CASE STUDY:
Geospatial tools for microplanning in Nigeria

JUNE 2023

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

CONTENTS

BACKGROUND AND CONTEXT

Malaria is endemic throughout Nigeria, with an estimated 97 per cent of the population of 223.8 million[1] at risk of the disease. Malaria transmission occurs all year round making it a major cause of morbidity and mortality in the country. Significant efforts have been made to reduce the prevalence and impact of the disease and progress to date is largely due to the scale-up of proven interventions, prominent among which is the use of insecticide-treated nets (ITNs) as the main intervention for malaria vector control, complementing other preventive, diagnostic and treatment interventions.

The utilization of ITNs has been demonstrated to be a highly effective intervention for preventing malaria. To reduce malaria mortality and morbidity, Nigeria aims to increase access to and use of vector control interventions among the targeted population to 80 per cent by 2025 (National Malaria Strategic Plan [NMSP] 2021–2025).

While the Nigeria National Malaria Elimination Programme (NMEP) and partners have made efforts to improve the efficiency and outcomes of ITN mass campaigns through adoption of digital tools, there has been limited use of geospatial mapping to enhance the value of the data collected. The data from the geospatial maps should help ensure maximum reach with ITNs and quantify gaps in ITNs to reach all settlements and populations to improve subsequent campaign outcomes or advocate for additional ITNs for distribution through continuous distribution (CD) channels.

Microplanning is crucial for a successful campaign, as it ensures that macroplanning based on hypotheses and assumptions is contextualized to the target area and population to ensure sufficient personnel and resources in the right place at the right time. Traditionally, ITN mass campaign microplanning has included simple hand-drawn maps with visual representation of key features and points of interest such as health facilities, settlements/communities of different sizes based on their estimated populations, roads and paved paths or routes and distances between key points (such as population and distribution points). However, there is a need to move from simple manual sketches with approximate assumptions of a few geographical features of interest to more advanced computer- based digital infographics[2] and geospatial tools to accurately depict additional socio-demographic and infrastructural features, as well as calculate accurate distances, for effective planning and implementation of health programmes.

To improve the quality and accuracy of microplans, the National Malaria Elimination Programme implemented a pilot project in 2022 to digitalize the mapping process for the Kano State ITN mass campaign using geographic information systems (GIS) and satellite imagery and further rolled out the project in three states (Osun, Kwara and Adamawa) in 2023. This project aims to generate valuable lessons in digitalization of the microplanning process, with the hope of extending digitalization to microplanning for all states in future campaigns and to use the generated maps and data beyond ITN campaigns to establish a georepository to improve planning and quantification moving forward for ITNs and other interventions.

1. World Population Dashboard -Nigeria | United Nations Population Fund (unfpa.org). Number at June 2023.
2. This is the graphical representations of information or data intended to present complex information quickly and clearly.

ITN MASS CAMPAIGN MICROPLANNING

Microplanning is one of the most critical aspects of a mass ITN campaign. It represents the first step towards implementing activities and the first operations-level activity. It is a bottom-up process done with key actors at the lowest implementation levels to transform the macroplans into context-specific operational plans and budgets, identify/map out the target population, and allocate and manage available resources. The microplanning exercise also helps identify potential gaps and possible risks during implementation. When done well and with sufficient detail, it will ensure proper identification of the target population, allocation of sufficient personnel to the right places, efficient management of resources and good monitoring outcomes, or in other words, smooth implementation of the entire campaign, reaching all of the target population with the correct number of ITNs.

Any ITN mass distribution microplanning process begins with maps. A map visually represents an area, displaying its physical features, cities, roads and other details. It facilitates a detailed comprehension of the area and helps plan distribution points and their catchment areas. Additionally, it serves as the base for populating the microplanning template and developing activity plans for household registration teams and ITN distribution. Furthermore, maps are used to identify hard-to-reach areas, transportation routes, social and behaviour change communication (SBCC) target groups and SBCC opportunities. Therefore, it is crucial to produce detailed mapping during microplanning, a process with a strong geographic component.

The main obstacle preventing the achievement of the 80 per cent ITN use target for the at-risk population is lack of access to ITNs during campaigns. The primary reasons for this are households not being registered or not receiving vouchers/net cards for ITNs[3]. Access to geographically precise data can help to ensure this does not happen. Maps are required to depict the extent of the pertinent geographic features (such as settlements, health facilities, schools, religious institutions, administrative boundaries, transportation networks, landmarks, water bodies, hard-to-reach or inaccessible areas) and related information.

