RBM Partnership to End Malaria
Vector Control Working Group (RBM VCWG)
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Hosted Online via Zoom

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RBM Partnership to End Malaria Vector Control Working Group

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Work Stream 3: Implementing the Global Vector Control Response
Co-Chairs: Mark Hoppe, Chadwick Sikaala

Welcome, introductions and meeting objectives – *Mark Hoppe, Syngenta & Chadwick Sikaala, E8*
All attendees were welcomed and thanked for attending the session. In Session 1, it was outlined that an online questionnaire for members had been circulated in order to identify areas of interest. Many of these key interest areas will be addressed today.

General discussions were encouraged and it is important to ensure that we have a wide range of participation from all different constituencies. The end goal is identifying the task forces/teams. One of the criteria mentioned in the previous session was to try and notice where much of the energy is, and where much of the focus is. That will be very important to ensure that focused efforts are made, with the ability to share a wealth of knowledge from the membership, as well as to be able to look at what are some of the recommendations that are going to come through our discussions are, and propose a way forward.

The session agenda was iterated.

The main aim of work stream 3 is to support the Global Vector Control Response (GVCR), to reduce the burden and threat of vector borne diseases that affect humans. There are four pillars that address this, and the work stream is built around these. The key response themes will be around integrating tools and an integrated vector management (IVM) approach, insecticide resistance management, entomology capacity building, and strengthening of intersectoral linkages. These themes will be addressed by way of task teams which will be comprised of people with particular skills, knowledge and resources. Task teams are not seen as long-term, and activities will be time limited.

Focus output areas have been identified as follows;

1. Identifying tool gaps and capacity needs, and to steer research priorities. Activities under this output may include capacity and collaborations assessment review, and mapping operational IVM and insecticide resistance management (IRM) and how these fit into the GVCR.
2. Policy clarification and evaluation pathways. Some of these activities are ongoing such as supporting of the vector learning exchange. Others include maintaining close links with both the multisectoral working group and the Building out Vector-borne Diseases in sub-Sahara Africa (BOVA) network, evaluation of linkages between epidemiological and entomological outcomes, as well as linkages with housing and other key sectors.
3. Implementation and operational scale up supporting training, capacity building initiatives, etc. Ongoing work is being conducted to deliver IRM MOOC, which will be published in the near future. Other activity areas include the promotion of scale up and integration of vector control (VC) tools within the framework of IVM, and to share best practices, innovations and entomological surveillance data.

Innovative strategies for vector control – Progress in the Global Vector Control Response – *Willem Takken, Wageningen University*
The GVCR was initially developed due to the outbreak of Zika in South America in 2015/2016. This caused widespread panic, and the WHO declared a global emergency. It was then realised that the entomological aspect of vector borne diseases actually had been ignored, or not given the attention

for decades that it actually deserved. This was one of the reasons why, in 2016, very few people actually knew how to address the Zika outbreak and what the first steps should be.

Based on this, the GVCR was developed. This is based on four pillars;

1. To strengthen the intra and inter sectoral action, and collaboration.
2. To engage and mobilise communities. This was one of the first time that communities were specifically mentioned, but they are so important not only for the acceptance of a control intervention, but they actually have to carry the burden of the disease.
3. To enhance vector surveillance, and monitoring and evaluation of interventions. In the last two to three years, a lot of emphasis has actually been placed on strengthening new surveillance so that we actually better know and realise where the vectors are, as well as diseases and where outbreaks might occur.
4. To scale up and integrate tools and approaches based on existing tools, and developing novel tools.

The foundations for this whole structure were to enhance vector control capacity and capability, and to increase basic and applied research. Research is of course, an ongoing and fluid activity, whereby people learn from previous experiments to improve their own interventions.

In 2019, two years after the launching of the GVCR a conference was organised in Wageningen to evaluate current progress. Many countries actually were setting up country teams, and these were integrated teams to improve work on vector borne disease control. The conference was attended by more than 200 participants. Recently, the outcome of the conference was published.

VBDs are strongly associated with poverty. Communities under conditions where vector borne diseases thrive are usually very poor. And poverty itself also is a reason for increased exposure to vector borne disease. When this was realised it was linked with the Global Sustainable Development Goals (SDG). Six of these goals are directly associated with VBDs. If poverty levels are improved, disease importance will also decrease. However, the other five aspects of the SDGs are just as important.

Today, there is a climate summit of more than 22 world leaders, and health is very strongly on the agenda there. The main driving force of the GVCR is to establish partnerships to reach goals, whilst the main goal of vector borne disease control as a whole is of course, to interrupt transmission of disease.

An integrated programme for malaria control was conducted in Southern Malawi over a five-year period, the impact of integrated vector control on the entomological inoculation rate (EIR) was studied, which was a proxy for the intensity of parasite transmission. During the baseline year, an EIR of approximately 50% was observed, which fell to virtually zero in the dry season (September-January). When the rainy season started again, malaria returned, roughly with the same pattern as a year before. At this point, the entire population of about 50,000 people were provided with insecticide treated nets (ITNs). Net distribution took approximately two months. At the end of this distribution, house improvements were introduced, whereby people closed all holes and entrances within their household either with netting or by putting bricks in holes. At the end of this operation, which took a year, most houses were more or less mosquito proof. Finally, novel larval source management (LSM) was also introduced, mainly by providing BTI to breeding sites. All of this work was done through community engagement. So, it was the population themselves who conducted housing improvements and LSM. One year after intervention, the EIR had become virtually zero. And one year further on, no measurable transmission was observed. This is just one example, where you can see that with a focus

on integration of tools and the local community, malaria can be controlled to such an extent that it is no longer considered to be a major health problem.

As of 2000, WHO advised that nets were introduced in as many communities as possible. Following this, malaria prevalence decreased by about 20% in 15 years. And more importantly, malaria deaths went down globally by 50% in these 15 years. 70 to 75% of these reductions could be attributed to use of bed nets and/or indoor residual spraying (IRS). But then, unfortunately, the whole programme stalled and very few further reductions were actually noticed. This has become a major point for discussion.

It is worth noting that vector control strategies for other VBDs and vectors such as work focused on *Aedes* mosquitoes rely largely on insecticides. There are at the moment very few alternative strategies that are not insecticide based other than house improvement. Alternative strategies are then switching to IVM. A study of LSM with BTI was conducted in Rwanda. In the control area, there were still pupae to be found in the field following 10 spray rounds over the course of 10 days. When the community were engaged to spread BTI themselves, pupae numbers decreased dramatically. Under expert supervision pupae eventually disappeared altogether, showing the potential impact of this method if conducted according to instructions.

Intersectoral collaboration and emphasis involves working with multiple groups of people outside of health departments including but not limited to water and sanitary departments and urban engineers. Societal interactions must not be forgotten, because people's behaviour and beliefs are very important for the success of a control operation. Similarly, in rural areas, you also can interact with the local community by encouraging them to work together. And once they understand what the impact can be, this can be very successful, as we just saw from this example in Malawi.

Country leadership, policies and activities, actions within and between countries, emphasis on integrated community-based approaches, and the adoption of novel interventions are all needed, to ensure successful vector control.

A book which shares its title with this presentation has been published in print, as part of the series the ecology and control of vector borne diseases. And within one year, it will be available online.

Building out vector-borne diseases: research on innovations and pathways for scaling-up – *Fiona Shenton, Durham University*

The GVCR emphasises the need for cross sectoral collaboration. BOVA is a coalition of vector control experts and practitioners from the built environment and carry out research to find innovative ways to control vectors through improvements to people's houses and surroundings.

Research is carried out by BOVA using a selection of developer funded pump priming projects. Research is in three broad areas of basic research, new tools, and then multi-sectoral approaches and scale up.

Basic research is undertaken to better understand transmission ecology i.e. how mosquitoes locate their hosts, and how they enter houses. In the Gambia, researchers investigated how house height might affect mosquito entry using experimental houses, which can be raised at different levels above the ground. The results of this show that the higher the house, the fewer malaria mosquitoes are entering. Using these same experimental houses, a group of Danish scientists are using computer fluid dynamic modelling of mosquito attractions, in this case, carbon dioxide.

In Malawi, mosquito filming is being conducted using sophisticated video recording equipment which utilises infrared light to look at different combinations of open blocked or screened windows and

eaves to follow the mosquito as they enter the experimental houses. In these houses which have both windows and screens, it is actually the eaves to which the mosquitoes are attracted and not screened windows, which gives an insight into the movements of mosquitoes.

Moving on to new tools to control vectors, an example was given to control tungiasis with new floors. This is one of the neglected tropical diseases which very unpleasant and debilitating. This is transmitted by the female larvae of sand flies, which inhabit the sandy unsealed floors of poor houses. These larvae bury into the feet of individuals where they lay their eggs. And this causes great discomfort, itchiness, pain and swelling and can often result in very serious secondary infections. In Kenya, a trial is being conducted looking at new flooring, and importantly, these all made from locally available materials. This is just a pilot study this stage but the floors were very popular, and were very robust. And importantly, they've halved the incidence of tungiasis in this setting.

In Tanzania, spatial repellent chairs are being used to reduce outdoor biting. Fabric treated with transfluthrin can be inserted into cartridges underneath the benches/chairs. Mosquitoes were collected through the night outside of houses and where these chairs were placed, number of mosquitoes caught were significantly reduced. Eaves ribbons are also being trialled. These are strips of material treated with the same transfluthrin. And they're simply just looped outside of people's eaves. This is potentially a really simple and effective way to reduce house entry by the mosquitoes.

In terms of improving multi sectoral approaches, a project in Juma city, Ethiopia is being developed to improve social housing design in ways that will reduce malaria. This is a collaboration between architects, social scientists, and entomologists. The architects produce very detailed plans of the layout of the buildings, social scientists finding out exactly how people use the space, and entomologists help to identify potential mosquito breeding sites. Using these disciplines in combination it is possible to advise ministries on improvements to the present housing stock, and also come up with designs for future tools and new builds.

