Microplanning: A promising approach to identify and reach zero-dose children in Democratic Republic of Congo (DRC)

A CASE STUDY

1. RATIONALE, CONTEXT, AND METHODS

A CHALLENGING RECOVERY FROM THE COVID-19 PANDEMIC

Democratic Republic of Congo (DRC) is the largest country in sub-Saharan Africa. It is located on the equator and has dense tropical rainforest in the central and eastern regions. The country has a young and growing population, with a fertility rate of 6.2 births per women in 2021 (World Bank 2022). DRC faces security issues in the east resulting from the presence of dozens of armed groups (World Factbook 2023). The last census in DRC was in 1984, demonstrating an urgent need for updated data on the population to inform health service delivery, including vaccines.

KEY LESSONS LEARNED

Microplanning was an integral part of the Mashako Plan and was implemented through a variety of programs in DRC.

DRC has faced multiple recent challenges related to virus outbreaks and the COVID-19 pandemic, causing many families to miss or delay vaccination due to both supply and demand issues (Kahondwa 2023; Sodjinou et al. 2022). According to World Health Organization (WHO)/United Nations Children's Fund (UNICEF) estimates of national immunization coverage (WUENIC), the third dose of diphtheria, tetanus, and pertussis immunization (DTP3) has not yet recovered to pre-pandemic levels. Coverage was at 65% in 2022 and 2021, a slight drop from 70% in 2020 and 73% in 2019 (WHO, n.d.). Additionally, the country has a high number of zero-dose children, estimated at 734,287 in 2021 (Gavi The Vaccine Alliance [Gavi], n.d.a). This case study explores how microplanning was used in DRC to improve vaccination services and outcomes in the face of recent challenges.

CHALLENGES ADDRESSED

Experts working on immunization efforts in DRC have identified many challenges to reaching all children with vaccination, one of which is low caregiver demand for vaccination. Within the densely populated Kinshasa, many unique factors influence caregivers' decisions regarding where to go to vaccinate their children, many of which related to transport within urban areas such as walking routes, public transit options, and proximity to their workplaces. Other barriers to vaccination in DRC include geographical inaccessibility throughout the country, worsened by poor infrastructure (e.g., roads and telephone service), supply chain issues, and availability of vaccines at the point of service delivery. Additionally, health zones are very large but sparsely populated, exacerbating the challenges to reaching communities with vaccination. Seasonal issues like floods can make transportation

difficult, both for caregivers to bring their children to vaccination posts and for health workers to travel to remote communities. Finally, security risks and conflict in DRC pose barriers to identifying and reaching all children with immunizations.

THE MASHAKO PLAN

"Reinforcing the Mashako plan in the new provinces would enable us to target not only zero-dose children, but also children who are insufficiently vaccinated"

In 2018, the Expanded Program on Immunization (EPI) within the Ministry of Health (MOH) collaborated with global partners to design and implement a revitalization strategy for routine immunization (RI) called the Mashako Plan (Lame et al. 2023), which initially covered nine provinces. The goal of the plan was to increase full immunization in children 12–23 months by 15% in selected areas within 18 months of implementation by focusing on five key intervention areas: coordination, service delivery, vaccination availability, real-time monitoring, and evaluation (Lame et al. 2023). The Mashako Plan was developed by the EPI with the support of Acasus, Gavi, UNICEF, the Bill & Melinda Gates Foundation (BMGF), and WHO. Despite some delays due to COVID-19 and other implementation challenges, the Mashako Plan led to a 50% increase in vaccination sessions in 2020 compared to 2018 and was expanded to all provinces during 2020–2022.

The Mashako Plan 2.0 began in 2021, with the aim to expand and build upon the success of the first iteration and make adjustments based on challenges encountered (PATH 2023). The Mashako Plan 2.0 involved expanding to more provinces, accounting for challenges presented by the COVID-19 pandemic and delays in implementation of the Mashako Plan 1.0 related to the large and rapid scale-up. In addition, priorities and indicators related to demand and outreach were updated for 2.0 (Lame et al. 2023). While the Mashako Plan 1.0 saw improvement during the first two years of implementation, beginning in 2021 there was stagnation and sometimes regression resulting from vaccine shortages, a health worker strike, poor monitoring mechanisms, and coordination and financing of the plan.

