AUGUST 2025

SIERRA LEONE CASE STUDY

DIGITALIZATION: A DATA-DRIVEN APPROACH TO THE 2023/2024 MASS ITN DISTRIBUTION CAMPAIGN

amp | The Alliance for Malaria Prevention
Expanding the ownership and use of mosquito nets

CONTENTS

BACKGROUND

Malaria remains a significant public health threat in Sierra Leone, where the entire population is at risk[1]. The disease accounts for 40.3 per cent of outpatient morbidity, 47 per cent of reported cases in children under five and 37.6 per cent of hospitalized cases, with a high case fatality rate of 17.6 per cent. Over 90 per cent of malaria infections are caused by *Plasmodium falciparum*, the most virulent malaria parasite.

The National Malaria Control Programme (NMCP) leads the country's efforts to eliminate malaria, in line with the Sierra Leone National Malaria Elimination Strategic Plan (SLNMESP) 2021–2025, which targets a 75 per cent reduction in malaria morbidity and mortality by 2025. These national goals align with the WHO Global Technical Strategy (GTS), which calls for a 90 per cent reduction in malaria incidence and mortality by 2030[2].

A core strategy under the SLNMESP 2021-2025 is the prevention of malaria through universal access to insecticide-treated nets (ITNs). Since launching its first targeted ITN campaign in 2006, the NMCP has conducted mass distribution campaigns in 2010, 2014, 2020, and most recently in 2023/2024. In addition to mass campaigns, ITNs are also distributed routinely through antenatal care (ANC) and the Expanded Programme on Immunization (EPI). Since 2006, over 22.1 million ITNs have been distributed through all active channels.

In preparation for the 2023/2024 campaign, the then Ministry of Health and Sanitation (MoHS) now Ministry of Health (MoH), through the National Malaria Control Programme (NMCP), decided to digitalize several of the operational aspects of the campaign. The data collection for past campaigns relied on paper-based systems which faced some limitations. Manual registration and data collection were prone to errors, inconsistencies, and were time-consuming, making campaign monitoring, evaluation and decision-making difficult.

Moreover, the inadequate level of transparency and accountability inherent in paper-based systems hindered effective tracking of ITN distribution to ensure that nets reached the intended recipients. It has been reported during household registration (HHR) using paper-based tools that some households were either duplicated or non-existent. These were probably deliberate acts either to meet the daily target without visiting the required household or to create avenues to pilfer nets during the distribution phase.

The earlier paper-based methods contributed to delays in data analysis and reporting, preventing timely decision-making and limited the ability to make necessary course corrections during campaigns. These limitations were addressed through the digitalization of the national campaign, beginning with the piloting of digitalization for ITN distribution in Bo District by the NMCP, in collaboration with the Bo District Health Management Team (DHMT), which served as a critical steppingstone towards ITN campaign optimization in Sierra Leone. The pilot helped to test and refine the digital approach ahead of the nationwide mass distribution

1. Sierra Leone National Malaria SME Plan 2021—2025.
2. National Malaria Control Programme (NMCP), Sierra Leone – nmcp-moh.gov.sl

THE 2023/2024 ITN DISTRIBUTION CAMPAIGN

For this crucial public health initiative, the NMCP was guided by the SLNMESP 2021—2025, aligned to technical guidance from the World Health Organization (WHO), and supported by the Government of Sierra Leone and partners such as Catholic Relief Services (CRS), the Global Fund, the U.S. President's Malaria Initiative (PMI), United Nations Children's Fund (UNICEF), the RBM Partnership to End Malaria and the Alliance for Malaria Prevention (AMP), among others.

The 2023/2024 mass campaign took place in two phases: the digitalization pilot in Bo District, and a full-scale implementation of the digitalized ITN campaign in the rest of the country from January to March 2024. The lessons from the pilot were incorporated into the national digitalized campaign strategy.

The ITN campaign included two types of ITNs:

i. 2,939,537 ITNs with a piperonyl butoxide (PBO) synergist

ii. 2,405,695 dual active ingredient (dual a.i.) ITNs

The approach adopted for the campaign was two-phase, with door-to-door HHR followed by fixed-point distribution. Both phases were digitalized:

i. Phase 1 was door-to-door HHR with the RedRose ONEapp registration application preinstalled on a mobile device and the issuance of vouchers for subsequent ITN redemption.

ii. Phase 2 was the distribution of ITNs at designated fixed, outreach and mobile distribution points (identified during the microplanning workshops) where vouchers were exchanged for ITNs at no cost and recorded using the preinstalled RedRose ONEapp distribution application.

