors; FEFO: first expiry, first out; MDA: mass drug administration.

Some of the major challenges faced in the field result from:

- poor inventory management governance and standardized processes;
- inadequate storage and transportation;
- the absence of end-to-end logistics information systems;
- limited dedicated human resources;
- lack of overall resource planning and insufficient infrastructure;
- poor infrastructure and accessibility due to road and security issues;
- lack of regular coordination and communication (HMIS-LMIS) among and between levels;
- poor data analysis; and
- insufficient sustainable financing.

To respond to some of the above challenges faced in the field and to improve the management of health products, WHO and global NTD partners have defined key indicators to improve the implementation of timely and effective inventory management and logistics information management processes at national and subnational levels.

3.2 Suggested best practices to improve last-mile logistics

3.2.1 Inventory control and management systems

A good LMIS supports inventory control and management systems by providing a technical assessment of the products at hand, giving details of the types and quantities of the product, batch numbers and the current expiry status. The purpose of inventory management is to ensure that adequate stock levels of health products are readily available in all locations. The logistics information system should support good inventory management by providing data to support decisions about resupply and/or the allocation of products to ensure adequate stock levels. Poor visibility and monitoring of inventory data can lead to overstocking or understocking, which in turn can lead to expiries and stock outs.

It is therefore essential to anticipate and forecast requirements and optimize both local and national order processes and set up itemized inventory management and logistics information systems. It is also important to consider inventory management and storage procedures, first expiry, first out (FEFO).

Stock control is about the management of supplies in a health facility. Stock control includes keeping accurate and reliable records of stock received and issued, checking stocks on a regular basis (stock taking) and carrying out an inventory of stock monthly. A stock control system uses tools such as bin cards, stock record cards and a stock control ledger. Effective stock control is important to help you order the right quantities of supplies and equipment; ideally, the health facility should carry out a stock take before placing an order for more supplies.

A LMIS uses standard types of forms for recording the essential data items for inventory management. These are: stock-keeping records such as bin cards, stock; transaction records such as requisition and issue vouchers and returns; and consumption records such as a daily activity record which tallies the amount of each product used or dispensed to patients each day.

3.2.2 Logistics information system

Timely logistics and inventory management systems play a crucial role in effective record-keeping and reporting requirements. They also ensure the efficient management of inventories and product utilization data. Logistics and inventory information systems improve accountability and allow timely decision-making in healthcare service delivery.

eLMIS tools will help facilitate the work of healthcare workforce, policymakers and partners. Regular monitoring and supervision are necessary to ensure that healthcare staff have the knowledge to correctly complete reporting tools and that the data submitted are of good quality.

a. Stock-keeping records

Every health facility needs a system for recording stock movement. Reliable record-keeping is very important, because errors caused by poor record-keeping will affect service delivery. For example, if stock records used to estimate requirements are not accurate, you may order too much or too little. Accurate record-keeping depends on easy to use, well-designed methods and forms. Stock cards (stock record cards) and stock control ledgers are the simplest, and examples are provided below.

Stock cards are kept for each type of item in stock. Although it is time consuming to keep up to date, stock cards have many advantages. They provide information about quantities received, issued and in stock at any time, can be used to calculate orders and are a useful tool for preventing shortages and over-stocking. Stock cards help supervisors to monitor overall consumption and use by different services, and to check stock levels, assess wastage and identify theft.

b. Transaction records (not included here)

Transaction records *document changes to stock-keeping records*, and consumption records document quantities leaving the supply chain to customers. Transaction records hold information about products being moved. Transaction records include requisition vouchers, issue vouchers, transfer vouchers, goods received notes, delivery notes, sales orders, bills of materials, and packing lists. Sometimes these records are combined to serve multiple purposes within a transaction process, such as a requisition, issue, and receipt voucher (RIRV).

c. Record-keeping, reporting and documentation

Record-keeping is part of overall mandatory logistics, warehouse management and accountability processes. Poor stock and inventory record-keeping and/or lack of proper documentation is commonly observed. Improved record-keeping will contribute to the overall planning and accountability in programme management, while also helping to reduce oversupply or undersupply of medicines, as well as stock-outs.