Finally, a project in Clark County in Kenya aims to reduce mosquito habitat by removing plastic waste. Plastic waste has been shown to be a very important aquatic habitat, particularly to *Aedes* mosquitoes. This has three benefits; first, of course, to remove the plastic waste itself, secondarily, to reduce the numbers of breeding sites, and finally, as a potential source of wealth for their communities, from recycled plastics. This team is working closely with those involved, including waste pickers themselves and the middlemen, as well as production yard owners to find ways to improve not only the profitability from the recycled plastic, but also the welfare of the workers (as this is this can be quite hazardous work). They are also engaging with scientists who are looking at novel ways to degrade and recycle this particular type of plastic, for example, using anaerobic bacteria. The Health and Environment Research Institute has been founded, bringing together scientists and the community to find ways to create a healthier environment through science, education, outreach, and advocacy.

BOVA work in partnership with a number of different international organisations, including the Commonwealth local government forum. Many of the sorts of interventions that are advocating will need to be implemented at the town and/or city level. And we have certainly seen through COVID-19 how important cities are in this regard. Supporting these is essential.

BOVA is very pleased to have been able to fund these projects. If you would find like to get more detailed information please follow on the slides, where you'll find recordings of presentations from the investigators themselves and other further details.

The Health Campaign Effectiveness Coalition – *Kristin Saarlas, Task Force for Global Health*
The task force for global health is a non-profit organisation that is located in Atlanta, Georgia.

The health campaign effectiveness program was formed with background from the success of various different health campaigns, such as those that have been used for the eradication of polio and other vaccine preventable diseases, as well as the work in malaria on ITNs and seasona malaria chemotherapy (SMC) and successful mass drug administration (MDA) campaigns.

There are countries where multiple campaigns that are planned where an overlap is seen in both timing, and with the same of similar target populations. The communities that are risk for malaria are also the same communities that are at risk for malnutrition, different neglected tropical diseases, and are often under immunised. Often these campaigns that are being planned and implemented may not be fully collaborating or communicating with each other, which is creating missed opportunities for more alignment and linkages to improve effectiveness.

A landscaping analysis was conducted which brings forward the evidence base highlighting what some of those problems and challenges are with the current methods of planning campaigns. But also, identifies the opportunities for what can be done differently. In addition to this, a group of stakeholders from across these various different health domains were brought together to think forward to how to build a coalition, what the visions and goals of this would be and the theory of change.

There is also a scientific and technical advisory committee as well as a campaign integration working group, who have a wealth of experience and these include malaria representation. There is a vision of country led health systems using a strategic balance of those targeted health campaigns, but also in conjunction with a regular and routine health services to achieve their health-related goals for all people.

Broad roles have been identified for this coalition. The first is to be able to foster that improved communication and collaboration among country leaders, donors and implementing partners. Core communication is of utmost importance within the different sectors, and to bring those different groups together and observe commonalities to document and accelerate learning. The second role is to consider what can be done differently to try new approaches around campaign planning and delivery, as well as evaluation, and the need to build the evidence base around what works. The coalition is supporting some implementation operational research, to identify, test and scale up different effective campaign practices and tools. And third concerns how to use those findings to really look at changes in practices, guidance and policies around campaigns.

Within these broad roles and the four pillars of the GVCR there are many similarities in aims, goals and missions, particularly surrounding inter and intra sectoral collaboration and how best to engage and work with community partners.

To support the testing and identification of best practice, the coalition has dedicated some funding from the Gates foundation to support implementation research. This aims to identify opportunities to strengthen cross-campaign planning, and how to integrate these whilst meeting the needs of each individual program. Within this, challenges and barriers must be identified and addressed. A subset of small case studies are being undertaken on collaborative planning and how this process can happen within different campaign domains. This work is being conducted in 6 countries. Nine new awards will also be announced for 16 months studies for implementation research around campaign. Four of these will have a real emphasis on malaria; two in Nigeria, one in Ghana, and one in Ethiopia.

The task force would like to hear from people conducting vector control, and suggestions are welcome as to where there is opportunity to leverage that work and those findings. The overarching aim is to

utilize information and knowledge sharing and lessons learned in ITN and SMC campaigns to complement broader partners and health domains.

Malaria campaigns have been largely successfully implemented during the COVID-19 pandemic and some incredible resilience and work is seen in this respect, and a question is posed of how we can bring those lessons learned to other programmes and foster cross-campaign collaboration. There are other specific areas which are of interest including microstratification, community focused approaches, data digitalisation and modelling using geospatial data. Any and all attendees are encouraged to share their research experience, and provide feedback on how the task force can help to be a platform to share these experiences outside of the malaria community. Finally, an integration decision tool that is currently being piloted, where feedback is welcomed.

Discussion

- Willem was asked regarding the expert vs community led LSM, what did the expert implementation involve? Were the community members trained and then sent off to do it alone? This was truly a community-based study in rice field areas. In Rwanda, in the hills, you have relatively isolated valleys. In one of the valleys, we had volunteer farmers from the community who participated in this. The expert supervisory group was a group of farmers who every 10 days when BTI treatment was needed were actually supervised by an expert Rwandese entomologist. This entomologist oversaw whether the farmers were using the correct amount of BTI, whether they were spraying the entire area, as well as where the larvae and pupae collections. In the next Valley, there was a group of farmers from the community who only received treatment training on one occasion, at the start of the programme. They were given the spray prompts, the BTI, and so on. At the end of the intervention programme, they had followed the original instructions beautifully, and organised themselves. This demonstrates that communities can do this very well. And they were extremely enthusiastic from the results, because they knew if there are fewer mosquitoes in the rice fields, there's also a lower risk of malaria.
- It was asked in the chat and to Fiona how did you/your camera system differentiate between mosquitoes and other insects that were entering the huts through the eaves? This comment was responded to in the chat by Jeroen that we filmed in a screen house, so (only) mosquitoes were released and not too many other animals present inside. However, based on flight characteristics we can filter out the occasional spider - ant etc.
- It was commented that recent research suggests that most plastic recycling programs in industrialized countries don't work because incorporating used plastics into new products is not economically feasible. So most "recycled" bottles wind up in landfills at the end anyway, or in the ocean. Fiona was asked what's happening with this in Kenya? That is completely right, especially with the pack plastic which these bottles are made from, it is very difficult to recycle. I think that's a problem in Kenya, as elsewhere. So, it is one of the reasons that the team is looking for collaborators who are investigating novel ways of degrading and recycling that particular type of plastic. The waste disposal, and the collection is also very piecemeal, if there's not a sort of seamless infrastructure, as you can imagine, to take care of the waste. And this is why it's valuable that the team is really developing a quite in depth understanding of exactly who the key players are and how it works. And that's it. Plastic waste is a huge, huge problem in Kenya, as well as in many other countries.
- Willem was asked if there are strategies being considered to address the emerging challenges in some areas of outdoor biting vectors? This question is a very important one, as outdoor biting and outdoor transmission is rapidly becoming a major issue in vector borne disease

control, and not only for malaria vectors, but for all kinds of other vector borne diseases, because most vectors actually bite people outdoors, and not indoors. Now, for malaria. What we are working on, together with colleagues worldwide, is the so-called push pull system, which is aimed to actually drive mosquitoes away from peri-domestic areas, and guide them to attractive devices where the enter a trap they cannot escape. There are several experiments going on at the moment with regards to this. We've run one experiment in Kenya, on removal trapping of outer biting mosquitoes. And we demonstrated there that if this works well, you can reduce malaria by more than 30% within one year. So, there is really hope that these tools actually can be very effective, particularly if they're combined with compounds like transfluthrin. To echo Fiona, if you have transfluthrin treated strips, or other repellent components on a strip, and you place them around the eaves of a house, and you effectively prevent mosquitoes from entering there. So, the indoor transmission at least goes down. But not only that, we've demonstrated that you also have a considerable reduction of outdoor biting mosquitoes. So yes, there are tools in development. And what we actually need are fairly large-scale experiments, where we can see whether these tools have an epidemiological impact.

- It was commented that plastic bottle recycling is working very well in some countries, and asked that surely a bigger problem is the spent nets and how they are dealt with? Fiona responded that it's potentially a bigger problem. But in that particular project in Kenya, it was bottles that were the main source of the plastic that was being collected by the waste pickers. Again, there may be people out there that have more insight into what happens to nets when they become too old and full of holes to be effective? Willem added that ITNs usually last around three years before being thrown away. Many of these nets are then actually ending up the garbage belt, and we have extremely little information on actually what the environmental impact of these nets is. There are now several research programmes going on to study that particularly what happens if the insecticide is still there. But the nets themselves disintegrate slowly., So a question is posed as to what will we do with such huge masses of nets? If you think that 1/3 of the world is sleeping under bed nets? We don't have the answer yet. The WHO is very concerned about it, and is working on supporting governments to find solutions. What do you do with abandoned bed nets?
- It was commented by Jan Kolaczinski that just to note that we (WHO GMP GVCR) have started to conduct country case studies to document best practices on GVCR implementation (or at least of parts of the GVCR concepts), starting with Sudan. Based on this experience we will conduct further case studies. I'd like to encourage any countries that would like to be part of this to get in touch with Ayman Ahmed, who is leading this effort: ayahmed@who.int

New developments in the WHO DHIS2 entomological surveillance toolkit – *Lucia Fernandez Montoya, WHO GMP*

At last year's meeting, the entomological surveillance toolkit was discussed. Since last year, much work has been conducted on developing implementation support tools, and a fully-fledged toolkit is now available. The goals of this toolkit are to support countries to collect and use the entomological and vector control data in a standard way to support integrated vector control strategies. This enables data acquisition on all the important vectors of a country, as well as the vector control activities conducted to control them, to support the integration of entomological data and vector control data with epidemiological data. This is a potential focus area/goal of one of the new task forces. Having a place where we can have both entomological data and epidemiological data will really help a lot to correlate this.

Another goal of this toolkit was to centralise and digitise historical data so the data has been collected up to date can be located in one place to analyse, and we can visualise historical trends and help countries to conduct global reporting. For example, when countries are asked to report the insecticide resistance data or if they have to report to donors, the toolkit has some tools to facilitate that process of reporting data.

The toolkit has been developed based on the regulatory official guidance, and this is evolving and will continue to evolve as guidance evolves, WHO GMP will continue to add new data collection forms, new indicators, new activities, and new standard procedures.

