

RBM Vector Control Working Group

Capacity Building for IRS Work Stream

Progress on 2012 Work Plan – Shiva Murugasampillay, WHO, Switzerland

Eighty countries currently recommend IRS for vector control and it is used with LLINs in 58 countries. While there are some problems with data completeness, the data suggests that there has been a plateauing of coverage.

The 2012-13 Work Plan included:

- IRS case studies.
- Systematic review of published IRS studies.
- A draft tool for IRS program performance reviews.
- Supporting of country and regional IRS annual reporting.
- Providing guidance on the scaling-up and -down IRS.

Strategic issues for the working group include:

- Scaling-up IRS in high transmission countries.
- Targeted and scaled-down IRS in low transmission settings.
- IRS with LLINs vs LLINs alone.
- IRS with LSM.

Operational issues for the Work Stream include:

- Annual reporting on IRS.
- Program capacity strengthening.
- Private sector support consistent with expanding CSR and CSI.

4th Capacity Building for IRS Work Stream Meeting
9.00-15.00, Tuesday 29th January 2013
Salle V, IFRC, Geneva

Chairs: Manuel Lluberas and Shiva Murugasampillay
Rapporteurs: Elizabeth Streat and Michelle Helinski

Objective

To discuss current and emerging issues on scaling up and sustaining IRS for malaria control and elimination

- 2012 Progress.
- 2013 Plans.

The meeting had the style of short plenary presentations by countries and partners on progress in 2012 which set the stage for discussions and group work on 2013-14 plans for advocacy, capacity building and scaling up IRS.

Key areas discussed in plenary sessions were:

- IRS as part of elimination strategies.
- Country IRS programs scaling up and scaling down.
- IRS for cross border malaria control and elimination programs.
- Public and private partnership in IRS and malaria control and elimination.
- IRS capacity building and training.
- New tools and materials for more effective IRS.

Two groups were formed to work on the 2013-2014 priorities and plans for 2013

- IRS advocacy and training.
- IRS training and capacity building.

1. *Scaling up IRS in 2012*

1.1. *Introduction*

This session aimed to discuss the IRS work plan for 2013-2014, key issues and group work, showcase what countries and partners are doing, and to introduce new tools and technology under development.

The main sub-groups to date include:

- IRS advocacy and financing-Richard Tren/Devanand Moonasar.
- IRS evidence and reporting-Rajendra Maharaj/ Immo Kleinshmidt.
- IRS supervision, reviews, evaluation-John Govere/John Bosco Rwakimari.
- IRS procurement and supply management-Rabindra Abeyasinghe/Gerhard Hesse.
- IRS training and country capacity building-Manuel Lluberas.

The two most active sub-groups are the advocacy and financing and the training and capacity building. To keep the Work Stream and groups functioning by teleconference and email network has been challenging as many are not involved in IRS on a full-time basis.

The strategic issues for IRS include:

- IRS scaling up in high transmission countries for impact.
- IRS combined with LLIN for impact.
- IRS being targeted and scaled-down in low transmission to malaria foci for malaria elimination.
- IRS being combined with LSM.

The operational issues for IRS include:

- Country IRS data base and annual reporting.
- Country IRS program capacity strengthening.
- Limited WHO capacity in entomology and vector control.
- Private sector cooperation for IRS and malaria control consistent with expanding Corporate Social Responsibility (CSR) and Corporate Social Investment (CSI) (AngloGoldAshanti, Ilovo Sugar, Rio-Tinto, Verdanta, Exxon Mobil, etc).
- PMI/ USAID contractors, e.g. RTI and Abt Associates, Chemonics working with national programs need to support country capacity building, together with other partners.
- Private malaria commodity providers are uncertain of the IRS chemical and sprayer (pumps) market (e.g. Arysta Life Science, Syngenta, Bayer, Tagros, H. D. Hudson Manufacturing Company, HIL, Goizper, etc).

IRS is a high impact malaria control intervention as demonstrated by its continued use in many countries as a malaria vector control tool. African countries on track for a >75% decrease in incidence of clinical malaria (2000-2015) include Algeria, Botswana, Cape Verde, Namibia, Rwanda, Sao Tome and Principe, South Africa, Swaziland and Eritrea. Countries on track for a 50-75% decrease are Madagascar and Zambia (World Malaria Report 2012). Similar trends have also been observed in countries in North Africa, Middle East and Eastern Europe, which have moved to or are moving towards malaria elimination over the last five years. A recent meta-analysis of IRS by Dr Kim and colleagues at North Carolina University provides further evidence of the importance and impact of IRS (poster available).

Africa Fighting Malaria (AFM) has been the leading advocacy and lobby group for IRS and continues to provide a monthly bulletin on the subject. Regrettably, Richard Tren, who founded the group and was co-chair of the IRS Work Stream, has left the field and AFM has now moved back to Durban, South Africa under the leadership of Jason Urbach (posters and presentation available).

The DDT expert working group met in December 2012 to revise the 2011 WHO position statement on DDT. DDT is still needed for malaria vector control as part of resistance management. This class of insecticide should be made available and used in rotation schedules where appropriate. IRS is also key for resistance management strategies.

The priority areas for the IRS Work Stream in 2013-2014 include:

- Recruitment of new Work Stream members and expanding the network.
- Advocacy for RBM and ALMA support for IRS with domestic and international financing.
- Reviewing countries' IRS annual programs and reporting procedures.
- Assessing and supporting countries' IRS technical capacity and training programs.
- Supporting IRS in malaria emergencies.
- Supporting IRS and other mosquito control interventions in the prevention and control of *P. vivax*.

