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A baseline study on biometrically verifying malaria vaccine delivery and strengthening routine immunisation data systems

AUGUST 2024

Executive summary

Simprints is a not-for-profit organisation that builds biometric technology to increase transparency and effectiveness in global development, ensuring that every vaccine, every dollar and every public good reaches the people who need them most.

Operating in Ghana since 2021, Simprints has been implementing a project to track routine immunisation with biometrics in maternal and child health services, in partnership with the Ghana Health Service (GHS), with the direct support of GAVI. This project aimed at preparing biometric technology for vaccine delivery at scale. After a successful initial implementation phase, the project is set to be rolled out at scale in the Eastern and Oti regions of Ghana, targeting 586 health facilities, benefitting over 350,000 children up to the age of two.

Simprints will provide devices to each facility and will train two to three Community Health Workers (CHWs) per facility, covering about 1,758 CHWs. Simprints will also support generating a community population register and sensitise communities to the benefits of using the technology, generate real-time data on children who missed their vaccine doses for CHWs, and send voice messages to caregivers of those who missed an appointment.

As a benchmark for assessing change, a baseline study was conducted by Simprints, in collaboration with consultants from the University of Ghana, measuring indicators of the project prior to the scale up. Key areas the study covered, to inform implementation and guide impact measurement at endline, included: immunisation coverage measurement, data quality, knowledge and acceptance of biometrics among community health workers, community members and community stakeholders.

Study objectives

- Determine routine immunisation (including malaria) vaccine coverage rates among children under two years of age.
- Determine children with vaccination cards, and triangulate vaccination status survey data with health facility records.
- Determine data quality including accuracy, completeness, timeliness and data consistency.
- Measure whether community members accept the technology and know the benefits of biometrics. Identify any concerns or hesitations that need to be addressed.
- Assess CHW knowledge and attitudes towards digital tools, including biometrics and the e-tracker. For already trained CHWs, measure their motivation to adopt digital tools.
- Assess the time taken by new and old clients to complete immunisation sessions during Child Welfare Clinics (CWCs).
- Measure the potential for scaling the project to over 350,000 children and 586 facilities from the perspective of CHWs, communities, and health stakeholders.

The study design was cross-sectional, with a mixed-methods approach, using a multistage stratified sampling technique. Multiple data collection methods were applied to address the study's specific objectives, including a quantitative survey with 1,114 household interviews, community member surveys with 1,000 participants, and community health worker surveys covering 398 participants. The qualitative methods included in-depth interviews (with 57 male and 106 female participants) and focus group discussions (FGDs) consisting of 11 FGDs with 9 male and 68 female participants. Additionally, record review and data extraction were conducted for data quality assessments, while observations were carried out to measure the time spent by new and old clients visiting the child welfare clinic for Immunisation services.

Immunisation coverage

From the 1,147 caregivers of children 24-35 months of age interviewed, full vaccination coverage (received all doses) for all antigens (excluding hepatitis B) was 18.7%, with higher rates in rural (19.7%) than in urban areas (17.4%). Oti region had a higher coverage, of 22.7%, than the Eastern region at 16.7%. For basic antigens (doses received within the first year), coverage was 78.8% overall, 82.4% in rural and 74.4% in urban areas. The Oti region had higher coverage (85.3%) than the Eastern region (75.6%). According to the national schedule, 55.6% of children received full vaccination, with higher rates in rural (58.1%) than in urban areas (52.5%). **Malaria antigen (exclusive for the Oti region) coverage was 62.7% and 55.1% for MV1 and MV4 respectively.**