The toolkit is composed of, firstly access to standard modules for entomology and vector control, a series of data collection forms, automatically generated dashboards and also automatically calculated indicators, as well as standard indicators. This is supported by the additional development of implementation support apps around these modules. So now we have an application to customise the module. It is acknowledged that not every country is doing exactly the same activities, and not every country needs exactly the same information. So that application is helping countries to customise the modules and make them relevant for their own activities or add new activities over time.

There is another application to facilitate the installation of these modules in the system, DHIS2 in countries are usually used to collected routine health facility data. This application also supports countries to report data.

There is also an application intended to build capacity that provides training within DHIS2, so without leaving the system, users are shown how to complete certain processes, how to fill in data for certain activities, or how to generate graphs or charts. There also exists another application for the integration of historical data or parameters.

The modules consist of standard data collection forms for things like insecticide resistance bioassays, IRS residual efficacy, LLIN bio-efficacy assays etc. They calculate entomological or vector control indicators automatically like campaign coverage, mosquito mortalities, sporozoite rates, human biting rates, and all sorts of other indicators. They do data analytics on the fly. So that means that as soon as data comes into the system, the graphs in the dashboards are displaying the latest data in the system. And all of the dashboards are customizable, so new dashboards can be created, but also existing dashboards can be valid for modification over time, so that the information they display is relevant for the decisions that countries need to make.

The main feature of these modules is that they are completely free of charge. So is a free tool, which can be used not only by countries but also research institutions and organisations can use them, they can be integrated into existing DHIS2 implementations. DHIS2 was chosen as this is where all the epidemiological data was being collected. It is important to have entomological and epidemiological data in the same place. This also reduces maintenance costs.

Data can be collected offline or online, and through mobile phones, tablets or computers. The modules allow for collecting coordinates of where the mosquito collections are happening, or where disease outbreaks are taking place etc. And they are multilingual. So, once they are installed they can be translated into multiple languages. English, French, Spanish and Portuguese is currently offered, but countries can translate it into Swahili, Arabic or any other language.

The activities that are currently covered on vector control are LLINs campaigns and LLIN efficacy, IRS campaigns and IRS residual efficacy and for entomology, IRM through standard bioassays, other surveillance and breeding site mapping and monitoring. There are three main developments on the

modules themselves that have been worked on over the last year. First, developing an individual mosquito data collection module so that the data from laboratories can be collected for individual mosquitoes i.e. all the results of the different assays conducted on individual mosquito samples.

Together with PSI and PMI, LLIN campaign modules and IRS campaign modules have been expanded upon. PSI has kindly contributed more modules for supporting the daily data collection during LLIN campaigns as well as household level data collection. PMI has contributed modules for daily data collection on IRS campaigns and also structure level data collection.

The individual mosquito data collection module supports the end-to-end data collection process of collecting mosquitoes from the field, capturing information on the conditions of the collection of the mosquitoes, and then tracking them through any insectary or laboratory assays that will be conducted with these mosquitoes. It is a very nice end to end process. And you can always link mosquitoes back to the portal. For example, insecticide resistance bioassays, or you can link the mosquitoes back to the place whether they have been collected with coordinates etc. The module produces a list of the mosquitoes that have been collected with information on their species sample preservation, and it allows to collect the results for each individual mosquito on their morphological and molecular identification, as well as blood meal analysis, resistance mechanisms and gene sequencing. It should be noted that this is a work in progress.

On the LLIN campaign modules that PSI contributed, the module for collecting data on a daily, weekly, or monthly basis during the campaign allows us to collect information on the beneficiaries of the campaign, the registration of the population, and the distribution of the nets (including stock management). It calculates standard campaign monitoring indicators, covariates, etc.

All the information the dashboards is customizable, so they can always be improved or tailored to the country needs. The second module PSI allows for the collection of household level data i.e. how many nets were distributed for every single household. This also calculates our standard monitoring indicators and source information on dashboards.

The IRS campaign modules that PMI contributed are more or less the same. They also support the daily, weekly, or monthly data collection during the campaign into consumption, population sprayed, the structures sprayed etc. And there is also another module designed to collect data per structure.

Screenshots were presented of some of the developed implementation support apps. Firstly, the training app. Here you see how users are being asked there what they need to do when they log into the application from DHIS2 so whenever they need to enter data, visualise data, export the data etc., they will be asked about different activities and go through a full tutorial on how to enter the appropriate data for each activity. The second app shown was the 'Bulk Load' app which generates automatic Excel templates from data collection forms DHIS2 and allows countries to share the templates with those that don't have internet connection, or with partners that want to report data. And it allows for the easy input of these data.

Thanks were given to PSI and PMI for all of their support, as well at the Clinton Health Access Initiative. It was noted that on the information page, there are a lot of links with introductory videos to modules, live demonstrations and Luiza's contact details should anyone wish to contact Luiza directly for questions or feedback.

Initiatives to strengthen vector surveillance in the Pacific to optimise vector control effectiveness – *Amanda Murphy, WHO Division of Pacific Technical Support*

The Pacific has quite a varied range of vector borne disease challenges across the region, with malaria in just three of the countries and the rest of the countries suffering from periodic outbreaks of arboviruses, which have been increasing in recent years.

There has been a lack of capacity in the region in terms of vector surveillance and control for some time, with any support provided being rather sporadic in nature, with sporadic funding, and little consistency. A lot more support is needed to expand capacity. Some of the more innovative new tools such as *Wolbachia* have been implemented by the world mosquito programme in a limited number of countries.

Many countries struggle with basic surveillance. The good news is that WHO has entered into partnerships with a range of regional partners to try and improve capacity. One of the recent achievements in the region has been the release of a new guidance document, the manual for surveillance and control of and vectors in the Pacific, which was developed in consultation with countries in the region and with the support of a consultant engaged by WHO and SPC. This extends upon the previous guidance, which was more broadly focused in the whole region. This is one of the first documents that actually focuses purely on the Pacific region.

During the process of consulting with the regional countries for the development of this manual, it also became apparent that there was a need for better experience and information sharing across countries in the region. And it was suggested as part of that process, that a network could be developed and modelled on one of the existing Pacific networks; the Pacific public health surveillance network, to get peer to peer support freely circulate technical advice in the region and have a forum to promote the best practice in vector surveillance and control. This is still in the early stages, but is hoped to be launched later this year. The establishment of this network has received support through the French Government Pacific Fund, the Australian government, Department of Foreign Affairs and Trade, WHO and CDC.

The 'PACMOSSI' initiative is a new initiative – Pacific mosquito surveillance strengthening for impact. This is an Australian government defence department funded programme, which is a three-year project to improve the capacity of vectors surveillance and control in the region. This will begin with a needs assessment conducted across 23 countries of the Pacific. That data will be used to develop training programmes, but also to support other measures to ensure integration into vector surveillance and control plans. There is some evidence-based planning and implementation of vector control ongoing.

In summary, there are a lot of big plans and optimistic goals for the region. It is hoped that this work will contribute to the enhancement of best practice vector surveillance and control, identification of needs, and promotion of the use of evidence-based decision-making. COVID-19 has proven challenging and has impacted work in the region, as there is a lot of focus on this currently which is diverting time and resources from vector control, and it is important to take conflicting health priorities into account.

Key findings from a global landscape analysis on entomological surveillance best practices – *Emily Dantzer, University of California, San Franscisco (UCSF)*

This work was conducted with and under the leadership of Neil Lobo from the University of Notre Dame and MEI senior entomologists with funding support from the Bill and Melinda Gates Foundation.

The overall objective in undertaking this landscape analysis was to identify, understand and document global best practices for entomological surveillance, including the level of variability or overlap across the different respondent types and countries. In terms of methods, the landscape analysis combined a review of relevant documents with semi structured key informant interviews – NMCP staff from countries identified as having strong entomological surveillance system from a wide range of settings from senior staff through to those who implement the interventions themselves, as well as regional entomological surveillance experts and key funding and policy representatives. Due to COVID-19 these interviews were conducted remotely. 29 interviews were conducted between March and August 2020. All transmission settings were represented. 15% of the total key informants represented funding or policy bodies. 60% of national programme respondents came from either Malaysia or Sri Lanka.

Despite these limitations, it was found that there was a large degree of question base saturations and convergence in responses across the different respondent types, which was encouraging. The key informant interviews explored best practices across a range of topics under five key thematic areas. The first thematic area was the governance, prioritisation and funding environments for entomological surveillance. Among the key findings that emerged were that the prioritisation and level of funding for entomological surveillance is very much tied to the perceived value. Countries that were found to have strong entomological surveillance systems have or historically had access to funding for this work. It is key to have an informed and capable advocate at the highest possible level within the Ministry of Health, as internal and external advocacy for entomological surveillance is important with donor investments, as well as to drive the prioritisation of entomological surveillance in countries. While there was considerable variability in the placement, structure and size of entomological surveillance staff in countries (as well as the level of decentralisation), it was found that dedicated meetings helped to keep entomological surveillance updated and on the national agenda with stakeholders active and engaged.

The second key thematic area was entomological surveillance strategies, activities, methodologies and minimum essential indicators. First best practice was the use of question base and entomological surveillance frameworks directed at answering priority programmatic questions. It is recognised however, that in practice this is not necessarily widely implemented. There was a strong consensus that baseline understanding of entomological drivers is important. Central site selection varied but best practices included use of defined selection criteria and temporal evaluation triggers for continuing or replacing sentinel sites. In terms ethical issues, human landing catches were still considered the gold standard. Responses regarding minimum indicators were quite mixed.

The third thematic area surrounds the data collection, storage, analysis, and use in programmatic decision-making. What worked for many of the countries that were looked into were often paper based tools supplemented either by Excel or Microsoft Access platforms. There was a difference in perception of digital tool use between funding/policy body representatives and country-level respondents. There is a recognized value afforded by digital tools such as the standardisation, visualisation and quality assurance of data. Countries did express concerns around the in-country capacity, training and funds required as well as the sustainability, standardisation and reliability of this work. Some frustrations were aired. Another key finding surrounded the best practice in terms of communication of entomological data to non-entomologists.

