

RBM Partnership to End Malaria
Vector Control Working Group (RBM VCWG)
16th Annual Meeting, Session 5: 29th April 2021
Hosted Online via Zoom

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RBM Partnership to End Malaria Vector Control Working Group

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Work stream 2: Expanding the Vector Control Toolbox

Co-Leaders: Sheila Barasa (CHAI), Allison Tatarsky (UCSF)

Welcome and scene setting

The Expanding the Vector Control Toolbox work stream is based on the old New Tools, New Challenges work stream, but bringing in larval source management. This allows a space for all potential new and existing tools to be discussed, whilst leaving IRS and LLINs to their own group. This group aims to looking at the gaps in vector control interventions, and is interested in new tools, new approaches, or new implementations of existing tools. The challenges of current interest are vectors that bite outside or during the early evening or daytime, or bite livestock. Elimination goals in many places may not be achievable with current tools alone, hence the need to expand the toolbox.

Consultation with the workstream members has produced the following emerging new themes:

- Reviewing existing tools/approaches but with improved methods or innovation around delivery, program implementation, and evaluation; examples include:
 - LSM (integrated during restructuring)
 - Space spray and targeted swarm spraying
 - Outdoor residual spraying, among others
- Emphasizing human behavior research in vector control research and incorporating human-centered design in the development of new vector control tools
- Supporting Ifakara Health Institute Master Classes on vector biology and control
- Including more voices from country programs

Workstream theme and focus outputs:

	Focus Output 1 Identify tool gaps or capacity needs & steer research priorities	Focus Output 2 Policy clarification & evaluation pathways	Focus Output 3 Implementation/Operational scale-up support/Training and capacity building initiatives
<p>Work stream 2: Expanding the Vector Control Toolbox Themes:</p> <ul style="list-style-type: none"> ➤ Larval Source Management ➤ Innovations in vector control and surveillance ➤ Anthropology and human centred design in the context of vector control <p>Co-Leads: Allison Tatarsky Sheila Barasa</p>	<ul style="list-style-type: none"> ▪ Review technology for LSM e.g., GIS, satellite imagery, use of drones, new application technology, etc. ▪ Develop and maintain an inventory of new vector control tools and approaches including repellents, endectocides, ATSBs, SIT, genetic control, etc. 	<ul style="list-style-type: none"> ▪ Gather evidence for environmental management including habitat modification and manipulation as priority interventions in LSM and promote within the Multi Sectoral Working Group (MSWG) ▪ Develop framework for, and actively track and share, updates on new vector control paradigm roadmaps ▪ Share VCAG updates on new paradigms as part of paradigm roadmap tracking 	<ul style="list-style-type: none"> ▪ Review operational LSM in national malaria programmes and collate evidence of impact, as well as training and technical support needs ▪ Elevate national malaria program operational research questions for vector control beyond LLINs and IRS ▪ Highlight innovation and opportunities to incorporate anthropological methods and human centred design into the development, evaluation, and scale up of vector control tools

AT also highlighted an existing resource: MESA Track. This an online tool, available to everyone, that collates malaria research projects around the world. You can search by products, and see results by institutions, projects, timelines. Landscape reports are also available on the website: www.mesamalaria.org/mesa-track

Discussion

- Clarification was given that although originally MESA was focussed on elimination related research, it does this now include all malaria control research.

Innovations in vector control and surveillance

Evaluation of the effectiveness of topical repellent distributed by village health volunteer networks against Plasmodium spp. Infection in Myanmar: A stepped-wedge cluster randomised trial. Win Han Oo (Burnet Institute)

A trial of topical repellent in Myanmar was presented. Village Health Volunteers were used to distribute repellent (12% DEET) to geographically isolated populations, and the trial reached around 28,000 people. The trial showed that the intervention was able to reduce *P. falciparum*, by 75% in RDT-detectable infections and 18% in PCR-detectable infections. However, no effect was seen on *P. vivax*. PCR detected 21 x higher infections than RDTs showing a high level of sub-RDT infections. The analysis also looked at compliance and work situation of the participants.

Discussion

- The different effect on falciparum and vivax infection was discussed. This has been noted in previous trials e.g., Pakistan, and may be due to relapses masking any reduction in new infections.
- The issue of compliance was also raised, as this has been observed to be a difficult issue previously. Dr Oo reported that a compliance survey was conducted where the VHV were asked about the frequency of application "on average" in their village. The percentage of village residents who were using the repellent is not known. The product itself was selected based on local availability, local registration status and effectiveness, so it is possible that acceptability and compliance may have been higher with a different product.
- The use of DEET on children in the trial was clarified. The repellent was recommended for everyone over 6 months old and instructions for safe application were provided.
- It was mentioned that Cochrane is updating their systematic review on this, and WHO will revisit this topic at its Guidelines Development Group meeting once a revised review is available.
- Some current research on the peripheral effects of repellents on mosquito behaviour was highlighted: <https://pubmed.ncbi.nlm.nih.gov/33472661/>

Spatial repellents for the control of vector borne diseases. Eric Ochomo (Kenya Malaria Research Institute)

A review of AEGIS (Advancing Evidence for the Global Implementation of Spatial Repellents) collaboration trials on spatial repellents was presented. Transfluthrin emanators have been, or are being tested in Mali, Kenya, Sri Lanka, Indonesia, and Peru. In Peru, the trial showed 34% efficacy against *Aedes* borne viruses, and 28% reduction in *Aedes* inside house. In Indonesia, there was around 30% (ns) protective effect on new infections. In Kenya, a cluster randomised trial is currently underway to investigate the impact on malaria, entomological outcomes, and diversion. In addition, social science studies are planned to evaluate retail channels and user perception. The Kenya Trial is due to

complete in 2023. All consortium trials are due to be completed in 2024, ready for submission to the WHO.

Operational research on vector control emergencies. Laura Paris (The MENTOR Initiative)

An operational research project run by the MENTOR Initiative in cutaneous Leishmaniasis (CL) in Syria was presented to the Group. Incidence of CL has increased 40x compared to pre-conflict levels, and vector control, case management, and improving health system capacity have been implemented in response. Spatial repellents (transfluthrin emanators) are being deployed in a trial covering both camps and urban areas (reaching 60,000 people). The trial will examine their epidemiological impact, entomological impact, feasibility in tents and houses, acceptance and uptake, and sustainability of small business distribution.