Immunisation coverage

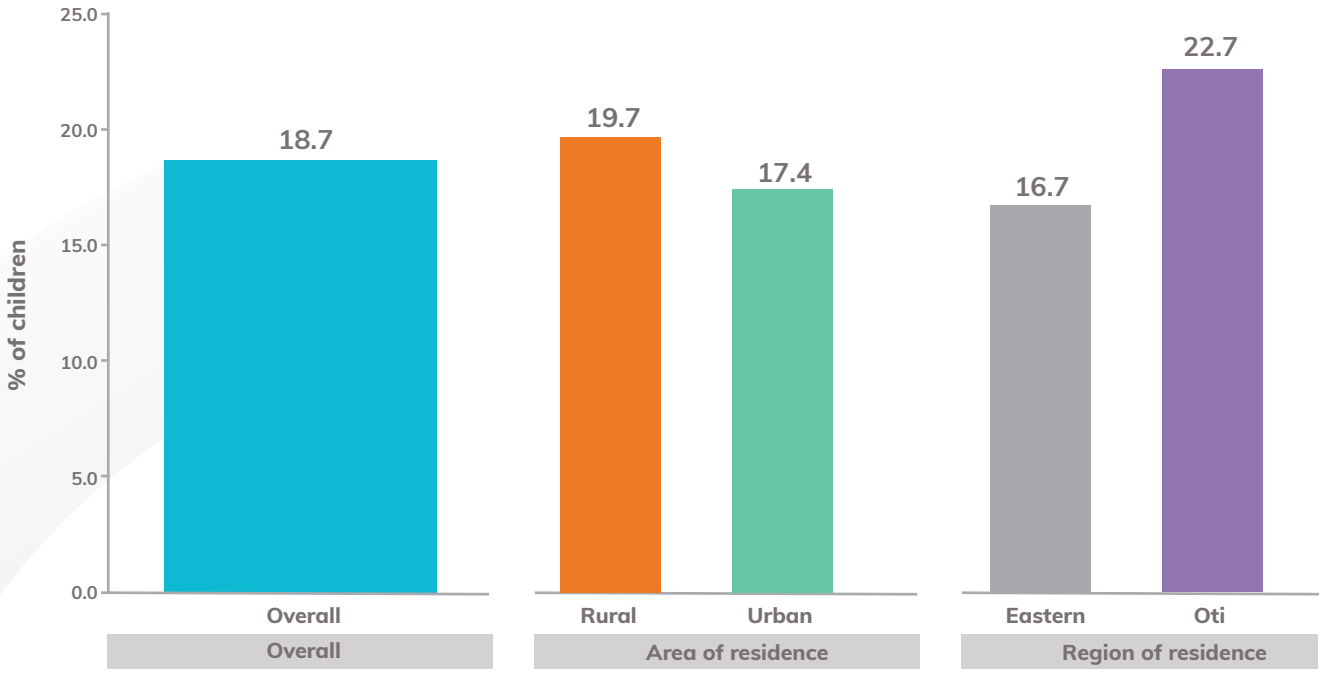

Figure 1: Full vaccination coverage of all antigens among children

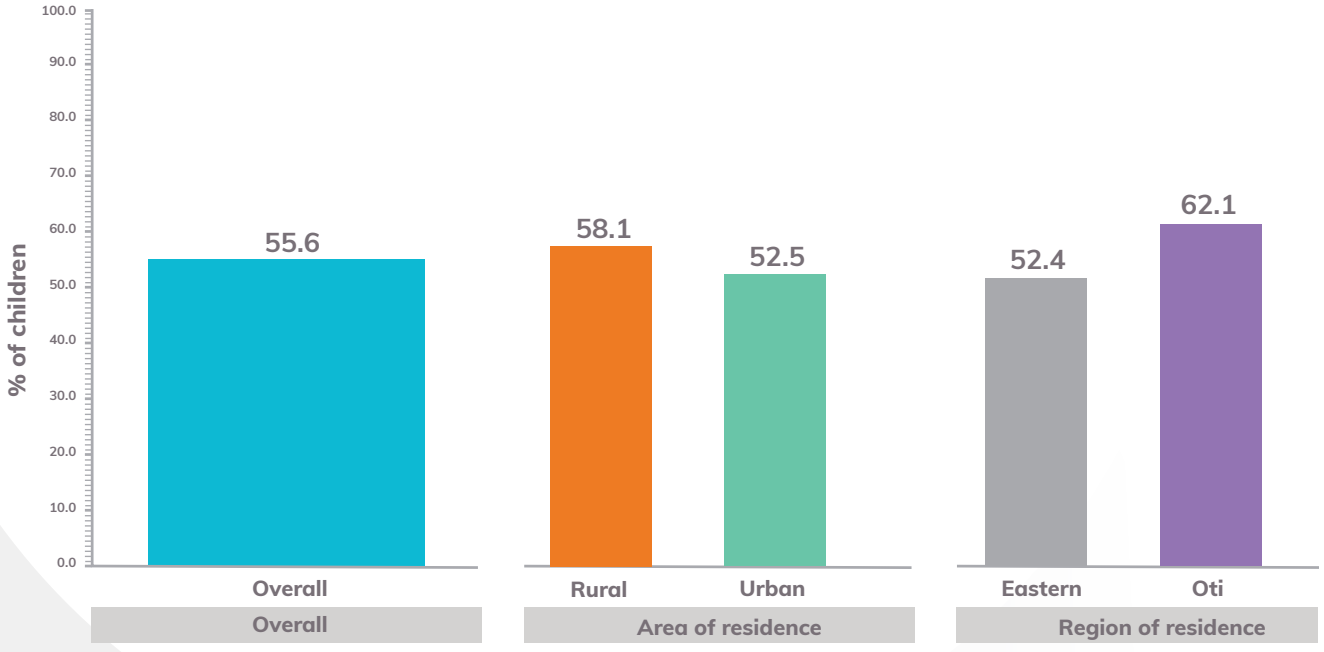

Figure 2: Full vaccination coverage of antigens according to the national schedule among children in the study