The fourth thematic area was human resources and required technical and operational capacities as opposed to optional for entomological surveillance. Across the board, it was found that there are insufficient human resources for entomological surveillance at all levels. Most of these constraints were attributed to just simply lack of funding, awareness of the importance of entomological surveillance and prioritisation. A number of informants commented that despite having entomological

laboratories and insectaries there is a lack of staff available. Standardised trainings and refresher trainings were considered a key best practice and highlighting the role that external partners play in these trainings. A number of information brought up issues of labour turnover and retiring workforce of entomologists, and that there are currently limited career paths and opportunities in order to entice this younger generation of entomologist.

The fifth thematic area was partnerships with local research or academic institutes. Broadly, these in-country partnerships were found to be highly valuable to NMCPs. Yet there is a need for clearly defined roles and responsibilities. Primary challenges cited with these partnerships included different priorities and interests across the different parties, citing the need for kind of need for identifying shared benefits, local capacity constraints, the development of trust between the partners, particularly around data sharing, and the lack of funding to make these partnerships happen. Local institutes may provide infrastructure and capacity support in the way of lab and insectary infrastructure and equipment as well as student support.

An upcoming manuscript will be released which goes into high levels of detail on all of the above.

Community control of disease vectors – *Dennis Aribodor, Nnamdi Azikiwe University, Nigeria*
The topic of training community vector control team (CVCT) became apt due to challenges of high costs of anti-malarial and other medicines. It is important that efforts are made to involve community members in vector borne disease control. This is a new innovation that will take into consideration women and youths in the community as well as training of CVCT on breeding preferences of mosquitoes (particularly *Aedes* and *Anopheles*). This will require advocacy and resource mobilization.

Activities of the CVCT include quarterly community sensitization on mosquito breeding preferences and disease transmission. This includes schools for early involvement of children in the fight against VBDs. Additionally, the identification and destruction and manipulation of breeding sites (particularly those which are productive) at weekly intervals. Activities will be coordinated by community heads of women and youth groups.

General coordination of activities of the CVCT will be done by traditional rulers of the community and there will be a monthly reporting system in place for interaction between the head of CVCT and the community. This ensures supervision, monitoring and periodical evaluation of progress. This has not commenced yet but is a proposed innovation to help drive down the burden of VBDs and particularly malaria in Nigeria, where transmission is seen year-round.

In order to assess progress, there will be 6-monthly administration of a structured questionnaire to assess the knowledge, attitude and practices of community inhabitants on vector control. Assessment of community health facility records on malaria and other VBDs will also be conducted. This will inform policy decisions.

Discussion

- A number of questions were posed to Lucia in the chat. Chadwick noted that some of these were answered in the chat itself, but asked for Lucia to make some further insight and reflections on the many questions asked. Firstly, the modules are very easy to customise. Anything can be added from sections to a data collection form to new variables, new indicators, or dashboards. The body is already there. But if eventually there is a new assay, or a new test that has to be conducted on mosquitoes, this can very easily be added and doesn't require IT support. Anyone with knowledge on monitoring and evaluation and some computing skills could do it, but it doesn't require any programming. They are very flexible,

and they can collect data with point coordinates, that are captured by mobile devices. They've got the accuracy of the mobile device that is collecting them. And that means that the information can be collected at the breeding site level or site level.

If a country decides, data can be collected at village, district, province or at national level. We have been developing an application in collaboration with another department to bring environmental climate data into DHIS2 using the coordinates of the data that has been collected. This application is already available and is working, the link has been provided in the chat. We hope that can help understanding the patterns of all the correlations between environmental factors and epidemiologic outcomes or entomological outcomes. This is not yet well documented so please reach out to me if you need more information.

The modules are continuously evolving and are available now. For example, we are incorporating the new discriminating concentration for insecticide resistance bioassays, as well as procedures for pyriproxyfen. They will be continuously evolving, but they are already available for any country to install them right away. Some countries have started using these modules already, some of them are restarted, but there is a lot of countries that could still benefit from the modules, and they can be implemented provided that there is a DHIS2 in the country. Otherwise, it will require implementation of DHIS2 from the beginning and that will take a little bit more time and may be costlier. But for countries with the DHIS2, it can be easily implemented right away and anybody at any institution can implement it. A special thanks to the Bill and Melinda Gates Foundation who have provided support in some countries to implement the modules. CHI has provided support in some other countries and we are happy and keen to work with any funders that want to support countries to install these packages as well, to collaborate to provide all the information needed to assist the implementation.

- Amanda was asked what the relationship of the network with APMEN? And do ORENE play a major role in improving capacities in the PIC where entomologists may be few and far between? The relationship between the APMEN VCWG and the new PacMossi programme, as Leo said is that we're working together. For those that don't know, the APMEN VCWG only covers part of the Pacific countries; Vanuatu, Solomon Islands, and PNG. The PacMossi project covers the entire Pacific region and is sort of focused more through the WHO countries in the region. APMEN have developed a number of resources in the ORENE platform as well. We looking forward to combining resources and working together in the region, because, as Michael MacDonald very rightly pointed out, there are very limited resources in the Pacific. Anyone we can work with to enhance what we have, we certainly would like to do that.
- It was commented that the no career path problem is often mentioned, and this has been around for decades. Does anyone have any ideas about how it could be tackled? Do we need internationally-recognised qualifications, equivalent to those of medical specialisations and continuing medical education (which could be recognised by Ministries of health)? Emily acknowledged that this is a long-standing issue. Perhaps internationally recognised qualifications or accreditations could be useful. It is also a matter of focusing on practical skills and helping ensure that there is a linkage to a career and a career path once you attain those necessary qualifications, I guess. But also, perhaps a broader paradigm shift and helping to increase the awareness and advocacy and prioritisation highlighting the role that entomological surveillance plays in elimination. And working also with donors to generate more funding for these courses, raising it on the malaria programme in general, to attract more funding, capacity building efforts, etc. This is definitely an area of focus.

- Emily was asked what was the scope of the work that you did? Was this confined to one region? Or maybe it was a global? It was intended to be a global landscape analysis, however, due to the limitations with COVID, namely access and ability of country level respondents to participate. A total of seven countries participated. African countries were not well represented. While we had Nigeria, and quite a few PMI and WHO representatives representing countries on the African region, we struggled to get their direct participation, namely because people were just really consumed with COVID response at the time. And then, of course, there's biases involved with our approach, recognising for example, that the people that may have been recommended by the programme to for us to speak with us may have only been English speakers, we also conducted some interviews in Spanish, or they may be have been people who were more likely to say positive things about the programme, so recognising certain limitations with our sampling, due to some COVID limitation, but as I did mention, though, we were very encouraged by the fact that there was a large degree of saturation across the questions and across respondent types.
- Dennis was asked if traditional leaders report the CVCT activities to WHO monthly? At this stage, this is just a proposal that we want to test. Traditional leaders are not to report to the committee. Vector control teams will report to the state minister, or the director of primary health care and disease control, or the commissioner. Inferences can be taken up, but they are there to coordinate people in their community because this implementation of the vector control will be carried out by the women and youths in the community. The crucial role of traditional leaders is to coordinate and encourage or support them, and the issues they come up with when they come up to the higher level where policy and decision making can be taken. But as I said, we have not tested this. We are just proposing it.

Controlling Emergent *Anopheles stephensi* in Ethiopia and Sudan (CEASE) – *Anne Wilson Liverpool School of Tropical Medicine*

CEASE is a four-year grant, which has been awarded to the Liverpool School of Tropical Medicine by the Wellcome Trust and National Institutes of Health Research. This is a collaborative project working with a number of different partners. In Ethiopia with Armauer Hansen Research Institute and Jimma University, and in Sudan with the University of Khartoum. Additionally, this work is being conducted with colleagues from Imperial College London, the Institute of Tropical Medicine in Belgium and Lancaster University.

The project began in January 2021, and is still in the early stages of setup and planning. *Anopheles stephensi* is typically found in South Asia and Persia, but was first identified in the Horn of Africa in Djibouti in 2013. And since then, it has been found in Ethiopia, Sudan, Somaliland, and Puntland and has been associated with increases in malaria cases. *Anopheles stephensi* has been shown to be competent for both *falciparum* and *vivax* malaria. *Anopheles stephensi* is associated with container habitats which are often found in rapidly urbanising settings. This is a real concern for Africa, which is the continent with the highest rate of urbanisation globally. Initial habitat suitability models suggest that over 126 million people in cities across Africa could be at risk if *Anopheles stephensi* populations are established.

CEASE brings together colleagues with expertise in vector biology, epidemiology, medical anthropology, and both mathematical modelling and geo statistical modelling with the aim to solve this problem. The vision of this project is to control the spread of *Anopheles stephensi* in Ethiopia and Sudan. Three key research questions will be addressed;

1. What was or are the roots of invasion of *Anopheles stephensi* and what is it's current and potential distribution?
2. What is the importance of *Anopheles stephensi* in malaria transmission in the Horn of Africa?
3. What are the most effective targeted multisectoral vector control strategies which we can use to combat further spread?

In order to address these questions, three distinct work packages have been developed;

1. To implement entomological surveillance networks across Ethiopia and Sudan by using ecologically informed adaptive sampling frameworks. This will build on existing Sentinel sites that are in use in both countries. In Sudan, there are approximately 120 routine Sentinel sites that will be incorporated into this sampling framework. As well as this, there will be a focus on the vector bionomics. This entomological surveillance data will now allow the update and validation of predictive distribution maps. Genomic surveillance will also be conducted under this work package
2. To conduct spatial and temporal analysis of routine malaria morbidity data from DHIS2 and overlaying this with entomological data. A case control study will be conducted to characterise the association between malaria cases and *Anopheles stephensi*. Focal screening and treatment will be conducted around the identified cases from this study. Imperial College London are conducting mathematical modelling of the contribution of *Anopheles stephensi* to malaria transmission.
3. To evaluate multi sectoral vector control strategies to combat the spread of *Anopheles stephensi*. Mixed methods research will be conducted to understand the social and ecological context in Ethiopia and Sudan. Work will be conducted with communities and partners from the health sector and non-health sector to identify factors that could constrain or enhance the effectiveness of existing and novel vector control strategies. Initial pilot studies will be undertaken to determine the entomological efficacy of different vector control strategies, such as housing improvements, or larviciding. Imperial College are also going to look at look to model the public health impact of those strategies, and their cost effectiveness.