THE DIGITALIZATION PROCESS

The NMCP as the Principal Recipient (PR) of the Global Fund grant, in collaboration with CRS, its co-PR, partnered with RedRose, a digitalization technical partner, to provide the digital solution for the mass campaign.

As part of the digitalization solution, a customized digital platform was developed by RedRose to support key components of the campaign including campaign planning, HHR, ITN distribution, supervision and monitoring. This platform included:

- ONEapp – supporting HHR and ITN distribution modules, enabling streamlined workflows for field teams.
- Collect – enabling real-time data collection and reporting through customizable digital forms, enhancing monitoring and supervision, and timely decision-making.

These applications were installed on Android smartphones (Nokia G20), which were procured using Global Fund resources and imported to the country in advance of the pilot phase. The smartphones were distributed to household registrars, ITN distribution team members and monitors deployed in the field. The data collected via the RedRose platform were synchronized and displayed through visualization tools, including:

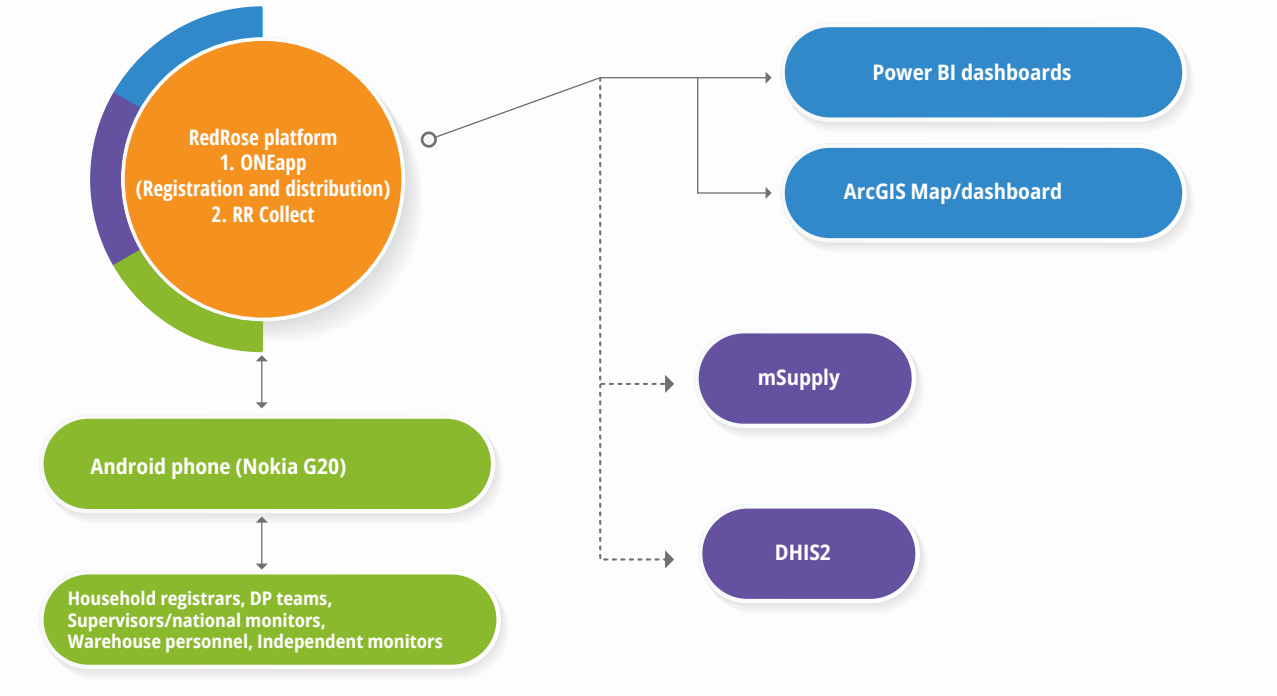
- Power BI dashboards – for dynamic visual reporting.
- ArcGIS Map/dashboards – for geospatial tracking.

There was also an intention to integrate the RedRose platform with:

- mSupply – for supply chain and stock data management.
- DHIS2 – for storage of campaign data in the national health management information system (HMIS).

Figure 1 shows the flow of data from the RedRose platform to various visualizations and proposed integration flow to the country-managed storage platforms.

Figure 1: Digitalization process flow diagram



OBJECTIVES OF DIGITALIZATION

The decision to transition from a paper-based system to a digitalized approach was driven by the following key objectives:

- Enhance data quality by implementing a data-driven and adaptive campaign process to improve the accuracy and reliability of collected data.
- Strengthen supervision and monitoring by enabling real-time data access to enhance supervisory support and decision-making.
- Improve accountability by ensuring transparency through rapid and real-time reporting, allowing for timely responses to emerging challenges.
- Optimize campaign effectiveness by utilizing real-time data visualization platforms to report coverage at both district and national levels as well as track progress.
- Ensure ITN supply chain efficiency by tracking ITN movement within the country (from regional and district levels) to Peripheral Health Units (PHUs) and distribution points (DPs), and ultimately to recipients.

