

Evaluating the impact of electronic Logistics Management Information Systems (eLMIS) and electronic Immunization Registries (eIR) in low- and middle-income countries

GUINEA

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Presentation outline

Objectives

- Background to research and tool introduction
 - Context of use of the tool
 - Research study
 - Findings
 - Next Steps
 - Limitations
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Background

Background to the research

- The research forms part of a multi-country evaluation.
- **Topic:** The impact of electronic immunization registries (eIR) and electronic logistic management systems (eLMIS) in low and middle-income countries.
- **Project duration:** 2020 – 2022
- **Countries evaluated:** Guinea, Honduras, Rwanda and Tanzania.
- **Evaluation team** (Tanzania): Mbeya Medical Research Center of the National Institute for Medical Research (NIMR-MMRC), the University of Bocconi, MM Global Health Consulting.
- **Data collection** (Tanzania): October/November 2021
- **Sponsors:** Funded by the Bill & Melinda Gates Foundation (BMGF) and co-sponsored by the World Health Organization (WHO) and Gavi, the Vaccine Alliance.

BILL & MELINDA
GATES *foundation*

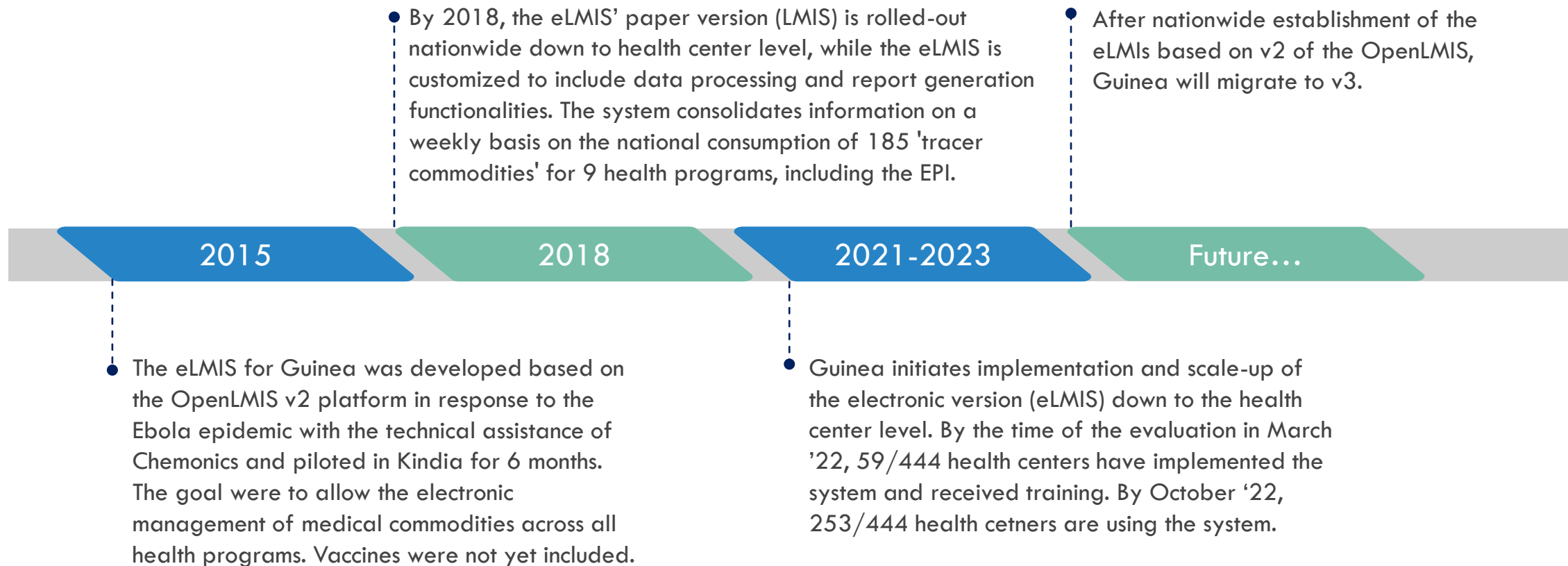


Why was Guinea selected as part of this evaluation?

- ✓ **Scale:** It is an ongoing implementation process with hybrid modalities (paper and electronic)
- ✓ **Tool:** OpenLMIS (version 2) meets the criteria of an eLMIS
- ✓ **Context:** Representation of a West-African country



Background to the Introduction of the tool



Implementation was supported by the Ministry of Health and Public Hygiene, a well-established national strategic plan and financial and technical support from the Global Fund and USAID (via Chemonics). The roll-out has adopted a progressive deployment approach. The current configuration of the eLMIS is hybrid both from a functionality standpoint and from a geographical standpoint.

Context to the Use of the eLMIS

- **Tool:** The eLMIS (referred to in Guinea as the eSIGL) is based on OpenLMIS (version 2) and manages health facility-level transactional data across 14 health programmes. The tool was selected to establish a more solid HMIS after the Ebola epidemic.
- **Scale:** a progressive deployment of the first 9 health programmes started in 2017 and has ramped up in 2022 after a break in implementation caused by COVID-19. As per October 2022, 57% of the country health centres (253 out of 444) that deliver immunization services (including communal medical, urban and rural centres).
- **Implementation:** the current configuration of the eLMIS is hybrid. In the centres that have been included in the roll-out, only data entry, consolidation and reporting are included in the electronic system, with ordering and forecasting still managed with the legacy system. The other health facilities are still operating with the legacy paper system across all functionalities. For vaccines, the legacy system consists of stock registries, tally sheets at health centre and district level and the excel stock management tool (SMT) and central level. The EPI is considering transitioning to a fully paperless system by introducing the electronic version of the SMT.
- **Integration and interoperability:** the interoperability of the eLMIS with the HMIS of EPI (DVD-MT and SMT) occurs at central level through DHSI2, allowing the visibility and central management of vaccine stock and consumption data. At all administrative levels, and under different governance responsibilities, multiple information systems and tools capturing data relevant to vaccine stock data are operating.
- **Impact of COVID-19:** during 2020, the pandemic affected negatively the continuity of the routine immunization programme and caused delays in supplementary immunization activities. From 2021, the overall situation is progressively coming back to the pre-pandemic state.

Use of the eLMIS at different levels

Health Centre (HC)

- EPI staff fills paper-based registers and provides data to Health Centre's staff dedicated to data entry in the eLMIS. In some cases, this staff carries out the data entry at the district level because of the lack of pc or internet access.
- Often the paper-based reports are transported to the DPS while the electronic ones are sent electronically as well to the DPS.

Prefectural/District Health Directorates (DPS)

- Manage the eLMIS for input of district data and consolidation of HCs ones.
- Two reports are generated including the vaccine stock indicators by LMIS/eLMIS and the legacy EPI reporting, and sent both electronically and on paper to the regions.
- Operate the DHIS2 capturing the number of vaccine doses administered. Vaccine stock data from the eLMIS is synchronized into DHIS2 every 25th day of the month.

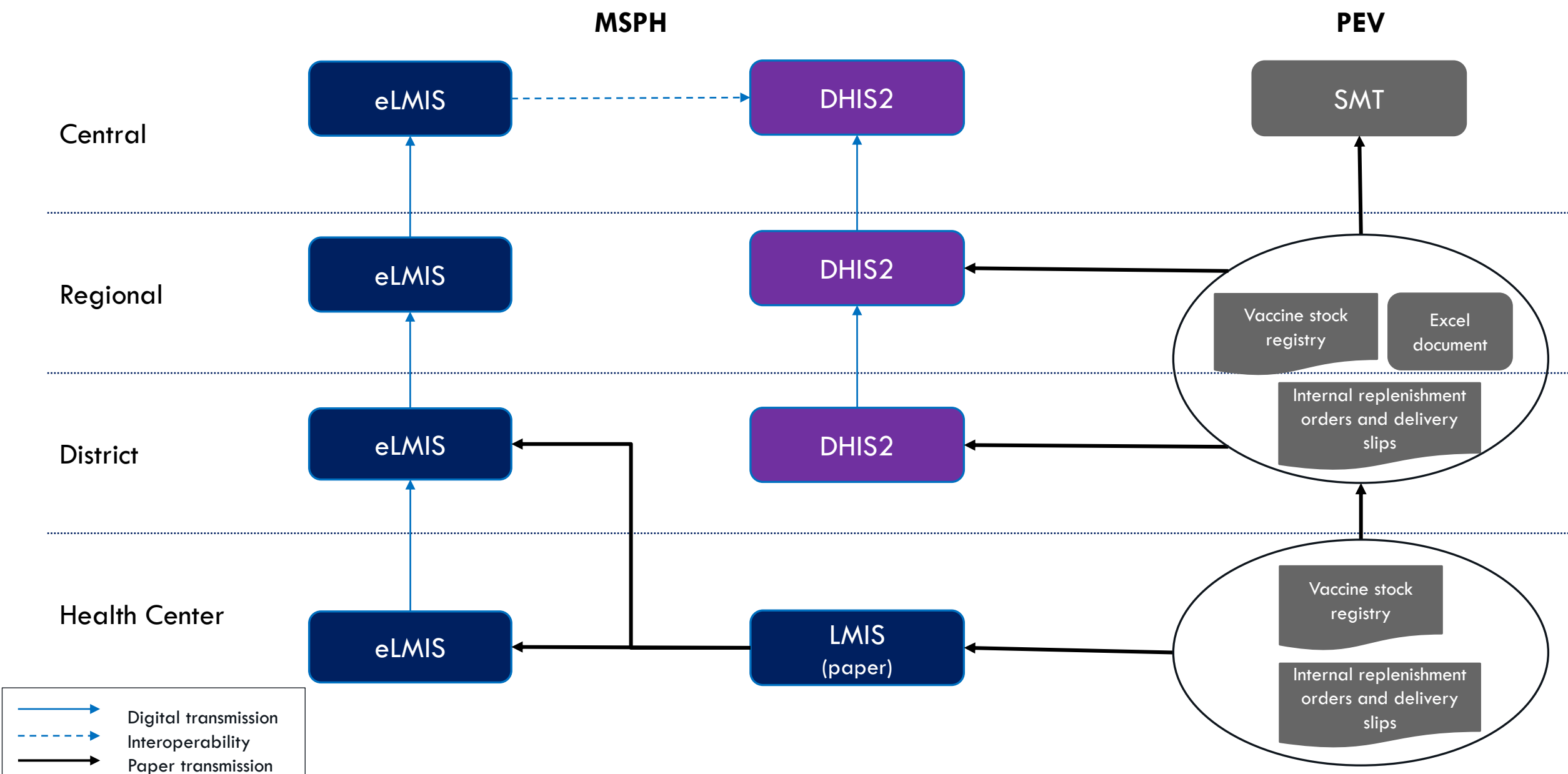
Regional Health Directorates (DRS)

