



**Geo-enabling microplanning and
delivery of health campaigns and
routine service delivery**



AKROS



THE CHALLENGE: REACHING THE UNREACHED

“Locating rural villages and homes on the ground is challenging... to better deliver services, we need to understand where people live and verify those services have been delivered.”

- District Health Officer, Zambia

- 1 Although reported coverage may be high, true coverage is often actually quite low.^{1,2,3}
- 2 Planning and delivery of campaigns is often impeded by outdated or unavailable population data, and the inability to ensure services actually reach people.
- 3 Good news: technology is providing an opportunity to map populations and settlements using satellite imagery, microplan strategically, and improve delivery.

(1) Mumbengegwi DR, Sturrock H, Hsiang M, et al. Is there a correlation between malaria incidence and IRS coverage in western Zambezi region, Namibia?. *Public Health Action*. 2018;8 [Link](#)

(2) Larsen DA, Borrill L, Patel R, Fregosi L. Reported community-level indoor residual spray coverage from two-stage cluster surveys in sub-Saharan Africa. *Malar J* 17, 93 (2018). [Link](#)

(3) Bridges, D.J., Pollard, D., Winters, A.M. et al. Accuracy and impact of spatial aids based upon satellite enumeration to improve indoor residual spraying spatial coverage. *Malar J* 17, 93 (2018). [Link](#)

(4) Analysis of WHO PCT Databank and Global Health Observatory data (accessed September 2019)

(5) UNICEF. Vaccination and Immunization Statistics 2021 [cited 2021 Aug 25] [Link](#)

(6) WHO, UNICEF. Progress and Challenges with achieving universal immunization coverage. Geneva, Switzerland; 2020 June p 1-25. Report No1. [Link](#)

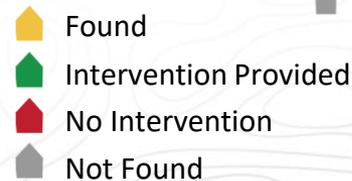
(7) Kainga HW, Ssendagire S, Ssanyu JN, et al. Proportion of children aged 9–59 months reached by the 2017 measles supplementary immunization activity among the children with or without history of measles vaccination in Lilongwe district, Malawi. 2021; PLOS ONE 16(1). [Link](#)

DENOMINATOR CHALLENGE

 80 / 90 = 89% “Reported” coverage

 80 / 140 = 57% “True” coverage

 If houses or people are “not found,” this is a driver for poor coverage and low impact.



END TO END GEO-ENABLED CAMPAIGN PLANNING, DELIVERY AND ANALYSIS

1 MAP & MICROPLAN



*Other Inputs: Google Footprints, DHIS2, WorldPop, Disease Risk Data

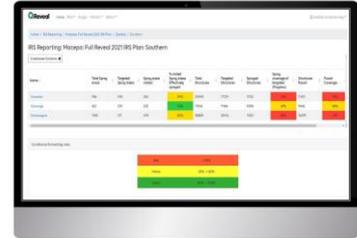
Outcome: Established denominator. Aligned strategy for HR and commodities. Paper based or digital microplanning.