MICROPLANNING

A key component of the Mashako Plan, as well as Gavi's targeted country assistance plan, is microplanning (Gavi 2019, 2020). Microplanning is a multifaceted process used to create or update maps, identify priority communities, identify barriers to services, and develop workplans with solutions (UNICEF, n.d.). It combines vaccination coverage data with geographic and population data and often uses community input to develop strategies and activities for immunization delivery (WHO 2009). Microplans can include technical guidance such as estimates for required resources, cold-chain plans, and tools and frameworks for reporting and monitoring. A recent rapid review of

available evidence on microplanning indicated that enhancing or improving microplanning is a promising approach for reaching zero-dose children, with six effectiveness studies showing meaningful increases in vaccine coverage or identification of missed communities after the introduction or improvement of microplanning (FHI 360 2023).

As presented in Gavi's IRMMA framework, microplanning is an intervention that cuts across multiple stages of the immunization process, including identifying and reaching unvaccinated children (Gavi n.d.b). Novel microplanning approaches or enhancements made to existing microplanning processes can be used to improve identification and reach of zero-dose children and missed communities. Enhancements might include geo-satellite mapping, geographic information systems (GIS), eco-tracking systems, digitization, global positioning system (GPS), increased community engagement, among others. Microplanning can help answer the following questions:

- What are the real needs of populations in vulnerable contexts?
- Are the activities to be carried out effective in meeting these needs?
- Are the strategies and objectives relevant and realistic?
- What resource allocation is needed? Are the resources available and adequate?
- What are the causes of vaccine supply and demand bottlenecks?

"The first lesson we've learned is that bottom-up microplanning is the key to recovering zero-dose and under-immunized children. The second lesson is that innovation is the most important thing in microplanning—we need to use innovation to reach all children, wherever they are."

—Key informant

METHODS

To explore the microplanning approach in DRC, qualitative interviews were conducted with key informants in the country, supplemented with information from published and grey literature. Key informants worked for the MOH and EPI and its international partners, including UNICEF, Acasus, JSI, and BMGF. Interviews were conducted in June 2023. Informants shared their perspectives on how microplanning is implemented in DRC, how it can be improved, and its impact on child immunization rates among populations in vulnerable contexts. These data allow for a greater understanding of the value and challenges of using microplanning as a pro-equity intervention to identify and reach zero-dose and under-immunized children.

To understand how microplanning is implemented and can help address challenges to childhood immunization, as well as how it may have impacted vaccination rates in DRC, two examples of microplanning are presented. One example is a mapping project from Geo-Referenced Infrastructure and Demographic Data for Development (GRID3), while the second is the urban vaccination strategy in Kinshasa.

2. INTERVENTION 1: GRID3 M4H—MICROPLANNING AS A KEY PILLAR OF THE MASHAKO PLAN IN DRC

KEY LESSONS LEARNED

- The GRID3 M4H project utilized multiple strategies to enhance microplanning and work towards the goals of the Mashako Plan
- It utilized the expertise of a large variety of partners, including government and non-governmental organizations, the private sector, and academia.

RATIONALE AND OBJECTIVES

Many key informants stressed the importance and relevance of the Mashako Plans 1.0 and 2.0 when discussing microplanning and immunization in general in DRC. Microplanning for immunization was a key pillar in the workplan of the Mashako Plan. The activities in this pillar included microplanning enhancements, such as geo-mapping and digital innovations, through GRID3's Mapping for Health (M4H) project. This was planned to culminate in December 2021, when the GRID3 deliverables were expected.

GRID3 M4H began in June 2020 as an initiative of the DRC MOH to support the execution of the Mashako Plan (GRID3 2022a). It was funded by Gavi's INFUSE program and developed in partnership with Flowminder and the Center for International Earth Science Information Network. Key collaborators included EPI, Acasus, UNICEF, WHO, UNOPS, and the Kinshasha School of Public Health (KSPH). The project had five main goals:

1. Improve RI through generating spatial data, including information on populations, boundaries, health facilities, and settlements.
2. Support geospatial and digital microplanning.
3. Create data on movement of populations to inform resource allocation.
4. Improve the ability of health personnel to perform geospatial analysis.
5. Increase the gender equity of RI and vaccination service delivery planning (GRID3 2022a).