- Validate the data received, this is consolidated into a monthly report containing aggregate vaccine and immunization data, by region,
- Send regional reports to the MSHP at central level.

Ministry of Health and Public Hygiene (MSHP)

- Analyse the reports received and monitor the data quality
- Synchronise data received from DHIS2 with those coming from two separate information flows (EPI legacy tools and eLMIS).

Guinea operates two separate vaccine stock information flows



Research study |

THEORY OF CHANGE (SUMMARY)

The Theory of Change serves as the foundation for an evaluation framework used to guide the interpretation of the key findings from this evaluation

Vision

Reduce morbidity and mortality from VPDs by enhancing equitable access to vaccines and strengthening immunization delivery within PHC (IA 2030)

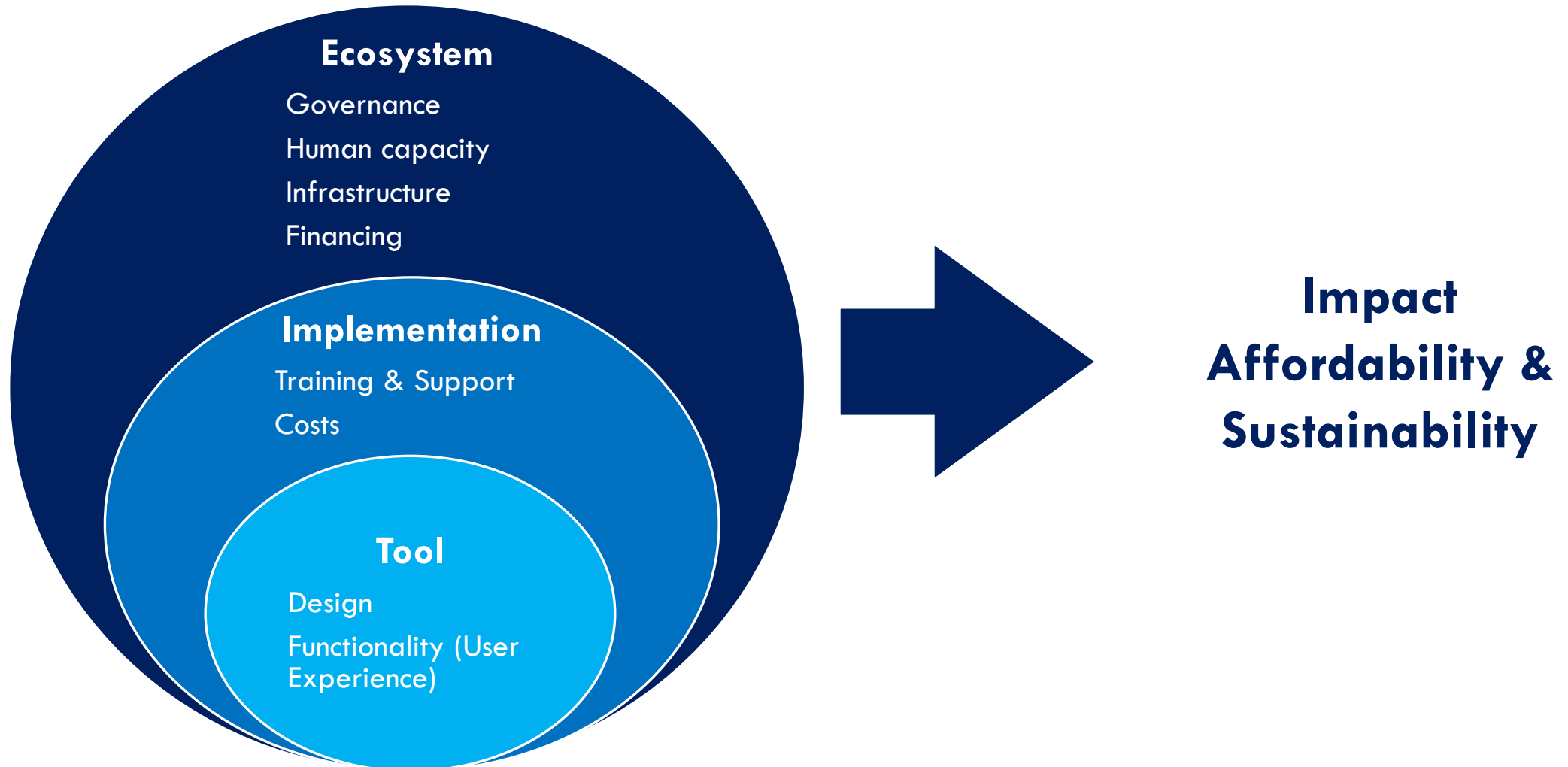
Mission

Improve immunization program performance (vaccine availability and equitable access, efficiency of logistics management) by sustained use of the eLMIS

Strategic outcomes

1. Improved functionality of the eLMIS
2. Improving the accuracy of vaccine forecasts
3. Improved inventory and stock levels (use of data for decision making)
4. More efficient, affordable, and sustainable eLMIS use
5. Increased stakeholder satisfaction and engagement

Evaluation framework



Research questions

- Has the implementation of the eLMIS improved immunization service delivery? *[Impact]*
 - What were/are the barriers and opportunities for implementing it in the country? *[Ecosystem, Implementation, Tool]*
 - What is the impact of the eLMIS on the national immunization program (e.g., cost saving, efficiencies, timeliness, coverage)? *[Impact]*
- What is the economic (i.e., costs) and financial (i.e., expenditure) impact of implementing and scaling-up the system in the whole country? To what extent is the eLMIS user-friendly and sustainable? *[Impact, Affordability and Sustainability]*
- How interoperable is the eLMIS with the national health information and management systems (DHIS2, stock management system)? *[Ecosystem, Tool]*
- How can new evidence on tools and technologies, modalities, and governance of the eLMIS inform further investments in other countries from domestic sources, health financing institutions and technical partners for its sustained operation? *[Ecosystem, Impact, Affordability and Sustainability]*

Purposive sampling of regions, districts and health centers

3 regions with and 2 without eLMIS were selected:

- Of the total 4 regions with eLMIS by March 2022, **Conakry, Boké, and Kindia** were included, while Labé was excluded because of logistical and security challenges in accessing health facilities to collect data.
- Regions without eLMIS were selected with the rationale of ensuring diversity and representativeness of the sample. **Mamou** and **N'Zérékoré** were included as they represented the smallest and largest regions of Guinea, respectively, in terms of territorial extension and number of facilities.