Timely record-keeping can also mitigate losses, anticipate product expiries and support appropriate forecasting. It is therefore imperative to set up and implement stock and inventory record-keeping systems and processes at each level of the NTD programme.

Data should be reported regularly, and logistics managers should review the reports to verify the quality of the data. Feedback reports and incentives can be used to motivate lower levels to turn in or transmit complete, error-free reports. Linking reporting with ordering also encourages timely reporting.

3.2.3 MDA planning and implementation best practices (in relation to inventory management)

In order to have good planning for each MDA campaign, from a supply chain perspective, the responsible officer at each level (sub-district, district, province, region/state, and national levels) should follow the 13 for their own level:

At top of the form record:

Data elements:

1. Opening balance (from the previous year or MDA)
2. Quantity received during the reporting period
3. Reporting commodities per expiry date and by batch
4. Number of treated people (information collected at programme – health facility or district level)
5. Number of medicines distributed during the MDA campaign (information collected at programme – health facility or district level)
6. Month of conducted MDA
7. Quantities transferred to or from another state/district (peer-transfer – negative or positive number); adjustment data
8. Quantity of expired/lost/wasted health products
9. Stock on hand or closing balance (followed by a physical count)
10. Nearest/ longest expiry dates
11. Theoretical balance
12. GAP between theoretical balance and stock on hand
13. Forecast for the following year or for the next MDA

Request and reporting forms for NTD medicines are provided in Annex 1.

3.2.4 Adequate transportation and timely delivery of health products

Timely planning for transport of health products is another critical area of a successful logistics system; anticipation of requirements and resource allocation are therefore important both at national, regional (subnational) and health facility levels. All transportation fleets should adhere to WHO good storage and distribution practices (GSDP), while monitoring energy consumption and the carbon footprint of transported items to enhance sustainability and operational efficiency.

Several factors should be considered, including routine delivery schedules, road conditions, distances, health product specifications and handling (cold chain etc.), and special situations such as outbreak campaigns. Further information is provided in WHO's *Good storage and distribution practices for medical products (4)*.

3.2.5 Improved warehousing, storage and planning

Oftentimes, national, subnational and health facility levels do not have adequate warehouse space and systems to manage large quantities of health products. It is therefore important to plan and anticipate required storage requirements and specific storage requirements for a range of health products, including cold chain and pharmaceuticals, and laboratory-related supplies. It is also important that sufficient storage space is available at the central medical store and regional warehouses, as well as at health facility levels. All warehouses should ideally also comply with WHO GSDP, while ensuring systematic monitoring of energy consumption and the carbon footprint of stored items.

3.2.6 Waste management of health products

Waste management processes help prevent dispensing of expired and unserviceable (unusable) medicines to communities and individuals and are essential to avoid diversion of unusable medicines for commercialization or illegal markets. This also includes the proper disposal of expired, damaged and unserviceable health products.

Expired and unserviceable health products include: all tablets and oral solutions that have expired; all damaged bottles of medicines (e.g. punctured or leaking bottles); all open bottles of chewable or reconstituted medicines or oral solutions that remain after completion of the MDA campaign; and all medicines in bottles without any expiry date or with a label that is illegible.

The waste management should be in line with both WHO's and national regulation procedures *(5)*.

