SEPTEMBER 2024

Geospatial Microplanning Toolkit (GMT): Identifying and reaching zero-dose and under-immunised children in Nigeria

Gavi The Vaccine Alliance

health.enabled

1. Why

Immunisations are among the most powerful public health interventions, and significant progress has been made to improve access to vaccines for children in low- and middle-income countries. Despite these global efforts, approximately 14.5 million children did not receive any vaccination (zero dose) in 2023 and another 6.5 million children were under-immunised, with significant disparity among and within countries [1]. In Nigeria, vaccination rates lag behind the global average, with children in hard-to-reach areas including conflict zones and geographically isolated areas having disproportionately lower immunisation coverage rates [2]. In these areas, settlements are sometimes scattered, often with poor infrastructure (e.g., road networks). The population may also be nomadic with high mobility impacting fixed population denominator data used for planning.

Kano and Kaduna states in Northwest Nigeria face significant immunisation challenges, where an estimated 27% of children in these areas are unvaccinated [3]. There is a large hard-to-reach and nomadic population in both states. In order to reach these children, health system managers must have a clear understanding of where children are located to enable effective planning for routine immunisations and outreach campaigns. This has traditionally been done by using hand-drawn maps relying on health workers' knowledge of the geographic areas in which they work, which are prone to errors and do not provide reliable information for planning.

Geospatial mapping is a visualisation method that enables the creation of customised maps that display geospatial data on populations, settlements, subnational boundaries and infrastructure which can be used by health system managers to identify elements such as missed settlements, health facilities and available roads to support microplanning processes for immunisation programs. This technology can help to identify communities that may otherwise be missed, where high numbers of zero-dose or under-immunised children are often located. Research has found that geospatial maps show better usability and accuracy compared to hand-drawn equivalents [4]. A recent report mapped key Universal Health Coverage (UHC) contributions of geospatial technology and data to include microplanning for targeted awareness creation and campaign planning; vaccination session tracking; campaign monitoring; vaccination coverage modelling; disease surveillance; health systems service point mapping; geographic accessibility modelling; and population estimation & spatial distribution [5].

2. What

Geo-ST4R is an initiative funded by the Bill and Melinda Gates Foundation and implemented by Pathfinder International, in collaboration with the Nigerian government and partners GRID3, Data Science Nigeria, and Natview Foundation for Technology Innovation, to deploy digital geospatial data, tools, and technology for Reproductive, Maternal, Newborn and Child Health & Nutrition (RMNCH+N) microplanning and decision-making.

While past Geographic Information Systems (GIS) initiatives have shown promising results, they have had limited focus on specific vaccine-preventable diseases (VPD) like Polio. The Geo-ST4R initiative aims to support health officials to leverage GIS-enabled microplans, coupled with advanced analytics for RMNCH+N data and visualisations, resulting in more accurate microplans and evidence-based decision making. This will allow health workers to identify and provide services to populations most at risk of being missed by traditional health service delivery, including a focus on zero-dose and under-immunised children.

This work leverages the Geospatial Microplanning Toolkit (GMT), a GIS application that maps health facilities, settlements and population data and enables ward-level health teams to capture, store, manipulate, analyse, manage, and present spatial geographic data. Due to its user-friendly interfaces, non-GIS experts are able to use the GMT modules to enhance data accuracy, enabling better planning and resource allocation. It is being considered a potential low-investment and high-impact solution. It also helps with the optimal establishment/placement of outreach sites and calculation of their catchment populations. The current GMT module is designed for immunisation and can be further customised to target other health domains.

