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POLICY BRIEF

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Tonny Odokonyero, Gemma Ahaibwe, Moses Kirigwajjo, Freddie Ssengooba

Financing Indoor Residual Spraying in Uganda: Cost-cutting options

Executive Statement

Renewed interest in large-scale Indoor Residual Spraying (IRS) as a major component of malaria control efforts is evidenced in the government plan to roll out IRS to 55 malaria-endemic districts, by 2020. However, progress towards the expansion of IRS beyond a few highly endemic districts has been dismal. The slow progress is primarily attributed to the perceived high cost of a sizable IRS program versus other vector control methods such as Long Lasting Insecticide Treated Nets (LLINS). There has also been a dearth of evidence on the actual cost of a country-wide roll-out of IRS by implementation modality.

To fill the aforementioned evidence gap, this brief documents requisite financial resources for funding country-wide, as well as the phased implementation of IRS. Cognizant that the economy is resource-constrained, with competing development priorities and needs, low-cost options for IRS implementation are also explored. The findings show that a total of UGX 235 billion (about 63.5 million US$) is required, to finance country-wide implementation of IRS using a district-led approach. Insecticides take the bulk share – accounting for about 66 percent of the total cost, while the rest are operational costs. The overall cost per structure sprayed and the average cost per person protected is UGX 28,000 (8 US$) and 6,000 shillings (2 US$), respectively. Implementing IRS in a phased manner, starting with most burdened sub-regions requires about 107 billion shillings (29 million US$).

The integrated district-led approach of IRS is associated with the least cost - it is about six times cheaper than the project-led approach. Also, IRS is more cost-effective than LLINs and malaria case management. Accordingly, our findings suggest that more investments in malaria prevention using IRS is a less costly venture for the government to take up and presents cost-saving opportunities in the fight against malaria. The government should utilize existing district Local Government and community-based structures, as well as spray logistics in IRS pilot districts as a basis for minimizing IRS cost. Some of the specific low-cost strategies for policy consideration include use of; existing spray logistics on a rotational basis; Community Health Extension Workers or Village Health Teams, the forces, and idle youth as Spray Operators; incorporating IRS Behavioural Change Communication (BCC) within national immunization day BCC; subsidization or fiscal incentives for manufacturing insecticides domestically.

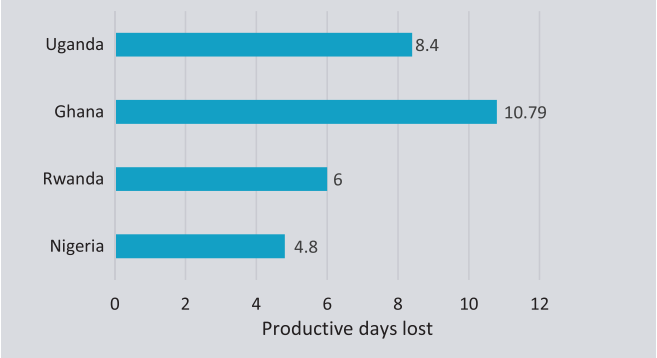
Background

Impact of malaria

Despite being a largely preventable and treatable disease, malaria is responsible for approximately 216 million cases and 445,000 deaths globally (WHO, 2017). Africa alone accounts for almost 90 percent of the global malaria burden, and the progress against malaria on the continent has stalled (ibid). Although Uganda has registered gains in malaria reduction efforts, having reduced the prevalence from 45 to 19 percent in 2014/15 (UBOS, 2015) and cases from 433 to 293 (per 1,000 persons) between 2016/17 and 2017/18 (MoH, 2018); it contributes disproportionately to the malaria burden in Africa. It is the second-highest contributor (17%) of the total estimated malaria cases in East and Southern Africa (WHO, 2017).