This is in early stages. Any feedback or inputs from members of the VCWG would be really appreciated. A a website and newsletter are being established, and details will be circulated.

Predicting the public health impact of *Anopheles stephensi* invasion on the transmission of falciparum malaria in Ethiopia – *Arran Hamlet, Imperial College London*

This rapid work was funded by PMI VectorLink to get an initial idea of the potential for *Anopheles stephensi* invasion to affect transmission of *falciparum* malaria in Ethiopia. The background of this threat has been covered, but it is important to note that the primary reason of concern is that *Anopheles stephensi* is an urban vector of malaria, and the primary urban malaria vector in India.

In Djibouti, there has been an astronomical rise in malaria cases between 2010 and 2019 from 1000 cases to approximately 50,000. *Anopheles stephensi* was first observed in this locality in 2013. This is not a causative relationship, but there is a very strong correlation. Much of Africa is suitable for transmission, especially in the urban areas.

This first project was an attempt to quantify what's potentially happened in Djibouti, in order to predict what could happen in Ethiopia. This is not a forecast or prediction of what will happen, but essentially a scenario modelling exercise where we take what has happened in Djibouti and apply it to Ethiopia acknowledging that there are many limitations and caveats, but this is a very first look into the potential. In order to do this, a deterministic malaria model of Djibouti malaria incidence was fit

in order to produce estimates of the required vector density to explain these changes of incidence, assuming that the entire change is due to *Anopheles stephensi*. The Imperial malaria model is used, which is a well-established model of malaria transmission, used extensively in both the research and programmatic context.

Multiple samples are taken around daily mortality, anthropophagy, endophily and the proportion of bites received indoors and in bed to account for uncertainties. This model fits well to the malaria atlas project estimates of malaria in Djibouti. This model also allows pyrethroid resistance to be considered, of which high levels have been detected in *Anopheles stephensi* in Ethiopia, as well as pre-existing malaria transmission and coverage, IRS and ITN treatment coverage, and *falciparum* prevalence. This also considers the extrinsic incubation period. Ethiopia is very mountainous country, and it has quite a wide variety in environments. There could be areas where *Anopheles stephensi* can establish itself, but will not meaningfully contribute to malaria transmission.

Overall, all of this data is being constantly updated and refined as more comes in. At the moment, we're updating these estimates with the Ethiopian NMCP data. The numbers will likely change, but the overall magnitude appears to be quite robust to these assumptions. The focus will then be on extrapolating what happened in Djibouti against Ethiopia's current context and seeing how this affects the overall transmission of *falciparum* malaria, and then scaling up interventions and applying these to its new projections for malaria transmission, in order to get an estimate of what can be done.

Preliminary results (though inherently uncertain) indicate substantial increases in prevalence across Ethiopia with large amounts of sub national heterogeneity. Large increases are in areas with low existing transmission. Predictions indicate 1 to 6.1 million additional malaria cases. With a current 2.1 million cases of falciparum malaria per year in Ethiopia, this is an increase of 50 to 300%. A number of vector control interventions were considered in this model, and there is much variability in the results of this modelling. However, it is evident that in no locality will a single intervention be appropriate, rather layering of multiple interventions. The costs associated with the implementation of vector control tools to combat *Anopheles stephensi* invasion will be astronomical.

In conclusion, large parts of Ethiopia are vulnerable to substantial increases in malaria. There is huge uncertainty in the estimated impact, this comes from both the methods used and the data available. Over time, this is going to be refined with additional data from the CEASE project and better understanding of how the vector contributes to the transmission in in Africa. The primary result of this piece of work is that additional surveillance and data is needed. Acknowledgements were made to all involved in this work so far.

The spread of *Anopheles stephensi* through East Africa is causing increasing concern amongst malaria programme managers – *Jo Lines, London School of Hygiene and Tropical Medicine*

The intended title for this talk is *Anopheles stephensi* in Africa – the strategic question. Jo reiterated the background of *Anopheles stephensi* and its spread into Africa. At first, the spread was slow before becoming more advanced and rapid. A study was undertaken with 10 sampling sites where these vectors were found in all of the sites and the spread was much farther than expected. Breeding sites are abundant and diverse and may vary between locations.

There are a lot of questions on what is happening. These are easy to answer in some places. But there are security issues in some of these settings.

It is 100% crucial that we the specialists address these tactical questions. What about its biology? How does the biology of *stephensi* in Africa compare with that of *arabiensis* that already has a role in manmade containers, water storage pits, in semi-arid parts of the Horn of Africa, with *Aedes aegypti*

which also breeds in small manmade containers? What about the transmission? Is malaria becoming more intense, not just in Djibouti? As we saw the evidence there is clear, but elsewhere, too. Is it invading previously malaria free urban centres? And how are we going to do the management? What are the training needs? How does this affect what we do for malaria vector control, if larval control in these urban centres is to become more important?

There are two possible long-term outcomes. Either we're going to decide now to drive it out of Africa to extinction somehow, however difficult and expensive that might be. Or it's going to spread quickly or slowly to most large towns and cities in Africa with the consequences that we have heard projected. Urban centres where malaria transmission has been uncommon or absent will also be affected by this. There are many consequences. Some believe that we must act now, whilst others believe it is already too late. This is a historical moment, and both outcomes will be costly.

We do have to think of the precedent in the 1930s when *Anopheles gambiae* was in Brazil. In Brazil it took a number of years to respond, even after the malaria epidemic started. But the response did work. It is our job as the VCWG to take this to the outside world, because this decision is bigger than us. It's very long term, it's very intersectional. It should not just be left to entomologists; the world must be informed that this is a big threat with technical constraints.

It is suggested that we begin with a consensus statement. The VCWG has produced consensus statements in the past that have been useful. Our job is to try to summarise the situation to people outside, so a bigger decision can be made, we need to evaluate the expected economic costs of a campaign, the health impacts the likelihood of success as well as the economic and health costs of mitigation and how successful that's going to be. We need to determine who can do this most appropriately.

Discussion

- Ann was asked if can we take a page from a community-based dengue control program, e.g. using Health Extension Workers in Ethiopia to enable communities to recognize anopheline larvae in containers- record presence and then eliminate? There is some evidence that *Anopheles stephensi* breed in similar containers to *Aedes*. By combining the containers, we could have a true IVM approach in terms of community level surveillance and control. I think that's a great idea. It's something we'd be interested to explore for this project and particularly through the final work package where we're going to be working with communities to co-design solutions for combating vectors, so definitely of interest.
- Arran was asked what about *P. vivax*, as *An. stephensi* is good transmitter of this? Yes, it is a very effective vector of both *vivax* and *falciparum*. We have done some work looking into *vivax*, but this has not been presented at this moment in time.
- Ann was asked will your project make a study of the ecology of *An. stephensi* on the Arabian Peninsula? On a WHO mission to the UAE I found loads of *An. stephensi* in water storage containers in gardens, so it appears to adapt easily to man-made habitats. We're mainly focusing on Ethiopia and Sudan. We're going to have samples for the genomic kind of invasion analysis from that part of the world, but we're not working there directly for this project.
- Ann was asked, given that this is an invasive and fast-moving vector since 2019, there is great value in the well-planned study you just described, but is anyone, boots on the ground, trying to control *An. stephensi*? There is quite some knowledge about habitats, is anyone controlling those? I'm worried by the time we answer the interesting scientific questions, the vector will be too far to eliminate. It's a difficult one, because we've got research funding from our research funder and thus are answering research questions. We want to make this research

as applied as we can to inform controlling and elimination of the vector. And while I think we have some answers to some of the questions like habitat, more information on biting and resting and routes of entry would be really informative for an elimination programme. The two go hand in hand. I think elimination would be excellent. And I think that should be our goal.

- Jo added that we need to not think that now we are studying the problem that we can wait until we get those results before we do something. The point is that we have to study and to do at the same time. In particular, we need to be ratcheting up the intensity of surveillance, even the surveillance tools, the training. Very few people know how to identify *Anopheles stephensi*, and the work of Seth Irish and PMI colleagues to produce tools to enable this need to be scaled up quickly. We do have some boots on the ground, though very few. Scale up is expensive, and we need to get the attention of the world outside in order to get that funding. It would be useful to have our case summarised for us, of course, and you'll find that that will be advocating clearly most of us in one direction, but you have to respect the opinion of others that it is too late and cannot be done, but aim to explain why it is worth starting work. WHO needs to be leading, needs to be charged to lead the technical content of that campaign.
- Ann was asked, have you included the parous rate of *An. stephensi*? We are intending to look at parity, in terms of bionomics and biology.
- It was commented that *Aedes aegypti* breed in the same containers and there is a larval competition; but egg spreading is the main spreading mechanisms for *Aedes*. It was asked if this is also the case in *An. stephensi*? Jo responded that this study has not yet been done, and encouraged that this is built into protocols. Jo mentioned a study by Paul Reietr on egg spreading in *Aedes* which is a great example. This is about hedging bets on which container will dry out before larvae mature.
- Ann was asked do you have stakeholders from Djibouti involved in your project? We're working in Ethiopia and Sudan. But we also have contacts in Djibouti, given the importance of Djibouti as a potential introduction site into Ethiopia. And in Djibouti, as far as I know, they've been implementing bed nets, IRS and larviciding on a small scale, as well some outdoor space spraying, including by plane during the peak season, and I think they've had varying efficacy.
- Arran was asked is it more possible to control because larval breeding sites are fixed and findable? I would imagine, yes, for the reasons that were stated. *Anopheles stephensi* bites both indoors and outdoors. It doesn't seem to rest in human habitation and prefers cattle sheds, which means that in terms of implementing IRS, there's a potential reduction in what you would expect with other *Anopheline* species. Jo added that the point about those small containers, if you've got a limited list of the large water tanks, that makes it a bit easier. But often those water tanks are in private premises. It's the same problem with *Aedes.* It is very time consuming. And the small containers move about. Experience in India and the burden of malaria in India despite big investment in larval control in those cities. It's a question of how you can keep up that thoroughness week in week out year in year out, and it doesn't bode well for that kind of larval control. It will be necessary and it will be better than nothing, but it doesn't bode well for the effectiveness of those campaigns in mitigating to close to nothing the consequences of *Anopheles stephensi.*
- Mark commented that we've clearly identified an area where there is a lot of interest and energy. VCWG is considering to have an event specifically looking at *Anopheles stephensi*. So, it might be an opportunity to save some of the other questions for that event. That is still be working on and yet to be announced.