WHAT: STAKEHOLDER ENGAGEMENT AND CREATION OF MAPS AND POPULATION ESTIMATES

The first phase of this project involved engaging a variety of stakeholders and conducting activities to ensure their sustained engagement, including forming steering and technical committees that included DRC government officials.

The second phase consisted of data collection to ensure that health zones and health areas, including health facilities and settlements, were properly accounted for, and the development of basemaps and a gridded population layer that would inform the vaccination plans (GRID3 2022b). Twenty-seven GIS technicians and

coordinators and more than 2,000 people from local health teams made visits to five provinces (Kinshasa, Kasaï, Kasaï Oriental, Haut Katanga, and Lomami) to collect data on a variety of features for the maps, including health facilities, settlements, and schools. Maps were also developed for four additional provinces using existing data. Maps were created at both the health area and health zone levels (GRID3 2022a).

BOTTOM-UP GRIDDED POPULATION ESTIMATES

To create more recent and accurate population estimates, KSPH, as part of the GRID3 M4H project, implemented a microcensus survey in March–April 2021 across seven provinces. By combining these data with geospatial covariates, population estimates endorsed by the government were developed and validated before being input into an optimization algorithm developed by Flowminder. This algorithm was used to create a model of optimal locations for vaccination sites, with a goal of having the entire population residing within 3 kilometers of a vaccination post. These data informed an immunization plan for each health area, which included key indicators such as total and target populations and vaccination sites, a color-coded microplanning map, and statistics of each vaccine site such as villages covered. Mobility estimates were also collected through a national phone survey in November 2021 (Flowminder 2021a; GRID3 2021, 2022a).

"The Mashako Plan 2.0 strategy takes equity and gender into account. It is totally aligned with the Gavi 5.0 strategy."

—Key informant

HOW: GRID3 LEVERAGED COMMUNITY ENGAGEMENT AND KNOWLEDGE TRANSFER TO CREATE AND IMPLEMENT M4H

Community engagement, knowledge transfer, and a focus on gender equity were crucial components of how GRID3 M4H was implemented, with a particular emphasis on training local collaborators.

COMMUNITY ENGAGEMENT AND KNOWEDGE TRANSFER

The steering committee was created to support the first step of the project: facilitating strong multi-stakeholder engagement. The role of the committee was to gain input from local officials in DRC to support government ownership, sustainability, and knowledge transfer.

Capacity strengthening was another core component of the GRID3 M4H project so that local partners could use and interpret GIS data. GIS training sessions were held at the national and provincial levels for 54 data managers and health information workers selected from priority provinces. They were trained in QGIS

to work with geospatial data and produce maps using the software. Additionally, knowledge was transferred through collaboration between the project team and local communities to identify the main barriers to vaccination related to social determinants of health (GRID3 2022a).

GENDER EQUITY

GRID3 M4H also undertook activities focused on gender in vaccination. One of these included a gender equality and social inclusion (GESI) audit conducted in four health zones, the results of which informed the development of a gender-based analysis barrier and action planning (GBA+) toolkit (Flowminder 2021b). A series of "training of trainers" sessions were held across multiple health zones on gender and social inclusion (GRID3 2022a). This culminated in 51 health professionals being trained in two health zones in Kinshasa, three health zones in Kasai, and eight organizations that spanned both provinces, who then trained 311 health care workers in Kinshasa and Kasai through 25 sensitization sessions on gender equity.

RESULTS

The GRID3 M4H project helped inform activities at the health zone level as well as national-level statistics estimates.