Discussion

- The possibility of other spatial repellents (e.g. metofluthrin) being evaluated at least in entomological effect at the same time was raised. This is not currently being addressed, but the point was made that this might help speed up alternative products once the product class has been established.
- Questions were also raised around the interaction of spatial repellents and insecticide treated bed nets, blankets, or other treatments. In the current studies, SRs are being placed next to bed nets, and the trials contain control clusters using bed nets alone. This will hopefully allow the effects to be examined.
- The requirement for this data was clarified. Although these products could be sold directly without epidemiological evidence, this data is required to be registered with the WHO and subsequently included in national malarial control programmes.
- It was also suggested that the two projects compare notes on the qualitative interviews that will be carried out. In Syria, MENTOR is looking at compliance, perceived effectiveness, preference to other tools, potential hazards and ease of use.
- The various methods of hanging the transfluthrin emanators were given: hung by wires on poles (preferred in camps), nailed to walls, and also affixed using durable sticky tape (preferred in urban areas).
- A question on cost-effectiveness, especially in sub-Saharan Africa, was asked. This will be a sub-study at the end of the AEGIS programme using the trial outcome and costs.
- The potential diversion or effect on untreated nearby areas was raised, and it was clarified that this effect will be monitored in the buffer areas around clusters.

Larval source management

Rice intensification: could climate change interventions help African malaria elimination? Elliott Dossou-Yovo (AfricaRice)

A presentation was given on an ongoing project looking at the effect of potential climate change interventions in rice production and their potential impact on malaria transmission. Rice production in Africa can be improved both in terms of yield, but also in terms of reducing malaria vector production (1 hectare of rice can produce >5 million female *Anopheles* per season). AfricaRice are investigating the effect of different water and nutrient management practices on rice yields, greenhouse gas production, water use and vector production.

Discussion

- A question was asked about the use of pesticides in rice farming and their role in insecticide resistance management (<https://croplife.org/case-study/importance-of-pesticides-for-growing-rice-in-sub-saharan-africa/>). The current project is not being done with any insecticides (or herbicides), but that work is planned.
- A study in Peru on intermittent irrigation in rice cultivating areas was highlighted (http://www.digesa.minsa.gob.pe/DSB/secas/Nivel_Nacional/Riego_con_secas_intermitentes_en_el_cultivo_de_arroz_para_el_control_de_la_malaria_2009.pdf). As were a number of studies conducted by IRRI (international Rice Research Institute) and collated and published under PEEM.
- Whilst the effect of nutrient management on larval production is being assessed, the effects of water quality and predators are not being evaluated yet.
- Similar projects, including one about to start in Tanzania, were invited to confer and compare notes.

Human behaviour, human centred design, and vector control

Community engagement for vector control: key learning from APMEN VCWG workshop. Htin Kyaw Thu (APMEN VCWG/Malaria Consortium)

In a well-received talk, the highlights of an APMEN VCWG workshop on community engagement in vector control were presented. The understanding of community engagement needs to evolve to include communities from design to implementation. One of the issues identified was the disconnect between users and product developers, with product users being passive receivers of solutions, without any input into, communication with, or inclusion in the product development and/or evaluation process. A lifecycle approach was recommended based on understanding needs and preferences of communities, delivering, and promoting vector control products, and involving the community in monitoring and evaluating and refining activities. Best practice examples included a community dialogue approach; women and children participating as delivery and change agents; use of non-health distribution channels (retail) to expand access; and use of mobile and digital methods to engage communities.

Unlocking the human factor to increase effectiveness and sustainability of vector control tools. April Monroe (Johns Hopkins Center for Communication Programs)

An overview of the potential for using behaviour to maximise the impact of vector control tools was presented. With core interventions (ITNs and IRS), behaviours such as net care and cooperation with spray teams greatly impact the effectiveness of these tools. Behavioural studies can also help identify and characterise gaps in protection, for example by quantify how much biting cannot be reached by bed nets, or who are the higher risk populations. All new tools will rely (although at different levels) on buy-in and compliance by the end users whether these are topical repellents or ATSBs. There is a need to elevate role of human behaviour in the product review process. Finally, the need to expand the use of human-centred design was highlighted with examples highlighted from bed nets in Ghana, mining communities in Guyana, and water storage in Jamaica.

Using the Entomological Surveillance Planning Tool (ESPT) to integrate human behavioural and entomological data towards identifying gaps in protection in Guna Yala, Panamá. Mario Avila (Ministerio de Salud de Panamá, MINSA)

The combined use of entomological and human behavioural data to evaluate the appropriateness of LLINs as a malaria intervention for indigenous communities in Panamá was presented. Both sets of data were collected by the same field workers, meaning the additional behavioural data came at a very low comparative cost. The combination of the two data sets allowed fuller evaluation of human-vector exposure, and to determine where and when primary exposure to vectors occurred. This in turn meant interventions and education campaigns could be better targeted to communities.

Discussion

- It was asked if there was a solution for the gaps in protection shown by the behavioural and entomological studies in Panamá. Other interventions are currently being sought to provide the protection against outdoor biting.
- The ease of integrating the human behavioural data collection into the standard landing catch activities was highlighted. A useful guide can be found here: <https://malariajournal.biomedcentral.com/articles/10.1186/s12936-020-03271-z>
- More detail on the “co-creating tools” approach was requested. This can take the form of co-creation workshops with communities (for example LLINs with a repellent for forest goers), although communities may not be able to create products themselves. Consultative workshops with the communities might help in planning an LLINs distribution campaign, instead of health authorities leading. The workshops themselves often include performances and games to increase engagement. Examples can be found at:
 - Examples of recent work in human centred design: <https://breakthroughactionandresearch.org/sbc-flow-chart/>
 - HCD for ITN Design: <https://www.ghspjournal.org/content/7/2/160>
<https://www.mizzima.com/news-features/women-garment-workers-find-support-through-thone-pan-hla>
 - HCD ITN work in Ghana: <https://www.ghspjournal.org/content/7/2/148>
- Including end users in LLIN design and delivery was discussed. This has been typically neglected in the past and now as donors prefer the easier, quicker, and cheaper route of donating imported nets. However, the local markets are a sustainable solution that should not be overlooked. An example was given of a social enterprise in Myanmar training women to sew bed nets, which are then sold in the community.
- A question was put to the panel about the high heterogeneity observed in entomological and human behaviour, and whether this would require a high level of data collection to target vector control programmes effectively. The level of heterogeneity might not be as high everywhere, and this data does help choose the intervention to use or promote.