2 NAVIGATE & DELIVER



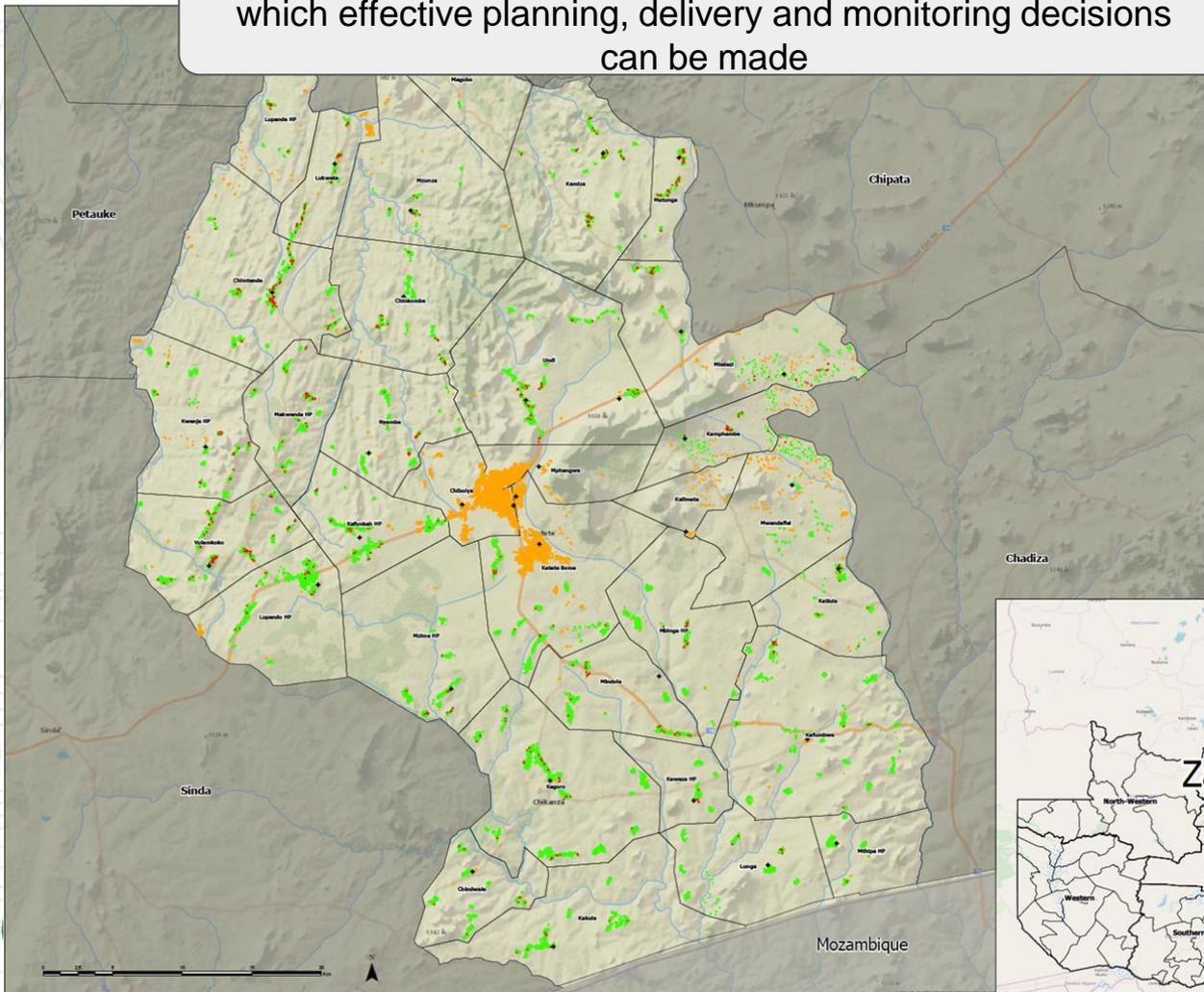
Outcome: Execution of plan. Interventions delivered even to last mile communities.

3 MONITOR & RESPOND



Outcome: Visualize true coverage, data-driven guidance, directed mop-ups. Integrates with DHIS2.

Building strong geospatial disease and population database on which effective planning, delivery and monitoring decisions can be made



Health Facility Catchment Area	Eligible Structures	Sprayed	Revised	Not Visited	IS Coverage
Chibolip	3,770	0	0	3,770	0%
Chiwanda	1,820	1,687	63	78	92%
Chiwanda	1,271	1,278	10	43	99%
Chiwanda	864	818	218	23	95%
Kafue	2,294	2,216	18	44	98%
Kafue	1,414	1,416	2	175	10%
Kafue	3,447	3,207	43	97	98%
Kafue	1,450	1,394	107	48	98%
Kamata	105	0	0	95	0%
Kamata	1,072	1,016	39	19	95%
Kampanzha	414	381	20	14	93%
Katete Boma	3,811	1,835	13	2,183	43%
Katete	299	696	17	42	99%
Kawango NP	411	410	7	4	97%
Kawango NP	1,308	1,275	28	57	98%
Lusaka	796	606	37	138	78%
Lungu	580	970	5	14	98%
Lusaka NP	285	350	76	44	82%
Lusaka NP	2,018	1,717	62	238	72%
Mago	113	94	1	18	83%
Makumbaka NP	1,170	1,121	27	49	99%
Mankwato	614	548	35	15	97%
Mankwato NP	1,151	1,094	14	43	95%
Mankwato	1,294	1,289	28	65	98%
Mphahlele	1,170	0	0	1,170	0%
Mtshani	713	696	27	80	85%
Mtshani NP	741	717	2	22	99%
Mtshani	714	496	2	242	67%
Mtshani NP	1,443	1,262	33	83	98%
Mtshani	415	396	11	43	87%
Nwemba	1,210	1,152	25	39	95%
Nwemba	1,414	1,350	41	36	98%
Nwemba	2,107	2,045	10	48	98%
NATITE TOTAL	43,268	31,811	681	9,318	72%

- Legend**
- Neighbouring Districts
 - Health Facility Catchment Boundaries
 - Health Facilities
 - Rivers
 - Roads
- Structures**
- Visited Sprayed
 - Visited Not Sprayed
 - Not Visited



743 **Reveal** Home Plan Reporting Admin trevlen.bahadur  

Digitized microplanning

Plan Simulation

Hierarchy:

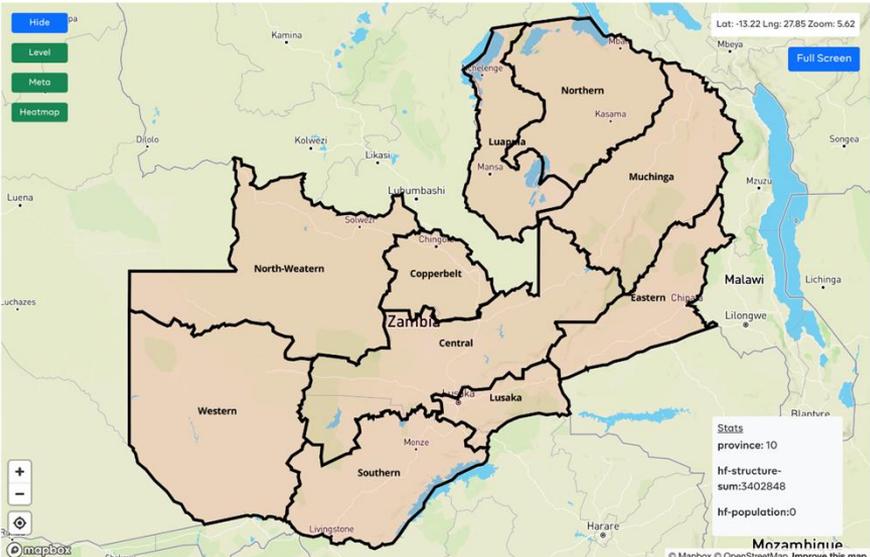
Geographic Level:

Location:

Geographic Level Filter:

Load inactive locations: Select to Load Inactive Locations

Add query attribute



Map controls: Hide, Level, Meta, Heatmap, Full Screen, Stats, province: 10, hf-structure-sum: 3402848, hf-population: 0, Mozambique, © Mapbox © OpenStreetMap. Improve this map

The Microplanning Module in Reveal allows you to:

- Compare campaign targeted areas to available resources (HR, drugs, nets, etc.)
- Strategize how to maximize your impact through geospatial analysis and assess various scenarios through the interface
- Disseminate the final plan to field teams for them to start data collection

Explore population, disease and intervention coverage data by HF or Village. Filter and select highest priority areas that meet campaign resource availability for most effective campaign

Omit Layers: Select to Omit Layers

Hierarchy: default

Filter locations by a Parent Location (Search results will be locations within this parent location)

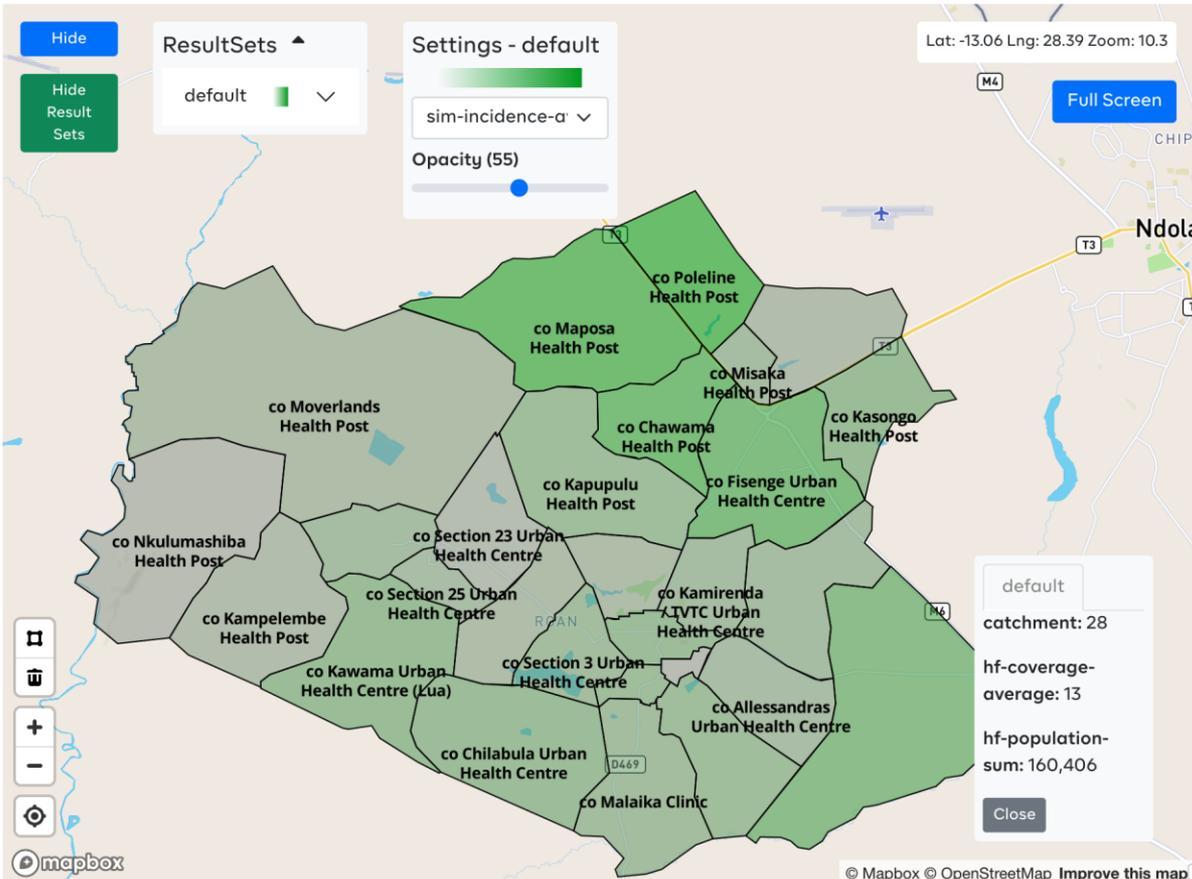
Geographic Level of Parent Location: district