Products developed under the GRID3 M4H project, including population estimates, data for maps, and models, were used to create maps and other microplanning materials that were provided to their corresponding health zones. Additionally, the National Statistics Institute stated that it would be using the population estimates to inform upcoming census activities. Other data produced as part of this project, including those related to demographics, population movement, and mobile phones, were made available for use by national stakeholders such as researchers and statisticians (GRID3 2022a). Additionally, research on the results of this initiative will be published soon, highlighting positive preliminary results in terms of uptake, use, and perceived impact. Further research is needed on the cost-effectiveness of the initiative.

KEY LESSONS LEARNED

- Urban environments in DRC have unique considerations, and microplanning facilitated successful vaccine interventions in these nuanced settings.
- Enhanced microplanning involving GIS allowed for the identification of patterns, which in turn informed service delivery.
- Increased attention to smaller geographic spaces (health areas) versus the large health zones was a key component of the urban microplanning approach.

3. INTERVENTION 2: MICROPLANNING IN THE URBAN VACCINATION STRATEGY IN KINSHASHA, DRC

WHAT: MICROPLANNING, INCLUDING WORKSHOPS AND MAPPING, AS A FOUNDATION OF THE URBAN VACCINATION STRATEGY

The urban vaccination strategy is another example of an improved microplanning approach in DRC. Microplanning is a key principle of the Reach Every District (RED) strategy, which is used in DRC to strengthen health systems. As there are specific challenges to vaccinating children in urban poor settings, the EPI, supported by JSI, adapted the urban-specific approach of the RED strategy in Kinshasa, the capital and largest city of DRC. This enabled the EPI to target each health area, which is a smaller geographic demarcation that facilitates tailoring interventions to the specific population and context, as opposed to the previous zone-by-zone approach (JSI n.d.).

Additionally, previously, microplanning tools had been developed and provided to the zonal central office without review and validation, lacking the engagement of a range of stakeholders including local authorities. The EPI and JSI developed and implemented a variety of strategies to improve these microplans. To address these previous challenges with engagement and support the improvement of microplanning in Kinshasa, JSI facilitated data review meetings and the development of microplans in each health area. Collaborative microplanning workshops were held in each health area in two health zones in Kinshasha—Limete and Kimbanseke—from 2018 through 2020 to improve RI. This was followed by a “consolidation workshop” in each zonal central office. Microplanning was conducted in each of the 22 health areas in the two health zones. GIS was a key component of these microplanning efforts.

HOW: ENGAGEMENT OF THE COMMUNITY AND A TECHNICAL PARTNER TO SUPPORT IMPLEMENTION

Deliberately engaging the local community was a key component of successful, urban-specific microplanning. Local authorities and community representatives were involved in the workshops to engage them in planning vaccination activities, a change from the previous approach which engaged local stakeholders only to conduct the vaccination sessions. Additionally, a key component of the workshop

was prioritizing the problems identified during the situational analysis and matching them with appropriate solutions, ensuring sufficient resources for those solutions, and assigning responsibility to the health area.

Furthermore, engaging a technical partner was a critical feature of implementation. JSI provided technical support for microplanning, which included assessment of data—such as estimated birth cohorts to inform the number of vaccination sessions needed per month—for successful immunization of unreached children in urban poor areas. Additionally, JSI conducted planning sessions to maximize the number of children reached and minimize the number of children missed.

As part of microplanning in the urban RED strategy, the organization of vaccination sessions at health care facilities considered key metrics such as walking routes, ease of public transit, distance to work, as well as traditional considerations such as population density.

"The interventions were effective because they were planned from the outset and there was this microplanning at the grassroots level, and JSI supported the implementation"

—Key informant

All health facilities in the two health zones were mapped using GIS software in addition to information such as type of settlement, RI delivery, level of awareness of vaccination, and frequency of vaccination sessions. These maps were then used during microplanning to identify patterns of vaccine access, delivery, and uptake and to help schedule vaccination sessions.

RESULTS

Microplanning as part of the urban immunization strategy revealed gaps and opportunities to reach missed children.