1.2. IRS for malaria elimination - Birkinsh Amenshewa, WHO-AFRO, Zimbabwe

As malaria control moves from control to elimination, there is a need to reorient IRS from universal coverage to targeted IRS. A number of countries in Africa are moving towards elimination. In Southern Africa, these include South Africa, Swaziland, Namibia and Botswana. National Programmes have reoriented towards elimination strategies and border issues. When incidence drops below 1 per 1000 of the at-risk population, programs reorient towards elimination strategies, i.e. from universal to targeted implementation. The aim is to achieve the maximum possible coverage in transmission foci. IRS in elimination helps to reduce malaria prevalence from low baseline to zero transmission and to completely interrupt transmission in targeted foci.

The objectives of IRS in elimination include:

- Reducing the number of active transmission foci to zero.
- Reducing receptivity and vulnerability in recent foci.
- Preventing introduced and indigenous cases from producing secondary infections.
- Preventing the re-establishment of local transmission.

IRS delivery for malaria elimination must be:

- Linked to case-based surveillance and investigations.
- Delivered in an epidemic preparedness and response manner.
- The frequency and timing of applications determined by the type of foci the program is dealing with.

1.3. Scaling up IRS in Tanzania - Renata Mandike, NMCP Tanzania

IRS scale-up in Tanzania started in the lake zone during 2006-7 to 2011-12, as part of the second national malaria strategic plan. This is an area of around 100,000km² (~1/4 of the country) and 6.5million people (~1/6 of the total population). This project was piloted in Kagera district in 2007 and then expanded gradually, with the population protected increasing from 167,871 people in 2007 to over 6.5 million in 2011-12. Initially, all households were sprayed with Lambda-cyhalothrin (*ICON™*) and again in 2011-12, when targeted IRS was introduced. In Muleba district, in response to detection of resistance, there was a shift from the use of pyrethroids to carbamates as part of a resistance mitigation plan.

IRS is conducted in collaboration with local authorities, communities, Research Triangle Institute (RTI) International, and *President's Malaria Initiative* (PMI). In 2011-12 RQK was introduced to supplement routine supervision and monitoring of the quality of spraying with bendiocarb. Between March and April 2012, a total of 1347 samples were collected from 251 randomly selected houses. 83% of the samples had optimal concentration of insecticide, 13% semi optimal and 4% had no

insecticide. The results were used to improve the quality of spraying. In the lake region, following IRS from 2007 to 2012, IRS operations are now shifting from blanket to targeted coverage.

Three types of IRS operation are conducted, based on under five malaria admissions in catchment area district hospitals: (1) knock down, (2) keep down, (3) target. Stratification of IRS is challenging due to misdiagnosis (lack of confirmed diagnosis), but the introduction of RDTs is helping to manage this. Muleba district is being used as a model to support the scale-down of IRS.

There are long-term plans to expand IRS to new areas in Tanzania based on the following factors:

- Need to identify where IRS can make a difference (stratification).
- Tool to knock down malaria in high transmission.
- Tool to progress to elimination in moderate - low transmission.
- Outbreak prevention/response.
- Combination with LLINs.

The main challenges for IRS include:

- Insecticide resistance and limited insecticide options.
- Capacity building.
- Combining LLIN and IRS.
- Monitoring quality of spraying.
- Funding and sustainability.

The next malaria strategic plan will focus IRS in the lake and southern zones. The way forward is stratification to target interventions, combining IRS with other vector control methods and intensifying resistance mitigation monitoring.

1.4. IRS Human capacity building in Tanzania - Joshua Mutagahywa, RTI and NMCP Tanzania

1.4.1. Need for training.

High quality IRS depends on well trained, disciplined and dedicated staff. Initially in Tanzania, as IRS was introduced, training was conducted by a few vector control officers. The demand for human resources and training kept growing with the scaling up of IRS. There was then a need to ensure additional staff was adequately trained by making the training process and materials more formal.

The different human resource categories for training were identified as: NMCP, Regional and districts teams, environmental compliance officer, Monitoring and Evaluation team, Information, Education, and Communication (IEC) team, spray supervisors and spray operators.

1.4.2. Training of IRS human resource 2007 - 2010

Initially, IRS training was conducted by a few trained vector control officers available in Tanzania. As the program expanded, district malaria focal officers were trained to support the expanding demand for training. This training was semi-formal since it was not based on a formal curricula, trainers guide or teaching methodology. Some of the staff categories were not covered (NMCP, regional and district supervisors).

1.4.3. Development of formal training modules for IRS in Tanzania

Since 2011, RTI-Tanzania, in collaboration with NMCP/ZMCP, started the development of IRS training guides. The developed guides were intended to bridge the gaps in training materials. Training materials were based on existing experience, both local and international, and cover IRS planners, supervisors and direct implementers.

In 2011, 12 training modules were developed by RTI. These include:

- M1: for managers and planners, targeting national regional district managers, how to set up IRS program.
- M2: for district technical team: best practices for logistic and supervision level at district level.
- M3: for site managers and team leaders.
- M4: guiding principles for spray teams (perform IRS).
- M5: IRS team, basic knowledge of malaria, for everyone.
- M6: environmental monitoring and human safety.
- M7: for clinicians, pesticide exposure and adverse reaction.
- M8: advocacy and community mobilization (IEC staff).
- M9: MandE for IRS, MandE officers.
- M10: best practices for logistics.
- M11: best practices for spray pump maintenance and repair.
- M12: entomological monitoring for VCOs.
- Modules A, B, C: trainers guide, curriculum and teaching methodologies.

1.4.4. IRS training used the case case approach

- Core facilitators.
- Training of trainers.
- Master trainers.
- Spray teams.