The GMT system allows users to:

- Download settlements, health facilities, population, boundaries, and other operational data necessary to facilitate microplanning
- Carry out spatial calculations of catchment areas and distance to health posts and outreach sites
- Edit, generate, and print microplanning maps
- Validate spatial data and monitor the dashboard to track progress

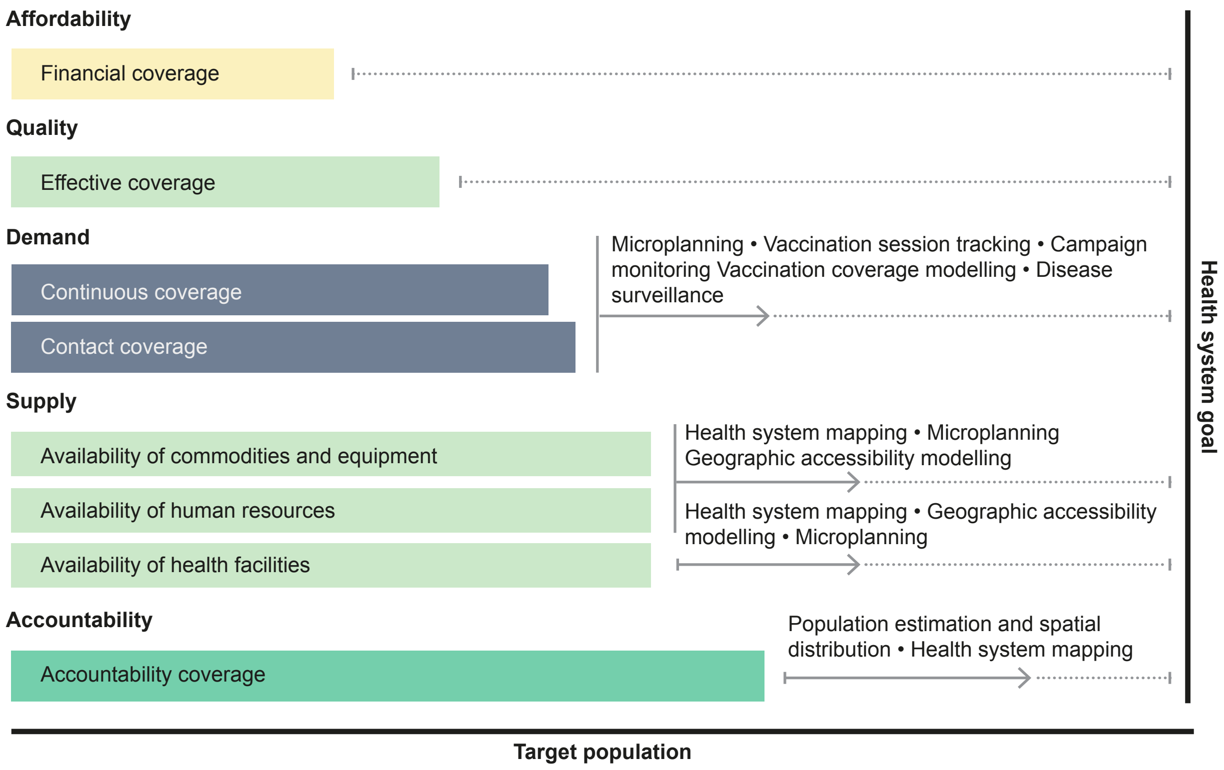
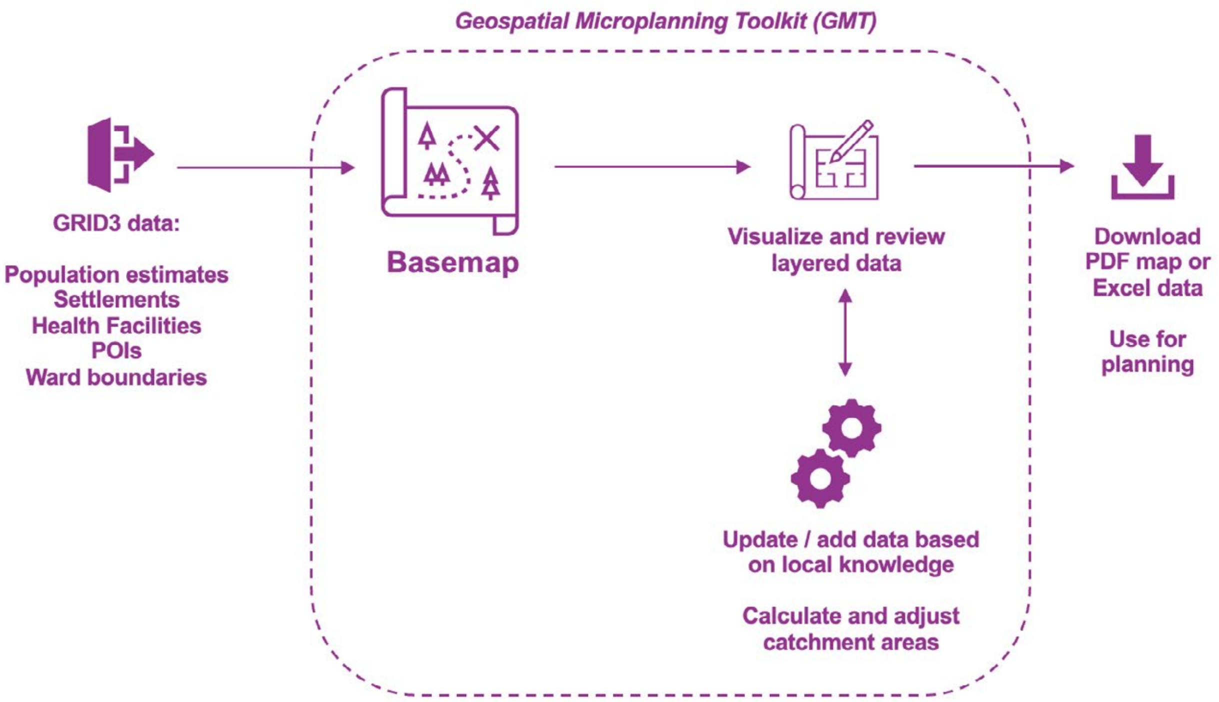