Paradigm updates

Attractive targeted sugar baits (ATSB): the development pathway of a new product class. Mathias Mondy (IVCC)

An update was given on the progress of the development of ATSBs (containing 0.1% dinotefuran) as a new vector control tool. Proof of concept studies including social science, risk assessment and evaluation of effect on non-target organisms have been completed. Modelling suggests that a feeding rate of 2-3% would reduce malaria incidence by 30%. Further product development is underway, and

it is expected that trials to evaluate public health value in Zambia, Kenya and Mali will begin at the end of 2021. The PQ listing process also underway, and engagement with VCAG to ensure trial designs are as high quality as possible. Market uptake is anticipated to be a challenge as LLINs and IRS currently hold such a key position. ATSBs address outdoor biting, which is of increasing importance, and a key area for IVCC. However, they do not provide personal protection, and community level deployment is key.

GM & Gene Drive Mosquitoes: Product Development Pathway. Laura Norris (BMGF)

An overview of GM and gene drive mosquitoes and progress to utilisation was given. Both technologies are species specific, transgenic, implemented through rear and release, and do not require behaviour change (although consent is required). The main difference is in duration of impact: GM is self-limited, so impact is localised and short term, whereas gene drive is potentially more powerful, but has never been tested outside of a lab. Most products are currently under lab development. Products are intended for regions with high transmission where intervention scale up will still not reach elimination. Currently there is a lot of research around the modelling of field release, but many research questions remain including around safety, efficacy, ecological impact, logistical implementation, social studies, and economics. The current estimated timeline is that gene drive field trials around 10 years away.

Making lab and field progress towards the development of gene drive mosquitoes for malaria control in Africa. Mamadou Coulibaly (USTTB Mali/Target Malaria)

An update was given on gene drive technology projects for malaria control in Africa, supported by the African Union and WHO. Currently there are project on Sterile Males (non-gene drive), Male Bias (non-Gene drive) and Male Bias and Female Fertility (Gene drive). A risk assessment has been developed to identify potential harms, which identified 46 potential pathways to harm. A first candidate has been developed (QFS2). Capacity building has also started with new insectaries, laboratories and offices in Uganda, Mali and Burkina Faso.

Endectocides: current state. Carlos Chaccour (ISGlobal)

An update on a presentation in 2019 was presented. The product class has been agreed, and endectocides are a potential tool where there is residual transmission and outdoor biting. Evaluations are taking place in the Gambia (2020), Burkina Faso (2021), Mozambique and Tanzania (2023), Guinea-Bissau (2022) and Thailand (2021). While the main endectocide is ivermectin, other formulations are being looked at. In addition, alternative doses, regimens, with seasonal malaria chemoprevention (SMC), with mass drug administration (MDA) and in livestock are being investigated. A number of research questions remain on robust efficacy of ivermectin alone, dosage and regimen, coverage, companion antimalarial regimen, non-human hosts, ivermectin alternatives. The current timeline is expected to see scale up in 2024-2029.

Discussion

ATSBs:

- A question was asked about the environmental conditions that affect the performance and efficacy of ATSBs. Currently, research is being conducted on housing and bait station density, and botanical surveys (competition against natural sugar source).
- The environmental impact of ATSBs was also discussed as the current plastic prototype is not biodegradable. The response was that this work is primarily aimed at opening a new product class, and once that has been established then it is very much hoped and expected that following work will refine and develop the ATSB better, including a more sustainable design.

A membrane that is both durable and allows feed through would be a key component. But other factors raised in discussion included; colour, attractants, synthetic baits, and better understanding of mosquito olfactory and visual cues in feeding behaviour will allow further development of this technology.

- The use of ATSBs indoors was raised, and evaluation of this was reported to be planning when ATSB availability allowed for this.

Gene Drive:

- A question was asked about the risk of the "intervention-gene" becoming dissociated with the 'driver'. This would not be an issue for population suppression, as the drive itself inserts into a female fertility gene, and there's no "cargo". For population replacement, it would be rare but is possible. LN responded that she thought the evolution of resistance at the insertion target site would be more likely to happen first, similar to insecticide target site resistance.

Endectocides:

- The potential for resistance against endectocides was also discussed. This was acknowledged as a potential problem and strategies to delay this would probably be similar to other insecticides: to use multiple formulations in parallel with rotation.
- The potential for secondary affect on non-target insects through the presence of ivermectin in faeces was discussed. This might be useful when trying to control *Culex quinquefasciatus*, however there are potential environmental impacts that need to be assessed.
- It was clarified that no effect on *Aedes* had yet been observed at the dosages studied.
- A question was also asked about the coverage levels required, as early modelling suggested this would need to be very high. CC replied that current models suggest treatment of 80% of eligible population (64% of general population) would be required.

General:

- The overall environmental impact of vector control tools was raised. Whilst there is a need to protect human health immediately, protecting the environment is important for maintaining human health in the long term. Research and development of vector tools should try to keep in mind a need to use sustainable materials and supply chains.

Wrap Up

Task teams and workstream communication. Sheila Barasa (CHAI) and Allison Tatarsky (UCSF)

The task teams are still open, and a list of names is currently being compiled. All were invited to get in touch with Sheila or Allison if interested in any of the areas below. Communication will follow on members and roles of the task teams.

1. Human behaviour, human centred design, and vector control
2. Larval source management
 - a. LSM technology
 - b. Evidence on habitat modification and manipulation
 - c. Operational LSM and impact at the NMCP level
3. Vector control paradigms
 - a. ATSBs
 - b. Genetic control

- c. Spatial repellents
- d. Endectocides
- e. Housing
4. Tracking national malaria program operational research agendas
5. Vector control product inventory – IVCC
6. VCAG updates – WHO VCAG

Workstream communication

Please also provide feedback on preferences for workstream communication, whether through semi-annual newsletters, ad hoc calls with task teams, and or webinars.