1.5. East African regional IRS training and support hub for scaling up malaria vector control - Evan Mathenge, Kenya Medical Research Institute (KEMRI), Kenya

IRS is a high impact intervention but scale matters. The cost per person protected depends on scale (costs in large and small programmes range from US\$2.62-5.52 per person protected per year). Many countries are expanding IRS to increase or sustain impact. High quality and timely IRS delivery to achieve greater than 80% coverage is needed. Countries are faced with the challenge of inadequate capacity for effective and efficient operational planning and management of IRS programs. There is need to increase regional capacity to plan, implement, monitor and evaluate IRS activities in an environmentally sound manner. Countries using IRS in East Africa include: Eritrea, Ethiopia, Kenya, Rwanda, Uganda, Tanzania, Somalia and South Sudan.

1.5.1. A regional IRS training and support hub is needed to:

- Harmonise IRS training to standardise operations.
- Establish a critical mass of high quality skill-oriented and field based IRS trainers of trainers (TOTs).

- Provide technical and operational support to countries.
- Provide a platform for sharing innovations and best practices.
- Provide prompt field support (pooled experts-IST) and pooling of capacity building resources.
- Allow for comparability of programs (meta-analysis).
- Provide continuity beyond the contractor.

1.5.1.1. The objectives of a regional training centre are:

- To establish a skills-based master field training and support centre for IRS in the East African region.
- To train and support national and provincial IRS coordinators for malaria control and elimination programs.
- To develop and conduct a skills-oriented and field-based IRS TOT training course.
- To develop and update IRS training curricula and training materials based on the WHO IRS operational manuals (regional harmonization and adaptation).
- To establish a network of IRS trainers and experts to provide training and follow up mentorship and field-based support for country IRS delivery.
- To strengthen public and private partnerships for scaling up IRS.

1.5.1.2. Expected outcomes

- Development of a skills-oriented and field-based IRS TOT training course.
- Development and updating of IRS training curricula and training materials, based on WHO IRS operational manuals (regional harmonization and adaptation).
- Established network of IRS trainers and experts to provide training and follow up mentorship and field based support for country IRS delivery.
- Strengthened public and private partnerships for scaling-up IRS.

1.5.3. Kenya's training potential

Kenya is expanding its IRS activities for disease burden reduction especially in the western part of the country. IRS has been conducted since 2002. KEMRI has field training facilities for IRS, such as the KEMRI centre for Global Health Research in Kisumu.

1.5.4. Moving forward

Discussions were held and identified the need for the following:

- Training, duration, methods, curriculum.
- Budget and source of funds.

Suggestions regarding trainees and facilitators included:

- National, provincial and district IRS coordinators/focal points (25?).
- Facilitators from (possibly) Kenya NMCP, KEMRI, Uganda, Tanzania, Ethiopia, WHO.
- Facilitators from NGOs (RTI, Mentor Initiative, Abt Associates).
- Facilitators from private sector (3).
- Training coordinator and secretary/administrator (1).

1.6. IRS for cross border malaria control and elimination - D. Moonasar, NMCP-RSA; J. Mberikunashi, NMCP-Zimbabwe; G. Matsihhe, NMCP- Mozambique; S. Kunene, NMCP-Swaziland and R. Maharaj, MRC- RSA

1.6.1. Why IRS for cross border control and elimination?

- Has been conducted in Southern Africa since the 1940s.
- Vast technical skills and technical experience exists.
- High level of political support.
- Common vectors (e.g. *An.arabiensis*).
- Community acceptance and support for IRS is relatively high.
- Proven impact on reduction of malaria morbidity and mortality.

1.6.2. Where do cross border malaria initiatives exist and who are the key stakeholders?

- TLMI: Trans Limpopo Malaria Initiative, South Africa and Zimbabwe.
- MOZIZA: Moziza- Mozambique, Zimbabwe and South Africa.
- LSDI: Lubombo Spatial Development Initiative, South Africa, Mozambique and Swaziland.
- TZMI: Trans-Zambesi Malaria Initiative, Angola, Botswana, Namibia, Zimbabwe and Zambia.
- TCMI: Trans Cunene Malaria Initiative, Angola and Namibia.

1.6.3. Measuring the impact of IRS spraying programmes

- Malaria morbidity.
- Malaria mortality.
- Vector density.
- Vector species elimination.

1.6.4. LSDI case study on cross-border IRS

The Lubombo Spatial Development Initiative (LSDI) is a programme conducted jointly by the governments of Mozambique, Swaziland and South Africa to develop the Lubombo region into a globally competitive economic zone. The aim was to create sustainable employment and equity in access to economic opportunity in the region, the rationale being that malaria is an impediment to economic development. The LSDI malaria initiative was set up by President Mbeki, President Chissano and King Mswati III in July 1999.

1.6.5. LSDI interventions include:

- Assessment of malaria control in Mozambique.
- IRS for rapid impact.
- Insecticide resistant profile assessment.
- Introduction of RDTs in 2000.
- Introduction of ACTs in 2006.

1.6.6. Progress, achievements and impact

Malaria incidence has declined in South Africa (KwaZulu-Natal and Mpumalanga Provinces) and Swaziland (Lubombo region) by 99% (2000-2009). Prevalence has disease has decreased by 92% in

southern Mozambique (2000-2009). This model has proven to be successful in malaria control and has been copied for other initiatives.

1.6.7. What are the consequences of not sustaining IRS programmes?

Since 2011 the project has not been sustained. A reduction in IRS coverage has been associated with an increase in malaria incidence observed in Southern Mozambique.

1.6.8. The challenges for sustaining cross border malaria IRS programmes include:

- Sustaining funding.
- Lack of leadership- who drives the collaboration?
- Lack of technical skills.
- Bureaucracy.
- Lack of understanding.
- Competing interests from partners and stakeholders.

