Utilizing Open Street Map and QGIS for Malaria Interventions

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Background

Despite being 100% preventable and curable, approximately 600,000 people across the world still die of malaria annually. 90% of these deaths occur in Sub-Saharan Africa and the majority are children under the age of five; making the eradication of malaria both moral and public health priorities for the global community[1].

Unlike many other African countries, Botswana is at a Malaria Elimination Stage, characterized by less than 1 case per 1000 people at risk[2]. The country's instrumental successes between 2000 and 2011 are attributed to rigorous malaria control strategies deployed by the Ministry of Health and the National Malaria Program with a focus on vector (mosquito) control through the application of an insecticide to the interior of homes, also known as Indoor-residual spraying (IRS)[3].

As the number of malaria-related cases lowers, the importance of surveillance rises (i.e. tracking, classification and mapping of individual cases, tracing potential malaria contacts, monitoring of vector control interventions such as IRS and mass distribution of long-lasting insecticide treated nets, etc.) which allows for targeted and localized strategic interventions[2]. In order for this to be achieved, a detailed, updated base map is required. Such maps do not exist for the majority of the country, especially for the rural villages most affected by malaria. As a result, the National Malaria Program, along with its technical partner, the WHO, have identified the need for case mapping and geographical reconnaissance as objectives in order to achieve the national goal to achieve zero local transmission in Botswana by 2018[3].

US Peace Corps Volunteer (PCV) Theresa Govert saw an opportunity to eliminate costs and facilitate the creation of detailed maps by utilizing OpenStreetMap (OSM) to crowdsource the task. She created a call to action for people in the United States to "Map My Village" (https://www.youtube.com/watch?v=dIaPD0FmeOg) With support from the Peace Corps Office of Innovation, utilizing the Humanitarian OSM Team (HOT) tasking manager, they mobilized people to create an OSM base layer for all 10 villages in Chobe District. Summarized below is one of the many potential applications for these maps as a tool in the eradication of malaria.

Intro- IRS Campaign Evaluation 2014- Kachikau, Chobe District, Botswana

This survey, conducted in early January 2015, demonstrates the simplicity and reproducibility of such projects. Two PCVs Mike Banfield and Theresa Govert, set out to map a village in Chobe West to determine the IRS coverage. With minimal resources, the project determined overall IRS coverage as well as reported reasons houses were not sprayed.

Methodology

Two teams covered the village in two days: January 14-15th. The teams consisted of one PCV and three unpaid volunteers from the clinic. The total man hours required for the project was 38. Teams used a Garmin eTrex GPS device to complete a simple survey to determine whether structures were sprayed and the reason if not. Every household in the village was visited. Paper forms were entered into Microsoft Excel and validated by another volunteer. QGIS was used to represent the results geographically. The 'Sprayed Structures' layer was overlaid on an OpenStreetMap layer.

Results

Of the 477 structures on which the volunteers were able to gather data, 61.4% of these were sprayed in the 2014 IRS campaign. The reasons for houses not being sprayed are presented in *Table 1*. Of the 184 structures reported not sprayed, 144 provided reasons. *Image 1* represents the geographical coverage of the spray efforts.

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[1] *World Malaria Report 2014*. World Health Organization. 2014

[2] *Disease Surveillance for Malaria Elimination: An Operational Manual*. 2012. World Health Organization

[3] *Updated Malaria Strategic Plan 2010-2018*. Botswana Ministry of Health. 2014

Table 1

Reason	Count	% of Unsprayed Structures
Missed Opportunity (Absent)	85	46.2
Refusal	49	26.6
Other	10	5.4
No Reported Reason	40	21.7
Total	184	100

Map 1
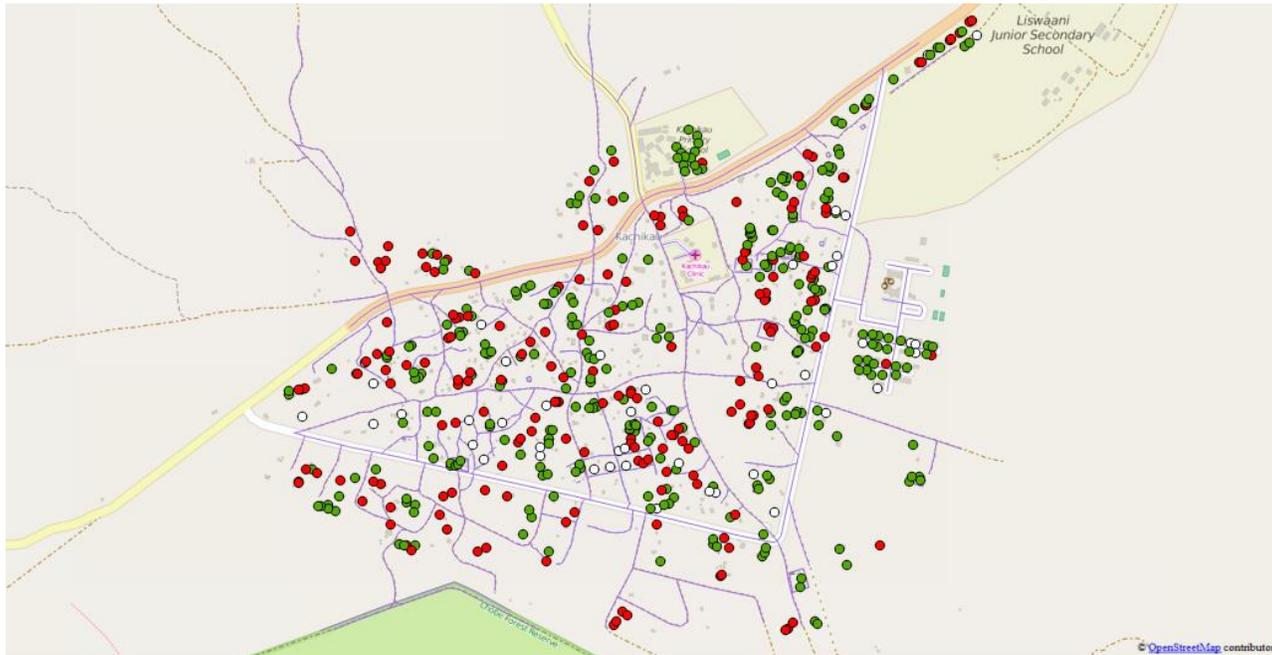
Discussion

The majority of responses for unsprayed houses dealt with an absence when the spray team visited. With a revisit to the 85 missed opportunities, the IRS coverage of the sample size could approach 80%, the minimum recommended coverage for IRS programs to achieve efficacy[4]. The slight increase in expenditure would result in a greater overall return on investment. During the visit by the IRS team, the majority of the village was attending an event at the kgotla. This can be observed in *Map 1*. The east-side of the village has a greater concentration of Red dots (unsprayed structures) as a result.

Conclusions

This project demonstrates that mapping IRS efforts can be simple and affordable. This demonstration used paper forms but the project could be made even easier using tablet-based surveys, removing the need for data entry later-on. With minimal training and logistical support from the National Malaria Program and the local District Health Management Teams, scale-up to a district level would be possible. This survey could be easily conducted with no additional staff or funding at the time of the actual IRS campaign.

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[4] *Indoor Residual Spraying: Use of indoor residual spraying for scaling up global malaria control and elimination*. 2006. Global Malaria Programme. WHO Position Statement.