7 districts were selected by the Technical Committee of Guinea that were representative of the country based on the following criteria:

- i) the number of health centers with eLMIS implemented; ii) the target population size (i.e., under 24 months of age); iii) the total population of the district; and iv) the vaccination coverage of the third dose of Pentavalent vaccine

42 health centers within the selected districts were chosen with the primary aim of ensuring a balance between the intervention and the control group:

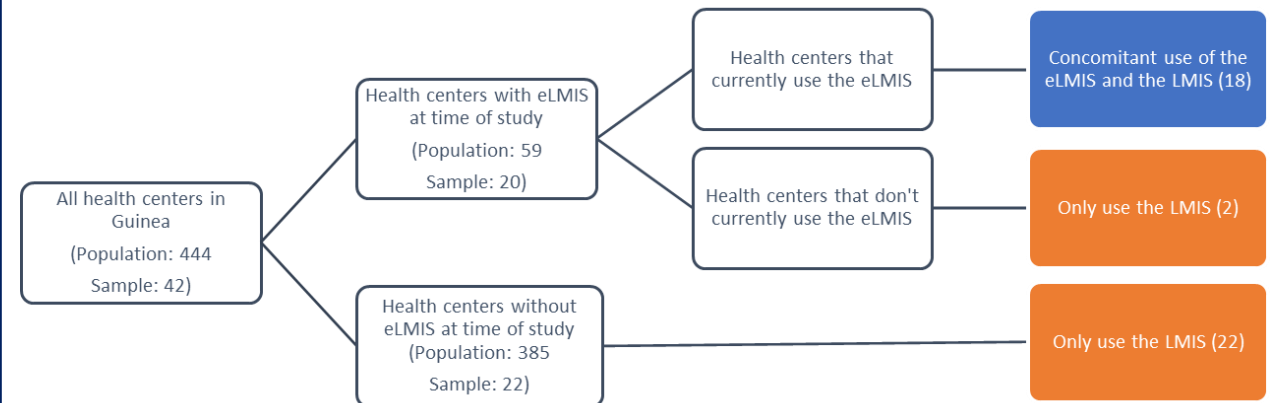
- The need to include enough health facilities with eLMIS in the sample when only 59 out of nearly 444 had eLMIS led to an over-representation of facilities with eLMIS (48% vs. 25% in the country).
- The distribution of rural and urban facilities in the sample was not representative of the distribution in the country as only 4 rural health centers out of 59 had adopted the eLMIS for vaccine stock management at the time of the study

Identifying a comparator:

User and non-users

- Even though the tool was introduced nationwide, the EPI module had only been deployed in 59 out of 444 health centers at the time of the study. Hence, a comparison was performed between users ($n = 24$) and non-users ($n = 18$).
- A health center was defined as user when it met the following criteria:
 - eLMIS implementation took place at least 3 months prior to the survey
 - The health center generates electronic reports and sends them to the health district level
- It was estimated that a minimum of 3 months was required for full operation of the system, including training of staff, preparation and installation of computer equipment and data entry.
- The classification was validated using inputs from other secondary data sources provided by the Technical Committee and confirmed against the a-priori classification of the extent of eLMIS use for reporting immunization data to the national level

Figure: Process of classifying health centers to users (blue) and non-users (orange) of the eLMIS (number of HCs in parentheses)



Methodology: Programmatic impact evaluation

A mixed-methods approach involving both quantitative and qualitative methods.

Analysis of the impact of the reporting and monitoring functionalities of the eLMIS on the performance of the immunization system as assessed by three vaccines (BCG, Pentavalent and measles)

- ❑ Two key direct measures of **programmatic performance**: stock levels and number of stock-outs.
- ❑ Two measures of **process performance**: data quality measured in terms of timeliness, completeness, and perception of quality and data use for decision.

Evaluation aimed to identify and explore discrete factors critical for the successful implementation and scale-up of the eLMIS

The total number of '**non-performing months**' (i.e., months when stock levels were outside the desired range) and '**performing months**' across all health centres was measured and used to:

- Calculate **percentage difference** of non-performing months for each of the vaccines and indicators between users and non-users (reduction of the number of months of stock out, or months outside the target range suggests an improvement in stock performance).
- Perform **statistical test (Chi-Square)** to test association between categorical variables. A significant test result ($p\text{-value} < 0.05$) considered to provide indication of potential association between stock performance and use of eLMIS.

Effect of **confounding factors** was evaluated. A stratified analysis was conducted based on the variables that emerged as most likely to influence performance and be associated with use of the tool: urban and rural location, type of health facility, availability of a computer, level of training and expertise in vaccine management and logistics, and performance and supervision of vaccine management.

Methodology: Economic impact evaluation

	1. Financial expenditures of implementing the eLMIS	2. Routine operating costs of using eLMIS	3. Cost impact of using eLMIS	4. Financial sustainability of eLMIS	5. Scenario analysis of a fully electronic registry
Scope of the analysis	Design & development and roll-out expenditure of eLMIS	Routine operating costs related to the management of immunization data using eLMIS	Difference in the operating costs of managing immunization data with eLMIS as compared to the paper-based system	Financial sustainability of maintaining the continuous operations of the systems, using domestic resources	Simulating the impact on costs of a complete paperless registry
Type of analysis	Descriptive analysis	Activity Based Costing analysis – subgroup analysis by user vs non-users and rural vs urban users	Activity Based Costing analysis using a cross-sectional comparison of avoided cost from eLMIS	Descriptive and comparative analysis. Analysis of the total cost of the system based on the Activity Based Costing analysis	Simulation
Source of data	Secondary data obtained from Chemonics (USAID)	Questionnaires, eLMIS data	Questionnaires, eLMIS data	International Monetary Fund (IMF), WHO and country report indicators, HMIS data extract	Questionnaires, HMIS data

Activity-Based Costing (ABC)

Collection of data through questionnaires on :

Direct costs

- Annual frequency of performing each activity
- Number of staff and their profile (salary) performing the activity
- Time spent to perform each activity
- Additional costs such as for consumable goods (fuel, paper costs for printing), services (transportation fares, per-diems, etc.) and durable goods (cables, spare parts for maintenance)

Indirect costs

- Electricity, internet

Activities impacted by the implementation and use of the eLMIS in Guinea :

Activity	Description
Report transmission	Transmission of weekly/monthly reports to higher administrative levels.
Defaulter identification	Reviewing registry to identify children who missed appointments, establishing list of defaulters
Determining vaccine orders	Preparation for the administration of vaccines as part of the EPI
Identifying performance gaps	Reviewing data to find performance gaps (such as not being on track for reaching coverage goals)
Report generation	Searching for and recording the data that will be included in the regular reports for immunization and stock management.

Findings

Tool Design

Functionalities:

- eLMIS serves as a reporting and monitoring tool across health programs
- eLMIS provides only partial stock management functionalities (ordering workflow and forecasting not included).
- System does not include all indicators required for the EPI vaccine procurement. As a consequence, the legacy excel-based system - Stock Management Tool (SMT) – is still in use at central level and paper forms in use at local level, in parallel with the eLMIS.

Interoperability:

- eLMIS interoperates with DHIS 2 at central level. This allows the visibility and central management of vaccine stock and consumption data.
- No interoperability with other information tools and systems capturing data relevant to vaccine management at all administrative levels (e.g., SMT).

Findings

ECOSYSTEM

Ecosystem

- **Governance and policy:** Guinea has experienced, in recent years, an unstable macroeconomic performance impacted by the Ebola epidemic, the COVID-19 pandemic, and political instability. However, Government has been progressively adopting integrated digital solutions across the different public health programmes, demonstrating strong interest and a political commitment in the digitization and streamlining of health information.
- **Human capacity:** under-staffing and inadequate training of personnel at HC level were observed which may hinder the actual use of eSIGL as well as its future potential as a unique electronic data management tool.
- **Standards & interoperability:** the eLMIS is centrally managed by the DNPM directorate, favouring a coordinated decision-making and the use of data across programs. However, to date, the eLMIS has not replaced the legacy information processes and systems in place used by the EPI.
- **Infrastructure:** intermittent access to electricity and internet, as well as limited availability of hardware are inhibiting factors for the use of the eLMIS.



Findings

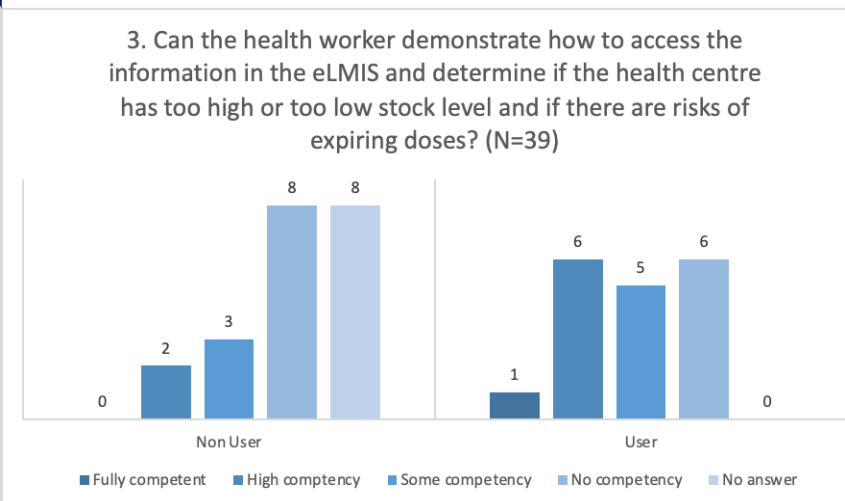
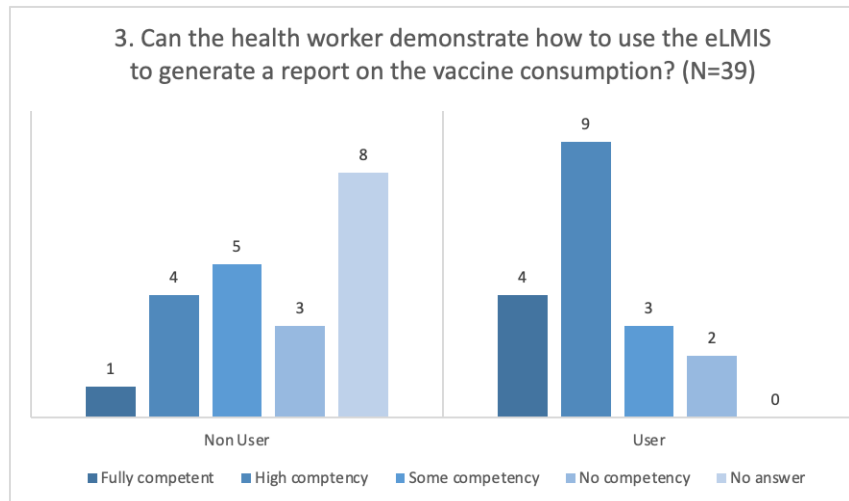
TOOL: TRAINING, SUPPORT &
USER EXPERIENCE