Locally, malaria remains the leading cause of mortality and morbidity. It accounts for at least 30% of outpatient visits and 32% of hospital admissions and up to 11% of all hospital deaths (MoH, 2018). With 2,257 thousands of years of life lost due to malaria between 1990 and 2010, malaria accounted for 15 percent of total years of life lost in Uganda over the same period (MoH, 2015). Whilst malaria prevalence is highest among children under five years and pregnant women, majority of the population is at risk since it is endemic in approximately 95 percent of the country, affecting over 90 percent of the population (MoH, 2015). Malaria not only devastates health; it also imposes a substantial economic burden on; individuals through

Figure 1 Productive days lost: 1 episode



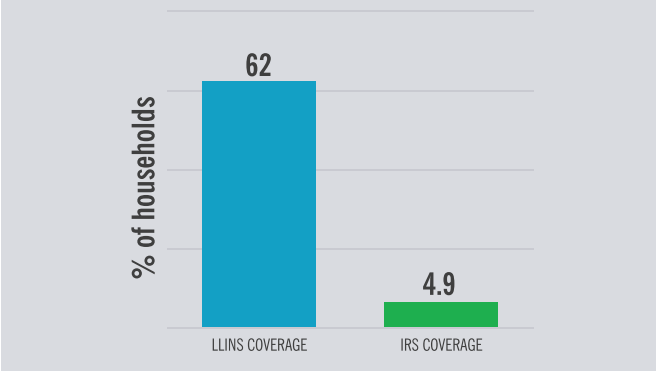
Source: Computed using Okorosobo et al., (2011)

health care costs, and the entire economy through decreased productivity (MoH, 2015). For example, an episode of malaria, is on average, associated with loss of 8.4 productive days in Uganda, 6; 10.79; and 4.8 days in Rwanda, Ghana, and Nigeria respectively (Figures 1 & 2). The socio-economic impact of malaria includes increased out-of-pocket expenditure. These costs are estimated to be between USD 0.41 and USD 3.88 per person per month (equivalent to USD 1.88 and 26 per household). A single occurrence of malaria costs a household, on average, about 3% of yearly earnings (MoH, 2014).

Malaria control interventions

To reduce the burden of malaria, the MoH has intervened through vector control methods - mainly the distribution of LLINs and IRS. However, over the last two decades, the government has promoted the use of LLINs than IRS, as the primary intervention for malaria vector control. This has led to high national coverage for LLINs than IRS (Figure 3).

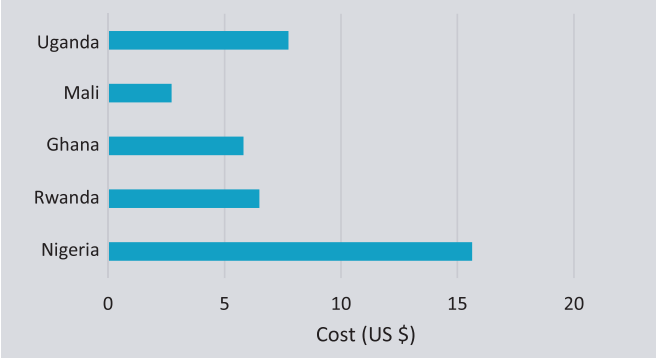
Figure 3 LLIN and IRS coverage



Source: Computed using UDHS 2016

The relative cost of IRS versus the LLINs has in part informed the slow roll out of IRS. Implementing IRS has been perceived to be very expensive based on estimates from project based implementation mechanism (MoH, 2017). However, given the renewed interest in implementing large-scale IRS programs and political commitment towards fighting malaria [His Excellency the President of Uganda recently (2018) launched the "Kick Malaria out of Uganda" campaign under the Mass Action Against Malaria (MAAM) initiative], there is a need to mobilize sufficient resources and identify cost saving delivery channels for IRS

Figure 2 Indirect HH cost: US$



This policy brief, an excerpt from a paper[1] on financing IRS for malaria prevention in Uganda, provides evidence on financing IRS universally or using phased implementation. Specifically, it provides cost estimates for a country-wide roll-out of IRS using a district-led approach of implementation; analyzes cost implications of implementing IRS in a phased manner; identifies cost drivers and cost minimization strategies for implementing IRS; and examines costs under different IRS delivery channels – project-based delivery versus the integrated district model. The data are from the latest Uganda National Household Survey, market price data, and data from IRS pilot districts. Cost estimates are based on pirimiphos-methyl (Actellic – using spray rate of 3 houses per 1.5L or 1500 gram pack), which is an organophosphate insecticide. It is recommended by WHO and successfully tested in IRS pilot districts of Northern Uganda.

