BASELINE ASSESSMENT OF THE PHARMACEUTICAL SUPPLY CHAIN MANAGEMENT SYSTEM IN RWANDA

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ABBREVIATIONS

AMELP	Activity Monitoring, Evaluation, and Learning Plan
BUFMAR	Bureau de Formations Medicales Agrees du Rwanda
CEO	Chief Executive Officer
CFO	Chief Finance Officer
CHUB	Centre Hospitalier Universitaire de Butare
CHW	Community Health Worker
CIIC-HIN	Centre for Impact, Innovation, and Capacity Building for Health Information Systems and Nutrition
CLAA	Collaborating, Learning, and Adapting Activity
CMS	Central Medical Store
COO	Chief Operation Officer
COR	Contracting Officer's Representative
CSPro	Census Survey Processing
DH	District Hospital
DLMSs	District Level Medical Stores
EHP	Essential Health Products
e-LMIS	Electronic Management Information System
FDA	Rwandan Food and Drug Authority
FEFO	First Expired First Out
FP	Family Planning
FY	Fiscal Year
GHSC-PSM	Global Health Supply Chain - Procurement and Supply Management
GOR	Government of Rwanda
HC	Health Centre
HF	Health Facility
HIV	Human Immunodeficiency Virus
HMIS	Rwanda Integrated Health Management Information System
HQ	Headquarters
HR	Human Resource
HSS	Health Systems Strengthening
IM	Inventory Management
IPR	International Reference Pricing
IT	Information Technology

KPIs	Key Performance Indicators
M&E	Monitoring and Evaluation
MCH	Maternal Child and Health
MEDIASOL	Medical and Allied Service Solutions
MOH	Ministry of Health
NDA	Non-Disclosure Agreement
NLMS	National Level Medical Store
NSCA	National Supply Chain Assessment
PH	Provincial Hospital
QA	Quality Assurance
QC	Quality Control
RBC	Rwanda Biomedical Centre
RH	Referral Hospital
RMs	Rwanda Medical Supplies
SC	Supply Chain
SCM	Supply Chain Management
SDG	Sustainable Development Goal
SDP	Service Delivery Point
SOP	Standard Operating Procedure
SOW	Scope of Work
STATA	Statistical software for data science
TB	Tuberculosis
TPM	Third-Party Monitoring
TRMS	Transforming Rwanda Medical Supplies
UN	United Nations
USAID	United States Agency for International Development
USG	United States Government
WHO	World Health Organization

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EXECUTIVE SUMMARY

While the Government of Rwanda (GOR) has achieved significant progress in public health care delivery, there are still areas for improvements in its health care system, particularly in the supply chain (SC) for health commodities. Established in 2020, Rwanda Medical Supply, Ltd. (RMS) has centralized the distribution of health commodities sourced from different providers by aggregating them its central headquarters in Kigali. These commodities are distributed to health facilities through branches located in each of Rwanda's 30 districts. As a key player in supply chain management, RMS contributes significantly to streamlining processes and ensuring consistent access to health commodities.

To support the effectiveness and efficiency of Rwanda's health commodity SC, USAID/Rwanda has provided material support to RMS's operations through the Transforming Rwanda's Medical Supply (TRMS) Activity. This Activity is significant, because several of USAID/Rwanda's other health investments rely on the sufficient stock of accessible, high-quality health commodities. USAID/Rwanda has requested that ME&A – through the Collaborating, Learning, and Adapting Activity (CLAA) – conduct third-party monitoring (TPM) of the TRMS Activity, to independently track and measure the Activity's progress toward its intended outcomes. In turn, ME&A subcontracted the Center for Impact, Innovation, and Capacity-building for Health Information Systems and Nutrition (CIIC-HIN) to conduct TPM activities.

This report presents findings from a baseline assessment of the SC conducted in 2023 with the aim of establishing baseline values for key performance indicators (KPIs), which will be tracked over the life of the TRMS Activity to measure its outcomes. Moreover, the baseline assessment addresses the following six objectives:

1. Assess the state of key tracer products from central to decentralized levels, and determine the level of implementation of each of the SC functions.
2. Assess the current use of Electronic Management Information System (e-LMIS) in the national SC system and determine its role in stimulating improvements.
3. Assess the bottlenecks hindering the use of clinical data [via the Rwanda Integrated Health Management Information System (HMIS) and registries] and logistic data (via stock at hand and e-LMIS) to support decision making processes.
4. Establish baseline values of identified KPIs for tracer commodities, thereby establishing supply chain management (SCM) system performance.
5. Assess quality assurance processes and activities, from national to decentralized levels.
6. Assess the level of client satisfaction across the national SC system.

Additionally, this baseline assessment identifies key areas for improvements in the SC for health commodities and identified problems and accompanying root causes – insights which will support the adaptive management of the TRMS Activity.

Given the objectives above, KPIs selected for TPM included all TRMS Activity indicators as well as additional indicators selected to reflect all functions of the SC for health commodities. CIIC-HIN collected data on these KPIs in February 2023, using a cross-sectional design including respondents from all levels of the SC and across all its functions, together with end-users. To respond to the first objective, CIIC-HIN identified and tracked 10 tracer commodities through the SC: three commodities associated with the programs that USAID supports, three supported by other partners, and four additional essential medicines. An end line assessment leveraging the same design will be conducted in 2025 upon the TRMS Activity's closeout, to establish whether the TRMS Activity achieved its intended objectives.

In general, this baseline assessment showcased an overall positive performance of RMS's SC management of health commodities, with some areas for improvement. Firstly, the company consistently demonstrated the ability to obtain competitive prices for their purchase, as benchmarked to international price references. Moreover, RMS achieved 87 percent of deliveries in full and on time, which positively impacts the availability of health commodities. Periods of stock-out, while still slightly above the threshold acceptable rates, were resolved in a timely manner using emergency delivery procedures and redistribution of commodities between branches to bridge the gaps. The procurement lead time has also improved from 8-12 months before baseline to 5-9 months. There was significant attention paid to governance and capability areas, including the availability and awareness of policies to guide SC operations, especially at the RMS central warehouse. Positive performance was observed in the areas of quality assurance processes, waste management, forecast and quantification, and response to emergencies.
Nevertheless, there were a few low performance areas identified; these findings are presented below, organized by objective.

Objective 1: Tracer commodities show deviations from recommended targets on three core KPIs used for this exercise – stockout rate, order fill rate, and stock according to plan – across all SC levels, although RMS branches consistently performed the best.
TRMS has set a target of 1 percent stock out by 2025, although maintaining a stockout below 5percent would be considered acceptable performance. The average stockout rate for all tracer commodities was found to be above the recommended 5 percent in all levels of the SC, except for RMS branches, which was still above the Activity's target. Similarly, whereas 90 percent of orders should be able to be filled from available stock, the average order fill rate across tracer commodities was well below this at all levels of the SC, although RMS branches showed the highest order fill rates at an average of 62.7 percent. Disaggregation by commodity, however, shows that there is a high level of variation in order fill rates by SC level and by commodity. Finally, whereas according to best practice 90 percent of commodities should fall within established minimum and maximum stock levels, the tracer commodities showed significantly lower levels of stock according to plan. Once again, RMS branches got the closest to the target, achieving 50.0 percent stock according to plan on essential medicine and 54.7 percent on program tracer commodities. Therefore, these KPIs show that inventory management is a key challenge in the SC for health commodities, which respondents attributed to complex factors including insufficient budget and storage space, supply delays and branch stock outs, and logistics problems.

Objective 2: e-LMIS utilization for decision-making remains low at Health Centers and hospitals, predominantly because it has not been effectively operationalized.
This baseline assessment identifies that the level to which e-LMIS has been operationalized and is used for decision-making varies significantly between the highest and lowest levels of the SC. Whereas 92.3 percent of respondents at RMS branches stated that they use e-LMIS for decision-making, only approximately a third of respondents at Health Centers (HCs) and hospitals did. Additional data from the assessment highlight the driving factors for this. Only a small proportion of HCs and hospitals report that e-LMIS is fully operational, and only about a third of HCs and hospitals report that Standard Operating Procedures (SOPs) are available to guide how the e-LMIS should be managed and used. Respondents in HCs and hospitals report several structural problems that prevent them from effectively using e-LMIS, including insufficient trained staff to dedicate to using the e-LMIS versus to other responsibilities and internet connectivity issues that constrain updating the e-LMIS.

Objective 3: Data accuracy is the most critical bottleneck hindering the use of logistical and clinical data for decision-making.
Comparing data captured in the e-LMIS and registers at health facilities, to data in the HMIS among HCs and hospitals, revealed inconsistencies between the two. Examining the sub-sample of tracer

commodities, most of the data on essential medicines (except for data on oxytocin) differed between e-LMIS and HMIS data by 97.1 percent on average at HCs, and by 79.6 percent on average at hospitals if removing this outlier. Data was more consistent between these two datasets for program tracer commodities, but there were still inconsistencies of 34.4 percent on average at hospitals and 20.4 percent at hospitals. There were even higher inconsistencies when comparing HMIS data to data in registers at health facilities. In part, these inaccuracies are due to the limited interoperability between these information systems. However, irrespective of the factors driving the disparities, health system SC actors are unlikely to use this data for decision-making when they are not sure of its accuracy.

Objective 4: Baseline values for KPIs (presented in Table 17) showcase that there are gaps between KPI values and TRMS Activity targets on most parameters, something that RMS will need to work to close during Activity implementation.

Objective 5: Quality assurance processes are strong across all levels of the supply chain, with a few isolated gaps.
Both at the central level (RMS headquarters and RMS branches) and the decentralized level (HCs and hospitals), baseline assessment data showed strong evidence of best practice in quality assurance (QA). This assessment used measures of inventory management – such as storage space and disposal practices – as indicators of QA processes. Across all levels of health facilities in the SC, physical inventories were regularly conducted and the disposal of unfit commodities was supervised, authorized, and documented – with only a few exceptions. However, there were some gaps in storage. All levels of health facilities reported that they have insufficient storage space, and while storage temperature is regularly recorded, humidity is not at HCs and hospitals.

Objective 6: All actors in the SC surveyed – key stakeholders, health facility personnel, and patients – had generally high levels of satisfaction with how the SC chain functions, while highlighting a few key gaps that remain unaddressed that the RMS/TRMS Activity should target.
This baseline assessment examined multiple aspects of satisfaction across multiple facets of the SC: health facility personnel's satisfaction with the SC's functioning, patients' satisfaction with the services that they have received at health facilities, and key stakeholders' satisfaction with the e-LMIS. Health facility personnel felt largely satisfied with the SC's functioning, although respondents across all health facility levels had more mixed opinions about e-LMIS features and whether information was shared in a timely fashion. In general, personnel in RMS branches were more satisfied with the SC's functioning than those in HCs and hospitals – something which should be examined further by the TRMS Activity. Overall, patients reported that they were satisfied with the services they have received from health facilities and trusted the health commodities that they were prescribed; however, they reported that they were not satisfied with the availability of health commodities. Key Activity stakeholders reported generally positive opinions of the usability of e-LMIS but had mixed satisfaction levels with system support, and they reported having largely positive working relationships with RMS, but had relatively low opinions on whether information sharing took place between RMS and their institutions in a timely fashion.

Ultimately, despite the many indicators of positive performance in SC management that this baseline assessment identified, there remain some important areas for improvement. The conclusion that follows at the end of this report highlights both, the gaps identified as well as their root causes. However, here we highlight four key gaps the RMS and stakeholders should be cognizant of and work to address:

- The e-LMIS has not been fully operationalized and used for decision-making at the lower levels of the SC.

- Stock levels of key health commodities are not optimal and order fill rates is still low, which affects the availability of commodities to meet patient needs.
- Data quality is still low which impacts how effectively these data can be used.
- While satisfaction levels across the SC are generally positive, gaps exist that the RMS and stakeholders should address, including delivery delays and logistics problems, challenges in computers and internet connectivity, inadequate staffing, and improved information sharing, among others.