Geo-spatial patterns helped reveal potential reasons for immunization gaps, which would not have been identified as quickly through administrative data or hand-drawn maps. For example, the maps showed that RI services were disproportionately provided between and within the two health zones and that there was gap in immunizations in the south of Kimbanseke due to a lack of services and geographic inaccessibility. This conclusion led to a variety of solutions, including increasing vaccination sessions in Kimbanseke and re-evaluating the catchment area to create a better estimate of the population denominator. In addition, land was marked as zoned for commercial or residential purposes, as caregivers in urban areas are more likely to utilize services closer to their workplaces and there are few health facilities in commercial areas, representing a missed opportunity (JSI, n.d.).

4. ENABLERS AND BARRIERS TO SUCCESS

Key informants discussed a variety of facilitators and barriers to implementing microplanning in the DRC context in general. Enablers included the expertise of health staff, verification of maps, and evaluation of microplans during or after implementation to assess coverage. Additionally, multiple key informants emphasized that for microplanning to be successful, it must involve grassroots efforts that include locally led solutions and consideration of the local context and village-level priorities. Prioritizing input from and partnering with local communities to inform optimal vaccine service delivery plans is essential, as is co-creation, or collaboration between government, external funders, and communities. Collaboration with humanitarian and civil society organizations was also mentioned as a key enabler. Finally, informants described the importance of conducting rapid situational analyses to identify local obstacles to vaccination, understand supply and demand bottlenecks, and develop strategies to remove them.

"A rapid situational analysis enables us to identify the obstacles to vaccination and even to confront them. What are the supply bottlenecks, what are the demand bottlenecks, and how can we remove them? And we also used the co-creation technique—what can we do with the funder and the community to remove the bottlenecks?"

—Key informant

Informants also discussed a variety of major barriers to creating and implementing microplans, including some that are also barriers to immunization in DRC such as geographic (in)accessibility, lack of infrastructure, large and sparsely populated health zones, and transportation challenges during the rainy season. Additionally, security risks and conflict pose challenges to conducting microplanning and creating maps, as accessing areas to map them was difficult. Epidemics including measles and Ebola can divert the attention of service providers away from microplanning to these emergencies. Additionally, the lack of or unreliable denominators for the number of people in a target population makes microplanning difficult in DRC. Human resource constraints and lack of consistent trained staff are also challenges, as high turnover can lead to sustainability problems.

A barrier described by some key informants was a focus by external funders on immunization campaigns instead of RI. This can lead to health workers receiving bonuses for their work on campaigns, which disincentivizes them from working on RI. Finally, poor coordination of partners leads to inefficient microplanning—investments would be more effective if there was a clear understanding across partners of who is providing what technical assistance and where.

A table containing a summary of these barriers and enablers can be found in Appendix 1.