Overall – Konstantina Boutsika

KB thanked the chairs and all contributors for all five sessions, and their work over the last year. This year's virtual meeting saw a lot of interaction and engagement on both established and new topics.

List of acronyms

AEGIS	Advancing Evidence for the Global Implementation of Spatial Repellents
APMEN	Asia Pacific Malaria Elimination Network
ATSB	Attractive Targeted Sugar Bait
BMGF	Bill and Melinda Gates Foundation
CHAI	Clinton Health Access Initiative
DEET	Di-ethyl-3,8-toluamide
GIS	Geographic Information System
GM	Genetically Modified
HCD	Human Centred Design
IRS	Indoor residual spraying
IRRI	International Rice Research Institute
ITN	Insecticide-treated net
IVCC	Innovative Vector Control Consortium
LLIN	Long-lasting insecticidal net
LSM	Larval source management
MDA	Mass Drug Administration
MESA	Malaria Eradication Scientific Alliance
MSWG	Multi Sectoral Working Group
PCR	Polymerase Chain Reaction
PEEM	Panel of Experts on Environmental Management for Vector Control
PQ	Prequalification (WHO product assessment pathway)
RBM	Roll Back Malaria
RDT	Rapid Diagnostic Test
SMC	Seasonal Malaria Chemoprevention
SIT	Sterile Insect Technique
VCAG	Vector Control Advisory Group
VCWG	Vector Control Working Group
WHO	World Health Organization
UCSF	University of California San Francisco

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 5

Work stream 2: Expanding the vector control toolbox

29 April 2021, 3:00 PM – 6:00 PM CET

- 14:55:45 Von Konstantina Boutsika an Alle : Welcome to session 5!
- 14:56:18 Von Konstantina Boutsika an Alle : Work stream 2: Expanding the vector control toolbox
- 14:58:58 Von Mohan Rao Arasada an Alle : Greetings from Hyderabad, India
- 14:59:38 Von Oliver Wood an Alle : Good afternoon/morning from Johannesburg, South Africa
- 15:00:21 Von Amelie Wamba an Alle : Good afternoon everyone from Yaoundé, Cameroon!
- 15:14:22 Von Sian Clarke an Alle : Originally MESA was focused on elimination related research, does this now include all malaria control research?
- 15:15:38 Von Sian Clarke an Alle : ie is it comprehensive or selective?
- 15:17:29 Von Allison Tatarsky an Alle : @sian, I'm hoping our MESA colleagues can jump in but my understanding is that it's inclusive of all malaria control research
- 15:20:35 Von Beena Bhamani an Alle : It is inclusive of all malaria control research. MESA track gathers all the projects/research in Malaria
- 15:22:26 Von Ole Skovmand an Alle : you would not expect a topical repellent to discriminate against Plasmodium species; are they carried by different species or is it a difference in detection level ?
- 15:23:41 Von Ole Skovmand an Alle : how was the cream, oily, "dry", how was the smell ?
- 15:23:43 Von John Invest - Sumitomo - UK an Alle : Repellents work well when there is good daily compliance but soon falls away when no supervision
- 15:24:09 Von Charles Mbogo an Alle : Is this repellent against the parasites or the vector?
- 15:24:34 Von Jan Kolaczinski an Alle : Just to mention that Cochrane is updating their systematic review on this. WHO will revisit this topic at its upcoming Guidelines Development Group meeting once a revised review is available.
- 15:27:04 Von Win Han Oo, Burnet Institute an Alle : @Ole - One of the explanations for less effect on P.vivax may be due to relapse of P.v.
- 15:27:11 Von Tom Mascari an Alle : QUESTION for Win Han Oo: Consistent use is particularly important for personal repellents. What was your process for selecting the 12% DEET cream you used? Was it sensory attributes/product experience? active ingredient? cost? local availability at scale?
- 15:28:37 Von Win Han Oo, Burnet Institute an Alle : @ John - Thanks for your comment. Yes, we also included compliance survey for repellent. Please read the manuscript.
- 15:28:50 Von Mark Rowland an Alle : I have seen the same phenomenon in coendemic Pakistan. It is probably due to falciparum malaria suppressing vivax relapse. If you prevent falciparum infection (ie. effect) by repellent the vivax relapses (i.e. no effect against vivax)
- 15:30:38 Von Win Han Oo, Burnet Institute an Alle : @ Charles - it does not kill mosquitoes—it deters and repels them. it interferes with neurons and receptors located on the mosquito's antennae and mouth-parts that detect chemicals such as lactic acid and carbon dioxide.
- 15:31:24 Von Win Han Oo, Burnet Institute an Alle : @ Jan - Thanks for your information.
- 15:32:49 Von Julia Cutts, Burnet Institute an Alle : @Mark Rowland, that was in your trial of repellent soap, is that correct?

15:33:01 Von John Invest - Sumitomo - UK an Alle : I thought you should not use DEET on children??

15:34:38 Von John Lucas an Alle : Question for Eric Ochomo. Hi Eric.....are there plans to conduct entomological studies alongside these trials with other spatial repellents such as metofluthrin in order to help speed up the entry of much needed alternative products (other than just transfluthrin/Shield) once the product class has been established?

15:34:40 Von jacquesderekcharlwood an Alle : Question Why not just put these repellents up for sale. Does it actually need to be shown that they work to a certain percentage? The emphasis will still be on distribution of LLINs (and there may well be a shortfall in funding for these) so will these products be supplied for free? They are not cheap.

15:34:46 Von Win Han Oo, Burnet Institute an Alle : @ Tom - We selected DEET based on local availability, registration at the government department and effectiveness of different products / chemicals back at that time. I understand that other products such as icaridin is available which can achieve better compliance.

15:34:53 Von Mark Rowland an Alle : Correct. also saw it with cattle sponging with pyrethroid in a highly endemic village

15:36:09 Von Julia Cutts, Burnet Institute an Alle : Thanks @Mark Rowland, very interesting and although disappointing to not see an effect against vivax it is validating to have seen similar effects/non-effects across such different endemic settings.

15:37:37 Von Olivier Briet an Alle : Question to Dr Oo: Could you comment on the amount of compliance (even if estimated by the VHV as stated in the paper)? In your paper you provide ORs, but in my quick scan I could not find data on the overall estimate of compliance in the participants.