1.6.9. Strategies for sustaining Cross Border IRS programmes include:

- Secure funding beyond donor support (local government funding is ideal).
- Building capacity (skills and staff numbers).
- Strong M&E mechanisms.
- Co-ordination.
- Articulation of the case for IRS.
- Harmonisation.
- Synchronisation.
- Optimisation.
- Collaboration.

1.7. Scale-up of IRS operations in sub-Saharan PMI countries - Richard Reithinger, RTI, USA

RTI funded the start-up of the US-PMI support for scaling up IRS1 (2006-2009). Since then, IRS2 has been introduced with support from other US partners Abt Associates and Chemonics. The key stakeholders are host governments, including Ministries of Health (MoH) and National Malaria Control Programs (NMCPs). The other country stakeholders include academic institutions and local communities.

1.7.1. Procurement and supply chain

The procurement and supply chain supports timely and efficient procurement; specific commodities need to be available at the right time and in the right quantities to provide coverage for the entire targeted area and for spray rounds to be launched and completed at the optimal time. It is necessary to balance international versus local procurements. The total number of sachets procured was 788,022 in 2010 and 2,009,086 in 2011. Total sprayers numbered 4300 in 2012 and 2650 in 2011. This was supported by transport, warehousing and storage system. Standardization was needed regarding supply chain management and warehouse and inventory management standard operating procedures (SOPs). Bulk procurement mechanisms were established to reduce labour costs, procurement processing time, shipping costs, and sometimes insecticide costs. This was supported by QA/QC of procured commodities.

1.7.2. Operational programme support

Operational programme support aimed to establish country partnerships with MoHs, NMCPs and other in-country stakeholders, followed by pre-IRS operations planning meetings with the involvement of district and community structures. Community mobilization was essential with >21,000 mobilizers trained annually. There is also comprehensive training of spray personnel (13792 in 2010 and 13777 in 2011).

1.7.3. Personal safety and environmental compliance

USAID required Supplemental Environmental Assessments (SEA) to be completed in every country where IRS was carried out. Guidance was provided through Best Management Practices for Indoor Residual Spraying in Vector Control Interventions (http://pmi.gov/technical/pest/bmp_manual_aug10.pdf). A supporting infrastructure was established including secure warehousing and storage, insecticide evaporation tanks and soak pits, washing areas and personal protection equipment (PPE). Annual training of spray operators and other IRS personnel was held. Environmental compliance inspections were conducted pre-, mid- and post-operations, together with insecticide disposal and incineration and soil sample and crop monitoring for DDT residue.

1.7.4. Monitoring and evaluation platform

The M&E platform consists of leaders and supervisors with checklists and daily data entry with data verification. Quality monitoring with QA/QC is conducted of insecticide application: wall bioassays and insecticide detection kits. Entomological impact monitoring of vector ecology, insecticide susceptibility and resistance and insecticide residual efficacy is also conducted. The economies of scale of IRS were found to improve as the number of household structures sprayed increased (i.e. costs per person sprayed simultaneously decreased).

1.8. AIRS project highlights – Brad Lucas, Abt Associates, USA

In 2012 the Africa Indoor Spraying program (AIRS) project was implemented in 14 countries in Africa for US-PMI. The program protects 7.31million people protected of which 199,681 are pregnant women and 1.38 million are children under five years. 730,483 insecticide sachets were used with 2.12 million houses targeted and 2.06 million houses sprayed. The project averages 97% coverage of target houses. Private sector involvement in IRS, through contractors, companies and corporations, is essential to advocate for funding, develop capacity in-country and to improve the quality of spray operations through the development of monitoring tools.

1.8.1. Building capacity for environment compliance

- Hundreds of soak pits and wash areas have been constructed or rehabilitated.
- Local ECOs in each country office.
- Pilot Smart Phone Technology (the use of checklists on smart phones to conduct pre- and post-inspections of soak pits).
- Annual environment compliance assessments and inspection overviews.

1.8.2. Building entomological capacity

- Entomologist staff position in each country office.
- Standardized entomological monitoring.
- Spray quality assurance and insecticide residual life testing.
- Insecticide resistance testing.
- Vector bionomics analysis including baseline data.
- Regional entomological training.
- Insectary-in-a-Box (converting a container to a entomological laboratory for less than US\$20,000).
- Low resource setting staffing.

1.8.3. Building operational capacity

The following checklists and tools are available for managers to plan and organize field operations:

- *Race to the starting line*
 - Enables project managers to assess progress in preparations to launch spray campaigns.
- *Spray supervision checklist*
 - Provides criteria for monitoring the implementation of spray operations activities in the field.
- *Logistics dispatch plan*
- *Spray team performance tracking*
 - Provides IRS project managers and spray operations field supervisors with the information required to track the performance and progress of spray teams on a daily basis throughout the spray campaign.
 - Tracking daily indicators such as number of sachets used and structures sprayed.
- *AIRS spray performance calculator*
 - Guides IRS project managers on how to determine spray operator performance standards, set performance targets, and use the Performance Tracking Sheet.
- *IRS supply chain and warehouse management guide*
 - Quantification of IRS commodities, equipment, supplies and human resources.
 - PMI BMP requirements for IRS warehousing.
 - Insecticide stock tracking and management.
 - Inventory management.

1.8.4. Building capacity for monitoring and evaluation

- New spray database and reporting tool.
- Increased M&E capacity at the country level.
- Spray data quality assurance monitoring.

1.8.5. Country capacity assessment

- AIRS Country Capacity Assessment Framework.
- Uganda Capacity Assessment Dashboard.