Parent Location: Luanshya

Geographic Level Filter: catchment

Load inactive locations: Select to Load Inactive Locations

Add query attribute



Assign these locations to data collectors (users) you have created during plan setup

Assignments

Assign Plans

Assign Teams (NMEP 2022 IRS Campaign Full)

Hide Map

Assign Locations | Assign Teams: 6652

Save

Assign Locations Assign Teams Assignment Summary

Location	Geography Level	Assign teams
> Zambia (3)	country	<ul style="list-style-type: none"> Macepa Team x Chisanga Team x Siabbamba Team x Nkeyema D Team x Sinafala Team x Sompani Team x Chipepo Team x Chabbobboma Team x Gwembe Team x Mungumbwe Team x Lukonde Team x Makuju Team x Bbondo Team x Chaamwe Team x Lumbo Team x Ntanga Team x Gulumunyanga Team x Kalelezi Team x Nazikuye Team x Buleyamalima Team x Hamatuba Team x Kaoma D Team x Luampa D Team x Luanshya D Team x GVDC Team x Sinamalima Team x Siameja Team x Maamba hahc Team x Siansowa Team x Sikaneke Team x Kafwambila Team x Siatwinda Team x Sinazeze Team x Chiyabi Team x Sinazongwe Team x Siavonga Team x



ENSURE NO ONE IS MISSED: OFFLINE REAL-TIME INDICATORS

Field teams use Reveal to navigate to targets and capture data about intervention delivery, and to make data driven decisions, in the field. This happens offline ensuring target coverage is achieved first time round instead of wasting resources on expensive 'mop-up' activities.



-  Household not yet visited
-  Received spray
-  Refused spray
-  Ineligible structure

Actions: direct teams to NW quadrant;
provide SBC to areas south of the road





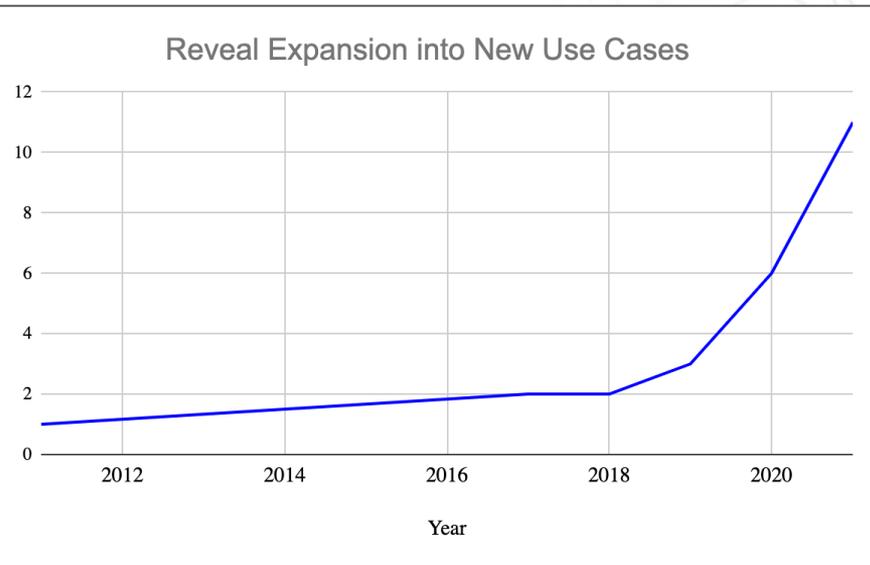
WHAT IS THE IMPACT OF REVEAL?

1. Increased health campaign coverages by 20-30%.¹
2. Reduction in malaria incidence by 15% (comparing IRS alone to IRS +
3. Reveal).²
4. Reduced cost per malaria case averted by 63% (\$118 → \$44).³
4. The ROI associated with the use of Reveal is significant – for every dollar spent, use of Reveal prevents nearly 3 times the number of cases compared to the intervention alone.