Based on these findings, we recommend the following:

- **RMS** should regularly assess KPIs through use of a dashboard for adaptive management toward the TRMS Activity's intended outcomes, and create a framework for timely sharing of information with Activity stakeholders.
- **The Ministry of Health (MOH)** should support the effective use of e-LMIS by mobilizing resources to incentivize health facilities to do so, and by working with RMS to set up a technical team to support health facility personnel in their efforts.
- **USAID/Rwanda** should support improving the stock of low-quantity products by leveraging its global health commodity procurement network, and advocating for flexible funding payment schemes for the procurement of essential health commodities.
- **Activity Stakeholders** should support increasing storage space at all levels of the SC system and should continually conduct data quality monitoring activities, taking corrective actions to ensure that the data intended for decision-making are of sufficient quality and usability.

1. BACKGROUND AND ACTIVITY CONTEXT

1.1 GLOBAL HEALTH SUPPLY CHAIN

Medicine and vaccine supply chains (SCs) represent critical systems for realizing one of the major targets of the United Nations' third Sustainable Development Goal (SDG) – access to safe, effective, quality, and affordable essential medicines and vaccines for all (1). The structure of a health SC system plays an essential role in optimizing the various processes and functions across the different levels of a health system. The SC system comprises structures and processes that encompass the sourcing of equipment, commodities, and supplies, purchasing and procurement, transportation, and finally, the distribution of products to end users. The interactions between the structures and processes have several implications for the availability of medical products across all levels of care. The key aspects that enable access to essential medicines and commodities across the health system include availability, affordability, accessibility (geographical), acceptability (rational selection and use), and quality (2).

The World Health Organization estimates that about one-third of the world's population lacks access to quality essential medicines and diagnostics, particularly for patients in low- and middle-income countries (LMICs, 2). Over the years, pharmaceutical SCs in sub-Saharan Africa have faced many challenges that have negatively impacted their performance. These include stockouts, fake and counterfeit products, disruptions, expired drugs, infrastructure issues, corruption, and weak regulatory systems. This undermines the effectiveness of healthcare and diminishes public confidence in the health sector (2).

In 2008, an analysis of data collected by the WHO and Health Action International on the availability and price of drugs found that among eight countries in sub-Saharan Africa, a mean of only 29.4 percent of 15 essential first-line medications was available in public-sector clinics (3). Consistently, across national and subnational surveys, the availability of essential health products (EHPs) in LMICs is higher in private-sector clinics than in public-sector clinics (4).

In Nigeria, poor planning and forecasting, insufficient information about consumption and current stock levels, funding and capacity constraints, and poor infrastructure are reasons cited for inappropriate stock levels (5). Public warehouse infrastructure in Nigeria consists of National-Level Medical Stores (NLMS), District-Level Medical Stores (DLMS), and health centers, and the study found that the SC challenges are more pronounced at the decentralized levels than the central level. There are eight NLMSs that struggle with moisture (leaking ceilings, roofs, drains, or taps), inappropriate cold storage capacity (5), and nonexistent designated areas for reception, delivery, and quarantined products. However, there are special areas for the storage of dangerous and narcotic medicine, products requiring cold storage, possibilities to secure products, and stores that are shaded from direct sunshine. Stock management is done manually with stock holding cards and follows the first-expired-first-out (FEFO) strategy.

Nigeria and Burkina Faso have created semi-autonomous medical stores, which positively influence agility and flexibility due to management expertise. NLMSs in Nigeria received several improvements such as the use of Standard Operating Procedures (SOPs) for Inventory Management (IM), the installation of a Logistics Management Information System (LMIS), and training for employees (5). According to Nigeria's Ministry of Health (MOH), Health Centers (HC) are usually run with a good infrastructure regarding storage, ventilation, and security. Nevertheless, stock cards, traceability of batches, and defined minimum/maximum stock levels are only common at hospitals. Furthermore, most HCs do not have temperature charts to control cold chains. Almost 67 percent of stockouts occur due to funding constraints or due to management constraints (e.g., FEFO, errors in forecasts, or modifications of Standard Treatment Guidelines).

Research in Ghana and Guatemala assessed the inventory performance of more centralized or decentralized warehouse management models. The results show that the use of centralized guidelines and standardized processes such as SOPs and clear stock cards improved performance (6).

As Figure 1 below shows, the core functions of an SC system are product selection, forecasting, procurement, quality assurance (QA), warehousing, storage, distribution, and waste management. An important tool in SC management in Rwanda is the Electronic Logistics Management Information System (e-LMIS), a digital organized system for collecting, processing, reporting, and using health product data gathered across all levels of the SC system. In a well-functioning SC, these individual components are supported by strong governance, strategic planning, financial management, and human resources. Effective coordination between the components prevents delays in supply that can affect patients' access to critical life-saving vaccines, medicines, and clinical treatments. Information management is at the heart of effective SC management and drives operational decision-making, planning, and resource allocation.

Figure 1. SC Functions

Source: Adapted from USAID DELIVER. 2011. *The Logistics Handbook: A Practical Guide for the Supply Chain Management of Health Commodities.* Task Order 1. Arlington, VA: US Agency for International Development.

1.2 RWANDA'S PUBLIC HEALTH SUPPLY CHAIN

The Government of Rwanda (GOR) has invested significantly in improving the country's health care system, including ensuring the accessibility and availability of essential health commodities to its citizens. In 2016, the Ministry of Health (MOH) conducted SC monitoring, training, and planning sessions in collaboration with the U.S. Agency for International Development (USAID) Global Health SC Program – Procurement and Supply Management (GHSC-PSM) Activity. These sessions identified several challenges related to the SC workforce, such as high staff turnover and the lack of SC professionals at the service delivery point (SDP) level. Additionally, the SC monitoring by MOH and GHSC-PSM identified other challenges in the SC's functioning, including a high stockout rate (10 percent), underutilization of the e-LMIS (55 percent), and inventory stock inaccuracies (25 percent), as reported by SDPs and RMS branches (7). The MOH and GHSC-PSM concluded that the key to successfully improving SC performance was to focus on areas that were underperforming, as well as areas that were not aligned with the overall SC strategy (7).

Rwanda's public health system is organized in a vertically oriented hierarchy, with centralized entities playing essential roles in strategic planning, governance, policy, and implementation. At the top of this hierarchy is the MOH and its directorates, which are collectively responsible for setting strategic planning priorities, policies, operational guidance, directing actions, and the coordination and allocation of funding. Regulatory oversight is provided by the Rwanda Food and Drug Authority (FDA), which is responsible for drug registration, pharmacovigilance,[1] and QA of products delivered to the decentralized levels. Specifically, the FDA's mission is "to regulate medical products, processed foods, household products, and tobacco products to ensure their quality and safety to protect the population of Rwanda from defective, falsified, and substandard products" (8).

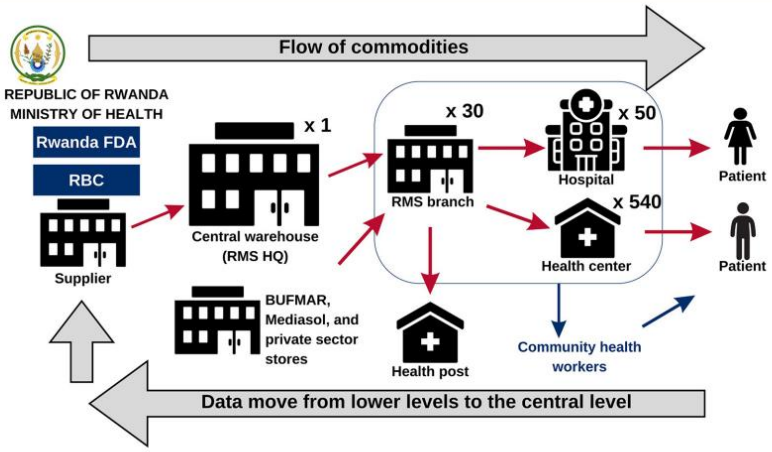
The execution of core SC tasks such as procurement, customs clearance, warehousing, and distribution is implemented at the national level by four institutions that together serve as central medical stores (CMS), as follows:

- *RMS:* RMS was formed in 2020 when the GOR merged the former national CMS (Medical Procurement and Production Division) with 30 district pharmacies to improve SC functioning. RMS serves as the national public health central warehouse, with a mission to ensure the availability of quality and affordable pharmaceutical products, medical equipment, and consumables to the national population (9). The institution has full financial, legal, and administrative autonomy in its work to procure, store, and distribute health commodities to be used in all public health facilities. RMS conducts integrated distribution of a variety of different commodity groups, including program commodities that are provided by international donor institutions. It has one central warehouse that serves as RMS headquarters and 30 warehouse across Rwanda that serve as branches, serving health facilities in those districts.
- *Medical Allied Service* Solutions (MEDIASOL): MEDIASOL is a group of private companies limited by shares categorized under health services. The company has recently signed an agreement with the MOH to act as a CMS for key essential medicines that the country procures for its health system.
- *Bureau de Formations Medicales Agrees du Rwanda (BUFMAR):* BUFMAR is a nongovernmental organization established in 1975 by Christian denominations working in Rwanda with approved health training. BUFMAR also serves as a CMS institution for essential medicine products for the Rwandan health care system (5).
- Rwanda Biomedical Centre (RBC): RBC's mission is "to promote high quality, affordable, and sustainable health care services to the population through evidence-based interventions and practices guided by ethics and professionalism." RBC is responsible for providing health care services in a variety of capacities, but from the SC perspective, they operate the vaccine SC including direct distribution to immunization sites throughout Rwanda.

Figure 2 on the next page showcases how the SC for health commodities is organized in Rwanda, demonstrating how these institutions operate with each other and how RMS branches centralize distribution across these institutions at the district level, providing health commodities to health facilities.

[1] Pharmacovigilance – or drug safety, as it is more commonly referred to – is the collection, detection, assessment, monitoring, and prevention of adverse effects with pharmaceutical products.

Figure 2. Rwanda's SC system



Abbreviations: BUFMAR, Bureau des Formations Médicales Agréées du Rwanda; FDA, Food and Drug Authority; HQ, headquarters; Mediasol, Medical & Allied Service Solutions; RBC, Rwanda Biomedical Center; RMS, Rwanda Medical Supply.

At the service delivery level, there are multiple types of health facilities that provide increasing levels of health services as they progress higher up the administrative layers. The primary health care facility types, organized from the highest and most centralized to the lowest and most decentralized, are as follows:

- *Referral Hospitals:* There are seven centralized hospitals in Rwanda, four of which are teaching hospitals, as well as four provincial hospitals and five specialized hospitals placed strategically throughout the country (10).
- *District Hospitals (DHs)*: These are the most common hospital type, with 40 DHs nationwide.
- *Health Centers (HCs)*: Also considered last-mile facilities, HCs, however, offer robust services through approximately 540 facilities nationwide.
- *Health Posts:* The lowest level in the health system, health posts deliver simple services to patients at approximately 1,245 facilities (although 92 are not functional).

The facilities listed above only refer to public health facilities. However, there are several private health facilities in Rwanda, although concentrated in Kigali, where 50 percent are located (10).

1.3 ACTIVITY CONTEXT

To address health system strengthening (HSS) issues, the GOR, its development partners, and key stakeholders recognized the urgent need to have strong and sustainable health systems for accessible, equitable, efficient, and improved health services that would significantly contribute toward the desired health outcomes. Strong leadership and management are the requisite ingredients for comprehensive policies, efficient planning, improved coordination, and effective implementation that will result in robust health systems. These systems would, in turn, benefit the health sector, including service delivery in both public and private areas.

Over the years, USAID/Rwanda has been a strong partner of the GOR, helping to address various health issues in HSS and health SC management. One of USAID/Rwanda's important focus areas is improving the efficiency of the health commodity SC management system, particularly around commodities related to key issues that USAID/Rwanda targets, such as Human Immunodeficiency Virus (HIV), malaria, maternal and child health (MCH), and family planning (FP).