Tool implementation

Training & support

- Deployment of eSIGL accompanied by specific **tool and process training** (80% of centres) but opportunity missed for vaccine management and logistic refresher training.
- **Supervision and support** for the eSIGL from the next organization level widely established. Supervision on vaccine management is already largely (2/3 of centres) using eSIGL data

- General level of **skills linked to vaccine management** improved in centres using eSIGL. Improvement was more marked on the transactional side (for reporting generation) compared to decision making
- **The overall implementation has focused on the data gathering and reporting consistently with the current goal of the roll-out**

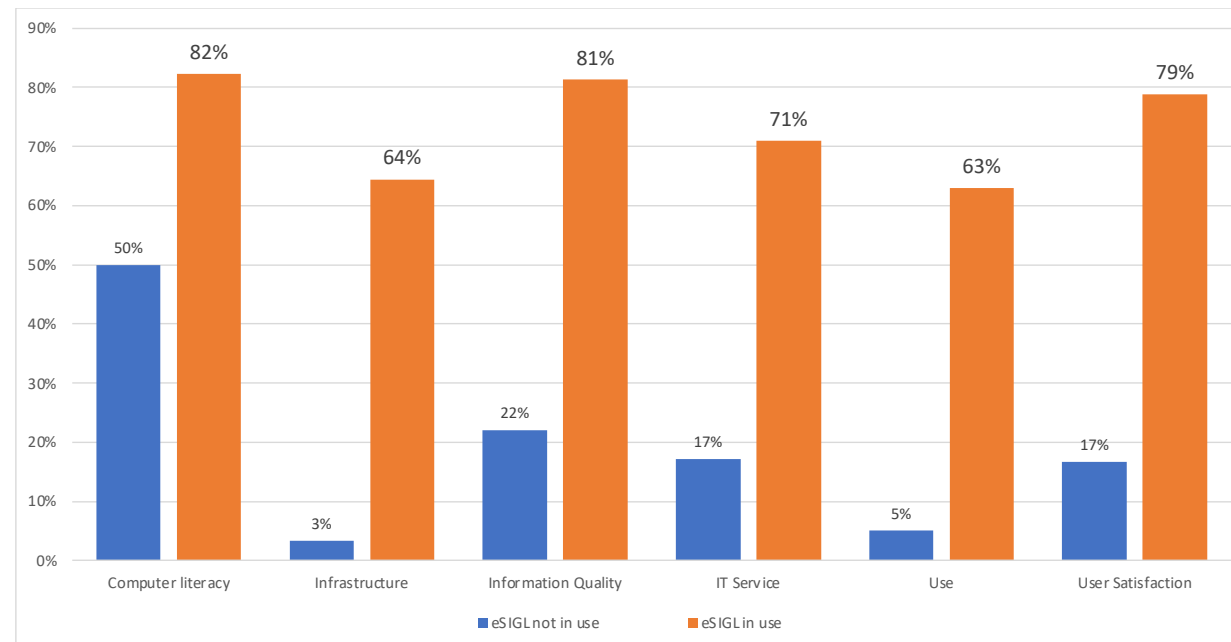


Tool functionality

User experience

- Significant differences were recorded in the scores related to perceived **quality of information** (i.e., 22% in non-users compared to 81% in users) and **overall user satisfaction** (i.e., 17% in non-users compared to 79% in users).
- Qualitative comments further highlighted four key areas related to the use of eLMIS:
 - i. the contribution that eLMIS can make to more **effective vaccine management**, particularly if specific EPI requirements are incorporated;
 - ii. improved **efficiency** in reporting and decision making;
 - iii. the importance of the availability of **electronic tools** to support vaccine management activities and of eLMIS supporting all vaccine management tasks;
 - iv. the critical role of **training** on eLMIS for successful roll-out and the call for expansion of the scope and scale of such training

Comparison of user satisfaction across 6 categories (N=42)



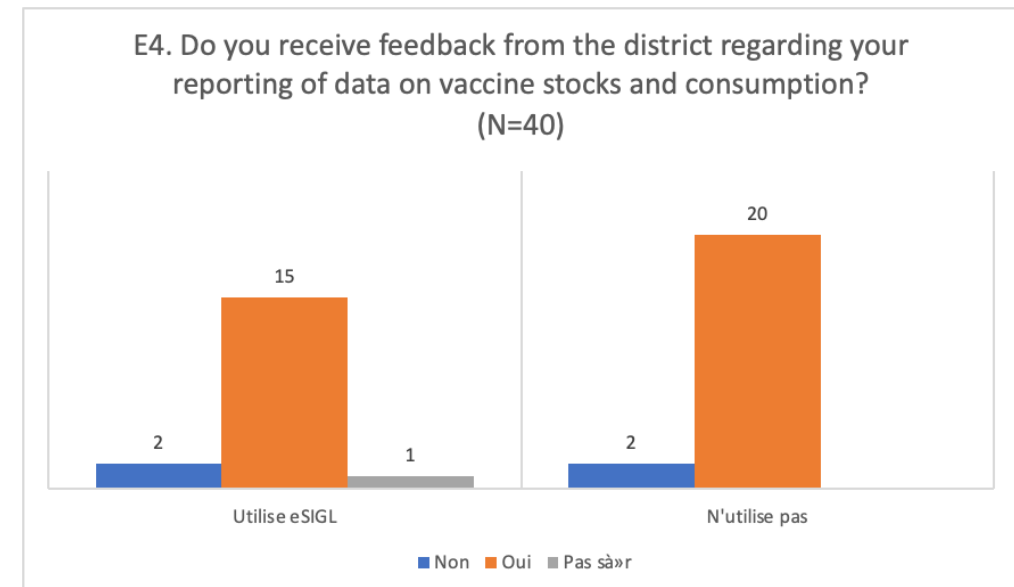
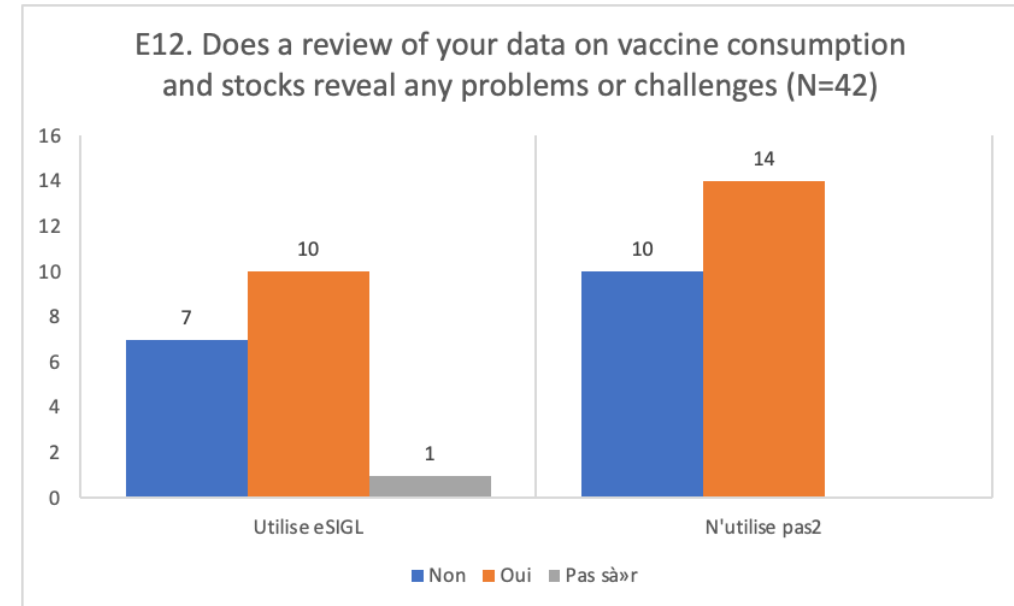
Findings

IMPACT

Impact

Data quality

- While the introduction of the eLMIS has **increased the perception of data quality** among users, about half of the facilities still reported problems in data on vaccine stocks and consumption. Insufficient training, lack of paper forms and errors in EPI primary sources were the most frequently reported
- **Quality assurance and control (QA/QC)** processes for eLMIS data were established and strengthened with the roll-out of eLMIS. Self-audit and feedback from DPS is happening in almost all centres.
- In the 6 months prior to the research, **data transmission** had been regular in all centers, and 40 out of 42 health centers of submitted data on time every month.