1. Larsen et al (2020). Leveraging risk maps of malaria vector abundance to guide control efforts reduces malaria incidence in Eastern Province, Zambia. *Nature Scientific Reports*. 10: 10307 <https://www.nature.com/articles/s41598-020-66968-w>
2. Keating, J., Yukich, J.O., Miller, J.M. et al. Retrospective evaluation of the effectiveness of indoor residual spray with pirimiphos-methyl (Actellic) on malaria transmission in Zambia. *Malar J* 20, 173 (2021). <https://doi.org/10.1186/s12936-021-03710-5>
3. Tropical Health (Josh Yukich). Cost and cost-effectiveness of 3GIRS in sub-Saharan Africa: results of data collection and analysis in the nGenIRS project. January 2019.

REVEAL HAS GROWN INTO NEW COUNTRIES AND USE CASES



Use cases:

- Malaria IRS
- Malaria Mass Drug Administration
- Malaria ITN
- SBC

- Foci Investigation
- NTD Mass Drug Administration
- Seasonal Malaria Chemoprophylaxis
- Immunizations

Opportunity areas:

- Climate
- HIV
- Disaster relief

REVEAL & INDOOR RESIDUAL SPRAY (IRS)

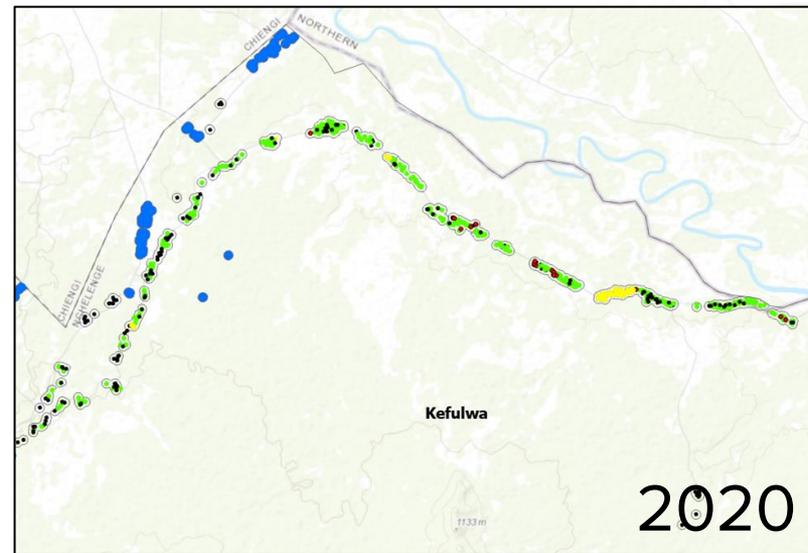
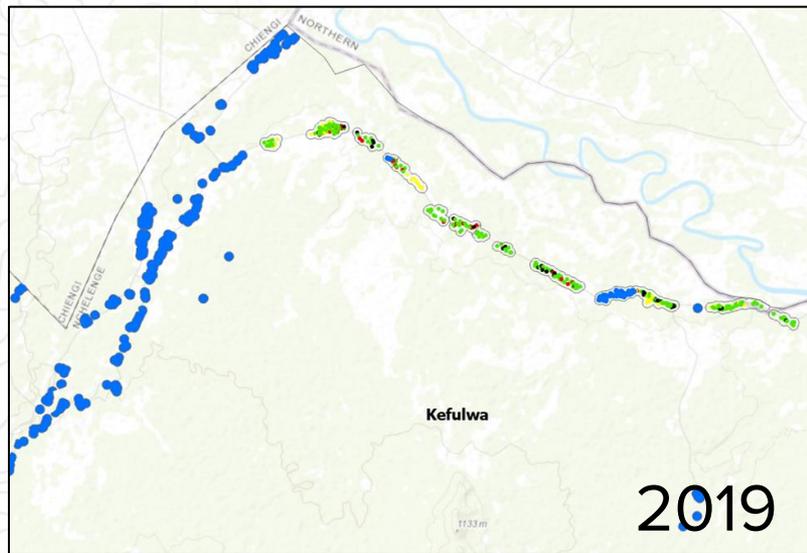
Where:	Angola, Zambia, Namibia, Senegal
What:	Use of paper and digital maps for microplanning. IRS teams use in-field monitoring and mop-up functionality within Reveal.
Results:	<ul style="list-style-type: none"> ● Improved understanding of gaps in campaign delivery. ● Increased IRS coverages by 20-30%. ² ● Reduction in malaria incidence by 15% (comparing IRS alone to IRS + Reveal) ² ● Reduced cost per malaria case averted by 63% (\$118 → \$44) ³
Next:	<ul style="list-style-type: none"> ● Deploy combined IRS and ITN planning and targeting approach. ● Scale integration of GRID3 data products with Reveal ● Scale Reveal to additional PMI and Global Fund countries for IRS ● Digitized macro and microplanning process to improve data use for critical resource planning