To this end, USAID/Rwanda has signed an Indefinite Delivery, Indefinite Quantity (IDIQ) contract with RMS, covering its services related to the procurement, warehousing, distribution, and management of all United States Government (USG)-funded health commodities targeted for Rwandan beneficiaries (11). This Activity is referred to as Transforming Rwanda's Medical Supply, or TRMS.

To complement the TRMS Activity's internal quality control and assurance measures, USAID/Rwanda has commissioned the Collaborating, Learning, and Adapting Activity (CLAA) implemented by ME&A to conduct third-party monitoring (TPM) of the TRMS Activity. Insights from these TPM activities will support USAID/Rwanda and RMS to continually improve the effectiveness and efficiency of the health commodities SC system throughout the life of the Activity. ME&A has in turn subcontracted The Center for Impact, Innovation, and Capacity Building for Health Information Systems and Nutrition (CIIC-HIN)[2] to conduct these TPM activities. As such, CIIC-HIN independently monitors and advises on the flow of USAID-supported health commodities from importation to eventual delivery to end users at the service delivery level. The next section provides more detail on the specific purpose of the assessment discussed in this report.

[2] This acronym is pronounced as "seek-in".

2. BASELINE AIM AND OBJECTIVES

2.1 BASELINE AIM

As mentioned in the previous section, through TPM, CIIC-HIN will support and expand existing efforts by USAID/Rwanda to monitor the flow of all USG health commodities through RMS by conducting a prospective, thorough, and independent process monitoring, with a particular focus on the relationship with end users at service delivery.

This assessment serves as a baseline for the TRMS Activity, serving as a basis from which to monitor the Activity's implementation and to eventually evaluate how well the TRMS Activity achieved its intended outcomes. However, this assessment is also useful to provide a current understanding of how well the Rwandan SC for health commodities is functioning, identifying key challenges in the SC system, their root causes, and recommendations for improvement. These insights will be similarly helpful to USAID/Rwanda and RMS to drive the adaptive management of the TRMS Activity.

2.2 BASELINE OBJECTIVES

Since this is a baseline assessment, its primary objective is to establish baseline values of Key Performance Indicators (KPIs), both to understand over time how the TRMS Activity performs, and to identify the root causes hindering the full implementation of the national health commodity SC across all core SC functions, as presented in Figure 1. These KPIs are examined through the lens of tracer commodities, specific commodities selected for ongoing tracking and monitoring.

In addition to this primary objective, this baseline assessment has six secondary objectives:

1. Assess the state of key tracer products from central to decentralized levels and determine their level of implementation for each of the SC functions.
2. Assess the current use of e-LMIS in the national SC system and determine its role in stimulating improvements.
3. Assess the bottlenecks hindering the use of clinical data (from HMIS and registries) and logistical data (from stock at hand and e-LMIS) to support decision-making processes.
4. Establish baseline values of identified KPIs for tracer commodities, thereby establishing SC management (SCM) system performance.
5. Assess quality assurance processes and activities, from national to decentralized levels.
6. Assess the level of client satisfaction across the national SC system.

Findings that follow in Section 4 are organized according to these secondary objectives, and are labeled by the objective's number as provided in the list above.

3. METHODS

3.1 ASSESSMENT DESIGN

To establish a foundation for tracking the change in KPIs over time, TPM data on the TRMS Activity will be collected longitudinally. Data presented in this baseline assessment were collected in February 2023. An endline assessment examining the same KPIs will be conducted toward the end of the Activity's implementation in 2025 to quantify the achievement of its intended outcomes.

This baseline assessment utilized a cross-section design, collecting data from respondents at each level of the SC and across all its functions. Additionally, the assessment included data collection from recipients of health commodities – health service patients. We discuss the detailed sampling strategy for this assessment in the following subsection.

3.2 SAMPLING

The baseline population constituted of all key staff involved in leadership or implementing functions of the SC system across different levels, including RMS Ltd. Headquarters (HQ, central level), RMS branches, hospitals,[3] and HCs. The baseline assessment also considered patients at all selected health facilities that were present on the day of the interview visit.

Sample description

Targeted individuals and staff working across 11 functions of SC, from central to decentralized levels, were included in the final sample. Additionally, individuals from UN family, BUFMAR, MEDIASOL, RBC, MOH, and Rwandan FDA were identified as stakeholders to be included in the final sampling selection. All respondents were interviewed about the SC functions relevant to their position. Including patients interviewed, the total targeted sample size for this baseline assessment was 843 respondents from health facilities. Annex 1 provides a detailed breakdown of these respondents by health facility level and by their role in the SC for health commodities.

Sample size estimation

A multistage sampling method was used to identify our sample size:

- At the RMS level, the headquarters and all the branches in 12 selected districts were included.
- Knowing that SC performance in LMICs was estimated at 30 percent (2), we included 12 DHs in the first stage of the sample, representing 30 percent of all DHs in Rwanda as reflected in Table 1 below. These were selected randomly using an Excel function (RANDBETWEEN).
- We applied systematic random sampling to identify HCs, organized per volume of patients. A total of 101 HCs were retained within the chosen districts, to have a confidence level of 95 percent that the real value is within ±5 percent of the measured/surveyed value, after applying 10 percent of non-availability of all products at SDPs.
- Finally, we applied a sample size calculation for repeated measures with the following formula, to select individuals within SC functions across all levels of SC system in Rwanda, as shown below.

[3] For the purposes of this assessment, we use "hospitals" to refer broadly to all hospitals in the Rwandan health system, including teaching hospitals, referral hospitals, provincial hospitals, and district hospitals.

$$n = \frac{deft\,[z\alpha\sqrt{2p(1-p)} + z\beta\sqrt{p2(1-p2) + p1(1-p1)}]^2}{(p2-p1)^2}$$

where:

- *n*: minimum sample size required per survey round.
- *deft*: anticipated design effect
- z_α: the probability with which it is desired to be able to conclude that an observed change of magnitude (p_2 - p_1) would not have occurred by chance (significance = 95 percent)
- z_β: the probability with which it is desired to be certain of being able to detect a change of magnitude (p_2 - p_1) if one occurred (power = 90 percent)
- $p = (p_1 + p_2)/2$, where p_1 is the expected population proportion at the baseline, p_2 is the population proportion at the end line, and *p* is the size of the decrease/increase of our desired outcome and is calculated as the difference (p_2 - p_1)

Assuming a change p, with equal variances across time, the following sample size will be used.

The current performance: p_1 = .3 and we wish to improve by 10 percent.

p_2 = .40

p = (p_1 + p_2)/2 = .35

z_α = 1.645 and z_β = 1.282 with deft = 2

The minimum total sample size required for each round was calculated to be 854 subjects.

As one of the objectives of the study was to collect the level of patient satisfaction, a purposive sample of 7–10 patients among those consulting one of the programs supported by USAID/Rwanda (HIV, TB, malaria, and FP) was included in the sample. Therefore, the targeted number of patients interviewed was between 707 and 1,010. These patients were selected from among those present on the day of data collection in the respective health facility.

Table 1. Distribution of hospitals per province

Province	Total Hospitals	30% of Hospitals
West	10	3
South	10	3
North	6	2
East	8	2
Kigali City	5	2
Total	**39**	**12**

Inclusion and exclusion criteria

All provinces of Rwanda were included in the assessment, and all public institutions working on or supporting the SC system in Rwanda were considered. Annex 2 provides a detailed list of sites selected for this baseline assessment. Personnel interviewed included the management and staff directly involved with finance, human resources, SC management operations, health commodities, and monitoring and evaluation (M&E) at each selected level, as applicable. Additionally, partners supporting RMS were also

included to understand the RMS client's perspective. Finally, patients who consulted services supported by USAID as well as those who come randomly for other clinical services were included.

Private wholesalers, private health facilities, and staff from the selected institutions who do not directly deal with human resource, SC management, health commodities, or M&E at each selected level and Community Health workers (CHWs) were not included.

Table 2 below presents the sample size by SC level of the eventual respondents who participated in the baseline assessment, as compared to the targeted sample size intended based on the sampling strategy listed above.

Table 2. Baseline assessment sample

SC Level	Sample Size (Targeted Sample Size)
RMS HQ	28 (27)
RMS Branches	61 (60)
Hospitals	138 (150)
HCs	693 (606)
Subtotal: Health Facilities	**920 (843)**
Patients	980 (707–1,010)
Stakeholders	9 (11)
Total: All Respondents	**1,909 (1,561)**

3.3 ASSESSMENT TOOLS

Tracer Products

Tracer products play an important role in health SC management. These products were tracked through the SC system to assess their availability, stock management, distribution, and overall SC performance. As shown in Table 3 below, we identified 10 products to serve as tracer products for this baseline assessment: three commodities that are associated with programs that USAID supports, three supported by other partners (these six are collectively referred to as "program commodities"), and four additional essential medicines. This selection of tracers was based on several factors including their importance and relevance, as well as representation of programs supported by USAID to ensure a comprehensive evaluation. For these specific products, a thorough analysis was conducted to check their stock levels and traceability from the planning up to SDPs.

Table 3. List of tracer commodities

Tracer Commodities	
Program commodities	
1	**HIV:** ABACAVIR 120 MG + LAMIVUDINE 60 MG TAB B/60
2	**HIV:** DOLUTEGRAVIR + LAMIV + TENOF (50/300/300)
3	**Malaria :** ARTE 20MG + LUME 120MG TAB (4X6) B/30
4	**Malaria:** QUININE 300MG
5	**FP:** IMPLANON
6	**FP:** MICROGYNON
Essential medicines	
7	OXYTOCIN INJ. 10 UI/ML
8	AMOXICILLIN 250MG TABS
9	IBUPROFEN 200MG TABS
10	LONG-LASTING INSECTICIDE-TREATED NETS (LLINS)/ MOSQUITO NETS

Throughout the presentation of the findings in the next section, these tracer commodities are consistently referred to both, by these two key categories and by the number that they are assigned in the table above.

Questionnaires

To respond to the different objectives of this study, a structured, interview-administered questionnaire was used for data collection. Six different questionnaires were developed, tailored to each category of respondent, as shown in Table 4.

Table 4. Baseline questionnaires administered, by respondent group

Questionnaire	Respondents	Purpose
RMS HQ	RMS HQ staff	Collected information about all key functions of the SC system, as well as working conditions and overall satisfaction of staff at the central level.
RMS Branch	RMS Branch staff	Collected information about six key functions of the SC system performed at RMS branches.
Hospital	Hospital staff	Collected information about 8 functions of SC implemented at the Hospital level.
HCs	HC staff	Collected information on 6 functions of SC implemented at the HC level.
Patient satisfaction survey	Random patients	Collected information to measure how satisfied patients are with the services provided and captured their perceptions of the SC and the system in general.
Stakeholder satisfaction survey	RMS stakeholders (UN, MOH, RBC)	Collected information to measure how satisfied they are with RMS's SCM and how the partnership between institutions works.

The questionnaires were initially created in English, later translated into Kinyarwanda, and then input into Census and Survey Processing (CSPro) software. CSPro is a freely available data processing software utilized for data entry, editing, tabulation, and distribution of census and survey data. Moreover, CSPro facilitates data collection on android devices, including both phones and tablets. The software is hosted on the CIIC-HIN server, situated at the national data center.

KPIs

As Table 5 on the next page shows, all TRMS indicators included in the Activity Monitoring, Evaluation, and Learning Plan (AMELP) were included as KPIs in this baseline assessment, to establish independently validated baseline values for these monitoring indicators. However, since the TRMS KPIs were limited in scope, additional KPIs to comprehensively measure all functions of the SC as presented in Figure 1, were included. These were identified during the earlier desk reviews.

For the purposes of this evaluation, we classified KPIs as either "core" or "complementary". Core indicators refer to the key functions of the SC. They provide information about the performance of the entire SC system and must be monitored regularly in short time intervals, such as monthly and quarterly. By contrast, complementary indicators examine the supportive system infrastructure requisite for SC effectiveness and efficiency. These complementary indicators may be monitored over longer-term intervals, such as 6 to 12 months, without creating a gap of information that is required for SC decisions.