1.9. Scaling up Indoor Residual Spraying in Ghana: Strengthening public-private partnerships - Sylvester Segbaya and Steve Knowles, AngloGold Ashanti Malaria Pvt Ltd, Ghana

AngloGold Ashanti (AGA) is a global gold producer which operates in over 20 countries including Argentina, Australia, Brazil, Ghana, Guinea, Mali, Namibia, South Africa, Tanzania and United States with explorations in Alaska, China, Malaysia, Philippines and Laos. The company feels strongly about Corporate Social Responsibility and partnerships for sustainable development.

Extract from AGA mission statement:

- *'...strive to form partnership with host community, sharing their environment, traditions and values, we want communities to be better off for AngloGold Ashanti having been there.'*
- *'In addition to benefiting the people, the reduction of malaria in our communities and mine makes good economic sense and the lessons learnt have been used to initiate similar projects in our other operations as well as scale up to other parts of Ghana.'*

Extract from the AGA Report to Society 2004:

- *'...Malaria remains the most significant Public Health threat to AngloGold Ashanti operations in Ghana, Mali, Guinea and Tanzania.'*

When maps of AGA global operations are superimposed over world malaria maps it is clear why AGA has a need for an overall group malaria strategy.

AGA has an integrated malaria program that consists of:

- Indoor Residual Spraying.
- LLIN distribution.
- Larviciding.
- Environmental Management.
- Surveillance, M&E, Research.
- Insecticide Resistance Management.
- Information, Education, Communication.
- Early, effective diagnosis and treatment.
- Community engagement.

The core of AGA IRS operations in Ghana started around in Obuasi and is now in its 7th year of implementation operations. A >78% reduction in malaria cases has been observed during this period with increased school attendance. Expenditure on malaria treatment has been reduced by 93%. Work lost in man days has been reduced from 6983 to less than 100 per month. The programme has 130 jobs for local communities. The programme costs AGA US\$1.5 million per year. Similar programmes exist in other AGA mine sites.

AGA together with the NMCP and MoH of Ghana, and with the support of GFATM, has started scaling up IRS in the whole of northern Ghana. This consists of a stepwise, sustained expansion of the number of districts covered by IRS annually, based on a five year plan. Insecticide susceptibility studies are conducted annually to support the choice of insecticide. An IRS weekly performance tracker is used to track cumulated target structures sprayed against estimated target structures sprayed.

1.9.1. Types of Partnerships

GOVERNMENT	ANGLOGOLD ASHANTI
<ul style="list-style-type: none"> • MoH nominated AGA as principal recipient for GFATM grant • Government Health facilities serve as sentinel sites for M&E activities • Government provides infrastructure in districts e.g. storage facilities, offices, security, etc • Labour is hired from communities being sprayed-job creation 	<ul style="list-style-type: none"> • AGA provides IRS expertise • Conducts procurements • Entomology Laboratory for vector control activities • Managerial support and infrastructure • Building local capacity for sustainability

1.9.2. The key partners are:

- MoH Ghana/Ghana Health Service/NMCP Ghana.
- Environmental Protection Agency (Regulation).
- USAID/PMI (IRS Implementers).
- Noguchi Memorial Institute for Medical Research (Entomology and Epidemiology studies).
- Kumasi Centre for Collaborative Research (Parasite Prevalence Studies).
- Municipal and District Assemblies (Recruitment process, offices, etc).
- Traditional and Opinion Leaders (Community mobilization).
- Community Members (co-operation and appreciation).
- Other mining companies (Newmont, Goldfields, etc).

1.9.3. The main challenges are

- Anticipated government offices in districts are sometimes non-existent.
- Entomological studies showing similar rates of indoor and outdoor biting.
- Occasional refusals due to odour of insecticide (pirimiphos methyl).
- Limited sources of insecticide supply.

1.10. Malaria private public partnership - Tjipo Mathobi, GBC Health Africa, South Africa

GBC Health brings all the private sector partners to support IRS and malaria control and elimination. GBC Health is the focal point for the private sector to GFATM. GBC Health is a catalyst and facilitator. GBC Health has been working with IRS Work Stream and RBM in supporting IRS and malaria control in Southern Africa since 2011 through annual consultation meetings and country follow up. There have been plans to establish the West Africa Platform in 2012-2014 and expand to Central and East Africa. In malaria PPP, the focus is on big corporates and there is a need to increase expenditure and cost savings, and to find ways to demonstrate return on investment.

1.11. IRS scaling up performance, progress and partnerships - Michelle Helinski, NMCP Uganda and Malaria Consortium Uganda

The primary malaria vectors in Uganda are *An. gambiae s.s.*, *An. funestus*, *An. arabiensis*. Six vector sentinel sites are supported by US-PMI, incorporating:

- Six susceptibility surveillance sites.
- Mosquito collections pre- and post-IRS by PSC to assess species composition, density, behaviour, infection rates and resistance mechanisms.
- Vector bionomics studies conducted monthly in two IRS districts and one non-IRS district.

A 2011 resistance map of major public health insecticides used has been produced to select insecticides and manage resistance.

The purpose of IRS in Uganda is to reduce transmission in high prevalence areas and to prevent epidemics. IRS policy is stipulated under national malaria control and prevention policy, 2010-11/2015. National IRS guidelines and training exists with the support of WHO manuals/Abt Associates manuals.

IRS is led by the MoH (NMCP), in collaboration with different sectors:

- Ministry of Finance, National Environmental Management Authority, National Drug Authority.
- Civil society advocacy activities.
- Bilateral development agencies: PMI (Abt Associates).