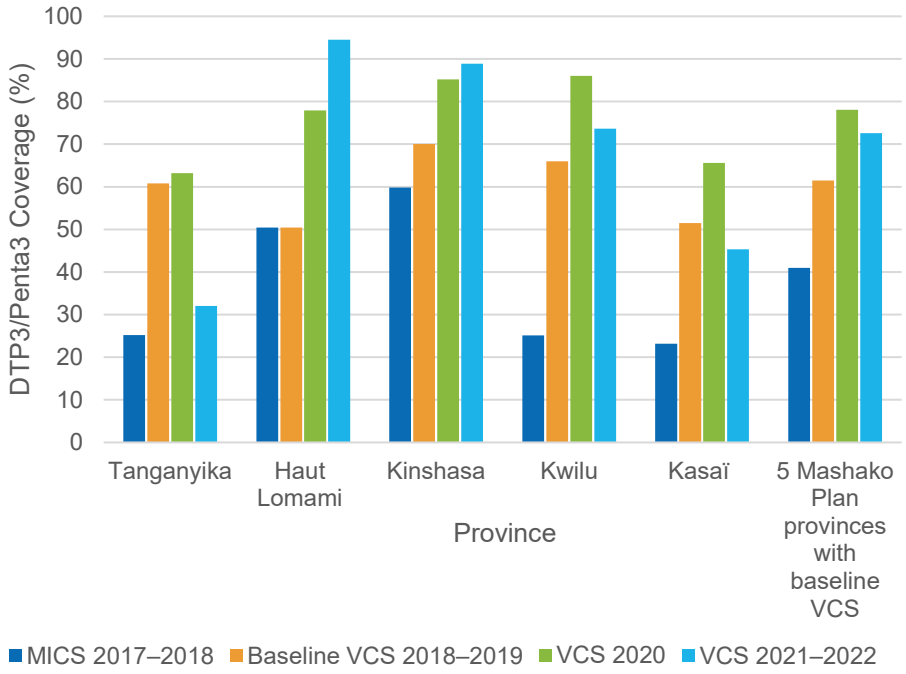
5. OVERALL RESULTS

A variety of data show the success of the Mashako Plan on vaccination outcomes.

The figure below, using data from a variety of coverage surveys from 2017 to 2022, shows how vaccination coverage increased over time in the provinces where the Mashako Plan was implemented. As a note, because the baseline vaccination coverage survey in 2018–2019 was only conducted in five of the initial Mashako Plan provinces, these five provinces are included in the figure (Lame et al. 2023).

Overall, there were increases in DTP3 coverage in the Mashako Plan provinces after the Mashako Plan began in 2018, microplanning began in 2018as part of the urban-specific strategy, and the GRID3 M4H project began in June 2020.

Figure 1. DTP3/Penta3 Coverage in 5 Initial Mashako Plan Provinces, DRC



Abbreviations: DTP3: diphtheria, tetanus, pertussis; MICS: Multiple Indicator Cluster Survey; VCS: vaccination coverage survey (Lame et al. 2023)

Similarly, increases were found in other indicators related to vaccine service delivery in DRC during Mashako Plan implementation from January 2019 through March 2020, including the number of health areas supervised (50% increase), health areas that have weekly vaccination sessions (12% increase), and vaccine availability (54% increase) (Lame et al. 2023).

KEY TIMELINES

- The Mashako Plan began in 2018.
- Microplanning in the urban-specific vaccine strategy began in 2018.
- The GRID3 M4H project began in 2020.

6. LESSONS LEARNED AND RECOMMENDATIONS FOR SCALE-UP

Microplanning was viewed as a promising approach to better identify and reach zero-dose children in DRC, but deliberate and evidence-based scale-up is required for success.

Several key informants suggested specific ways in which microplanning should be implemented to maximize its success. First, it is important to recognize the crosscutting nature of microplanning, spanning both identification and reach. It is critical that any enhancements to existing microplanning processes be applied to both areas. In addition, microplanning needs to be about more than *identifying* populations to vaccinate; it needs to also include identification of context-specific service delivery strategies, resource requirements, partnerships to leverage (including those within communities, such as with village chiefs, religious leaders, and schools) to help identify zero-dose children, and the creation of guides on how to *reach* these children. These guides should include local solutions based on human centered design, community design, and co-creation.

Second, tools developed at the national level to identify and reach children should be systematized, replicated, and made available from the provincial level down to the provider and community levels. Relatedly, bottom-up microplanning is key to effective microplanning that reaches zero-dose and under-immunized children, particularly in the most isolated areas. It is important for policymakers, planners, and implementers to reflect after each microplanning activity and assess whether the activity truly takes into account the real challenges, needs, and priorities of a community in a specific context, recognizing that this may differ within and between communities in DRC. This exercise will also ensure that interventions and innovations built into the microplan are tailored and targeted to specific communities with zero-dose or under-vaccinated children.

Finally, for true scale-up to happen, microplanning and enhancements to microplanning must be better integrated into RI efforts and not just campaigns. A focus on integrating enhanced microplanning into RI will allow for increased health care worker motivation, sustainability, and local ownership.

Due to initial positive results of the Mashako Plan, GRID3 microplanning will be scaled up alongside performance and accountability frameworks.

There are plans to scale up georeferenced microplans and dashboards to four priority provinces (Tshopo, Maindombe, Mongala, and Sakuru), which include 44 health zones. GRID3 and its partners, including local health teams, will create a comprehensive database with all essential geospatial data layers using satellite imagery, including town/village names, health zone and health area boundaries, health facilities, and important locations such as schools, religious centers, and markets. These future GRID3 interventions are part of the Immunization Equity Acceleration Fund (EAF) in DRC.