All indicators in Table 5 are presented in the analysis that follows, particularly in Section 4.5 where we present baseline values for identified KPIs aligned to Objective 5. However, to address Objective 1, we selected three KPIs – represented with an asterisk (*) in Table 5 – to determine the level of implementation of key SC functions at every level, two of which are TRMS AMELP indicators.

For this baseline assessment, we collected primary data for most indicators. However, where secondary data was available within the appropriate timeframe (2021-2022), we used these data instead.

Table 5. Identified KPIs, organized by SC function.

Category	KPI	Indicator Source	Indicator Definition and Significance
Core Indicators, Aligned to SC Functions			
Forecasting	Forecast accuracy	Additional TPM Indicator	This indicator measures how accurate forecasts of demand are, compared with the actual consumption of the product by patients. Subject to available funding to meet the supply plan volumes, adhering to the supply plan volumes should be under management control. Deviations from the target should ideally be within +/- 25 percent (12).
Procurement and Sourcing	Percent of international reference price paid	Additional TPM Indicator	This indicator measures the percentage of the international reference prices paid for each product line procured. WHO recommends that prices should be no more than 105 percent of international reference price and should be as close to the international reference price as possible (12).
	Procurement lead time	TRMS AMELP Indicator 1	This indicator measures the average amount of time in months it takes from when a contract or purchase order is issued to the vendor and when the vendor delivers the products. Long lead times or delays in shipments potentially lead to shortages and stockouts. The TRMS target is 6 months (13)by the end of the project, in 2025.
	Vendor on-time and in full delivery rate	TRMS AMELP Indicators 2 and 3	This indicator measures the percentage of orders that vendors delivered within the agreed-upon delivery window and in full. A high percentage shows good performance by the vendor and goods are available to meet the needs of the patients. A value of > 80 percent is recommended for international suppliers and > 90 percent for local suppliers (12); however, the TRMS target is 100 percent (13).
Warehouse and Inventory Management	Stock according to plan*	TRMS AMELP Indicator 7	This indicator measures the percentage of tracer commodities that fall between the established minimum and maximum stock levels at each assessed facility. The WHO recommended target is that 100 percent of stocks should be within this range. However, this would mean exceptional performance, and in practice 90 percent or above would be a good performance (12).
	Stockout rate by tracer commodity and level in the system*	TRMS AMELP Indicator 5	This indicator measures the percentage of tracer commodity observations with a stockout during the reporting period and on the day of the visit. The ideal would be that no commodity is out-of-stock. However, in line with the expectation that 90 percent of stocks should be within the max/min range, acceptable performance level for this measure in TPM would be within 5 percent (12), on the assumption that being outside the max/min tolerance will not result in a stockout in every case. The TRMS target is 1 percent by 2025(13).
	Stock accuracy	Additional TPM Indicator	This indicator compares the stock quantity on a stock card and/or inventory management software with the quantity of physical inventory conducted during a site visit. This value should be 100 percent as recommended by WHO (12).
	Order fill rate*	Additional TPM Indicator	This indicator compares the quantity listed in accepted orders to the quantity delivered, including the frequency that distribution orders from health facilities are amended. In line with supply plan accuracy, 90 percent of all distribution orders should be filled in full, and less than 10 percent should require amendment (12).

Category	KPI	Indicator Source	Indicator Definition and Significance
Distribution	On-time delivery to facility	Additional TPM Indicator	This indicator measures the percentage of orders that arrive on or before the scheduled delivery date. Most deliveries are made on a pre-agreed schedule; therefore, the target is that 95 percent of orders are received on or before the promised date.
	Percentage of orders placed by health facilities as emergency orders	Additional TPM Indicator	This indicator measures the percentage of orders placed by health facilities to a warehouse during the reporting period that were emergency orders. Acceptable levels of this indicator are <10 percent (12).
Quality Assurance	Wastage from damage, theft, and expiry	TRMS AMELP Indicator 6	This indicator compares the damaged, lost, and expired stock to the total stock during the reporting period. It can be looked at by the quantity or value of the stock. Overall target for losses is < 2 percent of turnover, with a target of 0 percent for theft, < 1.5 percent for expiry, and 0.5 percent for damage (12).
	Percentage of product batches tested that do not meet quality standards	Additional TPM Indicator	This indicator measures the percentage of product batches tested by a quality assurance laboratory that are rejected for not meeting established standards. The number of batches to be tested is usually defined in a national policy or appropriate SOP. A higher value indicates the poor quality of products received. The TRMS target value is no more than 0.4 percent by 2025 (13)
	Proportion of rejected items due to noncompliance to quality requirements	TRMS/AMELP 4	This indicator measures the percentage of products rejected due non compliance to quality requirements as per the suppliers agreement.
Reporting	Data accuracy	Additional TPM Indicator	This indicator measures the percentage of accuracy in reported data by comparing the system (sage/e-LMIS) to physical inventory and stock cards. A high percentage value shows that the system is effective, and data can be relied upon for decision-making.
	Facility reporting rates on time (reporting of consumption data)	Additional TPM Indicator	This indicator measures the percentage of facilities submitting their e-LMIS reports to the receiving facility (central or intermediary, e.g., district) on time. The value should be 100 percent as recommended by WHO, SC management system, and others (12).
Complementary Indicators, Aligned to Supportive System Infrastructure			
Human Resources	Staff turnover	Additional TPM Indicator	This indicator measures the percentage of SC-specific staff leaving their posts during the reporting period. Rates of staff turnover vary according to market and level of post, but human resources (HR) institutes in UK and USA suggest that a rate of 15 percent turnover per annum is healthy.

Category	KPI	Indicator Source	Indicator Definition and Significance
	Percentage of supply chain vacant positions	Additional TPM Indicator	Availability of required SC personnel for key positions affects SC efficiency. To maintain operation efficiency, > 90 percent of supply chain posts should be filled at any given time (12).
	Staff training and supervision	Additional TPM Indicator	This indicator measures the proportion of SC staff who received specific training and supervision for the position in the past 12 months. A carefully designed training and appropriate supervision is expected to improve SC performance.
Financial Sustainability	Sales/ receivable recovery rate	Additional TPM Indicator	This indicator measures the percentage of receivables recovered by RMS from facilities. A higher percentage indicates efficiency and funds available for the company to pay for essential medicines – it measures sustainability of the company.

3.4 DATA COLLECTION AND MANAGEMENT

Data collection

All tools used for this assessment were pretested in eight HCs across Kigali City to give room for corrections and modifications. These eight HCs were not included in the study sample. The final version of the tools used for data collection are included as Annex 4.

The assessment recruited 32 data collectors who were assembled into teams of four, including two enumerators, one intern, and a pharmacist with a bachelor's degree and experience in SC management serving as team leader. They were trained for three days on the interview protocols, using electronic tablets for data collection, and ethical principles, such as obtaining informed consent, assuring confidentiality, and maintaining an appropriate code of conduct during the interview. Annex 3 provides additional details on the field plan used to collect these data.

During the pilot, all data collected were analyzed to check for consistency (reliability) and how well the results correspond to established theories (validity) to reduce or control for systematic biases such as questionnaire, interviewer, and desirability bias. A number of techniques – such as clear instructions for enumerators regarding the data collection process, training sessions before data collection and supervision, and monitoring and quality control checks – were applied to ensure the accuracy and consistency of the collected data.

Additional data was collected directly from RMS as part of routine monitoring activities. This included information about recovery rates, position vacancies, and product prices.

Data management

During data collection, quantitative data was collected using the questionnaires developed and stored in the CIIC-HIN server located at the national data center. CIIC-HIN's Senior Data Manager conducted daily spot checks on the field to verify that the enumerators were filling out questionnaires correctly. The data was extracted and cleaned by cross-checking variables on statistical software, to minimize entry errors. Such information was not shared with any user other than the concerned parties of the USAID/TPM project, namely, the MOH, Rwanda Biomedical Centre (RBC), and RMS.

Data analysis

Quantitative data collected from questionnaires using CSPro were validated to check for completeness and cleanness, and data were exported for analysis to STATA.

Quantitative data were analyzed predominantly by calculating descriptive statistics. In particular, frequencies and proportions for both outcomes and exposure variables were calculated. Clustered chi-square tests were used to test the association between KPI values and respondents' demographic characteristics and the health facility type for the following key variables:

- The availability of both SOPs and health commodities
- The level of implementation of SC functions against the key products tracers
- The quality of the products and the data
- The perception from patients across the level of SC functions

Multicollinearity tests were done before running the multivariate analysis. The level of significance was set at 5 percent.

3.5 ETHICAL CONSIDERATIONS

Informed Consent

Participation in this study was voluntary and respondents were asked to sign an informed consent form (ICF) before starting: a qualified member of the study staff reviewed the information sheets and ICFs with potential participants; if they consented and passed the assessment of understanding, they were asked to sign the ICF form. The informed consent process occurred on the date of the interview or field visit. The signed and dated ICF remained at the study site, and a copy of the signed and dated ICF was offered to the participant to take home.

Confidentiality

In this assessment, the privacy of participants was protected: respondents were asked for their informed consent in participating in this study before being interviewed, within a secured and enclosed environment free from external distractions. The timing of interviews was at the convenience of the respondents. All secondary data received from the existing systems such as e-LMIS was kept in a private and secure space with restricted access to ensure the safety, security, and confidentiality of data. The data was collected and processed with precautions to ensure confidentiality and compliance with applicable data privacy protection laws and regulations.

Ethical Approval

Permission to proceed was sought from the Rwanda MOH. Ethical clearance was obtained from the Rwanda National Ethics Committee. For the conduct of the interviews, participation was voluntary, and responses were treated as anonymous and confidential. Once approval was obtained, we addressed the request to the Minister of Health for authorization to conduct the research.

4. FINDINGS AND ANALYSIS

The following chapter presents the results obtained from the baseline study, which aimed to assess and establish the initial state of the KPIs used to measure the eventual delivery of the TRMS Activity's intended outcomes. The organization of this chapter is as follows: First, we provide an overview of the demographic characteristics of the sample to ensure transparency and facilitate a clear understanding of the context in which the results were obtained. Subsequently, we delve into the main findings aligned with each research objective, in the same order that they are listed in Section 2.2. For each objective, we provide a detailed analysis of the relevant data, including relevant statistical measures and visual representations to enhance clarity and interpretation. Finally, we conclude this section with a discussion to the key gaps that our analysis has identified in the SC, as well as reflecting on the root causes of these gaps.

4.1 DEMOGRAPHIC CHARACTERISTICS OF THE BASELINE ASSESSMENT POPULATION

Before presenting the findings from the baseline data analysis, we present the demographic characteristics of the baseline sample. We do so to reflect on the characteristics of our sample and to transparently identify whose voices we heard from most. While our sample does not allow us to make conclusive statements about the demographic characteristics of SC actors in Rwanda, it could suggest features of the Rwanda SC. Table 6 on the next page presents the detailed summary statistics of the demographics of the baseline sample. We summarize this table below.

Gender: The gender composition of health facilities in our sample depends on the facility's level. While our sample included a higher proportion of female staff members in HCs, male staff members made up larger and larger proportions of the staff with increasing levels of health facilities.

Educational Level: The baseline sample reveals that at higher levels of health facilities and at higher levels within RMS, staff members have higher levels of education. While the majority of the staff in hospitals and RMS branches had a bachelor's degree, the majority of staff in RMS HQ held a master's degree.

Experience in Years: The lowest amounts of experience in years were identified at RMS branches and HQ, where most employees had less than 5 years' experience (branches: 73.8 percent, HQ: 71.4 percent). At HCs and hospitals, there were almost equal amounts of employees with less and more than 5 years' experience. HCs stood out, featuring 30.5 percent of employees with more than 10 years of experience.