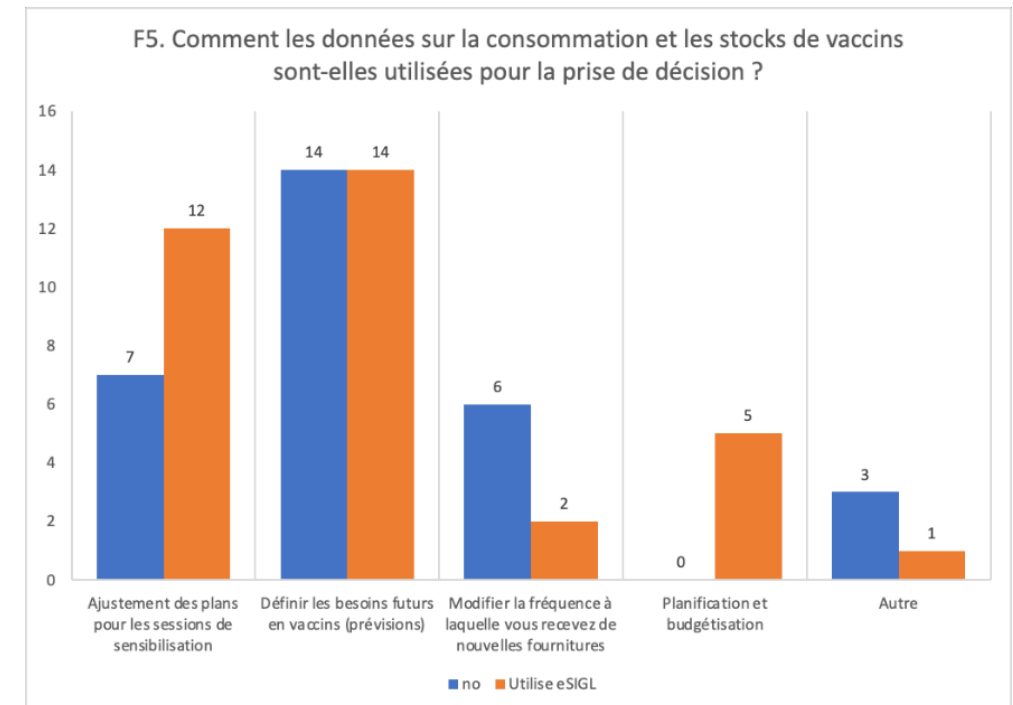


Impact

Data use

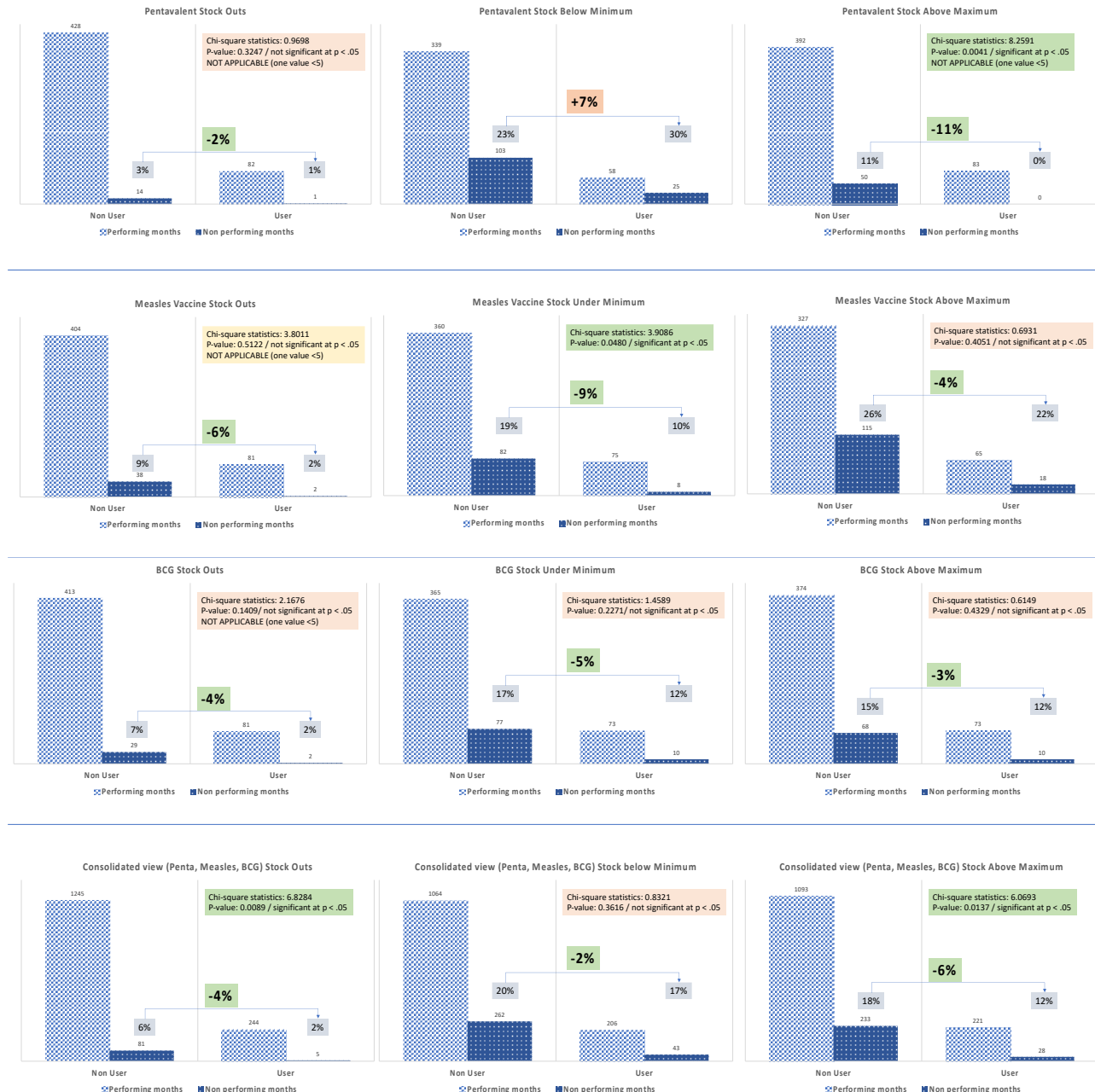
- Time required to **record the arrival of new quantities** of vaccines using the electronic form was 61% shorter compared to the same process using the paper forms, with around 50% less time required. The differences seem to be more substantial with reference to the communication/transmission of data.
- **Reporting of consumption and stock data** requires less time than the paper form in 53% of the health facilities, with half of them recording a shorter duration of 90% or more compared to the “legacy” forms.
- Use of the eLMIS data for **decisions-making** contributes primarily to:
 - monitoring stock levels;
 - triggering orders when stock is below the minimum level;
 - monitoring monthly consumption;
 - checking consumption data outliers

- All but two of the health centers reported having a **dashboard** in place to monitor performance and consumption of vaccine stocks. Similarly, all facilities hold **regular meetings where consumption and stock data are analysed and discussed**. This data is mainly used to forecast future orders, to refine outreach plans and to support planning and budgeting.