15:37:49 Von jo lines an Alle : Yes, it does not kill, so does not reduce longevity as IRS does. This is probably a major disadvantage. But this depends on the physiology of the effect: after a female has been repelled because of the effects on her antenna etc, how long is the interval before she comes back and feeds again? Has anyone measured? I'm no longer up to date in this area.

15:38:29 Von Dingani an Alle : To Eric, it would also be good to look at the cost effectiveness in sub-Saharan Africa.

15:38:31 Von Julia Cutts, Burnet Institute an Alle : @John Invest, my understanding is that DEET is safe for children older than 2 months, but should be applied by adults. In the trial, we recommended the repellent for over 6 month olds and provided instructions for safe application. But also interested in alternative views!

15:40:53 Von Win Han Oo, Burnet Institute an Alle : @Olivier - Participants were not obliged to use repellent, and, given the population size, compliance and the usage of repellent by individuals was not strictly monitored. However, analysis based on VHVs' estimates of the average frequency of repellent use in their village indicated lower risk of Plasmodium spp.

15:41:15 Von Mark Rowland an Alle : The point was there probably was an effect against new vivax infections. But if you stop new Pf infection with the repellent the old vivax infections relapse so you don't see an effect on new vivax infection. I was puzzled for a few years. Then Nick White put me right.

15:43:11 Von Olivier Briet an Alle : @Win Han Oo: Yes, I understand that. But as you could estimate ORs based on estimated compliance, could you let us know what the estimated compliance was as % of targeted participants?

15:43:51 Von Eric Ochomo an Alle : @John Lucas, we do not yet have plans for entomological evaluations of other products such as metofluthrin

15:45:30 Von Eric Ochomo an Alle : @Dingani, I agree it would be nice to figure out the cost effectiveness especially if we are to consider SRs against other vector control tools. We will discuss with the team on the feasibility of adding in this arm

15:45:43 Von John Invest - Sumitomo - UK an Alle : We did trials many years ago in Aleppo with LLINS and had c 80% reduction in leishmaniasis. So is this not better, cheaper and longer lasting?

15:46:41 Von John Lucas an Alle : Thanks Eric. Would be good to think about conducting additional ento studies with other products in parallel

15:47:05 Von Nicole Achee an Alle : Regarding cost-effectiveness assessment in the AEGIS program, this is a substudy that is planned using trial outcome data / costings.

15:47:42 Von Win Han Oo, Burnet Institute an Alle : @ Olivier - could you please leave your email? I will double check with our statistician and will share the information with you. Thanks.

15:49:11 Von guelbeogo moussa an Alle : To all. Given that repellent does no kill, but diverts mosquitoes, what is the impact of spatial repellent treatment on surrounding sites which are not treated?

15:50:31 Von Steve Harvey an Alle : Question: Laura, I am part of the social science team working on the AEGIS project on which Eric Ochomo presented earlier. Could you say more about the qualitative interviews you are doing? We will also be doing qualitative interviews with trial participants - perhaps we could talk off-line to compare research questions & instruments? Thank you.
steven.harvey@jhu.edu

15:51:14 Von Laura Paris an Alle : @Steven I am going to drop you an email

15:52:09 Von Eric Ochomo an Alle : @Guelbeogo, we really do not know, but that is what the diversity trial will be able to evaluate. If we see higher incidences in the buffer areas of clusters where we distribute SR as compared to the placebo clusters, we will be able to infer that SRs potentially divert mosquitoes to the non treated areas.

15:53:05 Von Suki Misra an Alle : @Steve Harvey happy to chat through Envelope qualitative research with you and @Laura Paris

15:53:24 Von Michael Macdonald an Alle : Q: Elliot: are you also looking at pesticide use in rice farming and their role in Insecticide Resistance Management? see: <https://croplife.org/case-study/importance-of-pesticides-for-growing-rice-in-sub-saharan-africa/>

15:54:43 Von Steve Harvey an Alle : Elliott & team: A team in Peru did a study on intermittent irrigation in rice cultivating areas. They found that irrigating intermittently greatly reduced mosquito reproduction & increased yield of rice crops. I don't think this study was ever published, but I could put you in touch with the investigators if you haven't already been in touch.

15:54:55 Von guelbeogo moussa an Alle : @Eric : Thank you

15:55:09 Von Jason Richardson an Alle : Jo, great question. Sarah Moore and colleagues at STPH are doing some great work exploring what they call the disarming effects of bite prevention tools. Check out their recent paper...<https://pubmed.ncbi.nlm.nih.gov/33472661/>

15:55:47 Von Julia Cutts, Burnet Institute an Alle : @Olivier, just to contribute to the discussion around compliance measures - the VHV were only asked about the frequency of application "on average" in their village, not the percentage of village residents who were using the repellent.

15:56:13 Von Jessica Rockwood an Alle : @Jo Lines, were you ever able to engage JICA on the rice irrigation and malaria issue?

15:57:38 Von Elliott Dossou-Yovo an Alle : @Michael, thanks. We are not using pesticide (insecticide or herbicide) in the experiments. But we plan to evaluate the individual effects of insecticide and herbicide on the mosquito productivity in rice fields.

15:59:00 Von Olivier Briet an Alle : At Elliott Dossou-Yovo: Great to see AfricaRice revisiting this important topic! When I was studying this (then AfricRise was called WARDA/ADRAO), I was always intrigued by how the larva production changed over the season with crop height / canopy cover, but this could also be related to water quality / predators etc., possibly also related to fertilizer. Are you monitoring such aspects?

16:00:17 Von Elliott Dossou-Yovo an Alle : @Steve, that will be excellent to liaise us with the team in Peru. The results from our experiments indicated that AWD and intermittent irrigation are promising options to increase rice yield, and malaria larvae from rice fields.

16:00:55 Von Elliott Dossou-Yovo an Alle : *to increase rice yield and reduce malaria larvae from rice fields.

16:02:23 Von jacobwilliams an Alle : @ Doddou-Yovo: A lot of info on timed irrigation and impact on the ecology of mosquito populations in rice fields - conducted by IRRI (international Rice Institute) and collated/published under PEEM. will encourage that you review those pubs. may find it very informative.

16:02:24 Von Elliott Dossou-Yovo an Alle : @Olivier, thanks. We are evaluating the effects of nutrient management, but not yet the effects of water quality and predators.