Staff who received training in the past 12 months: Almost all employees across all entities had participated in training programs in the past 12 months. The highest percentage of employees who had undergone training was in the HCs (84.1 percent), closely followed by the RMS HQ (82.9 percent), hospitals (82.6 percent), and finally the RMS branch (80.3 percent). Most employees in all entities had received training specifically related to their current position: HCs (96.2 percent), hospitals (99.1 percent), RMS branches (95.9 percent), and RMS HQ (93.1 percent).

Table 6. Demographic distribution of respondents, by health facility level

Health Facility Level (Sample Size)	HCs (N = 693)	Hospitals (N = 138)	RMS Branches (N = 61)	RMS HQ (N = 28)
Gender				
Male	43.1%	55.1%	55.7%	71.4%
Female	56.9%	44.9%	44.3%	28.6%
Highest Education Level Attained				
Diploma A2	13.2%	2.2%	-	-
Diploma A1	42.2%	18.8%	24.6%	2.9%
Bachelor's A0	43.8%	59.4%	65.6%	22.9%
Master's	0.9%	18.1%	9.8%	74.3%
PhD	0.0%	1.5%	-	-
Years of Experience				
<5Years	45.7%	50.7%	73.8%	71.4%
5–10 years	23.8%	27.5%	6.6%	11.4%
>10 Years	30.5%	21.7%	19.7%	17.1%
Received Training in the Past 12 Months				
No	15.9%	17.4%	19.7%	17.1%
Yes	84.1%	82.6%	80.3%	82.9%
Training Was Related to Position				
No	3.8%	0.9%	4.1%	6.9%
Yes	96.2%	99.1%	95.9%	93.1%

4.2 BASELINE FINDINGS RELATED TO OBJECTIVE 1

To determine the level of performance of SC functions at every level of the SC system using tracer products, three KPIs were considered, as mentioned in Section 3.3: (1) stockout rate, (2) order fill rate, and (3) stock according to plan. The three variables provide an indication of the availability of health commodities, and are used in this baseline as proxies to measure overall effectiveness of the health commodities SC.

Stockout Rate

The stockout rate indicator measures the percentage of tracer commodity observations with a stockout during the reporting period and on the day of the visit. High stockout rates are suggestive of poor SC management performance.

As shown in Table 7, at the RMS HQ, the average stockout rate for the fiscal year (FY) 2021–2022 was 9.0 percent, which is higher than the WHO's minimum benchmark of 5 percent. Stockout rates were also high at the decentralized level, including hospitals (7.2 percent) and HCs (10.3 percent). At health facilities, essential commodities showcased higher stockout rates than program products. Discussions with participants revealed that the high levels of stockout of essential medicines is partly attributed to lack of budget to pay for those products at the health facility level, as presented in Table 8 on the next page. Another reason cited was stockout at branches, although this was reported at hospitals (31.2 percent) to a lesser extent than HCs (62.1 percent), presumably since hospitals tend to be in the same

premises as branches and are likely served first. We found that 87 percent of all planned purchases from the procurement plan, for the period of FY 2021–2022 were delivered by suppliers on time and in full.

Table 7. Stockout rates on tracer commodities, by health facility level and commodity type

Health Facility Level (Sample Size)	HCs (N* = 693)	Hospitals (N = 138)	RMS Branches[4] (N = 61)	RMS HQ (N = 28)
Program commodities	8.4%	3.1%		
Essential medicines	12.2%	11.4%		
Average stockout rates	10.3%	7.2%	4.6%	9.0%

*the value N represents the number of respondents

Table 8. Reasons for stockout, according to discussions with respondents, disaggregated by health facility level.

Health Facility Level (Sample Size)[5]	HCs (N* = 103)	Hospitals (N = 16)	RMS Branches (N = 13)
Supply delays			
No	54.4%	56.3%	75.0%
Yes	45.6%	43.8%	25.0%
Delivery and logistics problems			
No	75.7%	68.8%	100.0%
Yes	24.3%	31.3%	0.0%
Lack of budget			
No	54.4%	68.8%	100.0%
Yes	45.6%	31.2%	0.0%
Poor customer experience			
No	98.1%	43.8%	50.0%
Yes	1.9%	56.2%	50.0%
Stockout at branches			
No	37.9%	68.8%	83.3%
Yes	62.1%	31.2%	16.7%

*the value N represents the number of respondents

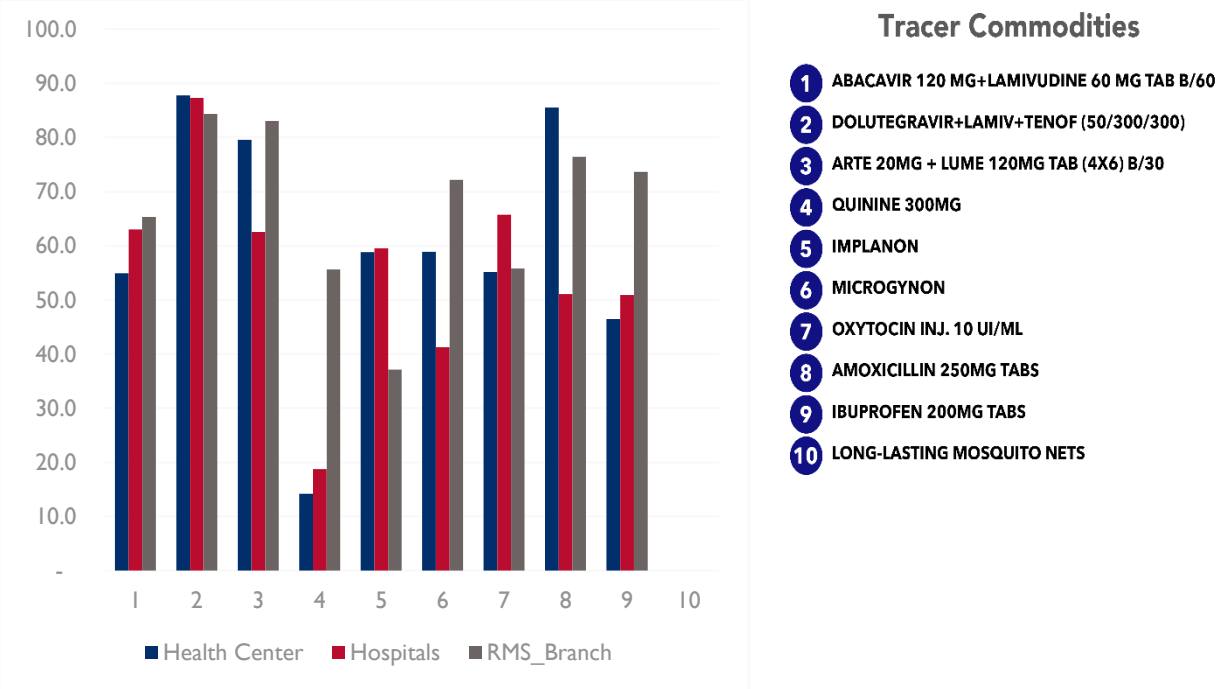
When closely examining the baseline data, several other factors that are linked to potential stockout emerge, such as insufficient storage space, commodity processing time, and logistical problems. These findings are consistent with 2022 National Supply Chain Assessment (NSCA) report findings. The National Pharmaceutical Strategic Plan 2018–2024 also highlighted that the SC struggles with "inadequate storage/ distribution capacity and management at district pharmacy and lower levels, as well as distribution capability at central warehouse" (RMS) (7).

[4] At both RMS levels, only the average stockout rates were computed in response to the study objectives.
[5] In several tables, sample sizes included are smaller than the overall sample size since some questions were only directed at those in specific functions who would be familiar with details regarding those SC functions.

Order Fill Rate

The order fill rate measures how many orders can be fulfilled immediately, with available stock; it is calculated by comparing the total commodities received to the total order. An order fill rate that is high reflects a good performance of the SC. Ideally, this figure should stand at 100 percent, although 90 percent is a reasonable target. Figure 3 indicates a high degree of variance in order fill rate at different levels, and for different tracers. For example, almost all Dolutegravir + Lamiv + Tenof (50/300/300) orders are fulfilled at all levels. By contrast, the order fill rate for Quinine 300mg at health facilities (hospitals and HCs) is the lowest, at less than 20 percent, despite being much higher at RMS branches. It appears that hospitals perform most poorly in this regard, only fulfilling an average of 47.2 percent of all tracer product orders, closely followed by 54.3 percent at HCs, as presented in Table 9. This falls below the target that 90 percent of all distribution orders should be filled in full.

Figure 3. Order fill rate, by health facility level and tracer commodity



Respondents identified the low order fill rate being largely a result of distribution and transport challenges, which was also reported in NSCA (2022) findings. The average delivery time from RMS HQ to RMS branches is reported as 14 days and varies from 3 days to 30 days. This may contribute to the delivery delays to hospitals and HCs.

Table 9. Order fill rate summary per level

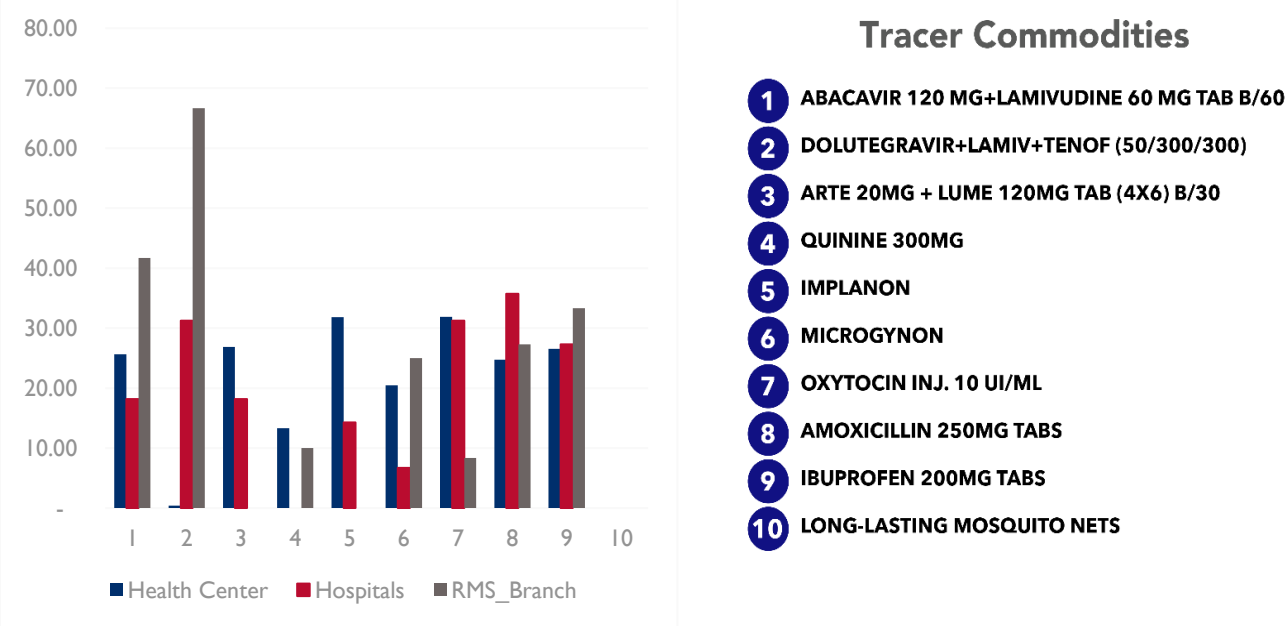
Health Facility Level (Sample Size)	HCs (N = 101)	Hospitals (N = 15)	RMS Branches (N = 12)
Program Tracers	59.9%	54.2%	56.8%
Essential Medicine Tracers	48.7%	40.2%	68.6%
Average Order Fill Rate Across Tracers	54.3%	47.2%	62.7%

Stock According to Plan

The stock according to plan measures the accuracy and effectiveness of inventory planning and management, by comparing the actual stock with the defined minimum and maximum levels. This indicator helps to assess whether the actual inventory aligns with the predetermined stock levels. A high percentage indicates close alignment, implying effective inventory management practices. Conversely, a low percentage suggests deviations from the planned stock levels, namely under- or over-stock, which can lead to issues such as stockouts, and expiries. The WHO recommends that 100 percent of stock should be within the max/min tolerance. While this would be an exceptional performance, in practice, 90 percent or above would be adequate.