Until the microplanning of the 2022 ITN campaign in Kano State, all microplanning maps for ITN mass campaigns in Nigeria had been manually drawn by ward focal persons. These hand-drawn sketches were based on local knowledge and served as the foundation for planning most activities such as clustering of settlements to the catchment area of a distribution point, route planning for transport of ITNs, and movement of household registration, supervision and monitoring teams. The importance of maps lies in their ability to assist with the selection of ITN distribution points, determining their catchment areas, identifying hard-to-reach areas, and highlighting key features, including markets, schools, religious institutions, and population groups that may have barriers to accessing healthcare (or campaign) services. This information is crucial when planning and implementing operational level activities.

3. Guideline for universal coverage ITN campaigns in Nigeria – June 2019 page 44

The use of hand-drawn maps for microplanning has presented numerous challenges which have contributed to setbacks in past ITN campaign implementation. These challenges include difficulty in reading and updating, as well as sharing and archiving the maps. The maps also fail to provide precise information about population distribution and positioning within the catchment area. Moreover, incorporating all necessary information such as population figures, hard-to-reach areas, seasonal barriers to movement and landmarks can make the maps more complicated to read.

Utilizing geospatial data and tools can mitigate some of these challenges and improve population distribution estimates while measuring physical accessibility to health services, such as distance and travel time. In addition, the resulting maps can be effortlessly updated with new information and archived for future reference. The digitalized Kano State ITN microplanning had the objective of:

- Demonstrating the value of GIS microplanning in the ITN campaign
- Developing capacity among federal and state-level teams for future applications of the tools
- Integrating data from the RedRose system[4] (GPS locators) with the maps developed by Geo-Referenced Infrastructure and Demographic Data for Development (GRID3)[5] to assess ITN outcomes and improve quantification for future campaigns
- Contributing to a perennial mapping database that can be used across campaign platforms and malaria interventions to improve service delivery outcomes
- Leveraging on existing and ongoing work under different Federal Ministry of Health (FMOH) departments and line ministries

4. RedRose - ONEsolution for the Humanitarian Sector
5. Home - GRID3

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METHOD AND PROCESS

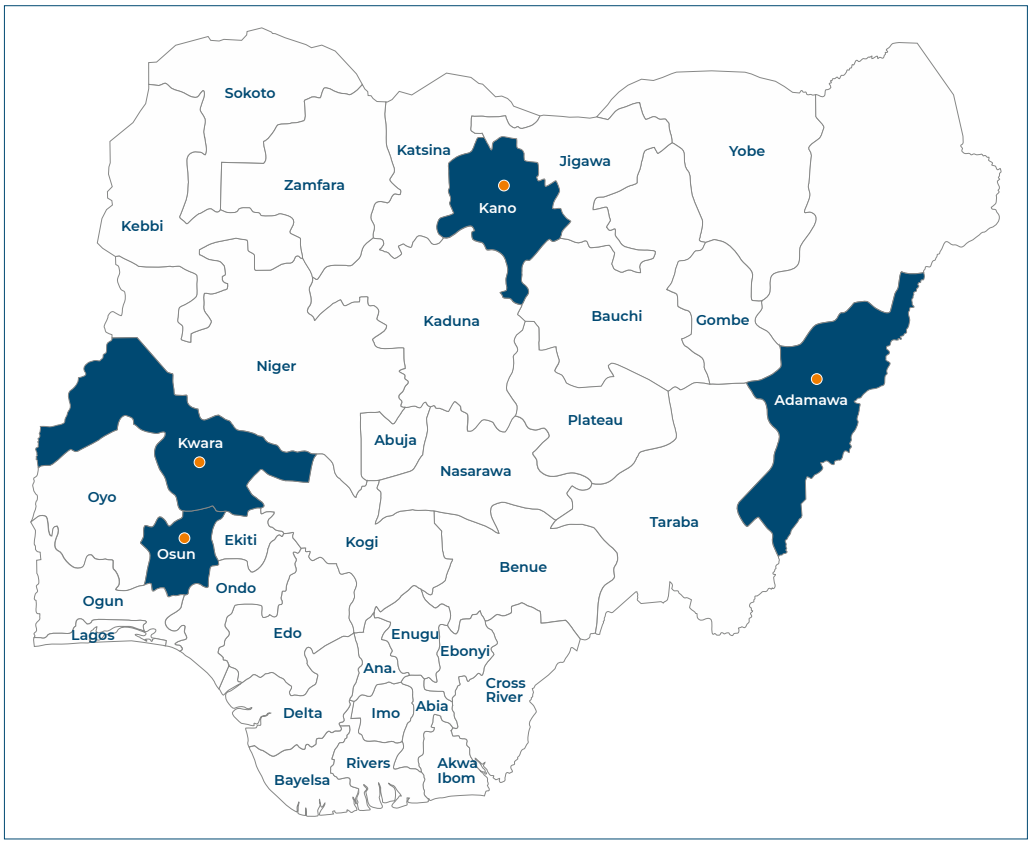
The pilot project methodology borrowed from successful digital microplanning programmes for immunization with similar objectives in other countries, including in sub-Saharan Africa. The World Health Organization (WHO), United Nations Children's Fund (UNICEF) and partners have supported countries by incrementally scaling up digital microplanning for many years. The experience with immunization has demonstrated that GIS can improve the quality and accuracy of the microplanning exercise. In the case of a mass ITN campaign, it should ensure equitable distribution of ITNs including for vulnerable and hard-to-reach groups.