Availability of vaccination records

Out of 1,028 vaccination records of children collected from the survey (extracted from their child health record booklet), 545 records (53%) were triangulated with records in the health facility registers (nutrition and child health register) to check for availability. On average, 46% of child records from the child health record booklets were available in the health facility register, with 60% availability in Oti region, and 38% in Eastern. Among the available records, individual vaccine records availability in the register ranged from 23.4% to 94% overall, with OPV1 records having the highest availability. In the Eastern region, record availability ranged from 18.1% to 93%, while in Oti, it ranged from 29.1% to 96.4%. Additionally, 92% of caregivers had the immunisation booklet available, compared to a little over 7% without the immunisation booklets.

Community acceptance

The findings indicated that trust in the health system and consumer trust is positively linked to perceived usefulness and perceived ease of use, implying that enhancing trust in these areas could increase user adoption of biometric identification services. The study also found a positive association between consumer trust, perceived usefulness, perceived ease of use, and behavioural intention. Trust in the health system significantly influences behavioural intention, while perceived usefulness and ease of use predict intention to use the system.

Community members recognised the fundamental role of technology in enhancing efficiency and modernising healthcare delivery. They highlighted the transition from manual methods to digital systems, making patient information more accessible and improving diagnostic accuracy. Real-time updates, advanced diagnostic tools, and efficient data retrieval were noted as key advantages of healthcare technology. While participants had a positive view of the impact of technology on service speed and overall efficiency, concerns were raised about the accuracy of certain tools and the need for reliable electricity and internet access.

Biometric technology, such as fingerprint recognition, was praised for its ability to expedite patient interactions, though privacy and security issues were also acknowledged. Establishing strong security measures and engaging with communities are essential in ensuring the successful integration of biometric technology in healthcare, particularly in child immunisation. Ongoing education, support, and consideration of cultural sensitivities are crucial in fostering acceptance and addressing concerns surrounding the implementation of biometric technology within healthcare systems.

CHW acceptance of biometric technology

The analysis of the Technology Acceptance Model variables revealed perceived usefulness, normative beliefs, security, and perceived ease of use positively influenced behavioural intention among community health workers regarding the biometric identification device. Emphasising the the usefulness of the device and ease of use, is crucial to improve adoption. Social expectations and security concerns also play significant roles in intention to use. Perceived usefulness and ease of use were found to reduce perceived risk, making CHWs more likely to accept the device. This implies that ease of use positively correlates with perceived usefulness, impacting CHW intentions to adopt the device. Addressing privacy concerns can further reduce perceived risks and increase CHW willingness to use the biometric device.

CHW readiness of using biometric technology

CHWs demonstrated familiarity with various digital tools and electronic devices used in health facilities. These tools simplify work by eliminating paperwork and reducing errors, ensuring secure patient data storage. Some CHWs indicated they use e-Tracker, Lightwave Health Information Management System (LHIMS), and Simprints biometric technology to capture data to improve healthcare services. Despite varying digital tool training, benefits include tracking defaulters, teamwork improvement, patient data privacy, and reduced waiting times. Digital tools also improve patient experience through appointment monitoring and follow-ups, streamlining processes and boosting communication among health workers.

Challenges like limited internet and electricity, alongside education needs, may hinder digital tool adoption. Stakeholder involvement and proper training are key. Biometric processes, like fingerprints and facial recognition, offer efficient care provision but face hurdles like network issues and privacy concerns.

Data quality measures

Data quality was assessed to ascertain the level of quality prior to the implementation.

Data accuracy checks, using recounted data from source documents (EPI tally books and Nutrition and Child Health Register), compared to the reported data from the DHIM2 database revealed a general over-reporting in all the three vaccination data – BCG, Penta 3 and MR2 – with a verification factor (a standard measure of vaccination data quality defined as recounted vaccination data / reported vaccination data) of 0.9, 0.8 and 0.7 respectively. Some reasons for this seeming over-reporting were that field data are usually reported on the DHIMS database but not recorded in source documents, and data not being properly captured at point of service.