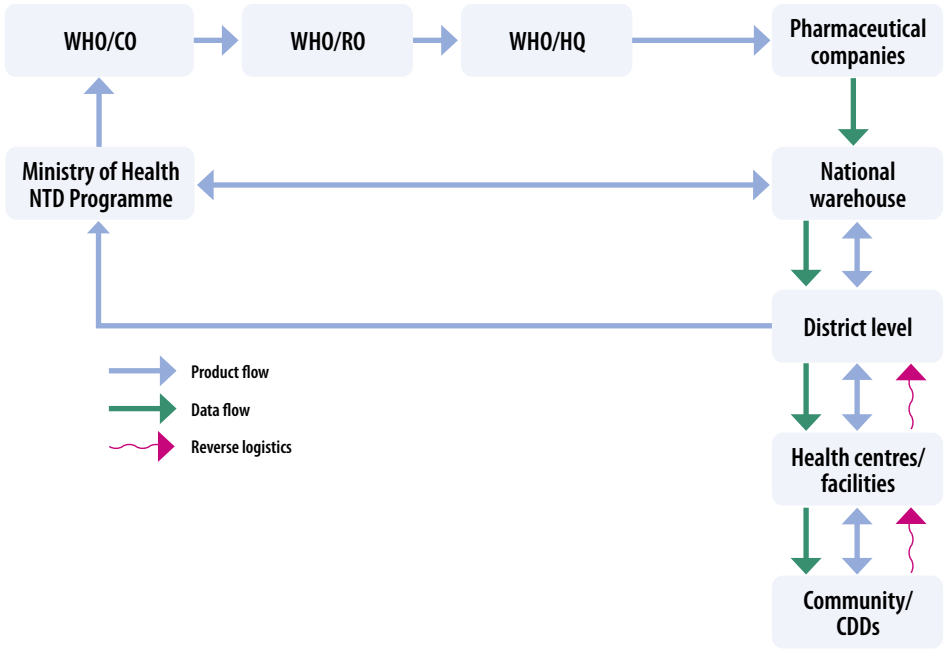
3.2.7 Reverse logistics

Reverse logistics for NTD health products includes the return and transfer of leftover health products after MDA from downstream to upstream within the supply chain system (including from health facility to district levels) so that the products can be safely stored and used for the next MDA. Arranging reverse logistics is as important as distribution planning and should be planned as part of MDA or any other distribution. The quantity of medicine that has been returned to the district or higher level should be entered into the stock records and reported to the national level, so it is considered during forecasting and procuring of medicines.

This process applies to all unused, unopened health products and is important to prevent diversion, theft or the commercialization of "leftover" health products. It also helps to avoid wasting resources by procuring or requesting more medicines for MDA needs.

A sample LMIS information and supply flow diagram is shown in Fig. 4.

Fig. 4. Sample LMIS information and supply flow diagram



CDD: community drug distributor; NTD: neglected tropical disease; WHO/CO: WHO Country Office; WHO/RO: WHO Regional Office; WHO/HQ: WHO headquarters.