The GIS project was designed as a five-step process:

1. Scope

The NMEP opted to conduct the pilot in Kano State. The state is in the north-western part of the country, with a population of over 15 million people spread across 44 Local Government Areas (LGAs). Thereafter the pilot was further modified based on lessons learned and used in Osun (south-west), Adamawa (north-east) and Kwara (north-central) States.

Fig 1: Map of Nigeria showing the three states where geospatial maps were used for microplanning



2. Base map

GRID3, with support from different partners, leveraged the work accomplished for routine immunization (RI), incorporated previous ITN campaign microplanning data and prepared the base map for all 484 wards across the 44 LGAs in Kano State. The base map combined datasets made available globally or for the continent (satellite imagery, building footprints, OpenStreetMap roads, etc.) with datasets available within Nigeria (health facility master list, health workforce list, etc.).

3. Capacity-building workshop

A planning meeting was held between GRID3, NMEP and its implementing partner where GRID3 orientated the national team on the development and use of base maps. Thereafter a four-day state training of trainers (STOT) was held for the campaign technical assistance team (CTAT) and key members of the state malaria team in preparation for the microplanning workshops in the LGAs. The training focused on the use of the base maps, how to update and review the maps, how to download and use the KoboCollect[6] forms to capture the geo-coordinates of distribution hubs, health facilities and new settlements.

Finally, five-day microplanning workshops were held across all the 44 LGAs in the state. The workshops trained the LGA teams on the digitalization process, so that they understood the maps, how to review and update them, how to use them to create the microplans based on the maps and how to capture geo-coordinates of missing/new settlements, health facilities and distribution hubs identified during review of the maps. This is an iterative process, where the base maps are validated and improved by the teams, a process which serves to calibrate the digitalization results and improve the base maps and the georepository.

4. Field validation

The base maps were validated on the ground for quality control by the LGA and ward-level personnel (health facility officer-in-charge and ward development committee chairperson). In the LGAs, the personnel reviewed the base maps together with tables containing the list of the settlements from microplanning and GRID3 and updated them with accurate information such as the correct names, locations and number of settlements with their respective population figures, confirmed whether a settlement had people living there or not, confirmed the names and location of health facilities, indicated new distribution hubs or new settlements (if any) and hard-to-reach areas.

The LGA personnel also collected geo-coordinates of all settlements with missing geo-coordinates, new settlements, distribution hubs and health facilities. The GIS microplanning process is iterative, and feedback was used in real-time to update the maps.

6. https://www.kobotoolbox.org/

5. Report and expansion plan for extending to other states

On completion of the first four implementation steps, GRID3 used feedback and corrections from the microplanning workshop to update the maps which were used for implementation during the Kano State mass campaign to develop workplans and route maps for the Mobilization and Distribution Teams (MDTs). A detailed report was drafted on the activities. The expansion plan was discussed and incorporated the lessons learned from the Kano pilot.

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KEY ACHIEVEMENTS

- The digital maps were successfully used for the microplanning exercise and the end users (health facility in-charges/ward focal persons and ward development committee chairpersons) found them to be:

  - ↘ Easy to understand and use, effectively eliminating the need to draw new maps at every microplanning exercise in the state.
  - ↘ User-friendly. Ward boundaries, settlements, key features, etc. could easily be identified and modifications or corrections in the context of the ITN campaign could be made without difficulty.

- The digital maps were updated and/or corrected based on the reviews by the ward personnel during the microplanning workshop and these updated maps will serve as a good base map for future microplanning in the states.

- Geo-coordinates of distribution hubs, health facilities and settlements that were not in the initial base maps were collected and used to improve the digital maps.

- Transfer of knowledge of digital map reading and use to the national, state, LGA and ward personnel was successful.