1. Larsen et al (2020). Leveraging risk maps of malaria vector abundance to guide control efforts reduces malaria incidence in Eastern Province, Zambia. Nature Scientific Reports. 10: <https://www.nature.com/articles/s41598-020-66968-w>
2. Center for Applied Malaria Research at Tulane University. Retrospective Evaluation of the Effectiveness of Indoor Residual Spray with Pirmiphos-Methyl (Actellic) on Malaria Transmission in Zambia. January 2017.
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SPRAY COVERAGE/SUCCESS IN 2019 (82.5%) VS. 2020 (93.3%)



- Kefulwa, previously unreachable areas - it was believed very few houses were located here
- However, Reveal maps were created in 2019 showed these unreachable areas
- In 2020, IRS was deployed to effectively reach those areas
- Structures in this rural, hard-to-reach, inland area now “green” indicating that they received spray

REVEAL & FOCI INVESTIGATION

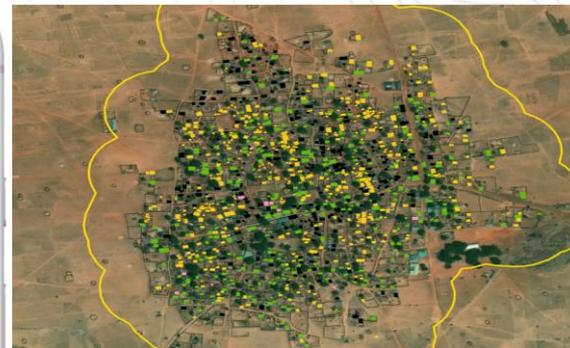
Where:	Thailand
What:	Reveal is now the primary platform to conduct foci investigation in Thailand. Reveal is aligned to Thailand's geographic focus areas, is integrated with the country case management system, and supports delivery of larvae collection, entomological studies, reactive case detection, delivery of LLINs and IRS. ¹ Initial pilot, 3 provinces: Ubon Rachithani, Tak, and Trat.
Results:	<ul style="list-style-type: none"> • Decreased time lag between reporting and data usability from two days to two hours • Increased the spatial resolution from the focus down to the household and individual • Significantly increased the visibility of the drivers of transmission and programmatic coverage of the different elimination activities within each focus
Next:	Expand foci investigation support to other countries within the Asia Pacific Malaria Elimination Network



WHO GIS CENTRE FOR HEALTH SUCCESS STORY:
<https://shorturl.at/qRTX0>

REVEAL & SEASONAL MALARIA CHEMOPROPHYLAXIS (SMC)

Where:	Nigeria
What:	Planning and delivery of SMC, monthly doses of antimalarial drugs to children during peak malaria season. Coordinate community drug distributors' (CDDs) field movements. Monitor real time coverage of SMC.
Results:	<ul style="list-style-type: none">• Usability testing and live-fire field testing in (2020/2021) showed usefulness, efficiency and learnability of the Reveal platform across health facilities in Sokoto State, Nigeria.• Challenges were overcome (updated server syncing times from hours to minutes). Upgraded dashboards. Proof of concept achieved and strong user experience.• Significant Improvements of visitation and distribution coverage from Cycle 1 to Cycle 3.
Next:	Mature the platform's data model in order to streamline data processing and persistence, which are key to long-term scalability and interoperability.



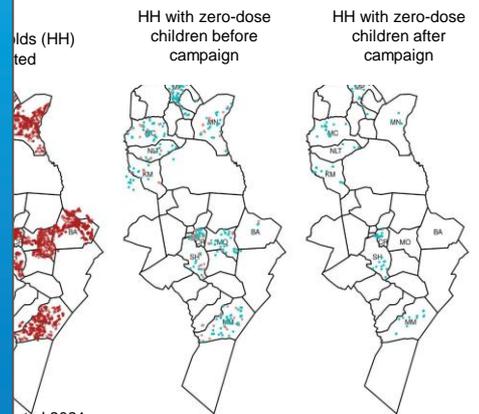
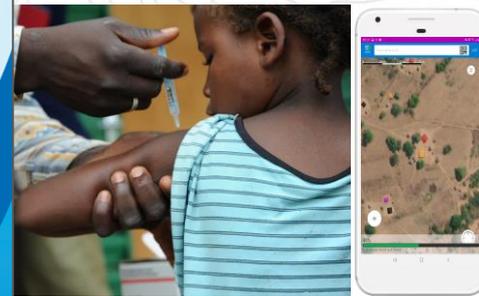
REVEAL & IM



Where:	Zambia
What:	<p>Reveal was used to identify whether these children were vaccinated:</p> <ol style="list-style-type: none"> (1) Pre-registration (2) Post-campaign (3) JHU has used GIS to identify high-risk locations (4) Initial pilot <p>Initial pilot vaccination campaign</p>
Results:	<ul style="list-style-type: none"> • 26% of measles children were vaccinated during the campaign.¹ • Of those zero-dose children, 26% were vaccinated during the campaign. • Tangible opportunity for targeted vaccination through sub-district level
Next:	Support targeted vaccination campaign

GIS mapping: A promising approach to identifying and reaching zero-dose children in Zambia