IRS is now conducted in 11 districts with 10 in the north supported by PMI/Abt Associates and 1 in the east managed by the NMCP. The spray cycle is twice a year between April and June and again in October and December. The insecticide used currently is Bendicoarb 80%WP. 650,000 sachets are required per year to cover around 1million households. The hand compression pumps in use are mainly Hudson X-Pert[®] sprayers and around 4,000 sprayers are stored in government stores at districts level. There are trained personnel to maintain and service pumps regularly. IRS annual planning meetings take place pre-intervention at all levels (Ministry, District, Sub-County, Parish). This is followed by training of trainers (VCOs, DHTs, supervisors), facilitated by MoH, Abt Associates and other partners. IRS and community mobilization is through use of key IEC materials and media with printed materials, electronic messages (local radio, TV), film vans, community health workers. The IEC and CM activities take place pre-and during the intervention. There is string base to mobilize traditional, local government leaders and members of parliament.

IRS monitoring and reporting is based on core indicators:

- Number of houses sprayed.
- Number population protected.
- Number sachets used.
- Number pregnant women/< 5s protected.
- Outcome: OPD attendance from HMIS data.

House spray cards record daily spray operator activities. This data is entered daily into a central database to map progress. IRS quality is assured by following WHOPES guidelines. This is supported by annual training and supervision and supervision at parish level. The community is vigilant, observing operators empty sachets into the sprayer tanks when requesting water. There is also entomological monitoring by PSC pre- and post-IRS with wall bioassays. There is an annual IRS program reporting system through PMI/Abt Associates bi-annual reports and NMCP activity reports.

IRS protected approximately 8% of the total population at risk in 2012 (around 3million people and 950,000 households).

The main challenges to the programme are funding for scaling-up and monitoring insecticide resistance to inform the insecticide resistance strategy.

The plans for the future are:

- To sustain IRS in the 11 districts with 2 rounds of spraying with bendiocarb and longer-lasting operations.
- To discuss the future of IRS in the northern districts.
- To consider universal coverage with LLINs in IRS districts in 2013.

1.12. Financing and results for IRS in Global Fund-supported programs - Jan Kolaczinski, Global Fund for AIDS, TB and Malaria (GFATM), Switzerland

GFATM has 125 active malaria grants in 76 countries. US\$10.6 billion has been approved by the board, of which US\$7 billion has been committed and US\$5.4 billion has been disbursed. The majority of grants (69) are for the WHO-AFRO region, followed by SEARO (18), AMRO (14), EMRO (11), WPRO (9), EURO (4). The ten largest investments have been made in Nigeria, Ethiopia, Tanzania, Uganda, DRC, Ghana, Kenya, Madagascar, Sudan and Angola. The largest investment has been made in procurement and delivery of LLINs (US\$1.3 billion since 2003, while approximately US\$212 million has been spend on IRS).

1.12. Number of countries implementing IRS with GFATM funding

Cluster	2009	2010	2011	2012
East Asia and Pacific	3	4	5	5
Eastern Europe and Central Asia	4	4	4	4
Latin America and Caribbean	2	3	4	4
Middle East and North Africa	3	3	3	3
South and West Asia	2	3	3	3
SSA: East Africa	2	3	4	4
SSA: Southern Africa	5	5	5	5
SSA: West and Central Africa	1	2	2	4
TOTAL	22	27	30	32

2. New tools and technology for IRS

2.1. Insecticide Quantification Kits - Chris Helm, IVCC, UK

Insecticide Quantification Kits are new quality assurance tools for IRS programs. Field reports suggest spray coverage can be variable, sometimes as low as 70%. The only options previously for gauging the effectiveness of spraying have been cone assays and HPLC, but both have practical challenges to use in the field.

2.1.1. IQK™ (Insecticide Quantification Kits) have the following qualities:

- Innovative, new quality control technologies for IRS.
- Quickly assess the level of insecticide on a surface.
- Cost effective and easy to use.
- Cover most common anti-mosquito insecticides.

- Proven in the lab and in the field in IRS programs.

2.1.2. The current scope and status of IQK development

To use on house surface and on LLIN are as follows:

- Pyrethroid IQK (*for class II pyrethroids*).
- Carbamate IQK.
- Organophosphate IQK.
- DDT IQK.

2.1.3. User feedback on benefits of IQKs

<p>Experience</p> <ul style="list-style-type: none"> • Field trials of IQKs have been carried out with early adopters in Tanzania, Bioko and Vanuatu • 23 locations in total • Kits work well 	<p>Development</p> <ul style="list-style-type: none"> • Aim for further simplification • Pre-package reagents ready for use • Reduce sensitivity to ambient conditions
<p>Effect</p> <ul style="list-style-type: none"> • Focussed supervision • Tailored training • Selective re-testing and follow up • Improve sprayer awareness and behaviour 	<p>Development</p> <ul style="list-style-type: none"> • Aim for further simplification • Pre-package reagents ready for use • Reduce sensitivity to ambient conditions

2.2. New tools to improve IRS Applications - Iñigo Garmendia, Goizper Group, Spain

IRS is an important method of malaria vector control. However it requires:

- Efficiency.
- Operator safety and comfort.

2.2.1. Objectives of IRS operators

To apply the correct dosage of insecticide on all surfaces (specified by the insecticide manufacture) at the correct droplet size ($\varnothing > 200$ microns WHO).

2.2.2. IRS spray parameters

- Concentration of insecticide in the tank.
- Nozzle: Even Fan 8001 or 8002.
- Pressure in the nozzle/tank.
- Distance from the surface: 45cm.
- Spray speed: 2.5 sec/m.

2.2.3. Challenges to spraying uniform dosages on walls

- Concentration of insecticide in the tank.
- Nozzle: Even Fan 8001 or 8002.
- Distance from the surface: 45cm.
- Spray speed: 5 sec for 2m wall.
- Pressure in the nozzle/tank: variable.