- The ward focal persons were able to easily use the RedRose Collect form developed for recording the geo-coordinates of distribution hubs and settlements.

- The process allowed an opportunity to compare the list of settlements and their corresponding population from the digital maps by GRID3 and the settlements lists from the technical microplanning template collected by the ward focal persons.

CONSIDERATIONS

Maps being a major component of the microplanning process, the introduction of digital mapping technology has provided a more precise alternative to hand-drawn maps. This has allowed the NMEP to accurately identify populations and plan for efficient distribution of ITNs to all households within targeted areas. The pilot contributed to identifying valuable insights for planning and improving future geo-enabled microplanning workshops. Some key considerations include:

- Availability of a local vendor with the capacity to print high-resolution geospatial maps at the best rates, with durable and quality flexible material in A1 size.

- Added cost for the microplanning: fees for GRID3 expert and consultants, cost of printing high resolution maps in A1 format, cost of transportation for ward focal persons to take geo-coordinates for new settlements, health facilities and distribution hubs.

- To ensure comprehensive community coverage, the integration of data from the RedRose system's GPS locators with GRID3's developed maps is crucial. Although this was an objective of the pilot project, it could not be accomplished in Kano due to time constraints and the challenges associated with integrating the two platforms.

PRINCIPAL LESSONS LEARNED

S/N	Lessons learned	Recommendations
1	**Planning and roll out:** • Due to the limited planning time in the pilot state (Kano), the process underwent several changes, which proved inconvenient and confusing for the national team. This, in turn, impacted the production of digital maps and settlement tables and their subsequent review. • The amount of work required to update the maps was not taken into account, and no time was designated for ward-level staff to collect geo-coordinates of missing settlements and distribution hubs during the microplanning workshop.	• Sufficient time should be allocated for rolling out innovations and a clear step-by-step work process should be provided. • The knowledge gained and lessons learned should inform the development of a precise work process and detailed Standard Operating Procedures (SOPs) for national team members, LGA and ward-level end-users. • The timeline for the microplanning workshop should be reviewed to include days for collecting geo-coordinates for settlements and distribution hubs.
2	**ITN campaign context:** The pilot base maps had communities clustered around health facilities, but for ITN mass campaigns under the current single-phase strategy, clustering is determined by distribution hubs. These hubs can be private residences, schools, village heads' houses, viewing centres, or other well-known locations, as they are chosen to meet the required number of distribution points based on the population and distance, rather than on health facilities.	• When creating base maps for future microplanning, it is important to identify key structures that could serve as potential distribution hubs even before the microplanning.
3	**Completeness of the maps:** Although improvements and updates were made on the maps during microplanning, there were still some noticeable gaps and errors when they were presented to the LGA teams during implementation. These included: • Some missing distribution hubs on both the base maps and the implementation maps. • Incorrect placement of some distribution hubs, health facilities and wards in Kano because geo-coordinates were not taken. • Missing settlement identities.	• All missing geo-coordinates should be collected/captured during microplanning, so that only new settlements that came after microplanning and relocated distribution hubs will be captured during implementation. • During implementation, the capturing of geo-coordinates for new settlements and relocated distribution hubs can be incorporated into the digital monitoring checklist. • Ensure comprehensive training on how to capture geo-coordinates is included in the training curriculum.

S/N	Lessons learned	Recommendations
4	**Printing and delivery of maps:** • The duration allotted for printing and delivering the maps was inadequate, resulting in maps being poorly sorted with errors and issues. • There was insufficient time to rectify the errors and re-develop the maps for reprinting. • Due to the constrained timelines for printing and sorting, some ward maps were not printed.	• To allow ample time for sorting and possible reprinting, it is recommended that the printing and delivery of maps be completed at least two weeks before the campaign implementation begins so that during the ToT the LGA team can verify the maps to identify possible errors which can be immediately corrected and the maps reprinted before cascade training commences.
5	**Number of maps:** • A single map was printed per ward as a visual representation of the areas to be covered and for use to develop workplans. However, since all wards have more than one supervisor, there is a need for each cluster supervisor to have their own map.	• In order to create accurate work plans for the MDTs to cover their catchment areas, the maps should be produced based on the catchment area of a distribution hub. • The .pdf versions of maps by ward can be shared with the LGAs. • It is worth considering the development of web-based maps and integrating them into the RedRose platform.
6	**Standard definition and names of settlements:** • Settlements are the primary focus of the ITN campaign; however, there are challenges related to what qualifies as a settlement. The criterion for defining a settlement varies across local governments and states. • There were discrepancies in the spelling and definition of settlements in the context of the ITN campaign.	• To ensure effective microplanning and implementation, it is crucial to understand and establish a standardized definition of settlements in consultation with other health interventions (such as for the National Primary Healthcare Agency [NPHCDA]). This definition can then be utilized to update the maps. • To prevent confusion during implementation, settlement names should be based on the list provided by the ward personnel, as there is no nationally approved standardized list.
7	**Additional features on the map:** • Absence of demarcation for catchment areas of distribution hubs led to overlap of teams in the field especially in catchment boundary settlements. • The team did not utilize the digital base maps' distance feature, which displays the time required to walk from settlements to health facilities or distribution hubs.	• Demarcating the catchment areas for distribution hubs would assist ward supervisors in creating precise work plans for their teams. • Utilizing the distance feature in the geospatial maps can lead to better planning of distribution hub locations, potentially resulting in increased ITN uptake.