DIGITALIZING KEY COMPONENTS OF THE CAMPAIGN

To address the inefficiencies and limitations of the previous paper-based system, the following components of the 2023/2024 ITN mass campaign were digitalized:

1. **Attendance tracking:** This was done to ensure accurate records of personnel involved in campaign activities, especially for those who operated the digital devices. Digital attendance, which recorded GPS locations and time stamps, was captured at all training locations for participants who were issued badges. The ICT4D team generated badges with QR codes for key personnel involved in the HHR and ITN distribution process, such as the national monitors, DHMT supervisors, chiefdom supervisors, DP supervisors, household registrars, ITN distributors and voucher verifiers. During the training and orientation of other cadres of campaign personnel, attendance was tracked using a paper-based attendance form.
2. **Household registration:** Following comprehensive hands-on training on the HHR application pre-installed on mobile devices, household registrars were deployed to settlements within their assigned health facility catchment areas.

Using the mobile application as shown in figure 2, household registrars registered households by following in-app prompts to capture key details such as the household head's name and phone number, household size, number of pregnant women, and number of children under five. GPS coordinates were automatically recorded once registration for each household was finalized. This information was linked to a digital voucher by scanning the QR code or manually entering the voucher serial number before issuing it to the household. This digital approach improved data accuracy and collection, minimized duplication, and enabled efficient planning for ITN allocation upon data reconciliation and validation by the DHMT and the national-level command centre.

Figure 2: ITN movement tracking (RedRose Collect) form and voucher scanning using the household registration application (RedRose ONEapp)

3. **ITN movement and tracking:** Macro positioning was tracked using mSupply, the Ministry of Health's digital logistics tool for monitoring medical supplies. In parallel, both macro- and micro-positioning of ITNs were captured through a digital form on campaign mobile devices, which recorded the origin, GPS coordinates of the dispatching store, destination and quantity of ITNs transferred between stores. These tracking systems provided near real-time visibility, improved accountability and helped minimize losses.

4. **ITN distribution:** Data reconciled from the household registration were used to position ITNs in the various DPs across the chiefdoms. At the DP, the application in the mobile device was used for the distribution of ITNs. DP personnel scanned the QR code or manually input the serial number presented by the household representative, to recall the data of the household and determine the correct quantity of ITNs to be issued. ITNs were issued based on pre-recorded household data, and each transaction was digitally logged in, often with real-time verification using the vouchers.

5. **Monitoring and supervision:** Monitors and supervisors used digital supervision checklists and GPS-enabled devices to monitor campaign activities and supervise campaign personnel in the field. Data from field visits were submitted in real time, enabling quick feedback, targeted support and timely decision-making. The digital dashboards as shown in figures 3 and 4 also helped monitors and supervisors visualize performance indicators for better oversight and reporting.

Figure 3: Campaign dashboards showing household registration data covering 15 districts