As shown in Figure 4 below, the proportion of facilities stocked according to plan was extremely low for most tracers. Most products were only stocked according to plan at fewer than 40 percent of health facilities and RMS branches; this means they were either under or overstocked in most cases. Quinine 300mg was almost never stocked appropriately. The only exception is the relatively high appropriate stock levels of Dolutegravir at RMS branches.

Figure 4. Stock according to plan, by health facility level and tracer commodity



As Table 10 below shows, on average, stock according to plan was lower further down the SC levels. A mere 6.8 percent of HCs and 12.5 percent of hospitals stocked tracer products according to plan, which is very low given the target of 100 percent. RMS branches perform better at 58.3 percent, but this still means that almost 40 percent of products are not stocked appropriately. There was no pattern in stock according to plan of essential medicines compared to program tracers. These low levels of appropriate stock reflect issues in inventory management practices that need to be addressed.

Table 10. Stock according to plan, by health facility level and tracer commodity category

Health Facility Level (Sample Size)	HCs (N = 101)	Hospitals (N = 15)	RMS Branches (N = 12)
Program Tracer Commodities			
Understock	3.9%	-	16.7%

Stock according to plan	**6.8%**	**12.5%**	**58.3%**
Overstock	89.3%	87.5%	25.0%
Essential Medicine Tracer Commodities			
Understock	51.5%	31.2%	8.3%
Stock according to plan	**19.4%**	**31.3%**	**50.0%**
Overstock	29.1%	37.5%	41.7%

Across all three key KPIs, then, there are significant deviations from the recommended targets for each indicator, suggesting large gaps in the health commodity SC's function from best practice.

4.3 BASELINE FINDINGS RELATED TO OBJECTIVE 2

The second objective of the assessment intended to determine the current use of e-LMIS and its role in improving the national SC system. The National Pharmaceutical Strategic Plan (2018–2024) acknowledges the "poor availability of accurate e-LMIS data to guide inventory management practices" within lower-level health facilities. Furthermore, it identifies that during the 2017 NSCA, "reliability of data from the e-LMIS was a concern with less than a third of HCs and district hospitals maintaining accurate e-LMIS data." The assessment considered the extent e-LMIS is operationalized at all levels of health system SC, factoring in the presence of SOPs for e-LMIS operation, real consumption data recording, data quality assurance, and the use of e-LMIS data for analysis and decision-making.

Table 11 shows challenges in e-LMIS usage at lower levels of the SC. The proportion of facilities that captured real time consumption data is very low: 15.1 percent at HCs and 50.0 percent of hospitals. Furthermore, it was observed that e-LMIS is fully operational in only 14.3 percent of HCs and 16.7 percent of hospitals. By contrast, it is fully operational at 92.3 percent of RMS branches, with 100 percent of products being received and distributed through the e-LMIS. This pattern is consistent with the observations presented in Table 13 on the next page, that most HCs and hospitals do not use e-LMIS for decision making (HC: 32.5 percent, hospital: 33.3 percent) and analysis (HC: 21.4 percent, hospital: 16.7 percent). Conversely, 92.3 percent of RMS branches use e-LMIS for decision-making.

Table 11. Use of e-LMIS by health facility level

Health Facility Level (Sample Size)	HCs (N = 126)	Hospitals (N = 18)	RMS Branches (N = 13)
Real-time consumption of data			
No	84.9%	50.0%	N/A
Yes	15.1%	50.0%	N/A
e-LMIS fully operational			
No	85.7%	83.3%	7.7%
Yes	14.3%	16.7%	92.3%

This assessment identified a lack of appropriate guidance for e-LMIS usage as a concern, particularly at the health facility level. As shown in Table 12 below, SOPs are available at only 37.3 percent of HCs and 33.3 percent of hospitals. Higher up the SC level, SOPs were available at 76.9 percent of RMS branches. This may explain why e-LMIS is operational at RMS branches to a greater extent than HCs and hospitals. The awareness and use of e-LMIS SOPs plays a key role in health SC management, and it provides necessary features to effectively manage and optimize SC operations.

Table 12. Availability of e-LMIS SOPs by health facility level

Health Facility Level (Sample Size)	HCs (N = 126)	Hospitals (N = 18)	RMS Branches (N = 13)
No	62.7%	66.7%	23.1%
Yes	37.3%	33.3%	76.9%

As Table 13 below shows, the usage of the e-LMIS and the availability of timely support across different facilities. Availability of timely support was cited as a concern by 44.4 percent of respondents in hospitals, which is much lower than HCs (93.7 percent) and RMS branches (84.6 percent).

Table 13. e-LMIS usability by health facility level

Health Facility Level (Sample Size)	HCs (N = 126)	Hospitals (N = 18)	RMS Branches (N = 13)
Receive timely support			
No	6.3%	55.6%	15.4%
Yes	93.7%	44.4%	84.6%
Use e-LMIS for decision-making			
No	67.5%	66.7%	7.7%
Yes	32.5%	33.3%	92.3%
Use e-LMIS for reordering			
No	49.2%	50.0%	30.8%
Yes	50.8%	50.0%	69.2%
Use e-LMIS for analysis			
No	78.6%	83.3%	61.5%
Yes	21.4%	16.7%	38.5%
Use e-LMIS for order requesting			
No	2.4%	50.0%	-
Yes	97.6%	50.0%	100.0%
Use e-LMIS for order receiving			
No	2.4%	55.6%	-
Yes	97.6%	44.4%	100.0%
Conduct Data Quality Assessments on e-LMIS data			
No	67.5%	55.6%	30.8%
Yes	32.5%	44.4%	69.2%

To be fully operational, the e-LMIS requires dedicated technical support, dedicated and trained personnel, computers, internet connectivity, and a formal process to address issues encountered during operations. Table 14 on the next page shows that 66.7 percent and 55.6 percent of respondents from HCs and hospitals report that there is no formal process to review e-LMIS, and lack of formal process of reporting of issues at 62.7 percent and 33.3 percent for HCs and hospitals, respectively. Insufficient training of personnel, lack of time due to other tasks, and internet connectivity were cited as major challenges for effective and efficient use of e-LMIS to support health SC system.

Table 14. e-LMIS support challenges in the health facilities

Health Facility Level (Sample Size)	HCs (N = 126)	Hospitals (N = 18)
Standard process to review e-LMIS		
No	66.7%	55.6%
Yes	33.3%	44.4%
Formal system to report issue for system improvements		
No	62.7%	33.3%
Yes	37.3%	66.7%
Insufficient training of personnel		
No	43.7%	33.3%
Yes	56.3%	66.7%
Insufficient number of staff (staff shortage)		
No	28.6%	16.7%
Yes	71.4%	83.3%
Lack of time due other tasks		
No	46.8%	55.6%
Yes	53.2%	44.4%
Availability of computers for use		
No	22.2%	88.9%
Yes	77.8%	11.1%
Internet connectivity problems		
No	22.2%	33.3%
Yes	77.8%	66.7%

The low use of e-LMIS in inventory management exacerbates the current situation of poor stock according to plan, as discussed above. The lack of use of e-LMIS in recording the consumption data leads to health facilities making orders based on estimates. The NSCA (2022) reported similar findings, where 60 percent and 80 percent of health facilities' and RMS branches' orders had to be revised before they were supplied.

4.4 BASELINE FINDINGS RELATED TO OBJECTIVE 3

To assess the challenge of the use of logistical and clinical data for decision-making, data quality from health facilities was assessed by comparing e-LMIS data and HMIS data with patient registers (number of patients).

This study shows that a major bottleneck is the quality and availability of data. In many health facilities, data are incomplete, inaccurate, or outdated. Insufficient data collection processes and limited interoperability among information systems can impede the effective use of data for decision-making. As shown in Table 15 below, the accuracy between quantities of products dispensed through e-LMIS compared to the number of patients that received the tracer products per HMIS do not match. There is high variability in accuracy levels: The accuracy of data on the products Quinine and Oxytocin are performing better than the other tracers, with accuracy values greater than 70%. By contrast, the tracer

products Amoxicillin and Ibuprofen stand out with exceptionally high level of mismatch in all health facilities sampled.

Table 15. Data accuracy between e-LMIS and HMIS, by health facility level

Health Facility Level (Sample Size)	HCs (N = 101)	Hospitals (N = 15)
DOLUTEGRAVIR + LAMIV + TENOF (50/300/300)		
Not Accurate	53.1%	33.3%
Accurate	46.8%	66.7%
QUININE 300MG		
Not Accurate	12.7%	5.6%
Accurate	87.3%	94.4%
IMPLANON		
Not Accurate	37.3%	22.2%
Accurate	62.7%	77.8%
OXYTOCIN INJ. 10 UI/ML		
Not Accurate	27.8%	27.8%
Accurate	72.2%	72.2%
AMOXICILLIN 250MG TABS		
Not Accurate	93.7%	77.8%
Accurate	6.3%	22.2%
IBUPROFEN 200MG TABS		
Not Accurate	99.2%	77.8%
Accurate	0.8%	22.2%
LONG-LASTING INSECTICIDE-TREATED NETS (LLNS)/MOSQUITO NETS		
Not Accurate	98.4%	83.3%
Accurate	1.59%	16.67%

Our study also assessed the accuracy of data at facility level, by comparing the data recorded in physical registers with data captured in the HMIS. Table 16 displays the results for our tracer commodities at both levels. The tracers Oxytocin, Dolutegravir + Lamiv + Tenof, and Amoxicillin have the highest mismatch.

Table 16. Data records accuracy between registers and HMIS, by health facility level

Health Facility Level (Sample Size)	HCs (N = 101)	Hospitals (N = 15)
DOLUTEGRAVIR + LAMIV + TENOF (50/300/300)		
Not Matched	91.3%	93.8%
Matched	8.7%	6.2%
QUININE 300MG		
Not Matched	38.8%	25.0%
Matched	61.2%	75%
IMPLANON		
Not Matched	82.5%	62.5%
Matched	17.5%	37.5%
OXYTOCIN INJ. 10 UI/ML		
Not Matched	94.2%	100.0%
Matched	5.8%	0.0%
AMOXICILLIN 250MG TABS		
Not Matched	89.3%	93.8%
Matched	10.7%	6.2%
IBUPROFEN 200MG TABS		
Not Matched	68.0%	75.0%
Matched	32.0%	250%
LONG-LASTING INSECTICIDE-TREATED NETS (LLNS)/MOSQUITO NETS		
Not Matched	97.1%	100.0%
Matched	2.9%	0.0%

Certainly, there are several bottlenecks that hinder the effective use of service and logistic data to support decision-making in the national health SC system, which include information system integration, data analysis, and interpretation and e-LMIS system support challenges.

4.5 BASELINE FINDINGS RELATED TO OBJECTIVE 4

For this project, the selection of identified core and complementary KPIs was done in consideration of different factors including their relevance and their valuable insights for monitoring and improving performance. Table 17 below shows the values of KPIs per function of the SC system. A regular monitoring and evaluation of the 16 identified KPIs through the project timeline will be conducted quarterly from Year 2, to measure progress and identify areas for continuous improvement.

Table 17: Baseline KPI values for SC system

KPI	Recommended Target	HCs	Hospitals	RMS Branches	RMS HQ
Forecast accuracy[6]	+/- 25%				64–124%
Vendor on-time delivery	>80% international supply, >90% local supply				87%
Vendor delivery in full[7]	>80% international supply, >90% local supply				87%
Procurement lead team	6 months				5–9 months
Stock according to plan	100%	Program tracers: 6.8%	Program tracers: 12.5%	Program tracers: 58.3%	Program tracers: 58.3%
		Essential medicine tracers: 19.4%	Essential medicine tracers: 31.2%	Essential medicine tracers: 50.0%	Essential medicine tracers: 50.0%
Percent of international reference price paid	105%				6–50% (below the international reference price)
Stockout rate	5%	7.2%	10.3%	4.6%	9.0%
Stock accuracy[8]	100%	66%	89%	64%	
Order fill rate	95% - 100%	54.3%	47.2%	62.6%	
On-time delivery to the RMS branch	95% of order received on or before promised date				14 days on average (Range: 3-30 days)
Proportion of rejected items due to noncompliance to quality requirements	0%				Program tracers: 18%
					Essential medicine tracers: 8%
Waste from damage, theft, and expiry	Theft: 0% Damage: 0.05%	0.3–1.5%			
Percentage of orders placed as emergency by facility[9]	<10%	27%	42%	15%	

[6] RMS SP Quarterly report FY 2021–2022.
[7,8] Rwanda NSCA, 2022.