A CASE STUDY



et al 2021



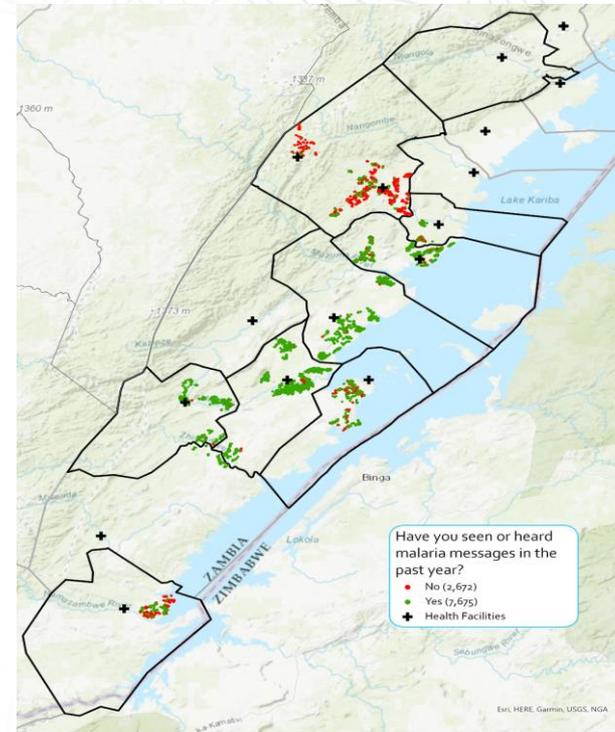
> [BMJ Glob Health. 2021 Dec;6\(12\):e007479. doi: 10.1136/bmjgh-2021-007479.](https://doi.org/10.1136/bmjgh-2021-007479)

Using geospatial models to map zero-dose children: factors associated with zero-dose vaccination status before and after a mass measles and rubella vaccination campaign in Southern province, Zambia

Rohan Arambepola ¹, Yangyuei Yang ², Kyle Hutchinson ³, Francis Dien Mwanza ⁴, Julie Ann Doherty ³, Frazer Bwalya ³, Phillimon Nduhane ⁵, Gloria Musukwa ⁶, William John Moses ¹, Amy Wesolowski ¹, Simon Mutembo ⁷

REVEAL & SOCIAL BEHAVIOR CHANGE (SBC)

Where:	Zambia
What:	SBC questions were used within Reveal to assess the level of awareness of malaria messages, the type of messages received, and preferred communication channels of communities. Health service delivery gaps were exposed and application of this platform for data driven approach to target SBC activities.
Results:	<ul style="list-style-type: none">● During an IRS campaign, SBC was successfully captured simultaneously from houses visited● Localized gaps in malaria messaging were described● Proof of concept established, future implementations could use this approach to then provide targeted messaging.
Next:	Continue to understand SBC gaps during other health campaigns. Provide Reveal for field teams to distribute SBC materials to fill gaps in a targeted manner.





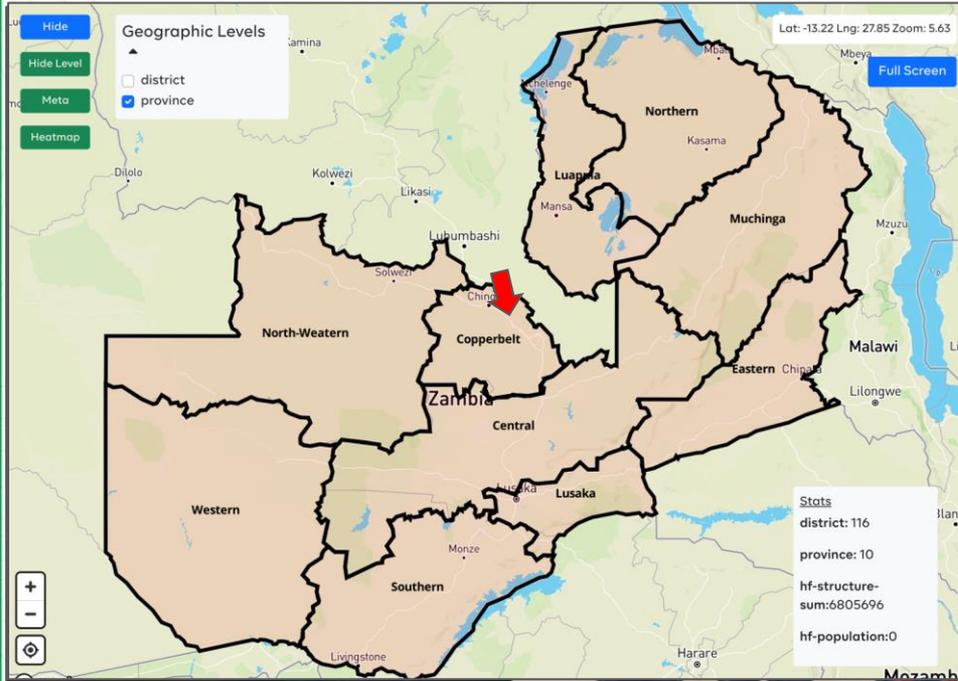
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DEMO SCENARIO