Data consistency checks of records captured in the child's vaccination booklet and the register at facility level indicated an overall 81% of data consistency. Data completeness checks showed that, completeness of records in the maternal and child health booklet was 86.6%, compared to 67.6% in the facility register. Another completeness check performed was the completeness of facility monthly reports which revealed 98.9% and 99.5% completeness for 2022 and 2023 respectively in the Eastern region, compared to 98.2% in 2022 and 98.7% in 2023 for the Oti region.

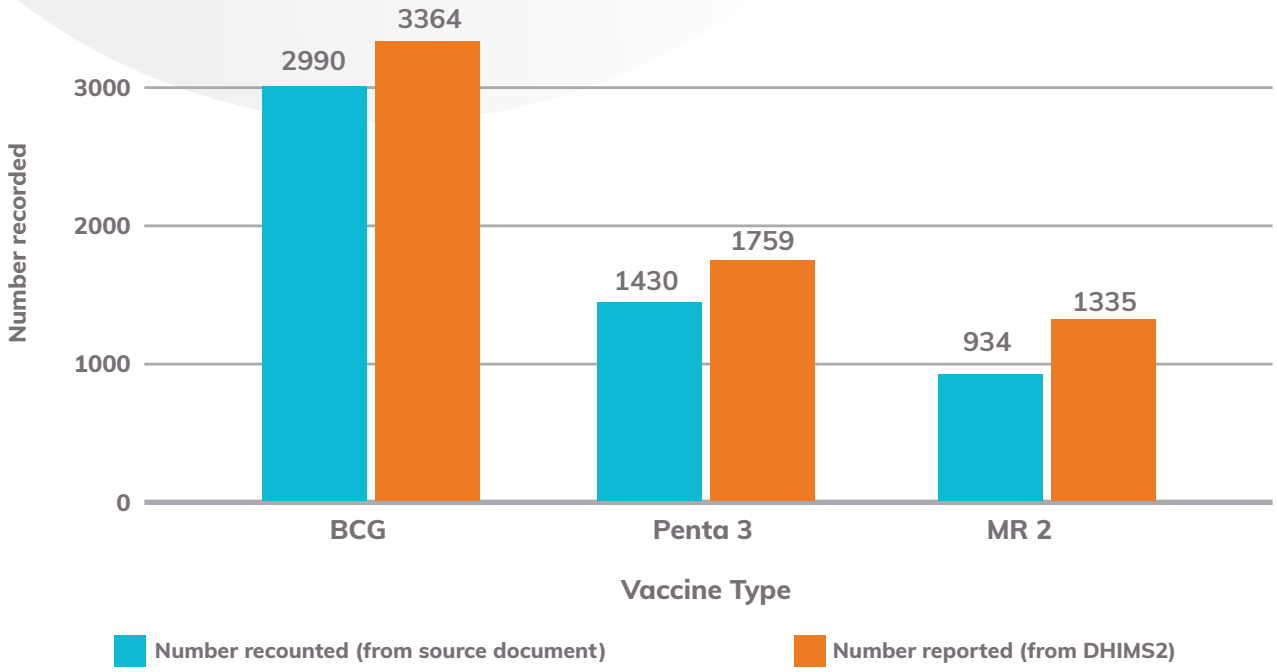

Figure 3: Immunisation data accuracy assessment at Health Facilities

Time taken to complete a Child Welfare Clinic session

Assessment of the time it takes a client to complete a clinic session revealed about 32 minutes for a first-time client to complete the entire visit and 22 minutes for a follow-up client in the Eastern Region. Similarly, a first-time client spends about 23 minutes while a returning client spends approximately 27 minutes in the Oti Region. For facilities that use e-Tracker/biometric, time spent was shorter (17 minutes), compared to 24 minutes (paper-based only) for Eastern Region and 26 minutes for paper-based only for Oti Region.

Recommendations

Key strategies have been proposed, based on the findings, for Simprints to consider during the project implementation:

- Engage all relevant stakeholders in the implementation process, ensuring their buy-in and addressing their concerns. Communicate the benefits of technology and biometrics clearly to facilitate acceptance and effective usage.
- Provide comprehensive training and support to healthcare workers to facilitate the effective use of biometric technology and address any resistance or issues.
- Ensure that privacy and security concerns related to biometric data are addressed through stringent regulations and guidelines. This will help build trust and confidence among users.
- Implement biometric technology at vaccination sites to verify the identity of children, ensuring they receive the correct vaccines and reducing the chances of missed doses, improving efficiency and reducing waiting times.
- Improve communication: focus on clearly communicating how easy it is to use the device, usefulness, and security features to reduce perceived risks and increase adoption among CHWs.

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