3.2.8 Quantification and quality forecasting

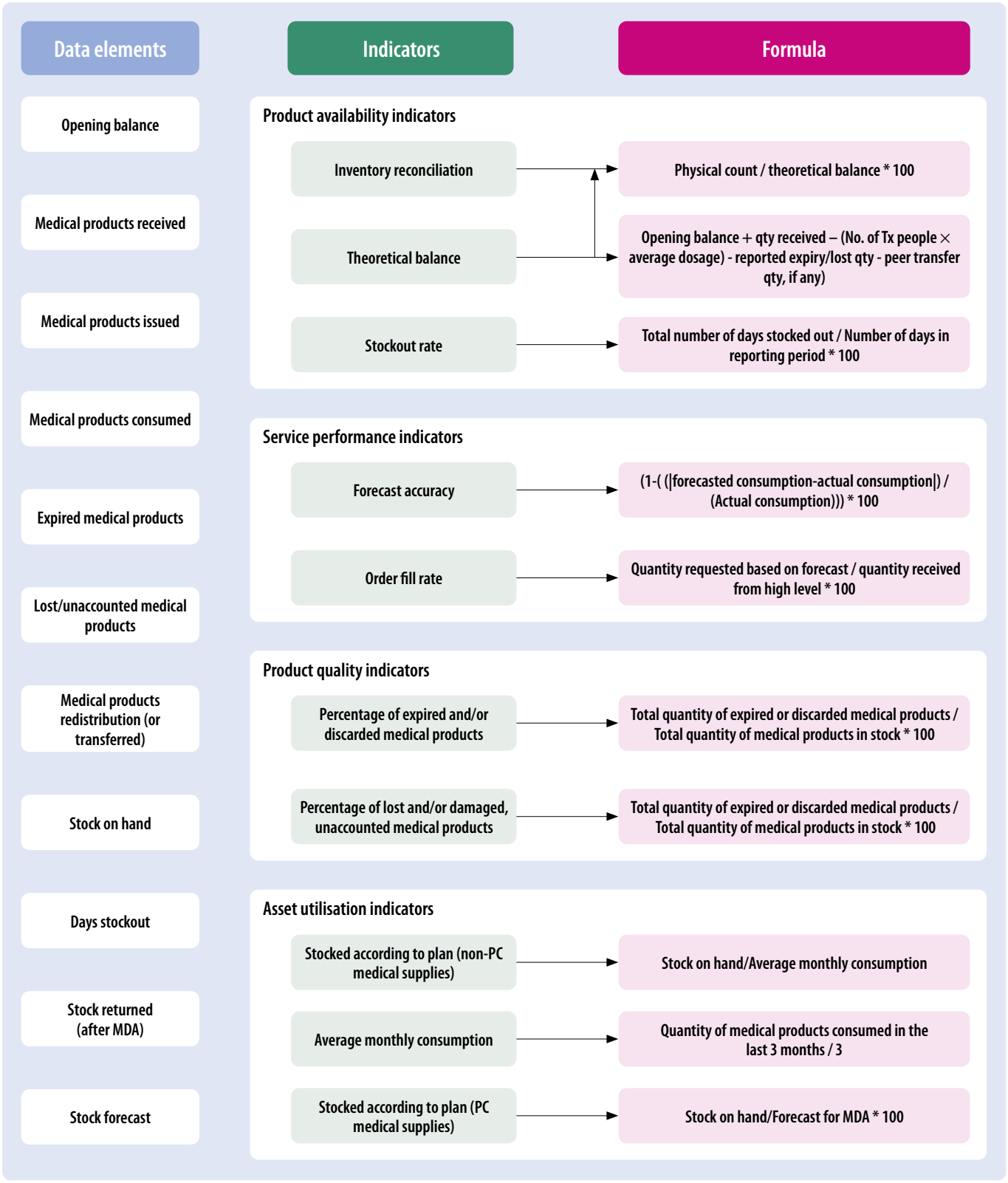
Quantification is the first step in the forecasting process. This exercise should be done by the national NTD programme and submitted to WHO's country and regional offices. The WHO regional office and WHO headquarters then review and finalize the forecast. The forecasted information is communicated by WHO headquarters to the donating pharmaceutical companies to help with their production plans. Accurate and timely forecasts are critical to the provision of donated medicines for NTDs amenable to preventive chemotherapy. Short-term forecasts are requested by WHO from country programmes to accommodate the planning, production and shipping time for the donating pharmaceutical companies to meet the annual need for production.

This forecast is submitted during the annual request for medicines in the Joint Application Package for the following year and (if possible) shows the forecasts for the next 3 years. WHO recommends multi-year forecasting models that incorporate disease prevalence trends, historical consumption and treatment coverage goals to improve supply planning accuracy; strengthening collaboration with pharmaceutical manufacturers and donors to ensure alignment between production cycles and country demands; reducing excess stock or shortages; and promoting rolling forecasts and supply plan reviews at bi-annual intervals to account for emerging outbreaks, programmatic scale-ups and seasonal demand fluctuations.

4. Last-mile logistics

A summary of how data elements and indicators are linked is shown in Fig. 5.

Fig. 5. Last-mile logistics data flow



4.1 Data elements

Table 2 lists the essential data elements to collect through LMIS records and reports to calculate key performance indicators for the last mile NTD supply chain. The data source column specifies on which records and reports this information should be collected.