KPI	Recommended Target	HCs	Hospitals	RMS Branches	RMS HQ
Staff turnover	15%	13%	20%	5%	
Staff training and supervision	N/A	58%	68%	27.8%	54.2%
Percentage of supply chain vacant positions	5%				6%
Facility reporting consumption data	100%	15.1%	50%		
Data accuracy (e-LMIS)	95%	21%	37%	49%	
Sales receivable/recoverable rate	95%				39%

4.6 BASELINE FINDINGS RELATED TO OBJECTIVE 5

The goal of this objective was to examine and evaluate the quality assurance practices and procedures within the national SC system, considering both national-level processes and decentralized or lower levels. This involves systematic activities and processes implemented to ensure that products, services, and processes met the specified quality standards. In this assessment, we factored in the availability and use of SOPs, monitoring of temperature and humidity levels, and management of unfit products (spoiled, expired, and unfit for use) to determine overall quality assurance.

At RMS HQ, the availability of SOPs, strategic plan, and guidelines is 100 percent, showing a strong capability at the central level. The quality control/testing is done both in-country and out-of-country, and mostly covered by RMS central warehouse.

Table 18 confirms the strong level of QA processes and activities at the central level, as well as good practices at the decentralized level. Overall, the required infrastructure for QA is in place, and best practices are exercised. Temperature is recorded at health facilities, RMS branches, and the RMS central warehouse, while humidity is recorded at the RMS branches, RMS central warehouse, and only a small number of hospitals. Unusable products are separated and quarantined in designated places at the RMS warehouse, RMS branches, and health facilities. Low performance was observed in the areas of humidity control and supervision of disposal at HCs and hospitals. The authorization of product disposal and disposal documentation in the branches also performed low. The shortage of adequate storage space in all health facilities, RMS branches, and the central warehouse presents a potential risk that can compromise the quality assurance of health products. The NSCA (2022) reported similar findings.

Table 18. Quality assurance processes and activities by health

Health Facility Level (Sample Size)	HCs (N = 101)	Hospitals (N = 15)	RMS Branches (N = 12)	RMS HQ (N = 1)
Physical inventory conducted				
No	0.0%	0.0%	0.0%	0.0%
Yes	100.0%	100.0%	100.0%	100.0%
Insufficient storage space				
No	39.8%	37.5%	33.3%	0.0%
Yes	60.2%	62.5%	66.7%	100.0%
Storage room temperature recorded				
No	20.4%	0.0%	16.7%	0.0%
Yes	79.6%	100.0%	83.3%	100.0%
Storage room humidity recorded				
No	98.1%	75.0%	50.0%	0.0%
Yes	1.9%	25.0%	50.0%	100.0%
Unusable products stored separately				
No	1.9%	0.0%	0.0%	0.0%
Yes	98.1%	100.0%	100.0%	100.0%
Disposal supervised				
No	35.9%	38.9%	0.0%	0.0%
Yes	64.1%	61.1%	100.0%	100.0%
Disposal authorized				
No	1.0%	0.0%	63.6%	0.0%
Yes	99.0%	100%	36.4%	100.0%
Disposal documented				
No	1.0%	0.0%	36.4%	0.0%
Yes	99.0%	100%	63.6%	100.0%

4.7 BASELINE FINDINGS RELATED TO OBJECTIVE 6

A key objective of this study was to assess the level of satisfaction among stakeholders and patients across the national SC system, which will inform about the key areas of improvement in the entire SC system.

Table 19 shows the level of satisfaction of personnel within different levels of the SC system. The major areas of concern identified were with e-LMIS features, where between 46.1 percent and 53.6 percent of respondents were dissatisfied, and timely information sharing, although only at health facilities (49.5 percent–52 percent dissatisfied). In general, levels of satisfaction were lowest in HCs, signaling a major need for improvement.

Table 19. Level of personnel satisfaction with SC processes by health facility level

Health Facility Level (Sample Size)	HCs (N = 222)	Hospitals (N = 34)	RMS Branches (N = 13)
Ordering process			
Difficult	37.4%	26.5%	23.1%
Easy	62.6%	73.5%	76.9%
Processing time of commodities			
Unacceptable	33.8%	100.0%	15.4%
Acceptable	66.2%	0.0%	84.6%
Response time in emergencies			
Unacceptable	27.0%	5.9%	15.4%
Acceptable	73.0%	94.1%	84.6%
Rating delivering time			
Unacceptable	36.9%	11.8%	15.4%
Acceptable	63.1%	88.2%	84.6%
Quality of commodities delivered			
Unacceptable	0.4%	0.0%	0.0%
Acceptable	99.6%	100.0%	100.0%
e-LMIS features			
Unsatisfied	53.6%	53.6%	46.1%
Satisfied	46.4%	46.4%	53.9%
Timely information sharing			
Unsatisfied	49.5%	52.9%	0.0%
Satisfied	50.5%	47.1%	100.0%

Table 20 shows the level of satisfaction from patients seeking services at health facilities. The level of general satisfaction was high at 87.5 percent. Nevertheless, there was lower satisfaction expressed with the total money spent and the availability of medicines, being 37.2 percent and 37.8 percent respectively. There is a high number of patients spending money out of their pocket because the prescribed medicines are not available in health facilities' pharmacy. The out-of-pocket cost (70.4 percent of respondents) presents a huge burden to patients, particularly for those who don't have money to buy medicines from private pharmacies and are obliged to find other alternatives (14.8 percent of respondents).

The survey revealed that a high number of patients were not satisfied with the availability of medicines, and this is consistent with the low order fill rate and stockout at the health facilities that were found. Lack of prescribed medicines is a significant area of concern as it may hamper and discourage patients from participating in community-based health insurance medical scheme (CBHI).

Table 20. Patients' level of satisfaction with securing health commodities from health facilities

Topic	Patients (N = 980)
Cost/money spent at facility	
Unsatisfied	62.8%
Satisfied	37.2%
Availability of commodities	
Unsatisfied	62.2%
Satisfied	37.8%
Waiting time at health facilities	
Unsatisfied	4.8%
Satisfied	95.2%
Medicine prescribed	
Negative Perception	26.9%
Positive Perception	73.1%
General satisfaction	
Unsatisfied	12.5%
Satisfied	87.5%

We also conducted a stakeholder satisfaction survey to provide an overview of how RMS central warehouse is responsive to stakeholder needs. Nine respondents participated, representing the MOH, RBC, Rwanda FDA, BUFMAR, MEDIASOL, and SFH. Table 21 provides an overview on respondents' usage of the e-LMIS, their satisfaction with various aspects of its functionality, and their working relationship with RMS central warehouse. Out of the total respondents, 66.7 percent indicated that they use data from the e-LMIS. Interestingly, this is higher than the number of individuals at RMS and health facilities who report using this tool. Of all respondents, 66.7 percent reported being satisfied with its features and usability and 33.3 percent expressed dissatisfaction. The majority (66.7 percent) reported that they have a good working relationship with RMS Ltd., but only 55.56 percent were satisfied with the timely information sharing and communication.

Table 21. Stakeholders' satisfaction level and e-LMIS uses

Topic	Key Activity Stakeholders (N = 9)
Use of Data from e-LMIS?	
No	33.3%
Yes	66.7%
For decision-making:	
No	16.7%
Yes	83.3%
For supply planning:	
No	33.3%
Yes	66.7%
For analysis and reporting:	
No	0.0%
Yes	100.0%
Rating of the e-LMIS in terms of features	
Unsatisfied	33.3%
Satisfied	66.7%
Rating the e-LMIS in terms of usability	
Unsatisfied	33.3%
Satisfied	66.7%
Rating of the e-LMIS in terms of system support	
Unsatisfied	50.0%
Satisfied	50.0%
Rating the e-LMIS in terms of data extraction	
Unsatisfied	33.3%
Satisfied	66.7%
Overall satisfaction with e-LMIS functionality	
Unsatisfied	33.3%
Satisfied	66.7%
Rating the working relationship with RMS Ltd.	
Fair	33.3%
Good	66.7%
Rating the timely information sharing/communication with RMS Ltd.	
Unsatisfied	44.4%
Satisfied	55.6%

5. CONCLUSION AND RECOMMENDATIONS

Rwanda has made significant progress in strengthening its public health SC system in recent years. The creation of the RMS and TRMS activity is supporting improvements in the performance of the country's SC system. The assessment revealed consistent improvements in the availability of health commodities, and a reduction in procurement lead time. Health commodities procurement has consistently achieved competitive prices and key areas of the SC demonstrate significant performance such as quality assurance, quantification and forecasting and waste management. However, like many countries, Rwanda's SC system still faces some challenges that present opportunities for improvement..

5.1 CONCLUSION: KEY SC GAPS IDENTIFIED AND THEIR ROOT CAUSES

To serve as a conclusion, we find it useful to summarize the key SC gaps identified from the baseline analysis and to present their root causes. Table 22 presents these 10 core SC gaps that as identified by the analysis presented above. Examining the SC gaps identified key root causes include the lack of dedicated staff for SCM due to the high workloads of existing staff and limited resources to bring on board new teams; challenges with data quality complemented by gaps in data accessibility and the ability of health facility staff to utilize data; and a lack of coordination between SC levels. We expect that these insights will be of particular value for the adaptive management of the RMS/TRMS Activity, assisting in flagging barriers that should be addressed in implementation and clarifying whether key theory of change assumptions – which could affect implementation as planned – hold true.

Table 22. Key gaps identified by the baseline analysis and their root causes.

Key SC Gaps Identified	Root Causes Identified
Variations in awareness of the existence of policies and important guidelines: 100 percent of RMS HQ, but only 40 percent at hospitals	• Absence of framework for effective dissemination of important policies from central levels to health facilities • Inadequate coordination and communication between actors at different levels of the supply chain.
Use of requisition/distribution data rather than consumption data	• Incomplete records for the consumption data • Lack of effective regular data quality management and data quality assurance reviews.
Issues with the accuracy and quality of data reported from health facilities	• No effective mechanism in place to monitor data quality and enforce corrective action at the service delivery points (HFs)
Only 87 percent of orders were delivered in full and on time	• Lack of interest from suppliers due to small quantity of orders • Challenges in the global market for health commodities, including disruption in production and logistics problems.
Under-/overstock of some products at RMS branches and health facilities	• Lack of dedicated staff and staff turnover in the health facilities. • Inventory largely operated manually and prone to errors. • Low use of e-LMIS and inadequate inventory management practices
Low order fill rates across all levels of health facilities	• High rate of emergency orders from health facilities due to inadequate planning and inadequate inventory management practices
Low usage of e-LMIS consumption data in health facilities	• Lack of internet connectivity, insufficient bandwidth and airtime • Lack of effective training and supervision to operate e-LMIS. • Absence of formal and standard methods to report issues for e-LMIS improvements • Inadequate or absence of systematic support for effective operationalization of e-LMIS

	• Absence and/or lack of awareness of e-LMIS policies and standard operating procedures
Delays in logistics and delivery of products from RMS HQ to branches, and to SDPs	• Delays in order validation processes by the parties in the SC • High rates of order adjustment (60–80 percent) RMS and Branches respetively. • Absence of transport and logistics KPIs, formalized policies and lack of logistics data • Inadequate and low-capacity tracks for commodity transportation
Low recovery from sales at the RMS level	• No effective recovery policies in place to improve the recovery rate. • Refund delays from the Rwanda Social Security Board (RSSB)
Lack of dedicated staff for SCM in health facilities	• High workload due to staff shortage and staff turnover • Lack of budget and finances to attract and retain key personnel