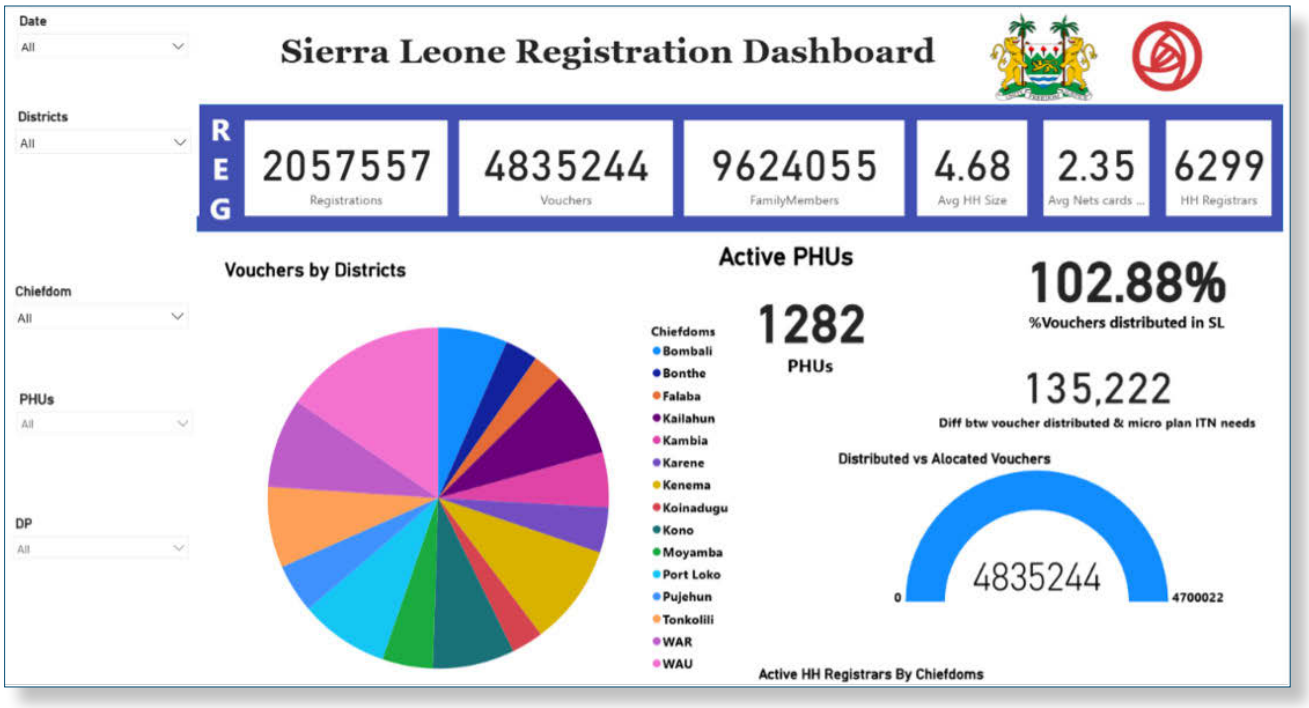
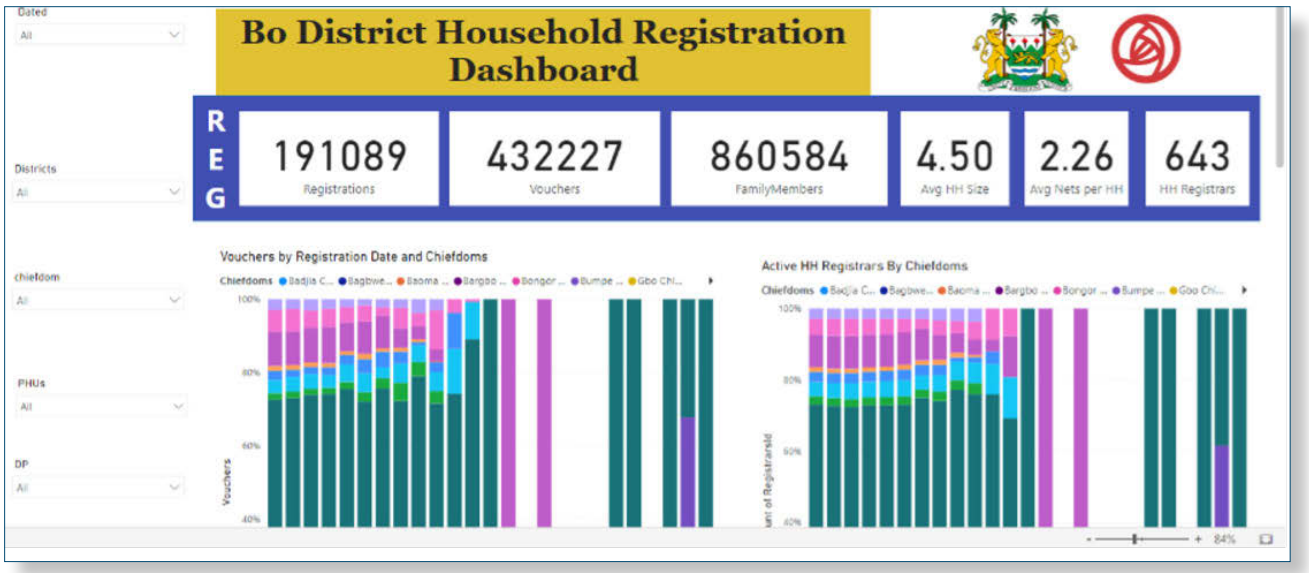


Figure 4: Campaign dashboard showing household registration data for Bo district (pilot campaign)



Common issues monitored through the campaign platform for resolution in the field were:

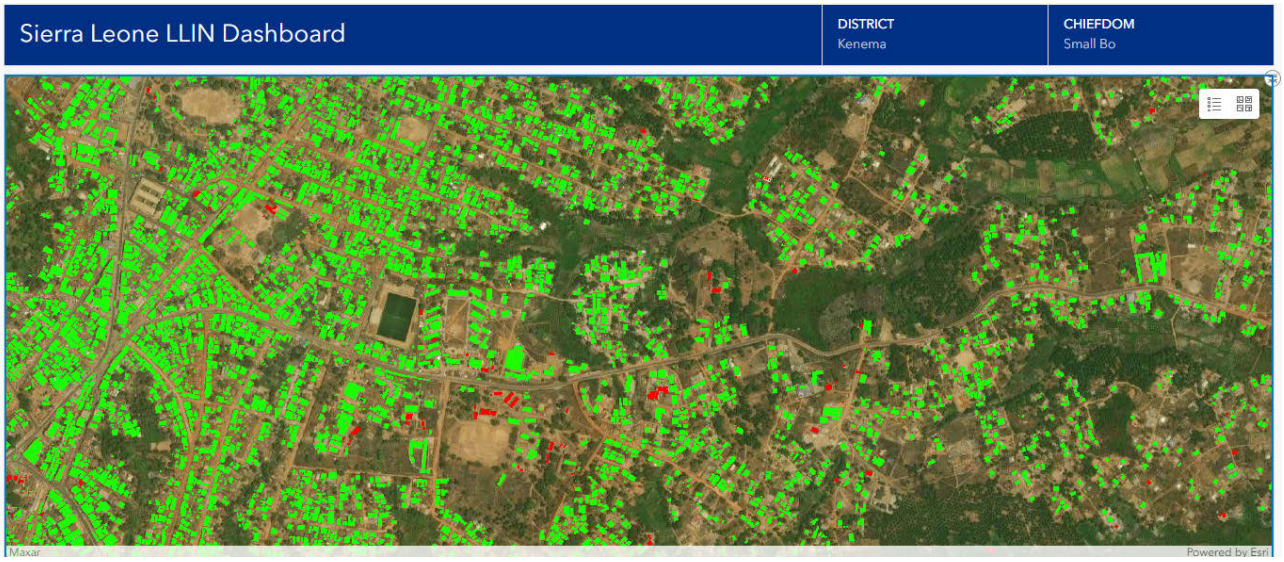
- Cross-registration data: This occurs when a household registrar unknowingly crosses into an area with no visible house markings but where households have been previously registered and begins to re-register the households.
- Dense registration data: This occurs when several households are registered from the same location, resulting in the same GPS coordinates being recorded for all the households.
- Yet-to-be registered areas.
- Total household coverage.
- Incoming, outgoing and remaining voucher stock on the devices.
- Missed scan vouchers.
- Yet to be activated DPs.
- Total nets distributed against nets positioned.
- Incoming, outgoing and remaining net stock on the devices.

The campaign visualization dashboard helped to ensure a more targeted and efficient monitoring of the household registration and ITN distribution process.

KEY OUTCOMES AND BENEFITS

1. Digitalization enabled real-time monitoring of the entire campaign process from anywhere in the world through the various digital visualization dashboards as shown in figures 3, 4 and 5.
2. Digitalization enabled faster decision-making and quick problem-solving due to real-time data collection and analysis.

Figure 5: Sample of household registration coverage map



3. Digitalization exposes fraudulent registration and distribution, previously a common challenge with the paper-based system that is difficult to detect within the campaign window.
4. Resource optimization is backed by data informed ITN pre-positioning of ITNs at distribution points.

5. Coverage visibility was significantly enhanced, with real-time data on dashboards enabling efficient tracking and verification of areas yet to be reached or covered.

6. Monitoring and supervision were data driven, allowing for the identification of underperforming or inactive campaign personnel, who were easily tracked and provided with additional support (e.g. 6,329 household registrars were trained and deployed but only 6,299 were active as seen on the dashboard): this issue could not have been detected quickly and efficiently through the paper-based approach.

7. The need for a mop-up day(s) was targeted and data driven, against the blanket mop-up practice of the paper-based approach.

8. Errors or inconsistencies were minimized with digitalization, while data storage and use of data for future planning has been made easier.

9. Local capacity-building of 17,400 personnel focused on campaign digitalization and health system optimization.

EVIDENCE OF IMPACT

The digitalization of the 2023/2024 ITN mass distribution campaign delivered measurable improvements across several key areas:

Enhanced visibility and transparency	Campaign progress was continuously monitored using real-time digital dashboards and interactive coverage maps, providing a clear visual representation of HHR and ITN distribution rates and geographical reach at national, district, and community levels.
Improved coverage and operational efficiency	The use of visual tools such as coverage maps and dashboards highlighted a more efficient HHR and ITN distribution process. Compared to previous paper-based campaigns, the digital system enabled better tracking, reduced duplication, and streamlined resource allocation, resulting in wider and faster coverage.
Timely, data-driven decision-making	Access to near real-time data allowed the NMCP and partners to make informed data-driven decisions.
Cost savings	Cost-effectiveness was ensured through the reduction of operational expenses from paper, printing, logistics, etc.
Scalability and sustainability	The digital infrastructure and data provide a solid base for future campaigns or health interventions, enabling easier data access, improved planning, and seamless monitoring and evaluation.
Strong stakeholder confidence	A post-campaign perception survey revealed that 93 per cent of respondents believed digitalization should be adopted for future health campaigns, highlighting widespread acceptance and support for the approach.