Impact EPI performance

- Use of the eLMIS was linked to a **reduction (between 1 and 11%) in the number of non-performing months***
- Chi-Square tests performed on the differences resulted in a p-value < 0.05 in 4 out of the 12 tests, indicative of a **potential positive impact of the eLMIS on stock management performance**
- **Confounding effects were ruled out for:** training in vaccine management, logistic skill levels, monthly logistic supervision, availability of hardware, urban/rural
- A shorter **start-up period** (3 instead of 6 months) before a centre is classified as users yields worst result for all three performance measures and for all three vaccines

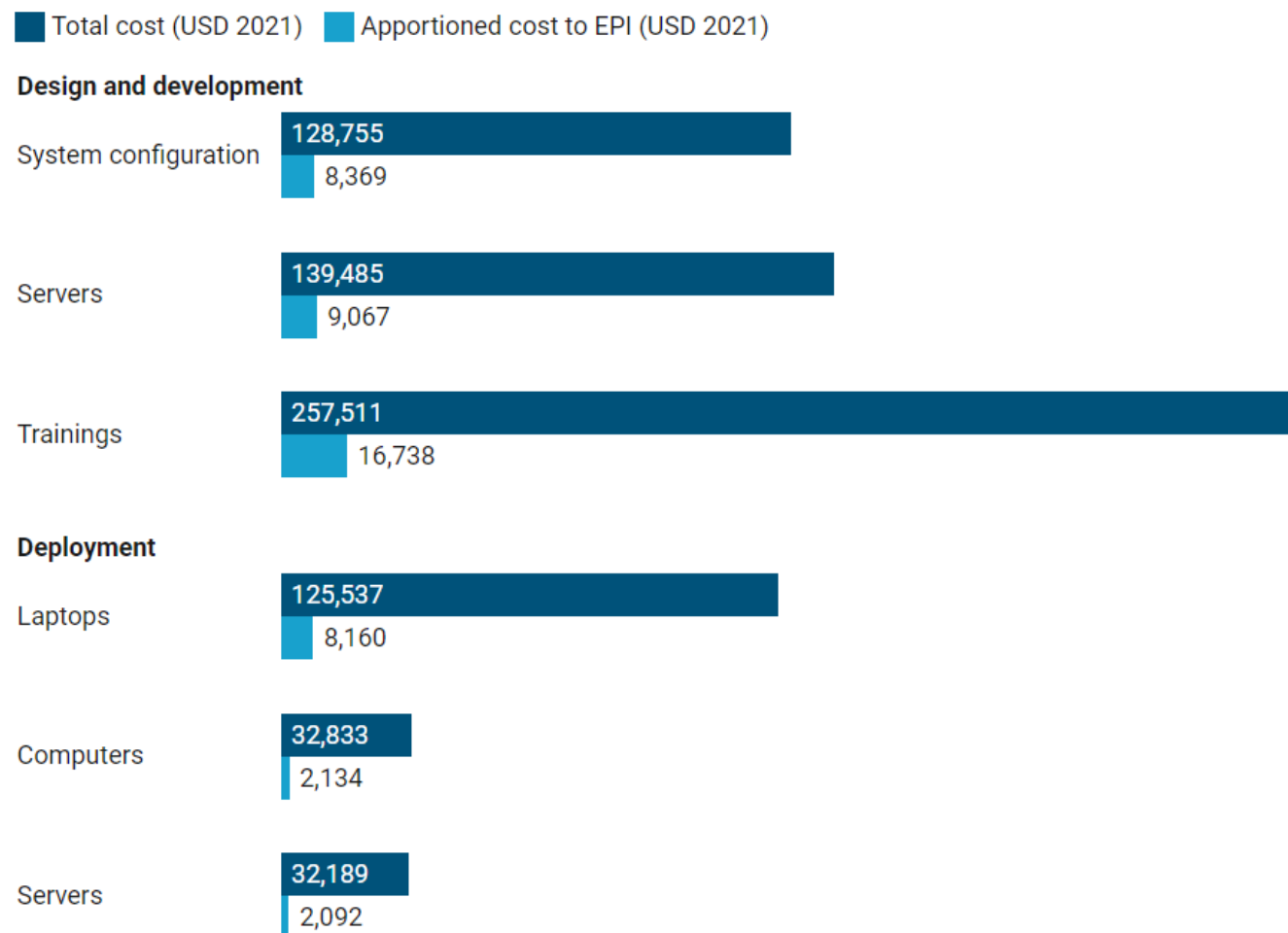


* months when the stock level are above or below the target levels, including stock outs

Findings

COSTS

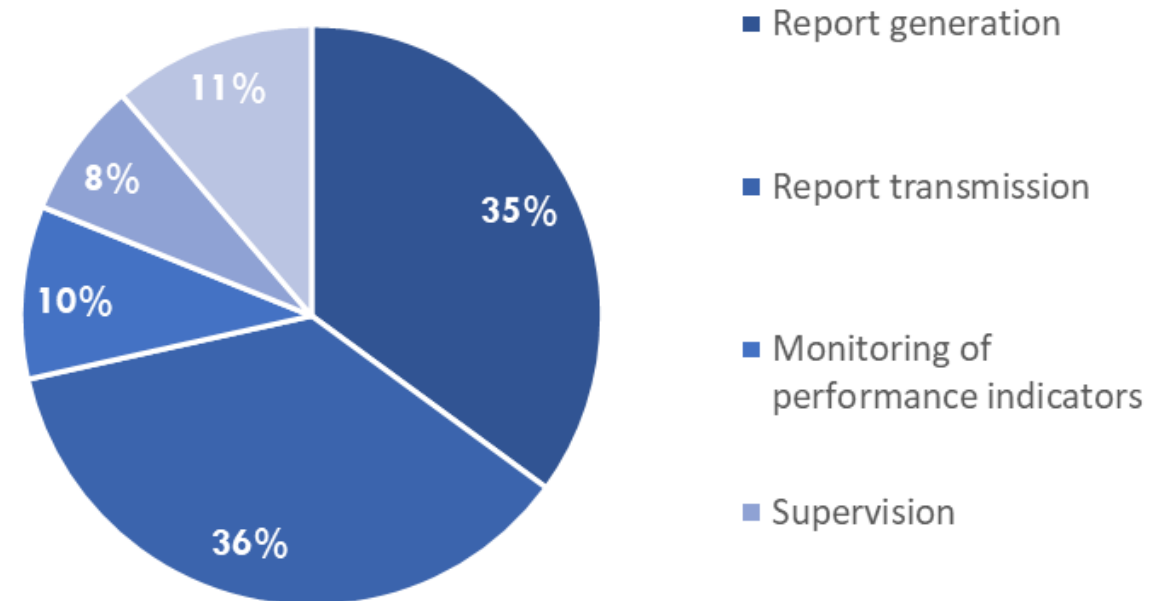
Financial expenditures for implementation



- The total financial expenditure for the implementation of the eLMIS in Guinea, incurred in 2018 by the Global Fund and USAID Chemonics, was USD 716,309.
- The 6.5% share of this total is apportioned to the EPI (i.e., the proportion of the expenditures attributed specifically to the EPI) was USD 46,560.
 - ✓ 37% of the total funding has been invested in designing and developing eLMIS
 - ✓ 63% of the total funding has been invested in the eLMIS deployment including training (57%) and goods (43%).

The average annual cost per health center of operating the eLMIS to perform vaccine stock management activities was estimated at USD 284.9 (79.1;490.6).

- Report generation and report transmission are the most expensive activities carried out using the eLMIS. The transmission requires more resources than the reports' generation because the HCs are still used in transmitting reports both electronically and physically the printed copies to the DPS.
- The largest cost input was personnel, accounting for 49% (USD 140) of the total cost per health center.



At central level, the average annual cost of operating the eLMIS apportioned to the EPI, is USD 8,253, with personnel and internet access driving this cost by 43% and 24%, respectively.

No substantial differences in costs were found between HCs using and not using the eLMIS.

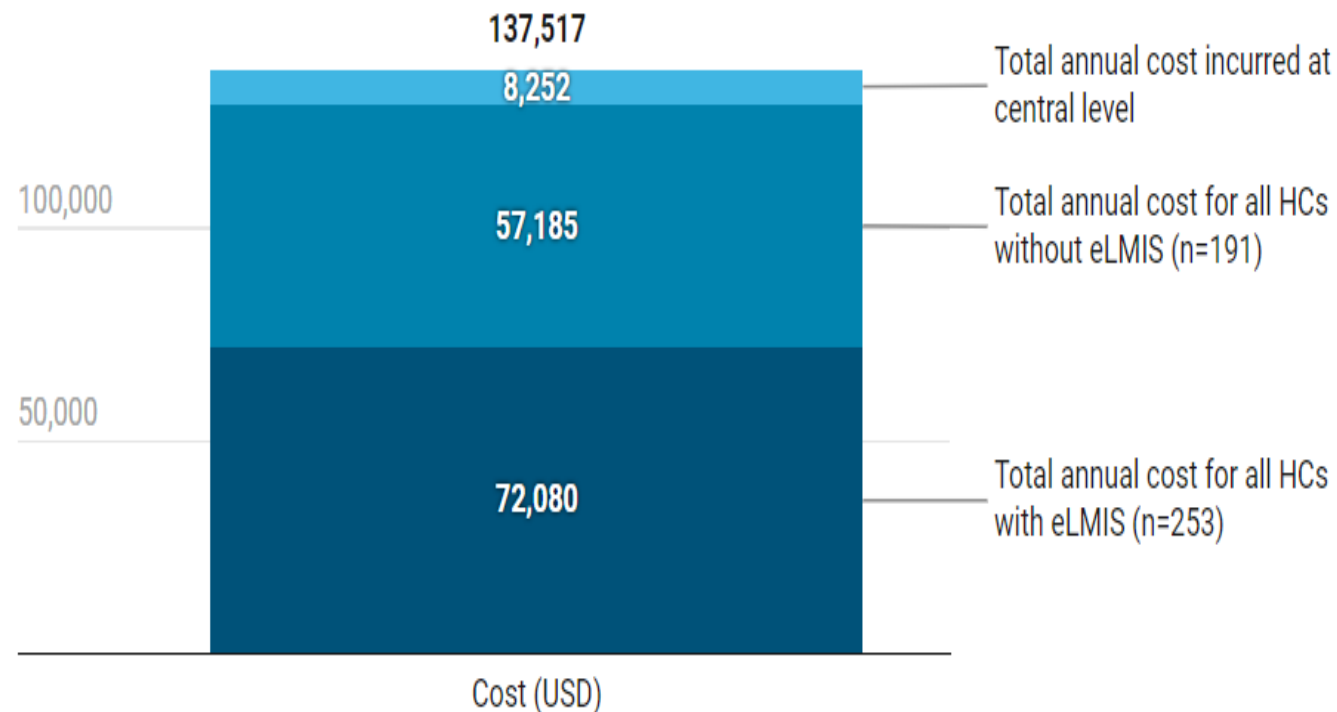
Activity	eLMIS costs (USD) (95% CI)	LMIS cost (USD) (95% CI)	Mean cost difference per health center in USD (95% CI)*
Report generation	99.9 (-19.7, 219.4)	62.3 (31.8, 92.9)	37.5 (28.5, 46.6)
Report transmission	103.8 (41.5, 166)	147.3 (-4.3, 298.9)	-44 (-91.2, 3.3)
Monitoring of performance indicators	27.4 (2, 52.9)	9 (3.2, 14.8)	18.5 (16.7, 20.3)
Supervision	21.6 (-2.3, 45.5)	41 (9.6, -72.5)	-19.5 (-29.3, -9.7)
Determining quantities of vaccines to be ordered	32.2 (5.7, 58.7)	39.8 (15.3, -64.3)	-7.6 (-15.2, 0.03)
Total	284.9 (79.1, 490.6)	299.4 (139.4, 459.6)	-15.1 (-73.6, 43.4)