Key findings

Spray structures and operation

Overall, there are about 8.5 million structures for spraying. To cover these, an estimated 42,000 Spray Operators (SOPs) are required for 25 days - equivalent to 1.1 million person-days. A total of 3.1 million packs (4.7 billion grammes[2]) of Actellic is needed (including buffer stock) to spray the existing structures, expected to cover about 8.5 million households in the country (Table 1)[3]. This is estimated at a spray coverage rate of 3 households per pack of 1.5 Liters of Actellic. This volume of insecticide if sprayed, will achieve a population coverage of about 39.8 million people. The population coverage ranges between 1.12 million people in Karamoja sub-region to 5.07 million people in Central 1.

Table 1 Insecticide required

	Structures	Insecticide packs	Insecticide volume (Liters)	Insecticide cost	Buffer stock cost (10%)	Total cost (UGX)
Total	**8,468,897**	**3,105,262**	**4,657,893**	**141,148,283,333**	**14,114,828,333**	**155,263,111,667**

Source: Author's computation from UNHS data (2016/17), IRS pilot data (2018)

Financing required for universal IRS coverage

The overall cost estimate of fund required to finance country-wide implementation of IRS is 235 billion shillings (Tables 2 & 3) - approximately 63.5 million US$. This is about 10% of the 2,308.4 billion shillings allocated from the national budget to the health sector in the fiscal year 2018/19. The cost drivers are; human resources (21.4 billions); training (6.7 billions); Behavioural Change Communication - BCC (417 million); spray logistics (42.3 billions); environmental compliance (254 million); transport logistics (589 million); storage – community level (725 million); and insecticide procurement (155.3 billions). The overall cost per structure is 28,000 UGX (about 8 US$) on average (Table 3). The average cost per household and person protected (per capita cost), is 28,000 UGX (8 US$) and 6,000 UGX (2 US$) respectively (Table 3). The costs per structure and per person protected are less than half[4] of the estimated costs incurred through the project-led approach (PMI project) in other countries such as; Rwanda, Ethiopia, and Mali; but the per capita cost is comparable to Mauritius's approach whose IRS programme was very successful to the extent of eliminating malaria, and was mainly driven by the government rather than donor projects.

The share of insecticide procurement is 66% of the total cost (Figure 4A). Thus the most significant cost driver in IRS implementation is insecticides. Given the high insecticide cost, exploring domestic initiatives for insecticide manufacture is compelling; and can be undertaken under the "Buy Uganda Build Uganda" policy. Suppose spray logistics are excluded from operational costs – on assumption of utilization of existing logistics. In that case, the share of operating costs reduces to only 19%; meanwhile, insecticide cost-share substantially increases to 81% (Figure 4B). Insecticide, therefore, takes about 66% - 81% of the total IRS cost depending on the model of implementation.

Cost implication of phased IRS implementation

The latest Uganda Demographic and Health Survey (UDHS 2016) data are used to gauge high burden sub-regions and provide cost implications for informing phased IRS implementation.

The first most burdened sub-regions (malaria prevalence of greater than 60% among children aged 6-59 months) are; Karamoja (69%), Acholi (63%), and Lango (62%). The total amount of financing required, considering these three sub-regions as the first IRS phase, is about 29.5 billion shillings (Table 4). The second most burdened sub-regions are Busoga and Teso. They require financing to the tune of about UGX 32.5 billion. The third most burdened sub-regions comprise Bunyoro, Bukedi, and West Nile. These need funding of about 44.7 billion shillings. Overall, the top three most burdened categories of sub-regions (prevalence of at least 25%) require a total budget of about 106.7 billion shillings (29 million US$). These are the eight top-most burdened sub-regions. This is expected to cover about 3.8 million households and 19.2 million people; at an average cost per structure and person protected of 28,000 and 6,000 shillings respectively.