SUCCESSES

The 2023/2024 ITN digitalized mass campaign achieved several notable successes, as highlighted below:

Training and implementation	A total of 17,400 personnel were trained and equipped with the skills needed to support various aspects of the digitalization process thereby contributing to the smooth and successful implementation of the digitalized campaign across all 16 districts.
Coordination	Daily review meetings (as shown in figure 6) in all 16 districts allowed real-time monitoring of campaign progress against targets, including for registration coverage and ITN distribution.
High redemption rate	The campaign achieved an impressive voucher redemption rate of 94.45 per cent, demonstrating the effectiveness of the digitalized distribution processes.
Successful digitalization	The use of digital tools for household registration and ITN distribution was a significant milestone. Real-time data synchronization and dashboard monitoring facilitated efficient tracking and management of the campaign.
Monitoring and effective supervisory support	• Addressed and resolved operational challenges and bottlenecks through effective monitoring and supportive supervision, ensuring smooth campaign execution. • Improved and effective monitoring and supervision support using real-time data.
Provision of campaign tools	The provision of essential tools and materials, including digital devices (as shown in Figure 7), enabled effective activity tracking, real-time data entry, and accurate documentation, contributing to improved coordination and overall campaign efficiency.
Logistics and supply chain management	• Successfully positioned 5,345,232 ITNs from district and regional warehouses to all microplanned PHUs across the 16 districts, using the HHR data. • Successfully tracked the delivery of ITNs from district stores to PHUs, increasing efficiencies in supply chain management and ensuring timely availability of ITNs for distribution.
Real-time tracking and digital data management	• Implemented successful real-time tracking of attendance and personnel data during training sessions, enhancing accountability and administrative management. • Improved the quality and timeliness of reporting at local, district and national levels, providing accurate and up-to-date information for decision-making. • Achieved successful real-time tracking and digital upload of registration and distribution data, ensuring efficient and transparent data management.

Improved efficiency and accountability	• Greatly improved efficiency, accountability and transparency, streamlining processes and reducing errors. • Increased accountability through rapid reporting of data, enabling the swift identification of gaps and ensuring timely response measures.
Data quality and adaptive management	Enhanced data quality and enabled data-driven adaptive management, allowing for responsive adjustments based on real-time insights.

Figure 6: Daily review meeting held in Bo district

These successes highlight the comprehensive planning, effective use of digital tools, extensive training programmes, operational experience of teams and strong community engagement, all of which contributed to the overall success of the ITN campaign as a significant contribution to the fight against malaria in Sierra Leone.

Figure 7: Distribution of campaign mobile devices

KEY CHALLENGES

1. **Mobile data inadequacy:** Mobile network operators were not able to manage the process efficiently and faced challenges in activating data subscriptions on the procured SIM cards, leading to significant delays and disruption of timely data synchronization for real-time data upload during the campaign. In some cases, campaign personnel had to resort to using personal devices to hotspot the campaign devices to facilitate the synchronization for real-time data upload and coverage tracking.

2. **Limited network coverage:** Data transmission via device synchronization in limited network coverage areas (as identified in some chiefdoms) was challenging. In some communities where network coverage was limited or unavailable, data synchronization could not occur in real time.

3. **Digital attendance tracking:** Issues arose due to late submission or non-availability of participants' lists, causing delays in printing of participants' badges for attendance tracking. Also, lack of working printers at the DHMTs and electricity challenges made digital attendance tracking more challenging.

4. **Training venue assessment and GPS tracking:** The inability to conduct training venue assessments during the microplanning stage made it difficult to cater for alternative training venues in areas with poor Internet and/or GPS signals. Attendance tracking and hands-on use of devices were therefore challenging as Internet and/or a GPS signal is key for usage of some of the campaign applications.

5. **Digital platforms integration:** There was no direct data handshake between the Sierra Leone health sector logistics tracking platform (mSupply) and the campaign digital platform (RedRose).

6. **Manual tracking of waybills:** Tracking and reconciliation of waybills used for prepositioning of ITNs was a cumbersome process.