Table 2. Key data elements to collect through LMIS records and reports

No.	Data elements	Levels	Definition	Data source and frequency of reporting
1	**Opening balance**	Community Health facility Subnational National	Quantity of each medical product available at the district/health facility at the beginning of the reporting period, by medical product.	Bin card, stock card, ledger, eLMIS, LMIS report Per reporting cycle (monthly, quarterly) or per event (MDA)
2	**Quantity of health products received**	Community Health facility Subnational National	Quantity of each medical product received at the health facility in the reporting period, by medical product.	Receipt vouchers, bin card, stock card, ledger, eLMIS, LMIS report Per reporting cycle (monthly, quarterly) or per event (MDA)
3	**Quantity of medical products issued**	Subnational National Health facility	Quantity of each medical product issued to a lower-level health facility/hub in the reporting period, by medical product.	Issue vouchers, bin card, stock card, ledger, eLMIS Per reporting cycle (monthly, quarterly) or per event (MDA)
4	**Quantity of medical products consumed**	Community Health facility	Quantity of each medical product consumed (used) or dispensed to a patient at the health facility or by a community health worker or drug distributor for the reporting period, by medical product.	Consumption records, such as daily activity register, MDA register, etc. Per reporting cycle (monthly, quarterly) or per event (MDA)
5	**Quantity of expired medical products**	Community Health facility Subnational National	Quantity of expired medical products during the reporting period by NTD medical product, by type.	Bin card, stock card, ledger, eLMIS Per reporting cycle (monthly, quarterly) or per event (MDA)
6	**Quantity of lost/ unaccounted medical products**	Community Health facility Subnational National	Quantity of medical products lost/ unaccounted during the reporting period by NTD medical product, by type.	Bin card, stock card, ledger, eLMIS Per reporting cycle (monthly, quarterly) or per event (MDA)
7	**Quantity of medicines transferred**	Health facility Subnational	Quantity of medical products transferred/ redistributed to other health facilities during the reporting period by NTD medical product, by type.	Transfer voucher, bin card, stock card, ledger, eLMIS Per reporting cycle (monthly, quarterly) or per event (MDA)
8	**Stock on hand (physical stock) or closing balance**	Community Health facility Subnational National	Quantity of medical products available at the health facility at the end of the reporting period by NTD medical product, by type.	Physical count at facility or storage facility Per reporting cycle (monthly, quarterly) or per event (MDA)
9	**Number of days stock out**	Health facility Subnational National	Number of days during which an item is out of stock at any time by NTD medical product, by type.	Bin card, stock card, ledger, eLMIS Per reporting cycle (monthly, quarterly) or per event (MDA)

No.	Data elements	Levels	Definition	Data source and frequency of reporting
10	**Quantity of medical products returned after MDA**	Community Health facility	Quantity of medical products (useable) returned after an MDA by NTD medical product, by type.	Only relevant for PC-related medical supplies Bin card, stock card, ledger, eLMIS Per event (MDA)
11	**Stock forecast**	Health facility Subnational National	Number of medical products required for the following year (period) (PC) for community; and non-PC for health facility). N= next 1–3 years' need + balance by NTD medical product, by type.	NTD medical product projection based on previous consumption and planned activities *Non-PC: stock balance – (# patients x treatment x duration +/- 0.15%)*

eLMIS: electronic logistics management information system; MDA: mass drug administration; NTD: neglected tropical disease; PC: preventive chemotherapy.

4.2 Indicators

The recommended full list of core indicators to be included in eLMIS for NTD health products, along with the levels, is outlined in Table 3.

While this document focuses mainly on the data needed for the monitoring and evaluation of the last-mile supply chain, the global level or first-mile indicators and additional information are provided in Annex 2.

Table 3. Logistics indicators for NTD medicines and health products: last mile (national and subnational levels)

No.	Key indicators	Levels	Definition	Formula/ calculation (if applicable)	Disaggregation numerator	Data elements (see Table 2)
			Product availability indicators			
1	**Inventory reconciliation**	Community Health facility Subnational National	Theoretical balance (explained below) compared with the actual stock (stock at hand).	Physical count / theoretical balance *100	By product name, type and NTD By administrative unit(s)	8, 1, 2, 5, 6
1b	**Theoretical balance**	Health facility	Calculated stock level based on opening balance and number of people treated.	Opening balance + qty received – (No. of Tx people x average dosage) - reported expiry/ lost qty - peer transfer qty, if any)	By product name, type and NTD By administrative unit(s)	1, 2, 5, 6 *Source:* HMIS or MDA registers
2	**Stock-out rate**	Health facility Subnational National	Percentage of time in a reporting period that an item is out of stock by medical product, by type.	Total number of days stocked out / Number of days in reporting period * 100	By product name, type and NTD By administrative unit(s)	9