Image Source: Leveraging Geospatial Technologies for Immunization - https://healthenabled.org/wp-content/uploads/2021/09/Leveraging_Geospatial_Technologies_RapidGuide-1.pdf

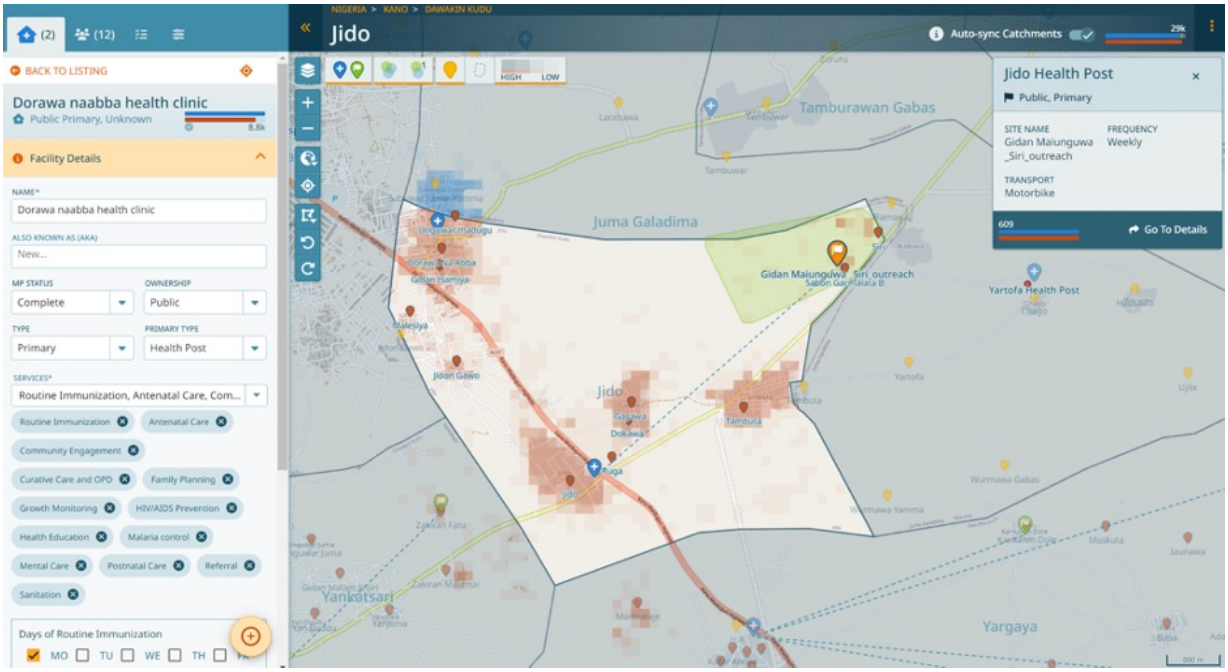
3. How

The GMT was developed by Novel-T in partnership with GRID3 along with the Nigerian government's National Primary Health Care Development Agency (NPHCDA). The intervention was piloted in Kano and Kaduna states, with Novel-T leading implementation in Kano state, and Pathfinder International leading the implementation in Kaduna state, all in collaboration with the local government. Government stakeholders were trained at state and LGA levels. In Kano and Kaduna states, 198 and 80 participants were trained on GMT, respectively. National and state-level stakeholders were trained at the state level to provide oversight and coordination, while ward and LGA staff were trained at the LGA level to operationalize the microplanning activities.

The GMT enables structured use of geospatial data (such as health facility and settlement locations, community boundaries, rivers, roads, markets, religious centres, population distribution) in microplanning. In addition, Ward Focal Persons (WFPs) can either use GRID3 gridded population data [6] to estimate population per ward / settlement /outreach /fixed-catchments or they can enter their own estimates. Both generated and entered estimates are displayed. The GMT includes information on population demographics like immunisation service availability, and other RMNCH+N health service availability status. See a typical flow in the chart.



These various data sources are cleaned and formatted, and then used to create maps that visually represent the data and their relationships. The process often involves overlaying one dataset over another in a visually simplified way to extract the most meaning from the combined data. Health workers and health system managers at the local government area (LGA), ward and health facility levels then use this combined data to gather insights that help them to develop targeted interventions, optimise vaccine and staff allocation, and better plan logistics. The GMT can support continuous data updates after the implementation, and overall monitoring ahead of next rounds. The screenshot shows the ‘Facility Details’ page where a user can view and edit information about each health facility using the pane on the left.



The GMT was user-tested in Kano and Lagos in December 2021 and October 2022, with updates made based on user feedback. In 2024, GRID3 and consortium partners commenced a pilot in Kano and Kaduna states in Nigeria to review geospatial baseline data (settlements, health facilities, operational boundaries) for microplanning. The pilot was conducted between April and July 2024 in six LGAs in Kano and two LGAs in Kaduna; these were LGAs with the highest rates of zero-dose children in the states.

Key stakeholders at the ward and health facility level were trained for one week using theoretical and hands-on training techniques. In addition, technical support on GMT use was provided to stakeholders in all wards involved in the pilot. The WFPs were then able to perform tasks such as reviewing and editing baseline spatial data, assessing catchment changes, and exporting PDF maps and data tables for use in immunisation planning sessions and other decision-making.