Table 2 Cost summary by category

Cost category/driver	Cost (UGX)	USD ($)
1. Implementation / Operational		
IRS Human Resources & Supervision	21,429,256,576	
Training	6,651,370,443	
Behavioral Change Communication (BCC)	416,864,000	
Spray logistics	42,322,510,182	
Environmental compliance	253,575,000	
Transport logistics	589,120,000	
Storage – community level	724,500,000	
TOTAL – operational (misc. = 10%)	79,625,915,822	21,520,518
2. Insecticide (buffer = 10%)	155,263,111,667	41,963,003
TOTAL (all)	**234,889,027,489**	**63,483,521**
TOTAL (without spray logistics)	**192,566,517,307**	**52,045,005**

Figure 4A Share of IRS costs - with operational costs including spray logistics

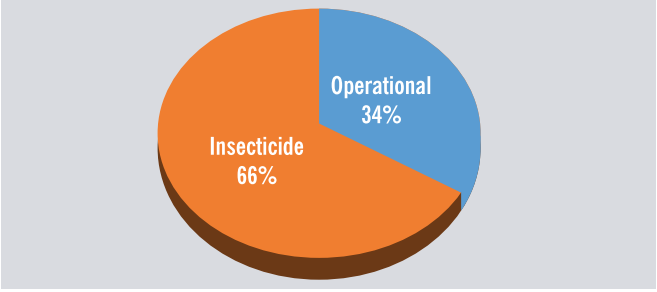
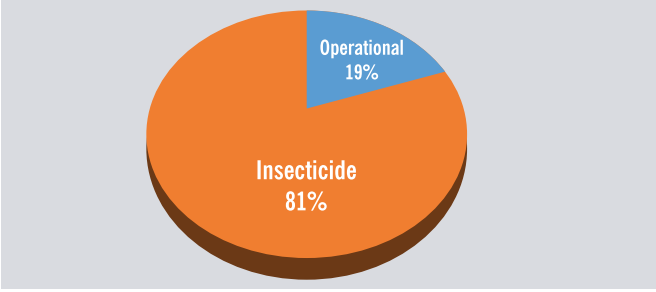


Figure 4A Share of IRS costs - with operational costs excluding spray logistics



Source: Author's computation using UNHS 2016/17 data, IRS pilot data, and market price data 2018

IRS cost reduction strategies and associated costs

IRS pilot evidence reveals that several techniques can be employed to minimize the cost of implementing IRS. This can be done through the integrated district-led IRS approach, that is, by utilizing existing District Local Government and community-based structures. Other cost minimization strategies identified include use of; spray logistics (e.g. pumps, respirators) on a rotational basis; existing health facilities, Village Health Teams (VHTs); elimination of wash persons; and incorporation of IRS BCC into national immunization BCC. Also, the use of locally available resources (e.g. the forces - Uganda Peoples' Defense and Uganda Police; and idle youth) can be explored, as SOPs. Trainees from health-related institutions can as well be incorporated into the IRS programme during practicum sessions for vector control. If such structures and logistics are effectively utilized, then some of the operational cost items can be eliminated, hence lowering the financial resources needed. IRS operating cost can be reduced by 42 – 76 percent depending on the strategy (Table 5).

Table 3 Coverage, and cost statistics by sub-region

Sub-region	Structure	Total operational cost	Insecticide cost	Total cost - All	Household (HH) size	Population	Cost per structure	Per capita cost
Acholi	328,288	3,525,084,880	6,018,613,333	9,543,698,213	5.5	1,805,584	29,071	5,286
Ankole	714,311	6,473,937,024	13,095,701,667	19,569,638,691	4.7	3,357,262	27,397	5,829
Bugishu	424,486	4,263,970,978	7,782,243,333	12,046,214,311	4.8	2,037,533	28,378	5,912
Bukedi	415,768	4,166,567,073	7,622,413,333	11,788,980,406	5.3	2,203,570	28,355	5,350
Bunyoro	514,476	4,892,429,405	9,432,060,000	14,324,489,405	4.7	2,418,037	27,843	5,924
Busoga	798,423	7,106,051,582	14,637,755,000	21,743,806,582	4.9	3,912,273	27,233	5,558
Central1	1,179,173	9,999,332,923	21,618,171,667	31,617,504,590	4.3	5,070,444	26,813	6,236
Central2	958,139	8,322,285,174	17,565,881,667	25,888,166,840	4.5	4,311,626	27,019	6,004
Kampala	460,519	4,423,160,689	8,442,848,333	12,866,009,023	3.7	1,703,920	27,938	7,551
Karamoja	214,677	2,671,280,822	3,935,745,000	6,607,025,822	5.2	1,116,320	30,777	5,919
Kigezi	340,409	3,568,345,851	6,240,831,667	9,809,177,517	4.5	1,531,841	28,816	6,404
Lango	476,566	4,655,360,151	8,737,043,333	13,392,403,484	5.1	2,430,487	28,102	5,510
Teso	373,461	3,880,510,291	6,846,785,000	10,727,295,291	6.1	2,278,112	28,724	4,709
Tooro	592,827	5,513,135,965	10,868,495,000	16,381,630,965	4.8	2,845,570	27,633	5,757
West Nile	677,374	6,164,463,014	12,418,523,333	18,582,986,348	4.5	3,048,183	27,434	6,096
UGANDA	8,468,897	79,625,915,822	155,263,111,667	234,889,027,488	4.7	39,803,816	27,735	5,901