Wrap up and close – *Mark Hoppe, Syngenta & Chadwick Sikaala, E8*

The idea of this session was to try and identify areas where there was a lot of interest, a lot of energy. We've clearly identified one. But there were some also some other interesting presentations, a lot of good questions around those as well. The work stream leads and VCWG will take what we've heard today and try and make some proposals for task teams. How these task teams will work is that we've asked for volunteers to put their names forward, and to highlight their particular areas of interest and expertise. We will look through those people who put their names forward to try and form relatively small task teams. If you have any particular comments, expertise, interests, contacts, etc. for any of the topics we've heard about today please do contact the work stream leads.

There are still many other challenges for malaria, and some of the other presentations will have a lot of relevance across those. And as we're very much promoting an integrated approach, that that's really quite fitting.

Mark and Chadwick thanked all speakers for their interesting talks, as well as participants with some excellent engagement in the chat (which will be published), and it was expressed that the work stream leads are looking forward to further collaboration and engagement.

List of acronyms

APMEN	Asia Pacific Malaria Elimination Network
BOVA	Building Out Vector-borne disease in Africa
BTI	*Bacillus thuringiensis*
CDC	Centers for Disease Control
CEASE	Controlling Emergent *Anopheles stephensi* in Ethiopia and Sudan
CVCT	Community Vector Control Team
DHIS	District Health Information Software
E8	Elimination 8
EIR	Entomological Inoculation Rate
GMP	Global Malaria Programme
GVCR	Global Vector Control Response
IRM	Insecticide resistance management
IRS	Indoor residual spraying
ITN	Insecticide-treated net
IVM	Integrated vector management
LLIN	Long-lasting insecticidal net
LSM	Larval source management
MDA	Mass Drug Administration
MEI	Malaria Elimination Initiative
MOOC	Massive On-line Open Course
NMCP	National Malaria Control Programme
ORENE	Online Resource Exchange Network for Entomology
PMI	President's Malaria Initiative
PSI	Population Services International
RBM	Roll Back Malaria
SMC	Seasonal Malaria Chemoprevention
SPC	South Pacific Commission
VBD	Vector borne disease
VC	Vector Control
VCWG	Vector Control Working Group
WHO	World Health Organization

Disclaimer

The views and opinions expressed in the Chat are those of the individual presenter and do not necessarily reflect the official policy or position of the Vector Control Working Group of the RBM Partnership to End Malaria or any of its co-chairs, co-leads, coordinator.

Chat from VCWG session 4
Work stream 3: Implementing the Global Vector Control
22 April 2021, 3:00 PM – 6:00 PM CET

14:56:34 Von Konstantina Boutsika an Alle : Welcome to the session 4!
14:57:27 Von Mohan Rao Arasada an Alle : Good morning Konstantina n everyone from Hyderabad, India
14:58:23 Von Konstantina Boutsika an Alle : Work stream 3: Implementing the Global Vector Control Response.
15:16:27 Von Jan Kolaczinski an Alle : Just to note that we (WHO GMP VCR) have started to conduct country case studies to document best practices on GVCR implementation (or at least of parts of the GVCR concepts), starting with Sudan. Based on this experience we will conduct further case studies. I'd like to encourage any countries that would like to be part of this to get in touch with Ayman Ahmed, who is leading this effort: ayahmed@who.int
15:23:18 Von Mohan Rao Arasada an Alle : Thanks Jan.
15:36:31 Von Lina Heltsche an Alle : Kindly ask your questions via the chat box, adding the word QUESTION in front of them!
15:36:32 Von Julia Mwesigwa an Alle : Very clear presentation Willem Thank you
15:37:00 Von Anne Wilson an Alle : Q. Thanks Willem for a great talk. Can I ask regarding the expert vs community led LSM? What did the expert implementation involve? Were the community members trained and then set off to do it alone? Thank you
15:37:01 Von Oliver Wood an Alle : @Willem Nice presentation
15:38:00 Von STUTZ an Alle : o191291
15:41:35 Von Tobias Suter an Alle : QUESTION: How did you/your camera system differentiate between mosquitoes and other insects that were entering the huts through the eaves?
15:41:49 Von Mohan Rao Arasada an Alle : Wonderful presentation by Willen Takken. At global level good strategies are identified for community action. However there are other non entomological vectors lik rodents transmitting VBDs and also cause agri and commodity losses. VCWG may throw some light in this direction. Even farm animals are badly affected with these zoonotic diseases.
15:42:26 Von Steve Harvey an Alle : Really fascinating idea - spatial repellent chairs!
15:42:54 Von Ole Skovmand an Alle : have you done any cost evaluations of transfluthrin treatments for repelling mosquitoes outside ?
15:44:25 Von Jeroen Spitzen an Alle : Answer Tobias: We filmed in a screen house, so (only) mosquitoes were released and not to many other animals present inside. However, based on flight characteristics we can filter out the occasional spider - ant etc.
15:44:36 Von Mohan Rao Arasada an Alle : The natural calamities are leading to many VBDs due to global warming. In case any support data are needed we may prepare for rodent pests
15:46:59 Von Tobias Suter an Alle : Thanks Jeroen!
15:48:55 Von Steve Harvey an Alle : Recent research suggests that most plastic recycling programs in industrialized countries don't work because incorporating used plastics into new products is not economically feasible. So most "recycled" bottles wind up in landfills at the end anyway, or in the ocean. What's happening with this in Kenya? Obviously it's nice to find ways to keep plastic waste

out of the environment, but how successful is the program at keeping it from winding up back in the waste stream.
15:51:33 Von Garth Drury an Alle : Small technical precision: Transfluthrin works predominantly by knock-down, not repellancy, but the "how it works" (MoA) not so important in the context of outdoor use because outcome is not effected by whether considered working (adult count reduction in traps) by repellancy or kd.
15:52:07 Von willemtakken an Alle : answer from Willem to Fiona: The expert supervised Bti intervention was supervised by an entomologist, who supervised farmers with the treatment. Farmers had volunteered to participate in the programme. The non-supervised Bti programme involved a team of farmers from the local community who had received one training in Bti treatment and mosquito larval/pupal surveillance. This team operated without supervision.
15:53:40 Von Dr David Zinyengere an Alle : Q. Wonderful presentation by Willen Takken. However are there strategies being considered to address the emerging challenges in some areas of outdoor biting vectors.

15:53:44 Von Anne Wilson an Alle : @Willem thank you
16:01:10 Von Kristin Saarlas an Alle : Link to our decision guidance toolkit for people-centered integration of health campaigns https://campaigneffectiveness.org/resources/decision-guidance-toolkit-for-people-centered-integration-of-health-campaigns/
16:02:01 Von Barna Zogo an Alle : @Willem. Great work!!!
16:03:40 Von Ole Skovmand an Alle : plastic bottle recycling in Vietnam is effective
16:04:51 Von Rose Peter an Alle : Plastic bottle recycling is working very well in some countries. Surely a bigger problem is the spent nets and how they are dealt with?
16:04:55 Von Steve Harvey an Alle : Thanks for your answer.
16:08:56 Von jo lines an Alle : My own experience with larviciding, is that it is relatively easy to kill the larvae in the breeding sites that you know about. The challenge is to find all the sites, I.e. all the sites producing the mosquito adults in the village. This requires work over a surprisingly large area. In Tz, our colleague Kato Njunwa cleared 100% of larvae within a 1km radius of the village (near Muheza). I personally checked this! But the adult vector population in the village was reduced by only 25%. The lesson is: larval control must be evaluated by measuring adult numbers.
16:10:30 Von Ole Skovmand an Alle : we did have in Burkina peri urban areas, Jo, and we reduced adult population 90 %, but the treated circle diameter was 1 km, and the effect most pronounced in the center of the circle and 200 m out
16:12:03 Von Amelie Wamba an Alle : Excellent session and thanks to all the presenters. I look forward to the outcomes of integrated vector control interventions in malaria-endemic sub-Saharan Africa.
16:12:07 Von willemtakken an Alle : from Willem to Jo: yes of course larval control programmes should be conducted with surveillance of adult mosquito populations. This was also done in Rwanda.
16:18:15 Von Eric Ochomo an Alle : Question: when does the entomology module become available to countries?
16:19:02 Von Sian Clarke an Alle : Question to Luicia: what is the smallest geographic area does the toolkit operate - in terms of inputs? And outputs?
16:19:54 Von Anne Wilson an Alle : Question to Lucia: maybe I missed it but can this be used by researchers or just programmes?
16:20:04 Von Nakul Chitnis an Alle : Question to Lucia: how easy is to add additional fields to the individual mosquito data? For example, if parity was also collected.
16:22:30 Von Steve Harvey an Alle : Lucia, can you provide a link for the DHIS modules, please?
16:22:56 Von Steve Harvey an Alle : OK, never mind.