No.	Key indicators	Levels	Definition	Formula/ calculation (if applicable)	Disaggregation numerator	Data elements (see Table 2)
			Service performance indicators			
3	**Forecast accuracy**	Health facility Subnational National	Assessment of how closely forecasts align with actual health product needs or usage.	(1-((|forecasted consumption-actual consumption|) / (Actual consumption))) * 100	By product name, type and by disease By administrative unit(s)	4
4	**Order fill rate**	Health facility Subnational National	Quantity of product received compared with the requested quantity.	Quantity requested based on forecast / quantity received from high level * 100	By product name, type and by disease By administrative unit(s)	2
			Product quality indicators			
5	**Percentage of expired and/ or discarded medical products**	Health facility Subnational National	Proportion of wasted medical products discarded/wasted and/ or expired compared to overall stock volume in the reporting period by medical product, by type.	Total quantity of expired or discarded medical products / Total quantity of medical products in stock * 100	By product name, type and NTD By administra-tive unit(s)	8, 5
6	**Percentage of lost and/ or damaged, unaccounted for medical products**	Health facility Subnational National	Proportion of wasted medical products discarded/wasted and/ or expired compared to overall stock volume in the reporting period by medical product, by type.	Total quantity of expired or discarded medical products / Total quantity of medical products in stock * 100	By product name, type and NTD By administrative unit(s)	8, 6
			Asset utilization indicators			
7	**Stocked according to plan (non-PC medical supplies)**	Health facility Subnational National	Percentage of facilities maintaining appropriate levels of stock (as defined by local policies, e.g. between minimum and maximum levels) usually defined by a certain number of months of supply (i.e. 1–3 months of supply).	Stock on hand / Average monthly consumption	By product name, type	8, 4
7a	**Average monthly consumption**	Health facility	Related health products. Average monthly consumption for each NTD medical product, by type.	Quantity of medical products consumed in the last 3 months / 3	By product name, type and by disease By administrative unit(s)	4

No.	Key indicators	Levels	Definition	Formula/ calculation (if applicable)	Disaggregation numerator	Data elements (see Table 2)
8	**Stocked according to plan (PC medical supplies)**	Health facility Subnational National	**Only relevant for PC-related health products. Percentage of facilities maintaining appropriate levels of stock (as defined by local policies, e.g. between minimum and maximum levels) (i.e. 90–110% of forecasted need).	Stock on hand / Forecast for MDA * 100	By product name, type	8, 11

MDA: mass drug administration; NTD: neglected tropical disease; PC: preventive chemotherapy.

Note: Some of the information requested in the formulas above (e.g. number of patients treated) is triangulated data originating from another source (i.e. disease-specific programmes).

5. Dashboard analytics for decision-making

Dashboard analytics in an eLMIS play a crucial role in transforming raw data into actionable insights, facilitating informed decision-making at all levels of the supply chain. These analytics calculate key metrics from various indicators, providing a comprehensive view of supply chain performance. The metrics can be categorized into three main levels: strategic, tactical and operational (Table 4).

5.1 Strategic metrics

These high-level metrics drive strategic decision-making and show overall supply chain performance:

- product availability;
- service performance (on-time delivery, On Time In Full [OTIF]), order fulfillment, cycle time, forecast accuracy);
- product quality (loss rates); and
- asset utilization (adherence to stocking plans, inventory turnover).

5.2 Tactical metrics

These metrics offer detailed performance insights and enable comparisons across regions or disease programmes:

- product availability by category or specific products;
- stock-out rates and durations;
- number of items at risk (less than 3 months central level, 1 month at facility level, depending on lead-times of the replenishment cycle), also risk of overstock resulting in wastage; and
- asset utilization measured in days of supply.

5.3 Operational metrics

These process-level metrics directly impact tactical performance:

- product quality indicators (expiration rates, waste/discard percentages).

By providing a hierarchical view of supply chain performance, from strategic overview to operational details, dashboard analytics empower stakeholders at all levels to make data-driven decisions, identify areas for improvement, and optimize the overall supply chain efficiency.