Users incur less costs by USD 15.1 for vaccine data management activities per year, driven by:

- Lower costs for report transportation in eLMIS users (i.e., reduced expenditures for fuel, allowances, public transport, and printing)
- Lower costs for supervision on data quality and use of the eLMIS system and forms.

This limited difference in costs is due to the concurrent use of electronic and paper systems for the same activity, resulting in increased staff workload, and additional costs for those health centers using eLMIS.

- With a cost of USD 284.9 per health center using the eLMIS (on top of the LMIS), the current annual incremental cost of managing national vaccine consumption data electronically across the country was estimated at USD 72,080 for the 253 facilities that have eLMIS.
- A cost of USD 299.4 per health center was used for the 191 health centers that perform reporting activities for vaccine management and logistics on paper (LMIS) for a total of USD 57,185.
- The annual operating costs of the LMIS/eLMIS process at central level, including hardware, licenses and personnel needs, as apportioned to the EPI, were USD 8,252.



The total annual incremental cost of performing vaccine stock data management activities using the the eLMIS/LMIS incurred by the country is approximately USD 138k.

Affordability of the eLMIS

- Guinea has relied on external sources of funds to cover all the upfront investment for the design & development, and deployment of the eLMIS, as well as current maintenance and operational needs (servers, upgrades, internet bundles).
- According to WHO financial indicators for immunization in 2021, Guinea's total expenditure from all sources for routine immunization, including vaccines, was approximately USD 7,412,948.
- The annual cost of managing vaccine stock data of USD 137,518 is mostly accounted for by Government resources at the health center level and corresponds to 1.9% of the total average budget allocated to routine immunization activities in 2017-2019 (inclusive of both external and national sources).
- While the affordability of the system is expressed in terms of the total EPI expenditures, the eLMIS is not financed nor operated currently by the EPI. Nonetheless, given its high affordability, it is recommended that the EPI considers integrating the tool in its information flows and processes.

Affordability & Sustainability

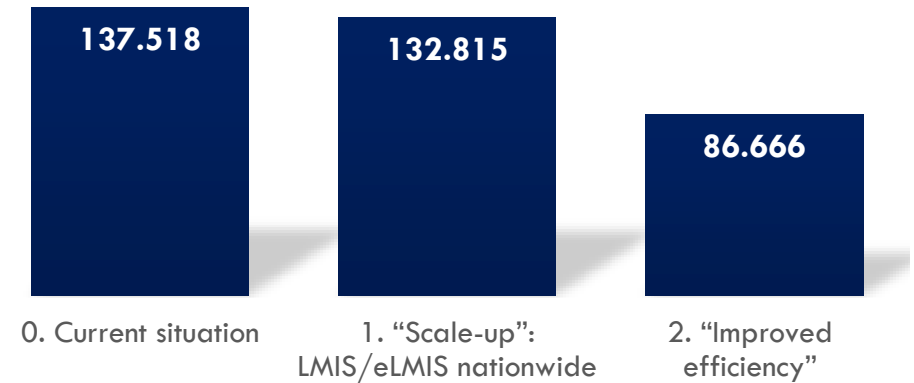
- HCs presently operate two parallel systems (i.e., both an electronic and paper-based system) for tracking vaccine consumption and generating reports for local and central planning. It is foreseen that this will persist in the short-term because of the challenges in IT infrastructure, the need for a stronger digital culture, and more widespread trust in digital tools.
- As implementation of the eLMIS at national scale likely will not result in the immediate use of a fully electronic system, two possible scenarios were explored, in addition to the current situation, to simulate the impact of moving progressively towards an increasingly electronic monitoring system.
 - **A first “scale up” scenario:** the expanded use of the LMIS/eLMIS across the country, whereby the two parallel systems continue to operate
 - **A second “improved efficiency” scenario:** paper plays a role only as a backup to the electronic system without activities duplication (e.g. transmission).

ACTIVITY		SCENARIOS		
Activity	Description of process, time spent and costs	Current Situation (253 HCs using LMIS/eLMIS and 191 HCs using LMIS only)	“Scale-up” (nationwide use of LMIS/eLMIS process)	“Improved Efficiency” (activities primarily performed electronically, and paper used as back-up)
Report generation	1-2 HWs (ex. EPI officers) to generate the LMIS report and 1-2 data managers to generate the eLMIS report. Data entry and report generation on paper only (LMIS) takes approx. 30 minutes each time, while with the addition of the eLMIS it takes approx. 40 minutes. The activity costs annually USD 62.3 with LMIS and USD 99.9 with the LMIS/eLMIS.	253 HC x USD 99.9 (LMIS/eLMIS) 191 HC x USD 62.3 (LMIS)	444 HC x USD 99.9 (LMIS/eLMIS)	444 HC x 37.6USD (eLMIS)
Report transmission	HWs physically transmit paper LMIS reports to the DPS by private or public transport, which costs USD 147.3 annually. The eLMIS users may avoid report transportation, thus incur USD 103.8 for report transportation in a year.	253 HC x USD 103.8 (LMIS/eLMIS) 191 HC x USD 147.3 (LMIS)	444 HC x USD 103.8 (LMIS/eLMIS)	HWs don't physically transport LMIS reports to the DPS as they only serve as a backup to the eLMIS data entry in HCss s (444 HC x USD 0)
Printing	This activity considers the printing and photocopying (for back-up) of eLMIS reports. LMIS users incur USD 12.1 per year for printing and eLMIS users USD 3.6	253 HC x USD 3.6 (LMIS/eLMIS) 191 HC x USD 12.1 (LMIS)	444 HC x USD 3.6 (LMIS/eLMIS)	Paper back-ups are maintained at the health facility as printouts despite no physical transportation of reports (444 HC x 3.6)
Central level costs	These cover internet, data storage, maintenance, and security needs for the continuous operations of the eLMIS for the EPI	USD 8,252.4	A scale-up and increased use of the eLMIS will necessitate an additional server and internet access to cover all 444 health facilities (USD 11,692.2)	

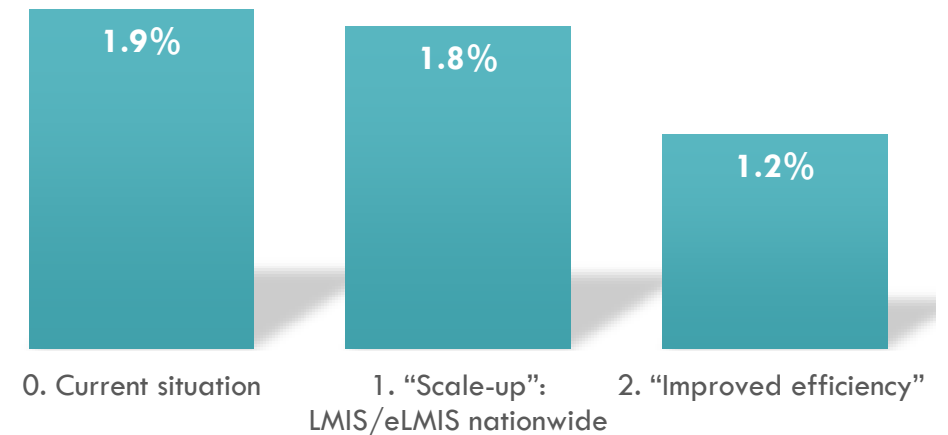
Affordability & Sustainability (cont.)