16:23:15 Von Sheila Barasa an Alle : Question to Lucia: Are there opportunities for WHO to support NMCPs to use this tool? Through consultants?
16:24:08 Von Mohan Rao Arasada an Alle : Good presentation
16:24:48 Von jo lines an Alle : Question for Lucia: A critical tool for understanding impact of LLINs etc has been DHS/MIS surveys connecting intervention coverage with epi outcomes at the household/cluster level. As discussions in VCWG show, we now urgently need to analyse how malaria risk is affected by local environmental variables - land use, agriculture incl. rice, proximity to forest, cultivated vs uncultivated and. But this can NOT be done with DHS because of the random spatial error in the geo-location data, introduced for anonymisation purposes. Given scales of mosquito movement, the scale of this error is exactly wrong! Will DHIS2 data be able to overcome this problem??
16:26:56 Von Lucia an Alle : The intro video to the modules can be found here: https://drive.google.com/file/d/1AG3GfXd8vWae-F0v_0n-C61_hnerVXT-/view
16:27:04 Von Lucia an Alle : The life demo is here: https://extranet.who.int/dhis2-ento-vc/dhis-web-commons/security/login.action
16:27:17 Von Lucia an Alle : And the information page: https://www.who.int/teams/global-malaria-programme/prevention/vector-control/dhis-data-collection-and-collation-tools
16:33:18 Von Michael Macdonald an Alle : Q: Amanda: what is the relation to APMEN VCWG?
16:34:54 Von Leo Braack an Alle : APMEN VCWG supports PacMOSSI and is an active partner at the invitation of PacMOSSI, contributes to two workstreams.
16:37:32 Von Michael Macdonald an Alle : Q2: to Amanda/Leo. I am sure ORENE play a major role in improving capacities in the PIC where entomologists may be few and far between
16:38:34 Von Amanda Murphy an Alle : https://spccfpstore1.blob.core.windows.net/digitallibrary-docs/files/9f/9f0d24a28d8d77575f1b03796940be98.pdf?sv=2015-12-11&sr=b&sig=D5v%2Fu40qgdg23staMPvL4ZRxZXr9IUZRAG9tMTxfda8%3D&se=2021-10-19T14%3A37%3A08Z&sp=r&rscc=public%2C%20max-age%3D864000%2C%20max-stale%3D86400&rsct=application%2Fpdf&rscd=inline%3B%20filename%3D%22Manual_for_Surveillance_and_Control_of_Aedes_Vectors_in_the_Pacific.pdf%22
16:39:03 Von Amanda Murphy an Alle : Link for the new Pacific Manual
16:39:05 Von Leo Braack an Alle : The platform (ORENE) exists, the challenge now is to get stakeholders to actually use the platform.
16:39:09 Von Lucia an Alle : DHIS2 Answer to Eric: they are already available to countries, some countries have implemented the modules relevant to their national activities already and a few others are getting started supported by partners or by WHO. Any interested country can get started any time.
16:39:58 Von Lucia an Alle : DHIS2 answer to Sian: the smallest geographical area is a geographical point (e.g. a collection site, or a breeding site)
16:40:01 Von Steve Harvey an Alle : Lucia, this link isn't working for me: https://github.com/WorldHealthOrganization/DHIS2-standard-packages-nonHF/tree/GMPNCR
16:40:55 Von Lucia an Alle : https://github.com/WorldHealthOrganization/DHIS2-standard-packages-nonHF/tree/GMP/VCR
16:41:31 Von Lucia an Alle : DHIS2 Answer to Anne: yes, any institutions can use the module provided the have a DHIS2 implementatin or want to implement DHIS2 to install the modules.
16:41:45 Von Steve Harvey an Alle : Thanks.
16:42:05 Von Lucia an Alle : DHIS2 answer to Nakul: the modules are very easily customizable, so new variables or sections of data collections form can be added without IT support. Parity is already there in the individual mosquito module.

16:42:19 Von Amanda Murphy an Alle : Answer to Michael/Leo: Hello again Michael, and thanks Leo for explaining. Yes, we're all working together and hope we can achieve some good traction on the new resources, and hopefully some capacity improvements in the region.
I can be contacted on: amurphy@who.int.
16:43:34 Von Lucia an Alle : DHIS2 answer to Sheila: thanks to the Bill and Melinda Gates foundation we have some resources to support countries to implement the modules, we are getting started in some countries but there is room for supporting some others in 2021. We are also very keen to work with any partners that want to support countries implementing the modules.
16:44:46 Von Sheila Barasa an Alle : Thank you for the answer Lucia. Good to hear this.
16:45:09 Von Lucia an Alle : DHIS2 answer to Jo Lines: DHIS2 collects point coordinates with themargin of errors that standard mobile phones have, there is no randomizaton since the data is stored safely in the Ministry of Health Servers. We already have another implementation support tool to allow for the import of data from Google Earth Engine (e.g. environmental and climate, etc.) which is also free for everyone to use and will help build that understanding of correlation with environmental factors.
16:45:41 Von Lucia an Alle : The application can be found here : https://github.com/WorldHealthOrganization/dhis2-gee-app-blessed but it is one of the least documented one for now, Hope we can improve documentation soon.
16:49:26 Von Emily Dantzer an Alle : Link to ORENE platform referenced by Leo above: https://orene.org/
16:49:54 Von jo lines an Alle : This “no career path” problem is often mentioned, has been around for decades. Does anyone have any ideas about how it could be tackled? Do we need internationally-recognised qualifications, equivalent to those of medical specialisations and continuing medical education (which could be recognised by Ministries of health)?
16:50:52 Von Leo Braack an Alle : Thanks Emily, I got distracted and should have provided link :-)
16:52:07 Von Ole Skovmand an Alle : to Dennis: do traditional leaders report monthly the CVCT actvities to who ?
16:52:15 Von Mohan Rao Arasada an Alle : Jo, This is a global problem. Goats need to take it up in UNO meetings to get political will
16:53:12 Von Michael Macdonald an Alle : @Jo: Heads of State for APLMA and ALMA have pledged support for malaria elimination. They must be convinced on the need for civil service reform to include entomology/vector control posts or expanded job descriptions at sub national level - and all the ancillary support that goes with that
16:55:47 Von Mohan Rao Arasada an Alle : This may bring a qualitative change. My experience is political will can accelerate the impact. Jo thanks.
16:56:32 Von Nakul Chitnis an Alle : Thanks a lot, Lucia. That’s excellent.
16:56:37 Von HP an Alle : Traditional rulers are expected to coordinate. In their coordination, they are expected to bring their influence in disease vector control and subsequent reduction in burden of vector-borne diseases.
16:57:34 Von Mohan Rao Arasada an Alle : Thanks Lucia
16:58:15 Von Sarah Burnett an Alle : Question for Lucia: What version of DHIS2 do you need to have to be able to use these modules?
16:58:19 Von jo lines an Alle : I’m especially interested in the political influence of those Goats in UNO. It’s a One Health issue, so maybe they can be persuaded.
16:59:05 Von jo lines an Alle : Perfect Lucia, that’s great.
17:00:10 Von Mohan Rao Arasada an Alle : I struggled from 2002 to 2009 to bring inter depth collaboration and later the Provincial govt developed political will. But it was hard time.

17:00:15 Von Lucia an Alle : Answers to Sarah: most of the modules work from 2.29, the ones that required the use of DHIS2 "tracker" features work mainly from 2.32 onwards. The modules are compatible with up to 2.35
17:00:39 Von Sarah Burnett an Alle : Thanks Lucia!
17:03:51 Von Mohan Rao Arasada an Alle : Dennis, Your country adjoining ones are struggling to control the rodent vector Multi mate rat. Are you consider this in your studies?
17:03:52 Von Frederik Seelig an Alle : On the note of training/education, we have a global directory of medical entomology training courses on GVH, developed with TDR, listing 126 courses from 32 countries at the moment: https://globalvectorhub.lshtm.ac.uk/courses
17:04:44 Von Konstantina Boutsika an Alle : All pdfs from the presentations can be found on the Attendees Hub!
17:05:26 Von Mohan Rao Arasada an Alle : I gave training on these vectors of several African countries with FAO support.
17:06:01 Von Konstantina Boutsika an Alle : Did you miss a previous session? Check out the recordings on the Attendees Hub!
17:14:00 Von jacobwilliams an Alle : to Dennis Aribodor: (CCDV) - I propose that you link up with counterparts in Rwanda. They have implemented an excellent and long standing community vector control program that has been successfully integrated into monthly community activities “Umuganda” (sp). Could facilitate a link up, should you wish (jacobwilliams@f-ph.org).
17:15:09 Von jacobwilliams an Alle : oops!, was intended as a DM to Dennis
17:16:06 Von Fiona Shenton (BOVA) an Alle : Excellent talk and project, thanks Anne Wilson.
17:17:21 Von Michael Macdonald an Alle : Q: Anne - I don't think you mentioned Aedes. Can we take a page from a community-based dengue control program, e.g. using Health Extension Workers in Ethiopia to enable communities to recognize anopheline larvae in containers- record presence and then eliminate?
17:18:48 Von John Invest - Sumitomo - UK an Alle : Question for Arran - What about P. vivax, as An. stephensi is good transmitter of this?
17:19:42 Von John Invest - Sumitomo - UK an Alle : Larviciding best method of control as you hit An. stephensi and Aedes at same time
17:19:43 Von willemtakken an Alle : from Willem to Ann: very interesting and necessary project! will your project make a study of the ecology of An stephensi on the Arabian peninsula? On a WHO mission to the UAE I found loads of An stephensi in water storage containers in gardens …….. so it appears to adapt easily to man-made habitats
17:19:45 Von Silas Majambere an Alle : @Anne, great talk. given this is an invasive and fast moving vector since 2019, there is great value in the well-planned study you just described, but is anyone, boots on the ground, trying to control An stephensi? there is quite some knowledge about habitats, is anyone controlling those? I'm worried by the time we answer the interesting scientific questions, the vector will be too far to eliminate...
17:20:04 Von Mark Hoppé an Alle : Question: An. stephensi, is there any evidence of adaptation as they've moved west into Africa? Is their behaviour, etc., the same as those found further east in South Asia?
17:20:55 Von Ole Skovmand an Alle : Aedes aegypti breed in the same containers and there is a larval competition; but egg spreading is the main spreading mechanisms for Aedes, but probably not for stephensi ??
17:20:59 Von Oliver Wood an Alle : @Mark Hoppe: Nice question!
17:22:12 Von Nelson Cuamba an Alle : Q to Anne-In bionomics within etc, have you included the parous rate of An. stephensi?