S/N	Lessons learned	Recommendations
8	**Capacity-building:** • Unclear plan for capacity-building and training for national and state teams on base map development.	• The use of digital mapping technology in the microplanning process has become a crucial component in improving the outcomes of an ITN mass campaign when used correctly and optimally. There is a need for local capacity to generate base maps and not over-rely on the GRID3 staff and consultants for subsequent roll-out of geospatial maps for microplanning in Nigeria. • There is need for a well-defined plan and process for the knowledge transfer to the national and state teams on the base map development.
9	**Use of digital maps** • The maps produced following Kano microplanning were printed for utilization during implementation. However, the printed maps had limitations such as inability to see all features and inability to accurately measure distances which are essential elements for enhancing the development of a comprehensive workplan for MDTs.	• Using digital maps as a replacement for route maps has several advantages, such as: ↘ Distance between distribution hub and settlements can be determined when clustering settlements around a distribution hub. ↘ Estimated population, health facilities and distribution hubs by ward and LGA are shown. ↘ Population of missed settlements can be determined. • **Increase in spatial resolution:** The printed maps are ward level maps so not all features (settlement point, minor roads, terrain, etc.) at settlement level are visible. But when it is a web-map there is an option to zoom to the desired spatial resolution, e.g. to settlement level or to LGA or state level. • **Get shortest route and direction:** Like Google Maps digital maps can be used by the MDTs to get directions to settlements and be guided to the quickest route during distribution. • **Tracking teams:** Teams can be tracked during the distribution and teams themselves can track or visualize their coverage and have an insight of the areas they have yet to cover. • **Elimination of use of tables accompanying maps:** With the web-map the attribute data of any feature can be accessed which allows for elimination of several hard copy paper versions.

S/N	Lessons learned	Recommendations
10	**Objective of using geospatial maps:** • The objective of integrating data from the RedRose system (GPS locators) with the maps developed by GRID3 to evaluate ITN outcomes and enhance quantification for future campaigns was not attained.	• There is a need for a clear process on how the microplan-generated maps can be used to monitor coverage during implementation by overlaying them on the footprints for household registration and distribution. • Integration of the digital maps into the ICT4D RedRose platform will improve efficiency and accessibility. • Being a web-map application, the maps can be easily integrated as a new feature on the RedRose platform. Therefore, data captured using RedRose can be displayed on the maps instantly using the geo-coordinates.
11	**Archiving of maps:** • There is no plan for a central archive for the maps developed during the microplanning sessions.	• A clear plan should be developed by the NMEP on the process of archiving the GIS-based maps for future use.

CONCLUSION

The pilot exercise provided valuable insights into the superiority and reliability of GIS-based maps over hand-drawn maps for geo-enabled microplanning. The use of GIS maps and data significantly improved the quality of microplanning maps, resulting in more effective campaign planning and work plan development for MDTs. The digital maps were found to be user-friendly and easy to modify during the microplanning workshops. The lessons learned from the pilot exercise have highlighted the need for a clear work process and detailed SOPs for the state team, campaign technical assistants, LGA and ward-level end-users. A review of the microplanning timeline is necessary to cover additional days for collection of geo-coordinates for settlements and distribution hubs during the microplanning workshops.

The LGA and ward-level personnel were able to easily use the maps and the RedRose data collection tool to capture geo-coordinates of distribution hubs and settlements. The digital maps were updated and corrected, laying a foundation for their sustainable use in future microplanning activities in the state.

The final updated maps were used to generate work plans and route maps for MDTs, improving coverage during implementation and tracking the performance of MDTs at distribution hubs. Overall, the pilot exercise proved valuable for planning, budgeting and improving future geo-enabled microplanning workshops.

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/2367777867?pwd=a1lhZk9KQmcxMXNaWnRaN1JCUTQ3dz09

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

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