Table 4. Summary of metrics

Performance area	Indicator	Purpose	Decisions or actions supported
Product availability	Inventory reconciliation	Accuracy of reported inventory compared to number of persons receiving treatment	Build capacity in completing reporting forms and conducting physical count.
			Conduct more regular stock audits and train staff on proper stock keeping and reporting.
			Identify and explore inventory discrepancies.
	Stock out rate	Measure proportion of reporting period where the health product was stocked out	Measures extent of stockouts, and ability of the supply chain to maintain stock.
			Sometimes used to adjust consumption rates.
Service performance	Forecast accuracy	How closely forecasts align with actual medical product needs	Assess the quality of the forecasting to enable refinement of forecasting models or methods if deviations from actual demand are significant.
			Enhance data collection at the community level to improve forecast inputs.
	Order fill rate	If sufficient stock was received/ supplied compared to what was requested or allocated and/or if overstock or understock may occur	Identify gaps in supply chain processes causing incomplete orders, such as insufficient stock due to poor forecasting, or capacity of staff to follow requests. Assesses how well the warehouse is meeting demand for facilities.
Product quality	Percentage of expired and/ or discarded medical products	Measures the proportion of health products that have expired from the overall stock	Assessment of operational efficiency.
			Reinforce first expiry, first out (FEFO) stock rotation policies.
			Adjust allocation quantities and delivery schedules to avoid overstocking.
			Investigate instances of loss and unaccounted medicines.
			Strengthen training on limiting leftover opened bottles.
	Percentage of lost or damaged medical products		Strengthen storage conditions to prevent loss due to environmental factors.
			Investigate instances of loss and unaccounted medicines.
Asset utilization	Stocked according to plan	Stock levels against established minimum level and maximum level	Determine areas that are over or under stocked and guides redistribution of to prevent stock expiries or stock outs.

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2. Toolkit for Routine Health Information Systems Data. In: WHO Health service data/modules [website]. Geneva: World Health Organization (https://www.who.int/data/data-collection-tools/health-service-data/toolkit-for-routine-health-information-system-data/modules, accessed 5 June 2025).

3. HMIS-LMIS integration: generalized use cases based on assessments in three countries. Seattle (WA): Village Reach: 2017 (https://www.villagereach.org/wp-content/uploads/2017/01/HMIS-LMIS_Integration_Use_Cases.pdf, accessed 5 June 2025).

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5. Chartier Y, Emmanuel J, Pieper U, Prüss A, Rushbrook P, Stringer R, et al (editors). Safe management of wastes from health-care activities, second edition. Geneva: World Health Organization; 2014 (https://iris.who.int/handle/10665/85349).

Suggested further reading

Ending the neglect to attain the sustainable development goals: a framework for monitoring and evaluating progress of the road map for neglected tropical diseases 2021−2030. Geneva: World Health Organization; 2021 (https://iris.who.int/handle/10665/341313).

Standard operating procedures for supply chain management of health products for neglected tropical diseases amenable to preventive chemotherapy. Geneva: World Health Organization; 2022 (https://iris.who.int/handle/10665/360835).

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Annex 1. **Medicine request and reporting forms**

Data platforms and tools to collect, manage and analyse data are available from the WHO Global Neglected Tropical Diseases Programme (https://www.who.int/teams/control-of-neglected-tropical-diseases/data-platforms-and-tools).

The green light checklist in Table A1.1 alerts the World Health Organization when countries are ready to receive the donated shipment. Responding "YES" to the question in the checklist indicates that the shipment can proceed (e.g. start booking cargo flight/vessel, etc.). Any additional information should be added to the list.

Table A1.1. Green light checklist

Shipment green light checklist		Responsible	Yes, No or N/R	Additional information on the response
Communication	Is the Customs Office aware of the shipment, including its quantity?	Consignee (WHO/CO or Ministry of Health)		
Customs duty waiver	Will the customs clearance duty waiver be prepared before the consignment arrives *(donated medicines are required to enter the country free of any import duties or taxes)*?	Consignee (WHO/CO or Ministry of Health)		*Please include an estimated availability date for the required customs duty waiver(s)*
Import permit	Is an Import Permit available *(If it is not required, respond "N/R" to this question)*?	Consignee (WHO/CO or Ministry of Health)		
Warehouse space	Will the central medical store warehouse(s) have space available to receive the consignment and personnel to offload the containers upon arrival?	WHO/CO and/or Ministry of Health		
Distribution	Is the country prepared to distribute these donated medicines and is funding secured?	WHO/CO and/or Ministry of Health		
Others	Have all other requirements for receiving the donated shipment been met?	WHO/CO and/or Ministry of Health		

N/R: not required (i.e. the checklist item is not required for this shipment); WHO/CO: WHO Country Office; WHO: World Health Organization.

Signatories

For consignee

Name, designation and organization .....

Signature .....

Date .....

For Government

Name, designation and organization .....

Signature .....