2.2.4. Pressure variation in the tank and nozzle

Not easy:

- Tank pressure will vary considerably.
- Nozzle flow rates vary considerably.
- Spray operator decides when to stop.
- Frequent checking of pressure gauge.

The result is considerable variation in the DOSAGE of insecticide (approx. $\pm 25\%$) measured on wall surfaces.

2.2.5. Low Pressure Constant Flow Valve (CFV)

Easier:

- No need to worry about pressure.
- Uniform flow rate (lower value) and dosage (median value).

This ensures a uniform dosage of insecticide is sprayed throughout the operation. 20% less water is used to sprayed 250 m² (8 litres in-stead of 10 litres).

2.2.6. Nozzle erosion

Main factors responsible for nozzle erosion are:

- Nozzle material and internal design.
- Insecticide type.
- Pressure in the nozzle (bar/psi).
- Working temperature.

Brass and hardened stainless steel nozzles result in erosion and increase flow rates which is inefficient. There is need to consider low erosion nozzles.

2.2.7. Blockage of nozzles

Blockage of nozzles is one of the common problems faced by spray operators, caused by dirty water and nozzles being placed on the ground. Possible solutions are a triple water filter system comprising a nozzle filter, filling mouth filter and on-handle filter. Nozzles can also come with guards for protection when not in use.

2.2.7. IRS spray operator safety

A high volume of inhalable insecticide droplets are sprayed. In the past only the pressure valve was used however there may now be a need to consider new tools such as the use of low pressure control flow valve and low drift nozzles.

2.2.8. IRS operator comfort

There is a need to consider the number of house sprayed in one day and in one IRS spray round, which may number 55 days. A spray operator's work is tiring and uncomfortable. The risk is a loss of precision in spraying technique.

2.2.9. New materials and manufacturing process

Changing technology from steel to new light weight materials presents new opportunities:

- Very light sprayers (less than 2kg when empty).
- More comfortable (possible to carry in the back).
- Pressure- corrosion- and UV-resistant.

2.2.10 Cleaning and maintenance

New materials offer new design possibilities for new sprayer designs (fewer parts)

- Very easy.
- 100 % tool free.

IRS remains an important intervention for malaria control and elimination. Continued use of traditional metallic equipment is not efficient, not safe and uncomfortable. Better tools are already available.

2.2. IRS Commodity Calculator - Manuel Lluberas, H. D. Hudson Manufacturing Company, USA

An IRS Commodity Calculator (IRSCC) is in its final stages of development and should be released by May 2013. The IRSCC will be web-based and will allow users to design IRS campaigns based on country-specific parameters. It takes the user through a questionnaire with options and recommendations used to generate a 4-page summary of the IRS plan, a multi-year budget, and a IRS calendar. The IRSCC is designed to save program managers' time and money by automating a good portion of the IRS needs-assessment phase.

3. IRS Work Stream Work Plans 2013-2014

3.1. IRS advocacy

Objective	Activity	Responsibility	Timeline
Advocacy at all levels that IRS is key VC intervention that should be used where applicable Advantageous	Generate evidence for advantageous application: resistance management, combined use, sole use. Secure funding for generating evidence: researchers and government	NMCP IRS WS WHO RBM	December 2013 December 2014
Secure funding for IRS from all levels: International; Local Governments, Partners-Private	Determine funding gap to advocate for resources where IRS is applicable Development of appropriate advocacy materials	NMCP IRS WS RBM	December 2014 July 2014
Advocacy to manufacturers for provision of better and more longer lasting tools/insecticides for IRS	Product development and testing evaluation and recommendation	Private Sector and IVCC RBM WHOPES	December 2014 December 2016
Advocacy at global, regional and national levels for human re-	Development of appropriate advocacy materials	NMCP IRS WS RBM	July 2014

sources, tools/ equipment and infrastructure			
Support for Africa Fighting Malaria	Communication	IRS WS IVCC RBM	May 2014
Private Cooperate Sectors Support for IRS	Central Africa Meeting East Africa Meeting	NMCP IRS WS RBM	October 2014

3.2. IRS capacity building

Objective	Activity	Responsibility	Timeline
Develop symposium on malaria in Africa for 2014 AMCA conference	1. Invite key NMCP members from Africa 2. Identify keynote speaker for AMCA 3. Visit US Senate and Congress to support IRS and malaria control and elimination	IRS WS RBM	March 2013 April 2013 March 2014
IRS Country Reporting	IRS country database IRS regional database IRS country profile	IRS WS WHO RBM	December 2013
Produce training modules specific to IRS operations	1. Collect existing training materials and modules from NMCP and private sector partners 2. Evaluate and review materials 3. Prepare consolidated draft 4. Evaluate and field test	IRS WS WHO RBM	April 2013 July 2013 October 2013 June 2014
Regional Training Centers for IRS	Identify and support centres	IRS WS WHO RBM	October 2013

3.3. IRS new tools development

Objective	Activity	Responsibility	Timeline
Finalize the IRS Commodity Calculator (IRSCC) tool	Finalize web-based IRSCC and release to NMCP	Hudson IRS WS RBM	May 2013
Constant flow valve	Make available a constant flow valve	Goizper IRS WS	April 2013

	for IRS spray operations	RBM	
IVCC- QC Kit	IRS quality assurance kit to be rolled out in IRS programs	IVCC IRS WS RBM	July 2014

4. *Poster presentation*

- Africa Fighting Malaria (Jason Urbach).
- IRS in Uganda (NMCP Uganda).
- Reduction of malaria prevalence by Indoor Residual Spraying-A meta-regression analysis (Doheyeong Kim, Kristen Fedak, Randell Karamer).
- Insectary in Box (Abt Associates-Brad Lucas).
- Community based IRS (Abt Associates-Brad Lucas).