17:22:20 Von Olivier Briet an Alle : Question to Arran/Anne: Do you have stakeholders from Djibouti involved in your project?
17:23:22 Von Ole Skovmand an Alle : if stephensi spread by flying, it is Worth reading the study of Wind spread of gambia in West Africa at the start and end of rainy seasons. Locusts spread from the African horn all over Africa across Africa winds !
17:24:33 Von Michael Macdonald an Alle : note that As eggs can withstand substantial drying - not quite dessication like Aedes, but viable for several days in "dry' conditions...
17:25:56 Von R.Adey an Alle : Q for Anne: Are there control approaches against An. stephensi which are already being implemented in Djibouti which show promise for expansion elsewhere?
17:29:59 Von Torben Holm Larsen an Alle : Do we have any data on the resistance profile of these A. Stephensi
17:30:42 Von Ole Skovmand an Alle : yes, pyr resistant and more
17:30:49 Von Arran Hamlet an Alle : @Torben this work has some good information on resistance in Ethiopia

https://malariajournal.biomedcentral.com/articles/10.1186/s12936-020-03252-2
17:30:59 Von Seth Irish an Alle : @Torben. Yes, we have found An. stephensi to be resistant to pyrethroids and carbamates in Ethiopia...sometimes OP resistant
17:32:10 Von Arran Hamlet an Alle : @ John Invest - Sumitomo - UK

An. stephensi appears to be an effective vector of both vivax and falciparum

https://wwwnc.cdc.gov/eid/article/27/2/20-0019_article
17:33:39 Von Anne Wilson an Alle : @ Richard As far as I know Djibouti is currently doing ITN, IRS, some larviciding and space spraying with varying efficacy.
17:34:39 Von Anne Wilson an Alle : @Olivier project is mainly focused on Ethiopia and Sudan but we have contacts in Djibouti given likely importance as route of entry
17:34:48 Von Fredros Okumu an Alle : Stephensi in the HOA is for eradicating, not researching. And its best done by Ministries of Environment, not entomologists
17:34:49 Von Mohan Rao Arasada an Alle : Jo, wonderful presentation, not mincing words.
17:35:00 Von jacobwilliams an Alle : @ Mark: (evidence of adaptation): in Djibouti, stephensi had demonstrated significant capacity to adapt - - from initial concentrated catches primarily during wet and colder seasons, it is now found all year round in catches, including the very hot summer months
17:35:25 Von jacobwilliams an Alle : fully agree with you jo!
17:35:33 Von Nakul Chitnis an Alle : Thanks Jo!
17:35:33 Von Seth Irish an Alle : I think that we don't have all of the information that we would like to have, but in light of what we do know, a robust and quick response - aiming at elimination - seems the best option.
17:35:37 Von Michael Macdonald an Alle : @ Jo - Hear Hear!
17:35:40 Von Anne Wilson an Alle : @Jo Not convinced that report needs to be independent?
17:35:45 Von Oliver Wood an Alle : @Jo Lines: Thank you so much
17:36:13 Von John Invest - Sumitomo - UK an Alle : Is it more possible to control because larval breeding sites are fixed and findable?
17:36:32 Von Nelson Cuamba an Alle : Does some one knows where the an. stephensi bites most (indoor v outdoor).
17:36:55 Von willemtakken an Alle : in my view this goes beyond Africa and is a global issue: we need something like an Abuja declaration and the urgency of actions cannot be stressed enough (is surveillance done in northern Kenya and Uganda?)

17:37:12 Von Fiona Shenton (BOVA) an Alle : Well said @Jo Lines, but wouldn't WHO be the organisation to push this?
17:37:30 Von jo lines an Alle : I like the comparison with the Abuja Declaration. It's the right level.
17:39:24 Von Sian Clarke, LSHTM an Alle : Re: independence. Moving beyond entomology (to engage other disciplines involved in malaria control) in developing consensus statement will get more traction
17:39:47 Von Torben Holm Larsen an Alle : Except for the fact that the Abuja declaration was mainly ineffective
17:42:58 Von jacobwilliams an Alle : I agree on ramping up engagement on stephensi beyond our ento-cabinet of discussions; after all effective implementation of public health is actually 60% "politics" and 40%" science.
17:43:04 Von Mark Hoppé an Alle : Could this have the momentum to bring the genetic approaches for population control with it?
17:43:32 Von Nick Brown an Alle : Excellent and thought provoking presentation Jo. Fully agree an independent report should be commissioned. I believe ALMA might be the right organisation to do that which will commission this
17:43:58 Von jo lines an Alle : Mmm ALMA. That's an idea.
17:45:05 Von Ole Skovmand an Alle : Larvae of An. stephensi breed in various artificial containers in homes and collections of water associated with construction sites and other industrial locations. In rural areas, An. stephensi larvae utilise fresh-water pools, stream margins and stream beds, catch basins, seepage canals, wells and domestic water-storage containers. Larvae have also been found in domestic wells, overhead water tanks, room coolers, cisterns and roof gutters in the city of Delhi, but greater numbers of larvae are typically found outdoors compared with indoors. Larvae of the mysorensis form (distinguishable by egg morphology) appear to exclusively inhabit stone pots and earthenware containers. In rural areas of Gujarat, An. stephensi is associated with canal-irrigated, non-irrigated and riverine villages all year round, but generally in low densities. In urban areas, An. stephensi is found throughout the year, but is most abundant in the summer months (between June and August), which coincides with the peak period of malaria transmission
17:45:32 Von Nick Brown an Alle : Correction to above which should have read: I believe ALMA is the right organization to commission this which will automatically involve the political leadership (and AU).
17:46:33 Von Justin (Video) an Alle : @Jo - comments on consensus statement and the voice of other members here are noted. Sounds like the more enduring question (which also takes into account Stephensi) is how to better address vector-borne diseases (more broadly) in (challenging) urban environments... (building capacity for Stephensi today as well as XXXX tomorrow ?)
17:46:49 Von jo lines an Alle : Question for all: any other ideas for independent report? Anyone object to ALMA? They might not want it!
17:47:04 Von Michael Macdonald an Alle : Chalam, BS. The resistance of Anopheles eggs to desiccation. Indian Journal of Medical Research 14 (4) April 1927 pp.863-866 [a reprint of this paper is available]
17:48:08 Von Steve Harvey an Alle : Jo, could you post a cite to the "gorgeous" study you mentioned? I didn't catch the author's name. Thanks.
17:48:32 Von Steve Harvey an Alle : I don't think it's the one Mike just posted.
17:48:40 Von HP an Alle : Thank you Jacob Williams. I will keep in touch.
17:48:59 Von Mohan Rao Arasada an Alle : Jo, I will send tomorrow. Thanks.
17:49:53 Von Olivier Briet an Alle : @Mark: At one point we had a malaria-refractory stephensi colony

17:49:59 Von Seth Irish an Alle : I agree...study and action should take place at the same time. Godey in Ethiopia is on the Shabelle river, which could be a way it moves to Mogadishu. An. stephensi in port cities in Sudan, Djibouti, and Somalia could lead to quick colonization in other sites. After Arran's presentation the risk for increase in cases seems very clear. And increases in urban malaria could mean decreases in funding for rural areas, where people are most at risk.
17:50:02 Von Anne Wilson an Alle : On the genetic control front, Oxitec are working on a new strain too
17:50:12 Von willemtakken an Alle : from Willem to Jo: this comment came from me. Nice to see that you like it.
17:50:35 Von Manuel Lluberas an Alle : I am available to help set up or evaluate IRS campaigns.
17:52:03 Von Oliver Wood an Alle : @Jo Lines: I saw them using drones to find larval sites in Mexico. It was working great
17:52:15 Von Fredros Okumu an Alle : 21st century entomologists can/should contribute to these efforts, but cannot lead any vector elimination/eradication campaign. The GVCR offers a good start, and Ministries of Environment are best in the lead
17:52:18 Von Graham White an Alle : Perhaps ALMA (African Leaders Malaria Alliance) would be good for promulgating the anti-Anopheles stephensi declaration suggested by Jo. In Asia/Arabia, urban An. stephensi with high vectorial capacity remain distinct from rural An. stephensi (that has very low vectorial capacity), so in Africa domestic foci need targeting for elimination URGENTLY.
17:52:27 Von Steve Harvey an Alle : Short Report: Dispersal of Aedes aegypti in an Urban Area after Blood Feeding as Demonstrated by Rubidium-Marked Eggs
Paul Reiter, Manuel A. Amador, Robert A. Anderson, and Gary G. Clark
View More
DOI: https://doi.org/10.4269/ajtmh.1995.52.177
Volume/Issue: Volume 52: Issue 2?
17:54:06 Von jo lines an Alle : Thanks Steve
17:54:33 Von Manuel Lluberas an Alle : I have worked with NASA on remote sending from satellites. works very well.
17:55:14 Von Anne Wilson an Alle : Thanks to the organisers, great session
17:56:13 Von jo lines an Alle : They used rubidium but also (I seem to recall) later DNA fingerprinting to identify sibling eggs in different sites. To show that a single family is scattered in lots of places.
17:56:22 Von Arran Hamlet an Alle : Yes thanks to the organisers, very interesting session
17:56:32 Von Oliver Wood an Alle : @Manuel: That's pretty cool. Airbus are putting up solar powered fixed wing drones that circle the globe and you can book "time slots" as they fly over a path and can direct their cameras
17:56:45 Von Konstantina Boutsika an Alle : Thanks a lot for attending session 4 :-) Next session is on Thursday 29 April at 3:00 PM Geneva time.
17:56:57 Von Frederik Seelig an Alle : Thank you to the organisers and speakers for this great session!
17:57:08 Von Fiona Shenton (BOVA) an Alle : Thank you organizers and all participants.
17:57:17 Von jacobwilliams an Alle : great session. Thanks to all the VCWG leaders.
17:57:19 Von Konstantina Boutsika an Alle : Expanding the Vector Control Toolbox Workstream.
17:57:21 Von Steve Harvey an Alle : Great session - thanks everyone!
17:57:22 Von Amelie Wamba an Alle : Thank you for the great session. Best to all!
17:57:23 Von Emily Dantzer an Alle : Many thanks, appreciate how great communication and organization has been!
17:57:25 Von Sola Oresanya an Alle : Thank you all, very interesting session.
17:57:51 Von Erin Foley an Alle : Thanks all for a very engaging and interesting session today

17:57:54 Von HP an Alle : Thank you all. It was quite an enriching experience.
17:58:46 Von Wolfram Wagner an Alle : Thank you very much for this Session
17:58:53 Von Vasanthan Paul John an Alle : Thank you all.
17:58:56 Von Gagik Karapetyan an Alle : Thanks all for the great session. Have a good day
17:58:57 Von BI ZAMBLE an Alle : Thank you all
17:58:57 Von Willy Ngulube an Alle : Thanks and bye.
17:59:26 Von Sian Clarke, LSHTM an Alle : Thank you for an interesting set of presentations and discussions today