Date .....

Annex 2. **Minimum list of products for tracking in eLMIS**

The following list of products are either purchased by or donated to countries through the World Health Organization. This list can be modified to include locally acquired products as required.

Disease	Product	Formulation
Buruli ulcer	Rifampicin	300 mg capsules
	Rifampicin	150 mg capsules
	Clarithromycin	250 mg tablets
	Clarithromycin	500 mg tablets
Chagas disease	Nifurtimox	120 mg and 30 mg tablets
	Benznidazole	100 mg tablet
	Benznidazole	12.5 mg tablet
Cystic echinococcosis	Albendazole	400 mg tablets
Foodborne trematodiases	Triclabendazole	250 mg tablets
	Praziquantel	600 mg tablets
Human African trypanosomiasis	Nifurtimox (Lampit)	120 mg and 30 mg tablets
	Suramin	1 g in vial
	Eflornithine	200 mg per mL in 100 mL bottle
	Melarsoprol	3.6% in 5 mL ampoule solution (180 mg of active compound)
	Pentamidine	300 mg powder for injection
	Fexinidazole	600 mg tablets
	DE52 cellulose	10 kg pack size
	Cytopore2	1 kg pack size
	Blood - Lancets	Box of 1 kit
	CATT	Box of 1 kit
	Coris Test	Box of 1 kit
Leprosy	Clofazimine	100 mg capsule
	Clofazimine	50 mg capsule
	Rifampicin	300 mg capsule
	Rifampicin	150 mg capsule
	Rifampicin syrup	100 mg bottle
	MDT-combi MB (adult)	Blister. Rifampicin 300 mg: 2 hard gelatin capsules, Clofazimine 100 mg: 3 soft gelatin capsules, Clofazimine 50 mg: 27 soft gelatin capsules, Dapsone 100 mg: 28 tablets

Disease	Product	Formulation
Leprosy	MDT-combi MB (child)	Blister. Rifampicin 300 mg: 1 hard gelatin capsule, Rifampicin 150 mg: 1 hard gelatin capsule, Clofazimine 50 mg: 16 soft gelatin capsules, Dapsone 50 mg: 28 tablets
	MDT-combi PB (adult)	Blister. Rifampicin 300 mg: 2 hard gelatin capsules, Dapsone 100 mg: 28 tablets
	MDT-combi PB (child)	Blister. Rifampicin 300 mg: 1 hard gelatin capsule, Rifampicin 150 mg: 1 hard gelatin capsule, Dapsone 50 mg: 28 tablets
Lymphatic filariasis	Albendazole	400 mg tablets
	Diethylcarbamazine citrate	100 mg tablets
	Ivermectin	3 mg tablets
	Filariasis test strip	Kit
Onchocerciasis	Ivermectin	3 mg tablets
Schistosomiasis	Praziquantel	600 mg tablets
	Praziquantel	600 mg tablets
	Praziquantel (paediatric)	150 mg tablets
Soil-transmitted helminthiases	Albendazole	400 mg tablets
	Mebendazole	500 mg tablets
Taeniasis	Niclosamide	400 mg tablets
	Praziquantel	600 mg tablets
Trachoma	Azithromycin	250 mg tablets
	Azithromycin	1200 mg in 30 mL (200 mg/5 mL) powder for oral suspension
Visceral leishmaniasis	Liposomal amphotericin B	Lyophilized 50 mg formulation in vials
	Paromomycin	300 mg vial
	Miltefosine	50 mg and 10 mg tablets
	Glucantime	1.5 mg vial
	Sodium stibogluconate injection	100 mg 30 mL vial
	DAT antigen	Kit
	RDT Abbott kits	Kit
	rk39 BioRad	Kit
	rk39 Inbios	Kit
	rk39 Mologic	Kit
Yaws	Azithromycin	500 mg tablets
	BD lancet	Kit
	DAT test	Kit
	DPP reader	Kit
	DPP Chembio kits	Kit
	DPP kit	Kit
Rabies	Vaccines	As used in country
Snakebite envenoming	Antivenom(s)	As used in country

DAT: direct antiglobulin test; DPP: dual path platform; MB: multibacillary; MDT: multidrug therapy; PB: paucibacillary; RDT: rapid diagnostic test.

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