5. *Summary*

5.1. *Key questions and issues*

- Tanzania started targeting spraying in 2011. This was based on inpatient data (stratification). Admissions can skew stratification, depending on the quality of case management practices and supply of medicines. However, they see it as a starting point.
- The East Africa region needs to consolidate efforts across borders to consolidate gains. Tanzania will focus more on the lake region, where Kenya is now spraying.
- In Uganda in the north where IRS is being carried out, the human biting rate was previously 6 bites/person/night. Malaria has declined in this region and the issue now is sustaining gains, building capacity at district level and among health officers. This might be put onto the VCWG website as a success story. The story could be worked on with AFM.
- In terms of the South Africa and Zimbabwe cross border initiative, differences have been noted on the two sides of the border, even though both have been sprayed for a long time. South Africa has been sharing resources and logistical support for malaria control with Zimbabwe.
- Capacity building of local programs could be conducted with local implementing partners and not just outside the private sector. Contractors should support country programmes to establish sufficient capacity to sustain IRS after donor funding ceases. Too often, once funding ceases, malaria returns. A model is required to create a private sector support mechanism.
- PMI advocacy, sustaining IRS beyond PMI. The contractors should advocate and build strong advocacy teams within the country so when they pull out something is left in place.
- Tools and spreadsheets should be available on the VCWG website so we can advocate and communicate these to other countries and programs.
- Contractors should leave a legacy of improved capacity, including permanent laboratories for entomological surveillance, as PMI contributed in Ethiopia.
- Capacity building: planning and implementing expertise should be strengthened.
- How constrained are we by the types of insecticides we use? Assurance that insecticides are registered in-country is necessary. Often a lack of assurance is a blockage to

implementation. Planning needs to include insecticide resistance management strategies (rotations). This will incur increased costs.

- Insecticides arriving for an emergency enter under a different scheme: exception rules.
- To secure more GFATM resources for IRS, there is need for more advocacy through vehicles such as African Leaders Malaria Initiative (ALMA) and costing of IRS in Africa and globally.
- In private-public sector partnerships it is noted that the return on investment is high with IRS, since it quickly reduces transmission. However it is necessary to find ways to sustain the gains. There are new tools and it is noted that more advocacy is needed.
- Focused private-public workshops at the regional level can be productive.

5.2. Summary of main points

- IRS should be considered a major vector control tool as countries move towards elimination and blanket spraying is replaced by more targeted spraying. Countries need to determine criteria based on the local context for this shift; mapping and surveillance of a wide range of variables will be required.
- There is a need for increased capacity building within countries, particularly in the areas of entomological monitoring and surveillance. National programmes should involve local implementing partners with experience in the local context, not just private contractors.
- There is a need to streamline activities and manuals between partners and countries. The VCWG website should be used to disseminate and provide updated manuals and management tools such as the planning calculator tool, supervision and capacity assessment tools.
- Global and national advocacy for sustaining IRS beyond big agency funding is needed. The private sector is becoming increasingly involved through corporate social responsibility programmes.
- A large number of new materials and tools are under development or undergoing field testing and these have the potential to improve the quality and management of IRS operations.

Actions and 2013 Work Plan

1. Advocacy at all levels that IRS is a key vector control intervention that should be used wherever applicable or advantageous.
2. Advocacy to manufacturers for the provision of better and longer lasting insecticides.
3. Advocacy at global, regional and national levels for human resources, tools and equipment and infrastructure.
4. Provide support for Africa Fighting Malaria
5. Produce training modules specific to IRS operations
6. Regional Training Centers for IRS
7. Develop symposium on malaria in Africa for 2014 AMCA conference
8. Develop IRS country reporting

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Agenda	
8:30 – 9:00	Coffee and tea Poster viewing
Session 1	Scaling up IRS in 2012
9:00 – 9:10	Introductions to day sessions Shiva & Manuel
9:10 – 9:20	IRS for Malaria elimination WHO-AFRO
9:20 – 9:30	Scaling up IRS in Tanzania NMCP-Tanzania
9:30 – 9:50	Discussion
9:50 – 10:00	Scaling up IRS RTI
10:00 – 10:10	Scaling up IRS Abt Associates
10:10 – 10:20	Malaria private and public partnership GBC Health
10:20 – 10:30	Scaling up IRS in Uganda NMCP Uganda
10:30 – 10:50	Discussion
10:50 – 11:00	IRS for Cross Border Malaria Control and Elimination NMCP South Africa
11:00 – 11:30	Morning break / coffee and tea Poster viewing
Session 2	Tools for IRS
11:30 – 11:40	Global Fund Support for IRSe Malaria Adviser-GF
11:40 – 12:00	Discussion
12:00 – 12:10	IRS quality testing Kit IVCC
12:10 – 12:20	IRS commodity Planning Tool Hudson
12:20 – 12:30	New technology for IRS Goizeper
12:30 – 13:00	Discussion
13:00 – 14:00	Lunch Poster viewing
Session 3	Group Work 2013 IRS plans and products
14:00 – 14:40	Group.1 Regional IRS Training and Support Centers & Curriculum and materials for IRS: Africa: West, East, Southern; Asia?; Americas?
	Group.2 IRS advocacy
	Group.3 IRS new tools and technology
14:40 – 15:00	Discussion & Summary of group work & plans participation at the 2014 American Mosquito Association Meeting
15:00 – 15:30	Afternoon break / coffee and tea Poster viewing