16:03:07 Von Elliott Dossou-Yovo an Alle : @Jacob. Thanks, we will do so.

16:03:40 Von Frances Hawkes an Alle : @Elliot / Jo - in next month or so we will start sampling at traditional vs. climate adapted rice cultivation (SRI) sites in Tanzania, it might be worth comparing notes, we are including water quality and nutrient management (possibly predators)

16:04:15 Von jo lines an Alle : The Peru intermittent irrigation work is a great example. Yes, thanks to Elliott's colleague at Africa Rice, Kazuki Saito, we pitched to a meeting involving JICA and Japanese 'Malaria No More'. The latter includes some senior ecological entomologists who worked on Anopheles in rice fields, including some work in Africa in the 1980s. It means that JICA are "thinking about" doing something about mosquitoes in their planned ODA investments in developing rice in Africa. Of course, thinking is one thing, doing is another. If they conclude that nothing effective can be done, they may decide there is no need to do anything!

16:04:52 Von Corine Ngufor an Alle : @Eric. Are you monitoring bed nets coverage.in combination with the spatial repellents? does the study area have the same brand of bednets?

16:05:27 Von Steve Harvey an Alle : @Laura - thanks - that is similar to what we have in mind, but look forward to talking with you & Suki in more detail.

16:05:28 Von michael.coleman an Alle : envelopesCL: In the camps are the tents, blankets etc, pyrethroid treated as this will impact the study.

16:05:30 Von Eric Ochomo an Alle : Question to Laura, what hanging methods worked for your team for this product?

16:05:39 Von jo lines an Alle : Yes Frances, you are right, we do need to confer and and map out this space. Same to anyone else interested in this space.

16:07:21 Von jacquesderekcharlwood an Alle : Metofluthrin emanators have been tested in Cambodia as have their acceptance by the local population.

16:09:18 Von Steve Harvey an Alle : On Peru intermittent irrigation:

http://www.digesa.minsa.gob.pe/DSB/secas/Nivel_Nacional/Riego_con_secas_intermitentes_en_el_cultivo_de_arroz_para_el_control_de_la_malaria_2009.pdf - In Spanish, but summarizes project & results.

16:10:23 Von Steve Harvey an Alle : <http://www.digesa.minsa.gob.pe/DSB/Resumen2010.asp>

16:19:53 Von Mamadou Coulibaly an Alle : Question@Htin: Would you mind elaborating more on the "co-creating tools" approach? How does it work?

16:20:57 Von jacquesderekcharlwood an Alle : Forest goers= illegal loggers??

16:22:41 Von Oliver Wood an Alle : Complement@Htin: Great presentation!

16:22:49 Von Win Han Oo, Burnet Institute an Alle : Forest goers are resident villagers who normally go to the forest for business such as cutting trees.

16:22:51 Von Tom Mascari an Alle : Of course there are also legitimate reasons for existing in a forested area...

16:24:51 Von jacquesderekcharlwood an Alle : After the floods in Mozambique in 2000 USAID, much to other NGO's shock and horror, gave people money instead of buckets or hoes. They did this so that 1) people could actually choose what they considered important and 2) they reestablished a market (since many shops were also destroyed by the floods). If there are different interventions that people might want to assess why not do something similar?

16:26:23 Von Htin Kyaw Thu an Alle : @Mamadou: co-creation workshops with communities in bundling products, e.g. LLINs with a repellent for forest goers. But of course, communities cannot create products. Consultative workshops with the communities are helpful even for planning a LLINs distribution campaign. Instead of health centre authorities leading the campaign, if we put youths in organising their own events, you will see such creative and innovative ideas, they will include performances and games and so on. Many new ways we haven't explored yet.

16:27:37 Von jacquesderekcharlwood an Alle : Elliot, of course, did this in Colombia many years ago.

16:27:50 Von Htin Kyaw Thu an Alle : @Jacq: not all forest-goers are illegal loggers, cannot generalize like this. some are local ethnic populations, migrant workers. In some countries, people who involve activities in the forest may regarded as illegal, e.g. logging.

16:34:40 Von Garth Drury an Alle : The first time I have seen in VCWG a presentation on ITN design (in-use) thinking about the end-user. Tremendous!

16:35:44 Von Mohan Rao Arasada an Alle : I agree.

16:37:25 Von Htin Kyaw Thu an Alle : echoing with @Garth! I remember my one encounter with one gentleman from minority ethnic group in Myanmar. They live for so long (longest civil war in Myanmar). He told me that he do not like the nets we gave him because of its bright colour. They need to have a dark green colour to camouflage from security forces and bright blue colour of LLINs make him vulnerable to his enemy.

16:45:28 Von Steve Harvey an Alle : Estamos haciendo el miso abordaje de observacion del comportamiento humano en el proyecto AEGIS presentado enantes por el Dr. Erico Ochomo. Me fascina lo que hicieron Uds. involucrando los colectores de mosquitos en la observacion. Seria sumamente conversar en mas detalle de sus metodos y ver la posibilidad de aplicarlos al nuestro.

16:46:10 Von Steve Harvey an Alle : Lo han sacado publicado ya?

16:47:38 Von Steve Harvey an Alle : So glad to see Latin America represented at VCWG!

16:52:37 Von April Monroe an Alle : Here is a link to a paper that outlines some considerations for observations as well as for integrating human and vector data in case it's useful:

<https://malariajournal.biomedcentral.com/articles/10.1186/s12936-020-03271-z>

16:52:47 Von Sarah Burnett an Alle : Question to panel: With the wide variation in entomological and human behavior, what level of data collection do we think is needed for effective planning & implementation? (i.e. per region, district, health facility) How should we prioritize where/when we collect additional data? Are there ways we can/should use existing data sources to prioritize?

16:55:07 Von jo lines an Alle : To echo Derek's comment, this is an interesting paper on the temptation of aid projects to do things that are meant to help but have unintended undermining effects. In the GMS, all kinds of untreated nets are abundantly available (and cheap) in rural areas, and HH surveys regularly show that >80% of people are sleeping under nets. This market is clearly a valuable public health resource, an opportunity for a sustainable and locally adapted solution! But instead of working with the producers and sellers to convert these untreated nets to LLINs, we give away LLINs made in factories elsewhere. Of course from the donors' point of view, that is much easier and quicker and cheaper. But from the local point of view, the opportunity for a sustainable solution is lost! Why don't we use these local markets, instead of trying to replace them!