7. **Monitoring and supervision:** The initial registration process was slow due to the new digital system, with missed scans and other issues that needed resolution through mop-up activities.

8. **Reference material accessibility:** The absence of reference materials for household registration and DP teams led to operational challenges.

9. **QR code scanning:** Difficulties in scanning QR codes during household registration.

These challenges highlighted the need for improved planning, resource allocation and coordination among all stakeholders to ensure success of future ITN campaigns. On the whole, however, the challenges were overcome for the 2023/2024 campaign through strong leadership and coordination, rapid decision-making, problem-solving in the field and the application of innovative solutions.

RECOMMENDATIONS

- Implement strengthened and innovative training and capacity-building efforts with the use of digital job aids and video tutorials.
- To mitigate challenges with data transmission in areas with limited or poor network coverage, field teams can periodically swap devices used in previous days with buffer devices. The devices used should then be taken to locations with stronger internet connectivity to enable timely data synchronization and near real-time decision-making for effective supervision.
- Mobile network providers should be formally included as members of the National Task Force to ensure that they fully understand the critical role of reliable connectivity in campaign operations, recognize the urgency and importance of their services and encourage proactive planning and timely support as key stakeholders for an enhanced real-time data synchronization during campaigns.
- Providing algorithms and tutorial videos for device usage was recommended to assist teams during tasks and troubleshooting.
- Need for an enlarged camera capture window on the HHR application for smoother scanning processes.
- Waybills used for ITN prepositioning should be digitalized to enable full digital tracking of the ITN transport process and improve efficiency in tracking and reconciliation.
- To promote sustainability and strengthen overall health system delivery, the digital ITN campaign platform should be fully integrated with existing national digital health systems such as DHIS2, mSupply and the National Malaria Data Repository (NMDR). This integration will ensure seamless data flow, improve interoperability and support long-term data storage for more efficient health programme planning and reporting.

CONCLUSION

Digitalization transformed ITN distribution in Sierra Leone, enhancing campaign visibility and stakeholder engagement particularly within the Ministry of Health. Based on the 2023/2024 digitalized ITN mass campaign data, over ten million household members were registered during the HHR (as shown in figures 3 and 4), surpassing the 9,547,304 macro projections. This translated into the successful distribution of over 4.8 million ITNs to over 2.1 million households (as shown in figures 8 and 9), significantly improving population access to ITNs and protection against malaria.

Figure 8: Campaign dashboards showing ITN distribution data covering 15 districts

