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The Impact of Shifting IRS Operations on Malaria Transmission Rates in Northern Ghana: 2014 - 2016

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Introduction

Since the beginning of indoor Residual Spraying (IRS) operations in Ghana, changes in active ingredient, as well as other logistical considerations, contributed to some shifts in operations and changes in the IRS status of several districts in the north of Ghana between 2014 and 2016. These changes allowed for observational study to better describe the public health impact of IRS with a third generation IRS (3GIRS)[a] product with a particular focus on the impact of shifting active ingredients and introducing IRS into previously unsprayed districts in the Upper East and Upper West Regions of Ghana.

[a] A 3GIRS product is one that is effective against pyrethroid resistant mosquitos and has a minimum residual efficacy of six months.

Study Location

IRS operations in Upper East and Upper West Regions were lead by AGAMal Limited.

Table 1. The IRS Implementation Landscape in Upper West and Upper East, 2014 – 2017.

	Region	District	2014	2015	2016	2017
AGAMal	UPPER EAST	Builsa	p	x	x	p
		Bolgatanga	p	x	x	x
		Kassena Nankana *	p	x	x	p
		Talensi Nabdam	p	x	x	x
		Bawku West	p	x	x	x
		Bongo	p	x	x	x
		Bawku Municipal	p	x	x	x
		Garu Tempane	p	x	x	x

	Region	District	2014	2015	2016	2017
AGAMal	UPPER WEST	Wa West	x	p	p	p
		Wa Municipal	x	p	p	p
		Wa East	p	p	p	p
		Sissala West	p	p	p	p
		Nadowli	x	p	p	p
		Jirapa - Lambussie	x	p	p	p
		Lawra	x	p	p	p
		Sissala East	p	p	p	p

p OP-pirimiphos-methyl

Upper East – In 2014, IRS was implemented in all districts of the Upper East region. However, operations were suspended in 2015 and 2016.

Upper West – In 2014 3 of 8 districts benefitted from IRS. In 2015 and 2016, operations were expanded to the full region.

Approach

For this analysis, we conducted a set of observational time-series analyses retrospectively on 5,617,962 cases of suspected malaria reported in the national District Health Information Management System II (DHIMS2) from January 2014 to February 2017. The following data sets were compiled, cleaned and analyzed:

- 806 monthly reports from 13 districts in Upper East Region (4,099,377 suspected cases)
- 658 monthly reports from 11 districts in Upper West Region (1,518,585 suspected cases)
- Cases represent suspected malaria with fever seeking treatment
- District population estimates from the most recent Ghana Statistical Service 2010 Census Report
- District suspected-case incidence rates were stratified by district IRS status for comparative analyses

Routine, epidemiological data from the DHIMS2 allow for the calculation of monthly malaria Rapid Diagnostic Test (RDT)-positive rates at the district level across the three districts of northernmost Ghana.

Upper East Results: 2014 IRS campaign followed by a drop in suspected cases

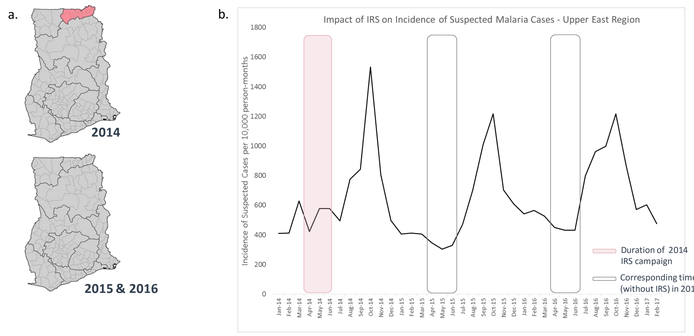

Fig 1. Impact of the changing IRS landscape in Upper East Region from 2014 to 2016. (a) In 2014, all districts in UE were sprayed with Actellic 300CS, while none were sprayed in 2015 or 2016. (b) Monthly incidence of suspected malaria cases recorded from UE in the District Health Information Management System 2 from 2014 to 2016. The 2014 IRS campaign is indicated, as are the corresponding periods form 2015 and 2016 in which IRS would have likely been scheduled.

In Upper East, district level analysis of monthly reporting trends from 2014, when Actellic 300CS was sprayed, show a clear reduction in the incidence of suspected malaria cases during June and July - the months that immediately followed the IRS campaign. There is no corresponding dip in the incidence curves from any month in 2015 or 2016, years in which IRS operations were suspended in the region.

Upper West Results: Expanding IRS operations in 2015

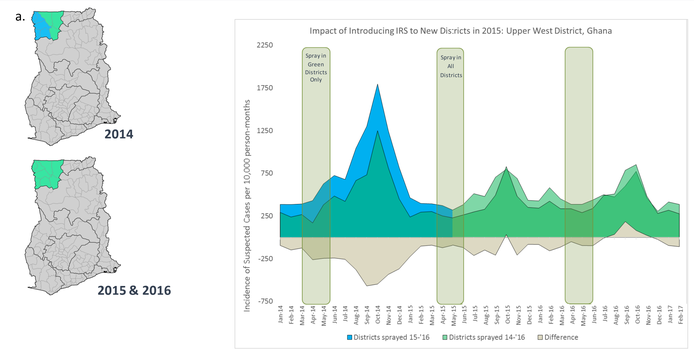

Fig 2. Impact of the changing IRS landscape in Upper West Region from 2014 to 2016. (a) In 2014,the districts shown in green were sprayed with Actellic 300CS, while districts in blue received no IRS. In 2015 and 2016, IRS operations expanded to include all the districts in UW Region. (b) Monthly incidence of suspected malaria cases recorded from UW in the District Health Information Management System 2 from 2014 to 2016. The duration of the IRS campaigns are also indicated, as is the difference in incidence among the two groups of districts (tan curve).

In Upper West, district level analysis of monthly reporting trends from 2014 show that districts where Actellic 300CS was sprayed had 2400 fewer cases per 10,000 person-months at risk than in the districts with no IRS in the 6 months that followed spraying (represented by the area of the tan curve). In 2015 and 2016, when IRS was expanded to all districts in the region, this difference disappeared and incidence rates were equivalent across the districts by 2016,

Conclusion

These preliminary time-series analyses show clear correlations in time and space with the indoor residual spraying of a 3GIRS product and reduced incidence of suspected malaria cases from routine surveillance systems in the northern Ghana, where pyrethroid resistance is widely reported. Further work will attempt to disaggregate epidemiological surveillance data to sub-district levels and align results with entomological surveillance and expanded ecological datasets to allow for more robust analyses.

Project Partners

*The NgenIRS (Next Generation IRS) project is a partnership, led by IVCC, that includes the US President's Malaria Initiative, Abt Associates, and PATH. NgenIRS works in close collaboration with leading insecticide manufacturers, national malaria control programs, the Global Fund, and other stakeholders to save lives and protect health by reducing transmission of malaria through affordable indoor residual spraying of long lasting, non-pyrethroid insecticides. It is funded by UNITAID. For more information please visit www.ngenirs.com or email David McGuire (david.mcguire@ivcc.com).