16:55:10 Von April Monroe an Alle : Examples of recent work in human centered design from my colleagues at CCP (case studies on left hand side): <https://breakthroughactionandresearch.org/sbc-flow-chart/>

16:57:17 Von April Monroe an Alle : HCD for ITN Design:

<https://www.ghspjournal.org/content/7/2/160>

16:57:20 Von Htin Kyaw Thu an Alle : Example: <https://www.mizzima.com/news-features/women-garment-workers-find-support-through-thone-pan-hla>

16:59:38 Von jacquesderekcharlwood an Alle : There is much talk about Integrated Vector Management - i.e. using two methods together to control the vectors. In many ways an LLIN should be thought of as two integrated interventions - the net and then the insecticide to treat it. This would then help focus on the production of good quality nets that might outlive the original treatment of insecticide and the treatment of the net - re-treatment may well return!

17:02:34 Von April Monroe an Alle : Thank you to the co-chairs for elevating this topic as a priority. There's still a lot of work to be done.

17:03:23 Von Michael Macdonald an Alle : and an editorial on the HCD ITN work in Ghana:

<https://www.ghspjournal.org/content/7/2/148>

17:12:14 Von Steve Harvey an Alle : I realize this is a controversial topic and there are differences of opinion about the relative importance of protecting human health immediately & protecting the environment (which is important for protecting human health in the medium- to long term, but what thought is being given to produce products like this & spatial repellents of material that, while durable, will also decompose when discarded (e.g., not plastic)?

17:12:26 Von sam an Alle : Question to Mathias Mondy: what are some of the implications of the environmental conditions to the performance/efficacy of the product, Has this been assessed?

17:13:08 Von Jose Saettone an Alle : In term of Quality how do you control film thickness, so mosquito can bite through the trap?

17:15:48 Von JMiller an Alle : Question to Mathias- what is the insecticide used in the trap?

17:16:49 Von Mathias.Mondy an Alle : @JMiller: it is dinotefuran (0.1%)

17:18:07 Von Mathias.Mondy an Alle : @Sam: We are doing a lot of research on housing density (influencing the density of bait stations) and botanical survey (to measure competition against natural sugar source) as well as impact on various mosquito species.

17:18:19 Von Suki Misra an Alle : @Steve Harvey For spatial repellents, our R&D has tested a wide range of substrates (both commercially available and in development stages) and continues to explore more sustainable alternative materials.

17:19:19 Von jacquesderekcharlwood an Alle : ATSB's are useful indoors.

17:20:49 Von Mathurin Fatou an Alle : Question to Mathias: why is the rim of the ATSB white? Is it for creating a contrast for mosquitoes to visually detect it? Is any test have been done with e.g. a fully black ATSB station to see whether there was a difference in attractiveness?

17:21:08 Von Mathias.Mondy an Alle : @Jacques: You are correct. We are waiting to have enough bait stations available to start testing indoor as well.

17:21:29 Von Graham White an Alle : ATSBs can be more effective indoors, particularly when combined with bednets

17:22:35 Von Mathias.Mondy an Alle : @Mathurin: This is just the back layer which is holding the bait. We have not study if the contrast is attractive to mosquitoes vs a complete black bait station.

17:24:15 Von Tom Mascari an Alle : @Mathias: Is there strong evidence that the proprietary blend in the ATSB is actually more "attractive" than just a sugar solution? Or are feeding rates the same? (i.e. is the A in ATSB real/necessary?)

17:25:11 Von John Invest - Sumitomo - UK an Alle : With this ATSB is there not a limitation by using a natural based sugar, so supplies are finite and could be problematical

17:26:01 Von Mathias.Mondy an Alle : @Tom: There have been a lot of screening (not by IVCC) done to identify the most attractive bait matrix. It is important to note that in addition to being attractive it also needs to remain effective for 6 months in field conditions.

17:27:27 Von Mathias.Mondy an Alle : @John: Yes, there are limitations in using a natural sugar source. Future generations of ATSB should aim to develop a synthetic bait.

17:29:15 Von Ole Skovmand an Alle : hi John: mix glucose, gelling agent, a bit of water and odour molecules that are fat soluble and will migrate through the membrane

17:30:34 Von Jose Saettone an Alle : how can you control that the film is thin enough so mosquito can bite and drink the insecticide. If exterior film is too thick mosquito cannot feed from bait glucose

17:31:03 Von Ole Skovmand an Alle : known technology, if you breed mosquitoes with membrane feeding

17:31:08 Von Oliver Wood an Alle : Interesting to see the BF MRR results confirm those seen in the multiple South African SIT MRR trials

17:31:59 Von John Invest - Sumitomo - UK an Alle : Hi Ole, interesting! I understand that the thinness of the membrane can cause transportation problems as it can rupture, don't know if this is true?

17:32:30 Von Jose Saettone an Alle : also which QC parameter you would use to characterize film thickness, for dinotetrafuran concentration I am aware of HPLC CIPAC Method. But how you get consistent film thickness.

17:32:57 Von Jose Saettone an Alle : thin enough so mosquito can feed.....and not too thick

17:33:42 Von John Invest - Sumitomo - UK an Alle : If you are sitting outside and a hungry mosquito comes along which do you think it will go to.....?

17:34:08 Von Jose Saettone an Alle : no idea.

17:34:16 Von Olivier Briet an Alle : @Laura&Mamadou: Can you comment on the risk of the "intervention-gene" becoming dissociated with the 'driver'. Do we only have one shot?

17:34:39 Von John Invest - Sumitomo - UK an Alle : A warm body will win every time!

17:36:31 Von Mathias.Mondy an Alle : @Jon: ATSB does not have the ambition to distract a female mosquito seeking a blood meal but to have a long lasting impact on the overall mosquito population including generating an age grading shift toward younger mosquitoes not in capacity to transmit.

17:37:21 Von jacquesderekcharlwood an Alle : Does Ivermectin affect faeces decomposition?

17:37:56 Von John Invest - Sumitomo - UK an Alle : Must affect insects feeding or living off it

17:38:12 Von jacquesderekcharlwood an Alle : dung beetles?