4. Results

In both Kano and Kaduna states, over 80% of LGA/ward level participants had not used digital enabled GIS maps before. The pilot program was evaluated using a pre-post study design to document the ease of use and effectiveness of the GMT. The evaluation involved a process review, observation and key informant interviews. The evaluation findings demonstrated that users in the pilot were able to effectively use the GMT to review geospatial baseline data, map outreach locations and review health facility catchment areas. In Kano's six LGAs, 664 outreach sites were mapped, identifying 106 hard-to-reach settlements, updating names of 291 settlements. Also, there were 157 settlements identified as abandoned, and 37 settlements' new location were updated. In addition, over 900 new settlements were added to the GMT digital geo-database. Being able to compare multiple population data sources (GRID3 estimates displayed in the GMT and the population figures entered by the WFPs) was valuable in assessing immunisation coverage.

GMT users in all observed sites generally had few challenges with understanding and navigating the GMT dashboard, downloading wards of interest, pan maps, and changing basemaps. Users could view details of settlements, staff members, and health facilities, and they were able to make changes to the map information such as adding settlements, creating outreach sites, splitting/merging settlements, renaming settlements, and editing ward boundaries.

There was unanimous agreement by respondents that the GMT based microplanning was superior and more accurate than the paper equivalents. Pre-post pilot surveys in both states showed a better understanding of key microplanning challenges and benefits of using GMT tools for microplanning.

During pilot evaluation and observation, most users initially had some challenges navigating GMT features or executing functions independently. The challenges were related to adding settlements, creating outreach, adding health facilities, merging and splitting settlements, exporting maps, locating a settlement on the map, and renaming settlements. With a little support, they were resolved and, by the end of the pilot, users were more comfortable using the GMT on their own. There were also some technical challenges with using the application, and some users reported that the application was slow due to poor internet connectivity and hot weather. Despite these challenges, users showed interest in continuing to use the GMT for their work beyond the pilot period.

5. So what

Based on the evaluation of the pilot, there was clear consensus that the GMT-based microplanning is favoured to manual paper-based microplanning. A number of lessons were learned that will help to improve GMT implementation in the future. These include:

- Hands-on training and continuous support is important for successful GMT implementation.
- It is valuable to compare GMT displayed population estimates with ward-level population data and with immunisation coverage and other health service delivery data
- Collaboration with government stakeholders both at the national level (NPHCDA) and at planning/operational (LGA, Wards, and Health Facility) levels remain crucial.
- The development of Standard Operating Procedures was necessary to provide guidance for use.
- Network and electricity infrastructure are crucial for the scalable use of the GMT.

The next step following this pilot is discussing a potential scaleup of GMT use while evaluating the implementation for impact on health outcomes, including immunisation coverage. In addition, robust evaluation of the impact of GMT over traditional paper approaches for microplanning and monitoring interventions will be valuable. A cost-effectiveness study could also help to quantify the value of this intervention and generate lessons critical for sustainability within project areas and for other Nigerian States and countries interested in deploying GMT or other GIS interventions.

Acknowledgement

In compiling this use case, insights provided by Johanna Snell, Bashir Yusuf, and Annie Werner were invaluable. The data used for this case study included data from GRID3 evaluation and process observation in all the LGAs where intervention was piloted.

6. References

[1] WHO, “Immunization Coverage,” 2024. https://www.who.int/news-room/fact-sheets/detail/immunization-coverage.

[2] WUENIC, “Nigeria: WHO, UNICEF Estimation of Immunization coverage,” 2022.

[3] Gavi, “Nigeria Zero-dose situation analysis,” 2023, [Online]. Available: https://zdlh.gavi.org/sites/default/files/2023-12/ZDLH_Nigeria_Situation_Analysis_2023.pdf.

[4] L. Dougherty et al., “From paper maps to digital maps: enhancing routine immunisation microplanning in Northern Nigeria,” BMJ Glob. Heal., vol. 4, no. Suppl 5, p. e001606, Jun. 2019, doi: 10.1136/bmjgh-2019-001606.

[5] U. & H. Gavi, “Leveraging geospatial technologies and data to strengthen immunisation programmes: rapid guidance for investment planning,” 2021.

[6] WorldPop, “Open Population Repository”, 2023, [Online]. Available: https://wopr.worldpop.org/?NGA/Population