Source: Author's computation using UNHS 2016/17 data, IRS pilot data, and market price data 2018.

Table 4 IRS costs in high burden sub-regions for a phased approach

Sub-region	Prevalence, %	Operational	Insecticide	Total cost - All	Structures	HH size	Population	Cost per structure	Cost per person	% total cost
Acholi	63	3,525,084,880	6,018,613,333	9,543,698,213	328,288	5.5	1,805,584	29,071	5,286	8.94
Bukedi	27	4,166,567,073	7,622,413,333	11,788,980,406	415,768	5.3	2,203,570	28,355	5,350	11.05
Bunyoro	32	4,892,429,405	9,432,060,000	14,324,489,405	514,476	4.7	2,418,037	27,843	5,924	13.42
Busoga	53	7,106,051,582	14,637,755,000	21,743,806,582	798,423	4.9	3,912,273	27,233	5,558	20.38
Karamoja	69	2,671,280,822	3,935,745,000	6,607,025,822	214,677	5.2	1,116,320	30,777	5,919	6.19
Lango	62	4,655,360,151	8,737,043,333	13,392,403,484	476,566	5.1	2,430,487	28,102	5,510	12.55
Teso	52	3,880,510,291	6,846,785,000	10,727,295,291	373,461	6.1	2,278,112	28,724	4,709	10.05
West Nile	25	6,164,463,014	12,418,523,333	18,582,986,348	677,374	4.5	3,048,183	27,434	6,096	17.41
TOTAL	48	37,061,747,217	69,648,938,333	106,710,685,551	3,799,033	5.2	19,212,566	28,442	5,554	100.00

Source: Author's computation using UNHS 2016/17 data, IRS pilot data, UDHS data (2016), and market price data 2018.

Table 5 Cost reduction strategies and related costs

	Strategy	Associated operational cost (UGX Bln)	Reduction in operational cost, %
1.	Status quo of operation (Do nothing)	79.6	0
2.	Use Spray Pumps (SP) on rotational basis (exclude SP as cost item)	46.3	42
3.	Use all Spray Logistics (SL) on rotational basis (exclude SL)	37.3	53
4.	Implement strategy 3, and utilize district & community or health facility stores	36.6	54
5.	Implement strategy 4, and use VHTs/CHEWS as SOPs (exclude SOPs)	25	68
6.	Implement strategy 4, with VHTs/CHEWS facilitated at half of SOP wage	31	61
7.	Implement scenario 4, incorporate IRS BCC into immunization BCC, and do not use Wash Persons	19.3	76

Source: Author's computation using UNHS 2016/17 data, IRS pilot data, and market price data 2018

IRS is a cheaper intervention: comparative costs

Findings show that the IRS is relatively less expensive compared to other interventions. As shown in Table 6, implementing IRS using the project led approach is more costly than using an integrated district-led system by almost six-fold. The district led strategy is thus instrumental as a cost-cutting measure. Use of LLINs per universal coverage costs more than one round of IRS by about 135 billion shillings. However, if LLINs are assumed to last for 2.5 years, then the estimated annual LLINs cost becomes comparable to IRS implementation cost. However, IRS is associated with higher effectiveness than ITNs[5]. IRS is also cheaper than malaria case management (Table 6).