- The calculation of the total costs for vaccine stock data management under the different scenarios shows how the progressive moving towards a full electronic monitoring system implies an increasing cost saving.
- The annual saving is USD 4,702 at the completion of the roll-out of the monitoring and reporting functionalities across all 444 HCs based on the current set-up of the LMIS/eLMIS system.
- Moving closer to digitalization, the annual saving increases to USD 50,852 compared to the current situation.
- Lastly, affordability improves as the percentual rate of EPI expenditure assigned to the vaccine stock management data decreases.

**Total incremental cost
for vaccine stock data management (USD)**



Affordability (% of annual EPI expenditure)



High-Level Summary of Findings

Research Questions and Answers

Summary of evaluation findings

	Strengths	Challenges
Ecosystem	<ul style="list-style-type: none"> Strong national ownership throughout the development and implementation phases Strong interest and political commitment in the digitization and streamlining of health information across multiple health programmes. 	<ul style="list-style-type: none"> Unstable macroeconomic performance Intermittent access to electricity and internet, limited availability of hardware. Low public investment in health
Tool	<ul style="list-style-type: none"> Multi-program tool (across 14 health programs) Interoperability with DHIS2 	<ul style="list-style-type: none"> Missing information necessary for forecasting and planning for EPI – eLMIS data not used for vaccine procurement by the EPI Continued parallel use of paper registries Current design and use limited to reporting and monitoring – eSIGL doesn't meet requirements of full eLMIS
Implementation	<ul style="list-style-type: none"> Adequate computer literacy and access to IT support Good routine supervision, compliance and QA/QC established 	<ul style="list-style-type: none"> Lack of clarity of roles and responsibilities for data management. Reliance on external funders to cover the investment for implementation
Impact	<ul style="list-style-type: none"> Improved stock levels and reduced stock outs (albeit indirect) Improved perception of data quality High user satisfaction 	<ul style="list-style-type: none"> Paper registry considered most trust-worthy data source for vaccine stock management by EPI Increase in costs (moderate) to operate parallel information flows for vaccine stock management (USD 138k p.a.).
Affordability & Sustainability	<ul style="list-style-type: none"> Shared cost of design, development and deployment (resulting in low cost for EPI). eLMIS considered affordable to the country's EPI Transition to fully electronic can be cost-saving, if infrastructure and capacity building are in place 	<ul style="list-style-type: none"> Parallel use of the eLMIS with paper registries and SMT unlikely to be cost-effective

Has the implementation of the eLMIS improved the delivery of immunization services? [Impact]

- Due to the limited extent of implementation and the effect of the COVID-19 pandemic on both immunization delivery and the roll-out of the eLMIS, use of the eLMIS was not expected to have a sizeable impact on immunization outcome indicators (e.g., coverage, timeliness, or drop-out rates). As EPI decision-making is still based on data from the EPI legacy information tools (SMT, DHIS2, Excel, paper registries), the evaluation prioritized assessing impact using process and output indicators, specifically those related to data quality and stock management.
- There was an improvement in the perceived data quality, as well as in reduced stock-out events and improved stock levels (measured as reduction of the number of months during which stock levels are not considered adequate). These were largely driven by robust supervision and by the establishment of a QA/QC mechanism by the DNPM. In addition, users reported high rates of satisfaction with the tool.
- Despite improvements, eLMIS adoption and use were hindered by limited access to internet and hardware. Furthermore, the level of IT skills, training on the use of the eLMIS, and clarity on roles and responsibility in the eLMIS processes varied across the staff using the system, suggesting that further trainings and clear allocation of responsibilities are still needed to ensure consistent use of the system.

To what extent is the eLMIS interoperable with the national health information and management system (DHIS2, stock management system) [Ecosystem, Tool]

- The eLMIS is well integrated in the overall health information data infrastructure, with national strategies outlining the future of the tool and its expected contribution to the health system.
- Integration between the eLMIS and DHIS2 is achieved at district level, where vaccine stock indicators reported in the eLMIS are transferred to the DHIS2. DHIS2 is then used as a monitoring tool by the MSHP across all programs.

What is the short- and medium-term economic and financial impact of implementing and scaling-up the eLMIS? How affordable and sustainable is it? [Impact, Affordability and Sustainability]

- The total financial expenditure incurred in 2018 for the design, development and deployment of the eLMIS across 9 programs was USD 716,309 (2021 USD value). Of this total, the 6.5% share apportioned to the EPI based on the number of EPI products in the system was USD 46,560. All expenditures were incurred by the Global Fund and USAID Chemonics and equally shared between the two. Chemonics also oversaw the implementation of the system. Of the total expenditure, 37% was spent on the design and development of the system, and 63% was spent on or budgeted for the deployment in 8 regions.
- Additional costs for personnel incurred by Chemonics for the design, development, and deployment of the eLMIS were estimated at USD 374,296, of which USD 24,329 apportioned to the EPI.
- The average annual cost for data entry and reporting activities was estimated at USD 284.9 for each health center using the eLMIS, with the main cost driver being personnel costs (40%) and the most costly activities being report generation and transportation.
- Compared to only using paper (LMIS), the eLMIS users incur USD 15 less costs. This was a result of reduced costs for consumables and services associated with physical report transportation.
- The total annual incremental cost for using the eLMIS for reporting activities related to the EPI was estimated at USD 137,518, in addition to the operation of the parallel EPI legacy system. This cost represents 2% of the annual budget allocated to routine immunization activities.
- Based on a scenario analysis, Guinea would benefit to a small extent from the national scale-up of the current system. Larger cost benefits could be observed if Guinea moves towards a fully electronic-based reporting system. Further gains may also be obtained if the eLMIS is able to provide the EPI with all vaccine management features needed, allowing for the replacement of the current SMT based system.
- Overall, the adoption of the eLMIS has led to incremental costs, as this system is operated in parallel to the EPI legacy tools, leading to duplication of reporting and efforts.

How can information on eLMIS and its modality of use and governance inform future investments (i.e., national resources, health financing institutions and technical partners) for sustainable implementation of eLMIS systems? [Ecosystem, Impact, Affordability and Sustainability]

- In order to ensure programmatic and financial sustainability, eLMIS should be designed such that all vaccine-specific features necessary to support decision-making by the EPI are present. This will enable the replacement of the current system. Based on the current understanding, no structural limitations exist in eLMIS that prevent the achievement of such a goal. It is highly recommended that Guinea fully adopts the eLMIS in such an integrated approach across health programs, including the EPI, and avoids duplication of efforts through operating parallel systems. This will likely require investments in a stepwise transition with alignment of both internal and external stakeholders.
- Targeting a fully electronic system whereby the paper-trail is eliminated should be the ultimate goal. Given the context of Guinea, it is most likely that data capturing and data management for vaccine logistics will continue in parallel using two information flows and both paper and electronic tools (LMIS/eLMIS) at health center level. Thus, investments should be prioritized at harmonizing information data sources on a single source of information in the short-term. This is expected to result in a reduction in the costs of vaccine stock data management as incurred currently.
- Investments in strengthening digital infrastructure, enabling greater access to internet and hardware, as well as in capacity building, will allow for a better adoption of the tool. These are foundational for the sustainability of the eLMIS before transition to a fully digital system.
- An overreliance on external financing partners is cautioned against. It is recommended that investments in the enabling environment are planned according to a long-term view of the program needs in such a fashion that ultimately allows Guinea to have full financial ownership of the tool.

Limitations

Main limitations

1. Relatively short period between the roll-out of the eLMIS (most of the centres implemented it in 2022) and timing of data collection (Q1 2022): data available for short period of use of the tool potentials still affected by initial implementation problems.
2. Sample of 42 health centres and 6 DPSs coupled with the purposive sampling strategy have an impact on the external validity of the results. Low number of rural health centres with eLMIS led to an overrepresentation of urban health centres.
3. Quality check of stock data at the health centres did not yield usable results because of the structure of the data collection forms and inconsistency of data collected.
4. Several of the primary programmatic and economic data sourced from health staff in interviews, hence with inherent information and recall biases. Recall bias might have been particularly relevant in the analysis of the cost impact between the eLMIS and the paper-based system.



Conclusions

Programmatic performance appears to have been positively impacted in terms of improved stock management. Ensuring the full roll-out of the eLMIS with all its functionalities and its adoption by the EPI will be critical to leverage all the potential programmatic and economic gains.

Sustainability of these results, success of scale-up and ability to take full advantage of the roll-out of the system will depend on the establishment of a robust digital infrastructure that allows for the migration in the long-run to a fully electronic system.

The future steps of the roll out should be done based on a solid and streamlined resource and financial planning across all health programs, and in particular the EPI. Technical partners must align to the plans of the Minister of Health and provide the necessary technical assistance to facilitate the full integration of EPI in the eLMIS solution refraining from supporting other solutions.

Appropriate follow-up and the updating of this research after completion of the roll-out will allow firmer conclusions to be drawn and will further guide future work on eLMIS in Guinea. Such update should be carried on with local resources.

END

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