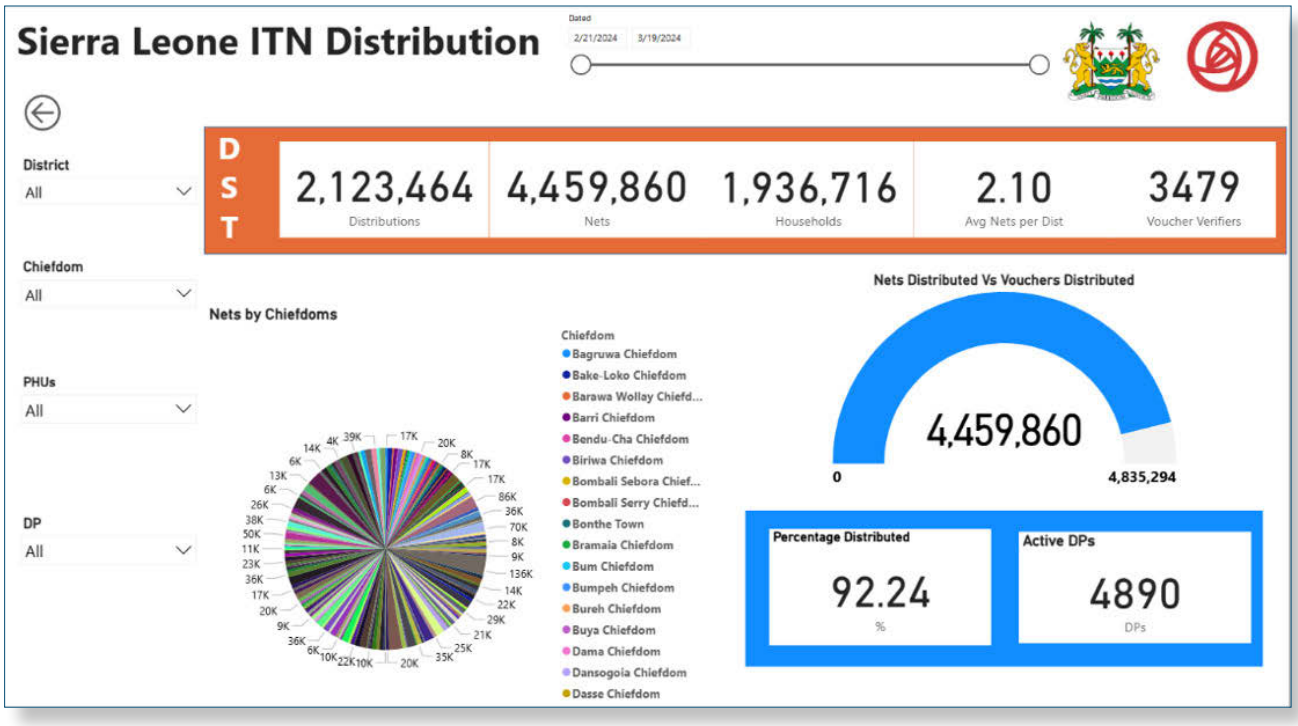
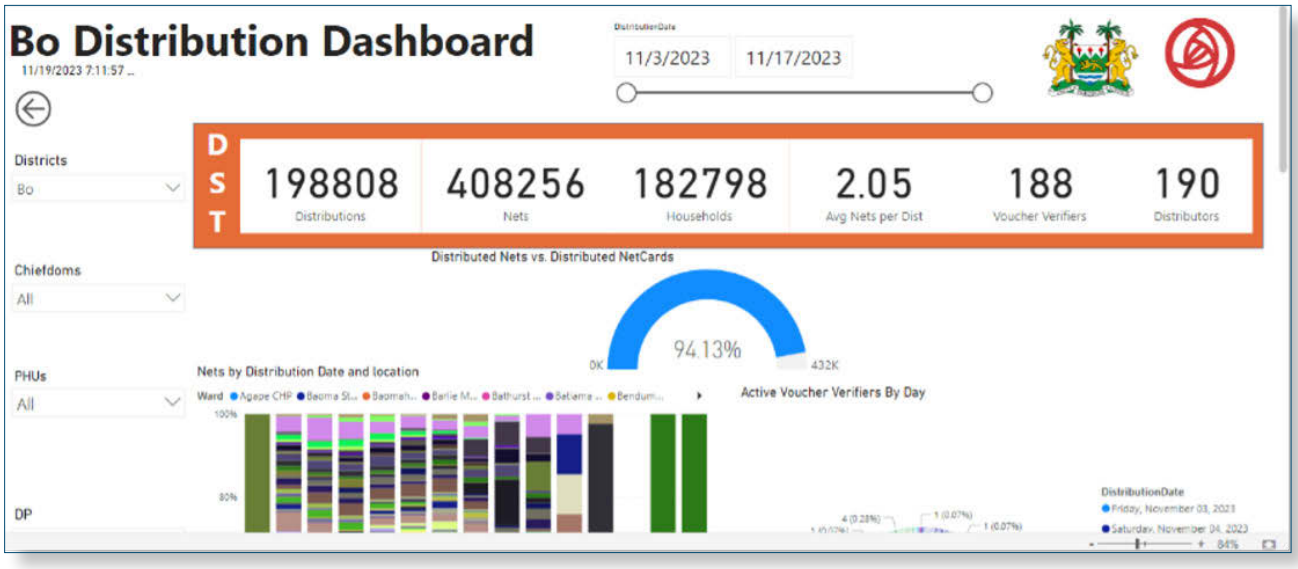


Figure 9: Campaign dashboards showing ITN distribution data for Bo district (pilot campaign)



Campaign activities demonstrated greater efficiency, accountability and reach, underscoring the effectiveness of both planning and execution. Digitalization enabled real-time tracking, enhanced data accuracy, improved coordination, and ensured effective decision-making throughout the ITN campaign life cycle. By integrating digital solutions, the 2023/2024 ITN campaign significantly improved data quality, accountability, and overall campaign efficiency, setting a new benchmark for future ITN distribution campaigns, as well as other health campaigns, in Sierra Leone.

Sustained investment in digital solutions, using the lessons learned from the 2023/2024 mass distribution campaign, as well as reuse of data for improving targeting, will continue to strengthen malaria outcomes in Sierra Leone.

AMP CONTACTS

To join the weekly AMP conference call each Wednesday at 10:00 AM Eastern time (16.00 PM CET) use the following Zoom meeting line:
https://us06web.zoom.us/j/88935481892?pwd=h3cuJ3x5LOsR58YXcEaub8ULqu5LMj.1

You can find your local number to join the weekly call:
https://zoom.us/u/acyOjklJj4

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info@allianceformalariaprevention.com

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