- I am the Luanshya district level manager tasked to deploy the IRS the campaign
- The national program has allotted me resources to spray only 10,000 structures
- I have 5 spray teams available for the campaign
- I must select the health facility catchments where I will target the campaign
- I must deploy the 5 spray teams to conduct the IRS campaign

Selection criteria for target areas:

1. Low intervention coverage in previous years
2. High incidence
3. High population

Demo



WHAT ARE GOVERNMENTS SAYING ABOUT REVEAL?



"I am convinced that this is a great resource especially with a global emphasis on real time data for decision making, targeting of interventions, and best use of resources."

Dr. Elizabeth Chizema
*RBM Partnership Board and ALMA's End
Malaria Council Secretariat Officer*

The Reveal pilot projects in Nigeria have resulted in the development of a tool that **adds substantial value to SMC campaigns**. In particular, we are **interested in its geospatial functionality, which could transform SMC campaign planning and coordination**. We are also excited about the role a geospatial tool could play in ensuring that hard-to-reach and vulnerable populations can benefit from this life-saving intervention.



"With traditional IRS, what happens is we just go and spray in the field and there's no direction or efficiency in the way we're spraying. Sometimes we may count numbers and say "okay, we've sprayed so many structures" but if you look at the density in the catchment areas where we've sprayed -- if you don't hit about 90% of the structure, you won't know without Reveal because that means is you'd be leaving out a lot of the structures, which would not accord much protection to the households as a whole."

Dr. Adamson Ndolovu
Katete District Health Director, Zambia



"We know that there is no cheating this program, we know that that structure has really been sprayed. No one can really cheat. There is nothing like falsifying the data. The data which is coming from the program is the correct data. It helps us with making decisions."

Jerry Maambo
IRS Manager, Katete District, Zambia

November 2019

Does Reveal require a license?

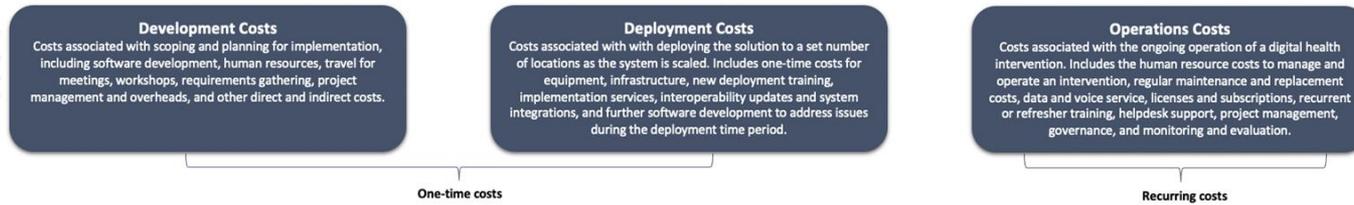
NO. There is no license or fees to continue to use Reveal.
Reveal is open source.

Source code:

Reveal source code is readily available here:

<https://github.com/akrosinc>

What are the cost drivers?



- Mobile devices → Individual CDD/CHW or Supervisor model; BYOD an option
- Training →
 - Master training (3 days national level)
 - Validation meeting (Test prior to campaign)
 - TOT for local teams (2 days)
 - Cascade training to community level (1 day)
- Local support staff → Not full time positions, use existing capacity, or build capacity over time
 - Reveal Program Coordinator
 - GIS Capacity*
 - DevOps*
 - Software*

What is the Reveal Stack?

- Java Spring
- Android Mobile Client
- React JS
- PostgreSQL
- Apache Kafka
- Apache Spark
- Elasticsearch

What hardware is required for the Reveal mobile application?

Hardware:

- The platform is Android-based and can be used on smartphones or tablets.
- Reveal cannot be used on feature (“dumb”) phones.

Cost:

The cost depends on how many people will use the mobile application and which device.

- Household data collection: every CDD/CHW will need a device.
- Health facility-level data collection: CDD/CHW supervisors need a device.

Here are examples of hardware used in Reveal campaigns:

- Galaxy A03 Core phones
*used in Kenya
- Samsung Galaxy A30
- Samsung S6
- Samsung Galaxy Tab A
- Samsung Galaxy Tab 3
- Techno DroidPad 7D ProLTE
- Tecno Camon 15
- Mara phone X1

What is the integration capacity of Reveal with 3rd party products?

Reveal can integrate with 3rd party products via the use of an API.

- Integration could include just the microplanning module, or the full end to end workflow.
- The roadmap includes an integration mapping tool to allow mapping between different DHIS2 instances, but this plan is not yet funded.

awinters@akros.com

Thank you!

www.akros.com

www.revealprecision.com