To ensure that microplanning efforts are effective, maps and microplans need to be used as planned at the subnational level. To achieve this, GRID3 microplanning efforts as part of the EAF, which supports the Mashako Plan 2.0, will include an increased focus on stronger accountability mechanisms for microplanning. The goal of this is to avoid challenges encountered in the first iteration of the Mashako Plan related to poor monitoring mechanisms and coordination and financing of the plan overall, as well as ensuring that microplans are adapted for and used at the local levels. To build on early successes and optimize microplanning so that it can be fully utilized to identify and reach zero-dose children, future GRID3 digital microplanning includes plans for performance and accountability frameworks.

Finally, an important consideration for scale-up is the sustainability and cost of the intervention. As local capacity must be strengthened to ensure that the maps are effectively used and impactful, and because costs of the intervention are high, there is some concern regarding sustainability. To facilitate success of the intervention, targeting scale-up in a few priority areas with a focus on increasing local capacity could contribute to simplifying implementation and controlling costs to render it locally sustainable.

ANNEX 1. ENABLERS AND BARRIERS TO IMPLEMENTING MICROPLANNING IN DRC BY INTERVENTION

Intervention	Enablers	Barriers
Microplanning in general	• Expertise of provincial health personnel and other health staff • Verification of maps developed as part of microplanning and evaluation during or after implementation of microplans to assess coverage • Collaboration with humanitarian and civil society organization • Grassroots efforts that include locally led solutions and consideration of the local context and village-level priorities • Prioritizing input from and partnering with local communities to inform optimal vaccine service delivery plans • Co-creation, or collaboration between government, external funders, and local communities • Rapid situational analyses to identify local obstacles to vaccination and supply and demand bottlenecks, and to develop strategies to remove them	• Geographic inaccessibility and poor infrastructure (roads, telephone networks, electricity) combined with very large and sparsely populated health zones, and seasonal issues such as floods in the rainy season that make transport difficult • Security risks/conflict • Epidemics (e.g., measles, Ebola, yellow fever, meningitis, cholera) divert the attention of service providers away from microplanning • Lack of or unreliable denominators • Human resource constraints, lack of consistent trained staff (high turnover, leading to sustainability problems) • Focus on campaigns instead of routine immunization—external funders often focus on campaigns, and health workers might receive bonuses from campaigns, which disincentivizes them from working on RI • Poor collaboration and communication among partners (UNICEF, MSF, Gavi)
Urban microplanning (JSI)	• Engagement of a variety of stakeholders, including community leaders and health facility managers • Concrete service delivery targets for populations that live in slums • Regular mapping exercises and checking, adapting, and updating existing microplans to account for changes in infrastructure, housing, and facilities as urban environments evolve constantly • Focus on mapping high risk areas that should be prioritized for vaccine service delivery or awareness-raising activities	• Lack of accurate administrative demographic data (in which case alternative data sources, such as lot quality assurance sampling [LQAS], could be considered)

REFERENCES

FHI 360. 2023. *Microplanning: Evidence on Pro-Equity Interventions to Improve Immunization Coverage for Zero-Dose Children and Missed Communities*. Durham, NC: FHI 360. https://zdlh.gavi.org/sites/default/files/2023-09/9._microplanning_evidence_brief.pdf

Flowminder. 2021a. *Flowminder Launches a National Phone Survey in the Democratic Republic of the Congo to Support the Production of Mobility Estimates*. Accessed October 16, 2023. https://www.flowminder.org/news/flowminder-launches-a-national-phone-survey-in-the-democratic-republic-of-the-congo-to-support-the-production-of-mobility-estimates.

Flowminder. 2021b. *Flowminder Releases Tools to Help Tackle Gender Barriers to Vaccination in DRC*. Accessed October 16, 2023. https://www.flowminder.org/news/flowminder-releases-tools-to-help-tackle-gender-barriers-to-vaccination-in-drc.

Gavi The Vaccine Alliance. n.d.a. *Congo, DR Factsheet*. Accessed November 15, 2023. https://www.gavi.org/programmes-impact/country-hub/africa/congo-dr.