Table 6 Estimated costs under different malaria prevention and treatment options

Strategy	Cost (UGX)	Cost (UGX – Billions)
District Led Approach of IRS (with spray logistics)	234,889,027,489	235
District Led Approach of IRS (without spray logistics)	192,566,517,307	193
Project Approach of IRS	1,258,000,000,000	1,300
Annual cost of case management (treatment)[6] – direct & indirect		
(a) Direct cost	120,798,340,000	121
(b) Indirect cost	467,489,575,800	468
Total costs related to case management	588,287,915,800	588
LLIN (mosquito nets) cost per universal coverage round	370,000,000,000	370
LLIN annual cost – assuming LLINs last 2.5 years	148,000,000,000	148

Source: Author's computation using UNHS 2016/17 data, IRS pilot data, and market price data 2018, and MoH malaria statistics (various years). NOTE: IRS cost computation is based on Actellic (insecticide) which can be implemented approximately one round per year.

Conclusion and recommendation

Universal IRS implementation in Uganda requires spraying at least 8.5 million structures, using 1.1 million person-days of SOPs, and financing to the tune of 235 Billion Shs. The estimated cost per structure and person protected using the integrated district-led IRS approach are 28,000 and 6,000 Shs, respectively. The largest cost driver of an IRS programme is insecticide. When implemented in a phased manner, starting with most burdened eight sub-regions, the IRS requires total financing to the tune of about 107 Billion Shs (29 million US$). IRS presents cost-saving opportunities for the government in the fight against malaria. The integrated district-led IRS approach is associated with the least cost, compared to project-led strategy, LLINs, and malaria case management.

Therefore, investments in malaria prevention using IRS is a less costly venture that the government can take up large scale. It is paramount to have consistent domestic resource mobilization and financing. The financing landscape must be adjusted to target malaria prevention and elimination as a recurring investment, similar to routine vaccination. To minimize cost, the government should utilize existing District Local Government and community-based structures, as well as spray logistics in IRS pilot districts. Some of the specific low-cost options for policy consideration include; use of existing spray logistics on a rotational basis; exploring the use of VHTs, the forces, and idle youth as SOPs; incorporating IRS BCC within national immunization day BCC; subsidization or fiscal incentives for domestic manufacture of insecticides to counteract high insecticide cost.

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About the Authors

Tonny Odokonyero Research Fellow at the Economic Policy Research Centre, Kampala, Uganda.

Gemma Ahaibwe is a Research Fellow at the Economic Policy Research Centre, Kampala, Uganda.

Moses Kirigwajjo is a Programme Officer from Uganda National Health Consumers Organisation

Freddie Ssengooba is Associate Professor from Makerere University School of Public Health

Endnotes

1 Odokonyero T; Ahaibwe, G; Ssengooba, F. (2019). Financing Indoor Residual Spraying for Malaria prevention in Uganda: Options for cost minimization. Research Series # 147, Economic Policy Research Centre.
2 About 4.7 million Liters.
3 Other spray logistics required include among others; spray pumps, respirators, boots, and gloves.
4 From PMI comparative cost analysis for 10 African countries, the average cost per person protected by programme size is $4.34 for large programmes, $8.73 for medium programmes, and $54.57 for small programmes. The overall average cost is $10.50. Source: PMI IRS COUNTRY PROGRAMS: 2014 COMPARATIVE COST ANALYSIS in 10 African countries (Benin, Rwanda, Senegal, Zambia, Zimbabwe, Mozambique, Ghana, Mali, Angola and Ethiopia).
5 Odokonyero T; Ahaibwe, G. (2018). Financing Indoor Residual Spraying for Malaria prevention in Uganda: Options for cost minimization. Draft working paper, Economic Policy Research Centre.
6 This excludes costs for Intermittent Presumptive Treatment (IPT) for malaria in pregnant women.

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Address:
Economic Policy Research Centre
51, Pool Road, Makerere University Campus,
P. O. Box 7841 Kampala, Uganda
Tel: +256414541023/4 Fax: +256414541022
Email: eprc@eprcug.org, Website: www. eprc.or.ug