As above, the TPM baseline conducted by CIIC-HIN with support from ME&A outlines key findings and gaps in Rwanda's SC system and reveals critical areas that present further opportunities for improvements in the national SC system, as highlighted below:

- ***The e-LMIS has not been fully operationalized and used for decision-making at the lower levels of the SC.*** The assessment revealed that the awareness of availability of e-LMIS standard operating procedures (SOPs) in the health SC system was very low. Consequentially, very few facilities reported recording real consumption data using the e-LMIS system, tracking completeness of data reported, and using e-LMIS data for decision-making. Further, the results show that only a minority of health centers and hospitals conduct data quality assessments and use e-LMIS for data analysis. This is an important gap that is cited as a root cause of various other challenges. The low level of general operation of e-LMIS is attributed to lack of systematic support for the use of e-LMIS system, shortages in human resources, lack of dedicated computers, lack of internet connection, and inadequate training. Addressing these factors presents an opportunity to improve aspects of the SC system as a whole.
- ***Stock levels of key health commodities are suboptimal, impacting order fill rates and the availability of commodities to meet patient needs.*** The results show relatively higher stockout rates at the health facilities for both the essential medicines and program products. The reasons for the stockout at the health facilities included logistic challenges, supply delays, insufficient storage space, and commodity processing time. The stockout for essential medicines, in addition to other challenges, is caused by the lack of sufficient budget to pay for the medicines.
- ***Several gaps in data quality impact how effectively these data can be used.*** The results also show significant mismatch in the records in e-LMIS, HMIS, and patient register (number of patients) in the health facilities. The mismatch in data is attributable to human resource challenges and failure to adhere to use of the systems.
- ***While satisfaction levels across the SC are generally positive, key gaps persist that the TRMS Activity should address.*** The patients generally have a good impression of the services provided at the health facilities but were less impressed with the availability of medicines at the facilities. On the other hand, stakeholders' overall interaction with RMS is relatively good, but they have a lower impression in terms of timely sharing of information from the RMS.

This baseline assessment confirms that significant progress has been made in Rwanda's SC system. Nevertheless, the challenges revealed, which were also identified in previous studies (including the low operationalization of e-LMIS, gaps in human resources for supply chain management, data quality inconsistencies, and logistics and infrastructure challenges) remain to be addressed. Currently, these issues

are a rate-limiting factor in realizing even greater gains in SC efficiency and effectiveness. Any continued improvement to the supply chain will be limited until these prevailing challenges are addressed.

5.2 RECOMMENDATIONS

The baseline assessment provides detailed findings and makes targeted recommendations that could drive desired efficiency and effectiveness of the Rwanda health system SC, if implemented. These are described in Table 23.

Table 23. Recommendations for an improved Rwanda SC

RECOMMENDATIONS	
RMS	**Short terms- Quick wins** • Regularly assess SC key performance indicators (KPIs) and implement continuous improvement initiatives for all functions of the SC. • Create a dashboard to monitor and track SC KPIs on a timely basis and in real time. • Ensure formal tracking of transportation and distribution-related KPIs, in order to identify regular logistical issues and address them on a timely basis. • Create a framework for regular, timely sharing of information with other stakeholders, including the dissemination of important policies and guidelines. • Improve order response time between RMS central, branches and health facilities **Medium and long-term (resources dependent)** • Evaluate the underlying causes of logistical challenges and implement route optimization to ensure efficacy. • Carry out warehouse optimization and determine if additional space is required at the RMS branches
MOH	**Short-term- Quick wins** • Explore ring-fencing of proceeds from essential medicines to ensure they are used only to pay for the essential medicines to ensure availability at HFs. • Address operational challenges in the use of e-LMIS, including ensuring formal standardized reporting of e-LMIS issues for improvements, and dissemination of policies and guidelines. • Set up an e-LMIS technical team to support HFs in using the e-LMIS effectively to ensure operational efficiencies and effectiveness. **Medium-long-term (resources dependent)** • Advocate and mobilize resources to incentivize the use of e-LMIS at the HFs and recruit dedicated personnel for SC functions at health facilities. • Advocate for resources for the provision of internet connection, and computers and increase storage spaces at the HFs. • Accelerate the harmonized health information systems and ensure systems interoperability in SC to improve data quality and timely data availability.
USAID/Rwanda	• Leverage the global health commodity procurement network to support procurement for the low-quantity products that face supply challenges.
USAID/ Rwanda, MOH, and RMS	• Support efforts to automate the inventory management system for the Central warehouse and health facilities

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13. THE TRANSFORMING RWANDA MEDICAL SUPPLY CHAIN (TRMS) Revised AMELP, 2021December.

ANNEXES

ANNEX 1: TARGETED RESPONDENTS BY HEALTH FACILITY AND FUNCTION

Health Facility Level (No. of Respondents)	SC Function	Targeted Respondents
RMS-HQ (27)	Governance and policy	CEO and Strategic Advisor
	Strategy and planning	COO, M&E and Planning Officer
	Human resources	HR and Admin Manager
	Quality assurance	QA/QC Manager; QC Officer
	Quantification (Forecasting and supply planning)	Head of Procurement and Quantification; Quantification and Data Visibility Manager
	Procurement and customs clearance	Head of Procurement and Quantification; Procurement Manager; any other staff in Procurement
	Storage and Inventory management	Head of Warehouse, Sales, and Distribution and Purchase, Transport, and Central Warehouse Manager and 2 staff working in Storage and IM
	Distribution	Regional Warehouse Manager; Sales, Distribution, and Marketing Manager
	Reporting and e-LMIS	Chief Information & Digital Officer, IT Manager and 2 additional other 3 staff working in e-LMIS
	Waste management	Deputy Chief Executive Officer and QA officer
	Finance sustainability	CFO, Finance Manager, Accountant
RMS-Branches (60)	HR	Assistant regional warehouse manager (Branch manager)
	Quality assurance	Assistant regional warehouse manager (Branch manager)
	Storage and Inventory management	Inventory processing and receiving officer
	Distribution	Order picking and dispatching officer
	Reporting and e-LMIS	Data quality field officer
	Waste management	Inventory processing and receiving officer
Provincial and Referral Hospitals (30)	Governance and policy	Hospital Director General
	Strategy and planning	Planning, M&E Officer
	HR	Director of Finance and Administration or HR Manager

Health Facility Level (No. of Respondents)	SC Function	Targeted Respondents
	Quality assurance	Pharmacist (Head of Pharmacy)
	Storage and Inventory management	In charge of stock (Pharmacist)
	Reporting and e-LMIS	M&E Officer, Data Manager and Statistician, Pharmacist
	Waste management	Environmental Health Officer
	Finance sustainability	Finance/ Accountant
Hospitals (120)	Governance and policy	Hospital Director General
	Strategy and planning	Planning, M&E Officer (head)
	HR	Director of Finance and Administration or HR Manager
	Quality assurance	Pharmacist (Head of Pharmacy)
	Storage and Inventory management	In charge of stock (Pharmacist)
	Reporting and e-LMIS	M&E Officer, Data Manager and Statistician, Pharmacist
	Waste management	Environmental Health Officer
	Finance sustainability	Finance/Accountant
HC (606)	HR	Head of health center
	Quality assurance	Nurse in charge of pharmacy and any other staff working in quality assurance
	Storage and Inventory management	Nurse in charge of pharmacy and any other staff working in the stock
	Reporting and e-LMIS	Data Manager and Nurse in charge of pharmacy
	Waste management	Community and Environmental Health Officer
	Finance sustainability	Head of health center and Accountant
Patients (707–1,010)	7–10 per each HC	N/A

ANNEX 2: SELECTED STUDY SITES

Province	District	Site	Health Center
CoK	Gasabo	RMS Ltd.	Central Warehouse
South	Huye	CHUB RH	Referral DH
West	Karongi	Kibuye RH	Referral DH
South	Ruhango	Ruhango PH	Provincial DH
COK	**Nyarugenge**	**Nyarugenge - RMS Branch**	Cor-unum CS
		MUHIMA DH	Kanyinya CS
			Muhima CS
	Gasabo	**Gasabo - RMS Branch**	Gatsata CS
		KIBAGABAGA DH	Gihogwe CS
			Gikomero II CS
			Jali CS
			Kabuye CS
			Kagugu CS
			Kayanga CS
			Kinyinya CS
			Nduba CS
			Nyacyonga CS
			Rubungo CS
			Rwanda Women's Network CS
			Solace Ministries CS
EAST	**Kayonza**	**Kayonza - RMS Branch**	Cyarubare CS
		RWINKWAVU DH	Kabarondo (Kayonza) CS
			Ndego CS
			Nyamirama CS
			Ruramira CS
			Rwinkwavu CS

Province	District	Site	Health Center
			Camp Nyabiheke CS
	Gatsibo	**Gatsibo - RMS Branch**	Gituza CS
		NGARAMA DH	Kageyo (Gatsibo) CS
			Ngarama CS
			Nyagahanga CS
			Nyagahanga CS
WEST	**Nyabihu**	**Nyabihu - RMS Branch**	Bigogwe CS
		SHYIRA DH	Birembo CS
			Gakamba CS
			Jomba CS
			Kabatwa CS
			Kintobo CS
			Kora CS
			Mwiyanike CS
			Nyakigezi CS
			Nyakiliba CS
			Rurembo CS
			Rwankeri CS
			Shyira CS
	Nyamasheke	**Nyamasheke - RMS Branch**	Cyivugiza (Nyamasheke) CS
		KIBOGORA DH	Gatare (Macuba) CS
			Karambi (Nyamasheke) CS
			Karengera CS
			Kibingo (Nyamasheke) CS
			Kibogora CS
			Mahembe CS
			Nyamasheke CS

Province	District	Site	Health Center
			Rangiro CS
			Ruheru (Kanjongo Nyamasheke) CS
	Ngororero	**Ngororero - RMS Branch**	Gashubi CS
		MUHORORO DH	Muhororo CS
			Ntaganzwa CS
			Ntobwe CS
			Nyange A CS
			Nyange B CS
			Rususa CS
NORTH	Rulindo	**Rulindo - RMS Branch**	Bubangu CS
		RUTONGO DH	Burega CS
			Cyinzuzi CS
			Kajevuba CS
			Kiyanza CS
			Masoro CS
			Murambi CS
			Remera-mbogo CS
			Rulindo CS
			Rwahi CS
			Shyorongi CS
	Gakenke	**Gakenke - RMS Branch**	Coko (Ruli) CS
		RULI DH	Minazi CS
			Muhondo (Gakenke) CS
			Nyange (Ruli) CS
			Ruli CS
			Rushashi CS
SOUTH	Ruhango	**Ruhango - RMS Branch**	Byimana CS

Province	District	Site	Health Center
		GITWE DH	Gitwe CS
			Karambi (Ruhango) CS
			Munanira CS
			Muyunzwe CS
	Nyanza	**Nyanza - RMS Branch**	Cyaratsi CS
		NYANZA DH	Gahombo CS
			Gatagara (Nyanza) CS
			Kibilizi (Nyanza) CS
			Mucubira CS
			Mututu CS
			Mweya CS
			Nyabinyenga CS
			Nyamure CS
			Nyanza CS
			Nyarusange (Nyanza) CS
	Kamonyi	**Kamonyi - RMS Branch**	Cyeru CS
		REMERA-RUKOMA DH	Kabuga (Ntamba Kamonyi) CS
			Kamonyi (Gacurabwenge) CS
			Karama (Kamonyi) CS
			Kayenzi CS
			Kigese CS
			Mugina CS
			Musambira CS
			Nyamiyaga (Kamonyi) CS
			Remera Rukoma CS

ANNEX 3: FIELD PLAN USED FOR DATA COLLECTION

ANNEX 4: TOOLS (QUESTIONNAIRES)