Gavi The Vaccine Alliance. n.d.b. *Reaching Zero-dose Children*. Accessed October 16 2023. https://www.gavi.org/our-alliance/strategy/phase-5-2021-2025/equity-goal/zero-dose-children-missed-communities.

Gavi The Vaccine Alliance. 2019. *Targeted Country Assistance Plan DRC 2019*. Accessed November 15, 2023. https://www.gavi.org/sites/default/files/document/targeted-country-assistance-plan-drc-2019pdf.pdf.

Gavi The Vaccine Alliance. 2020. *Rapport sur le dialogue multipartite 2020*. https://www.gavi.org/sites/default/files/document/2020/Joint-Appraisal-DRC-2020_FR.pdf.

GRID3. 2021. C*ountry-wide Phone Survey in DRC to Strengthen Mobility Estimates*. Accessed October 16, 2023. https://grid3.org/news/phonesurvey-drc-strengthen-mobilityestimates.

GRID3. 2022a. *A Milestone in DRC's Campaign to Make Vaccination Planning More Effective and Equitable*. Accessed October 10, 2023. https://grid3.org/news/drc-campaign-vaccination-planning.

GRID3. 2022b. *New Datasets and Basemaps to Strengthen Health Service Delivery in Five DRC Provinces*. Accessed October 16, 2023. https://grid3.org/news/datasetsbasemaps-health-drc.

JSI. n.d. *Atteindre les enfants non vaccinés*. JSI. Accessed November 15, 2023. https://publications.jsi.com/JSIInternet/Inc/Common/_download_pub.cfm?id=23343&lid=6.

Kahondwa, P. 2023. *Is the DRC's "Game-Changer" Vaccine Plan Working? (VaccinesWork)*. Accessed November 15, 2023. https://www.gavi.org/vaccineswork/drcs-game-changing-vaccine-plan-working.

Lame, P., Milabyo, A., Tangney, S., Mbaka, G. O., Luhata, C., Gargasson, J.-B. L., Mputu, C., Hoff, N. A., Merritt, S., et al. 2023. A Successful National and Multipartner Approach to Increase Immunization Coverage: The Democratic Republic of Congo Mashako Plan 2018–2020. *Global Health: Science and Practice, 11*(2), e2200326. https://doi.org/10.9745/ghsp-d-22-00326.

PATH. 2023. *Advancing Immunization Coverage and Combating Epidemics in the DRC*. Accessed October 16, 2023. https://www.path.org/media-center/drc-makes-historic-gains-child-immunization-coverage/.

Sodjinou, V. D., Mengouo, M. N., Douba, A., Tanifum, P., Yapi, M. D., Kuzanwa, K. R., Otomba, J. S., & Masresha, B. 2022. Epidemiological Characteristics of a Protracted and Widespread Measles Outbreak in the Democratic Republic of Congo, 2018–2020. *Pan Afr Med J, 42*, 282. https://doi.org/10.11604/pamj.2022.42.282.34410.

UNICEF. n.d. Microplanning for Immunization: How to Strengthen Every Step of Your Process. Accessed October 16, 2023. https://agora.unicef.org/course/info.php?id=6730.

World Bank. 2022. *Fertility Rate, Total (Births per Woman)—Congo, Dem. Rep.* [Data]. (World Development Indicators). Accessed October 16, 2023. https://data.worldbank.org/indicator/SP.DYN.TFRT.IN?locations=CD.

World Factbook. 2023. Congo, Democratic Republic of the. Accessed October 16, 2023. https://www.cia.gov/the-world-factbook/countries/congo-democratic-republic-of-the/.

World Health Organization (WHO). n.d. *Immunization Dashboard*. Accessed November 15, 2023. https://immunizationdata.who.int/.

World Health Organization (WHO). 2009. Microplanning for Immunization Service Delivery Using the Reaching Every District (RED) Strategy. Accessed October 16, 2023. https://www.who.int/publications/i/item/microplanning-for-immunization-service-delivery-using-the-reaching-every-district-(-red)-strategy.