17:38:19 Von Ole Skovmand an Alle : yes, and this was a problem in Australia where it was used on cattle; cattle shit remained for years at soil surface

17:38:57 Von jacquesderekcharlwood an Alle : I remember that - but may actually be useful in controlling Culex quinquefasciatus

17:39:43 Von Laura Norris an Alle : Hi Olivier! For population suppression, it wouldn't be an issue, as the drive itself inserts into a female fertility gene, so there's no "cargo" tethered to it. For population replacement, it'd be a rare event but over time and very large mosquito populations, could be possible! My feeling though is that the evolution of resistance at the insertion target site would be more likely to happen first - similar to insecticide target site resistance. And in that case yes, you'd have one shot with a particular target site and would want to get it right.

17:42:35 Von jacobwilliams an Alle : increasing understanding of the sequencing of olfactory and visual cues in the mosquito in targeting and feeding decisions , provides emerging additional opportunities to further exploit utility of toxic attractants away from "warm bodies"

17:44:17 Von Jackie Cook an Alle : QUESTION @Carlos Does Ivermectin also impact Aedes populations?

17:45:36 Von John Invest - Sumitomo - UK an Alle : Has environmental impact been assessed re the faeces and affecting non-targets other than the study Ole mentioned?.

17:45:46 Von jacquesderekcharlwood an Alle : It might be a double whammy for Cx. q since the larvae as well as the adults might be exposed to Ivermectin

- 17:46:06 Von Carlos Chaccour an Alle : Hi Jackie, no impact on Aedes at relevant doses
- 17:46:11 Von Olivier Briet an Alle : @Carlos: Initial modelling studies suggested that very high coverages would be needed to have impact. Are there indications that these parameters have changed?
- 17:47:02 Von Carlos Chaccour an Alle : Hu Olivier, modelling is currently looking at 80% of the eligible population, which is around 64% of the general pop
- 17:49:01 Von guelbeogo moussa an Alle : Question to Chaccour: Is there any potential development of resistance for anopheline mosquito to ivermectin if it is widely use?
- 17:51:03 Von Carlos Chaccour an Alle : Yes, there is, selective pressure is always a potential. There are strategies being studied to delay this unavoidable effect to which all interventions are subject to
- 17:55:55 Von Mohan Rao Arasada an Alle : This is wonderful session giving research highlights. All 5 sessions were organized excellently by chair persons and by the speakers including Dr. Lina n coordinated by Konstantina.
- 17:57:51 Von jacquesderekcharlwood an Alle : tanks for an interesting meeting.
- 17:57:54 Von jo lines an Alle : One Q: in what LSM category do we put work on how not to grow mosquitoes when you got rice (or make bricks, or grow vegetables tc)? Avoiding man-made mosquitoes is a separate group?
- 17:58:24 Von jacquesderekcharlwood an Alle : Thanks - not tanks!!
- 17:58:37 Von Fredros Okumu an Alle : Great meeting. Thanks everyone. Wonderful Updates
- 17:59:15 Von Lina Heltsche an Alle : Thanks a lot for attending session 5!
- 17:59:20 Von Sheila Ogoma an Alle : For the next Master class please join here: https://ternet-ortz.zoom.us/meeting/register/tZAsceCqrzsuHdK_SdEKwKGsGamycn-rvULY
- 17:59:21 Von Molly Robertson an Alle : In the OR space there is overlap with the RBM SMERG so it would be great if you had a representative in that committee too
- 17:59:21 Von Jason Richardson an Alle : I second Fredros' comment. Great meeting!
- 17:59:30 Von Steve Harvey an Alle : Great presentations throughout!
- 17:59:38 Von Basiliana an Alle : Excellent meeting. Thank you every one.
- 18:00:06 Von Oliver Wood an Alle : Awesome presentations, and great conversations. Thank you all
- 18:00:09 Von Molly Robertson an Alle : Thanks all Allison, Sheila and Konstantina!
- 18:00:15 Von Amelie Wamba an Alle : Thank you for this amazing and enlightening session. all the best going forward!
- 18:00:26 Von manjurano an Alle : Great presentations
- 18:00:26 Von Lina Heltsche an Alle : Thanks to everyone for participating in this year's VCWG meeting!
- 18:00:34 Von Laura Norris an Alle : Thanks all, especially Allison, Sheila, and Konstantina!
- 18:00:39 Von David Gittelman an Alle : Thanks to the organizers and presenters!
- 18:01:30 Von Charles Mbogo an Alle : Thanks to all presenters and organizers for great updates
- 18:01:35 Von Josiane Etang an Alle : very nice meeting
- 18:01:42 Von Josiane Etang an Alle : Thanks
- 18:01:45 Von Garth Drury an Alle : Thank you to Konstantina, the other organisers/chairs and presenters. Great job on virtual.
- 18:02:02 Von Michael Macdonald an Alle : Konstantina deserves a "Malaria Heroes" award!
- 18:02:11 Von Sheila Ogoma an Alle : Ifakara Health Master Class: https://ternet-ortz.zoom.us/meeting/register/tZAsceCqrzsuHdK_SdEKwKGsGamycn-rvULY
- 18:02:31 Von Nick Brown an Alle : Excellent meeting. Many thanks and congratulations to all the organisers and presenters.

- 18:03:24 Von JMiller an Alle : Great meeting- very interesting presentations and thanks to all involved.
- 18:03:27 Von Silas Majambere an Alle : Not sure Konstantina knows the slides are not showing, but we don't want to spoil a great meeting :-)
- 18:03:59 Von Gagik Karapetyan an Alle : Thanks to all, and yes, Konstantina and session chairs, moderators, presenters- are all great
- 18:04:13 Von Allison Tatarsky an Alle : Thank you for all the excellent contributions! Fantastic to hear about our growing vector control toolbox and opportunities to engage more with communities and end users. Huge thanks to Konstantina for yet another wonderful VCWG meeting!
- 18:04:16 Von Ole Skovmand an Alle : thank to Konstantina and all speakers
- 18:04:16 Von jacobwilliams an Alle : Konstantina the super woman and team at the secretariat pulled off the first virtual meeting. well done. congrats to the our co-chairs and work stream co-leaders!!!
- 18:04:21 Von Gagik Karapetyan an Alle : Bye everyone and be well
- 18:04:24 Von Sola Oresanya an Alle : Thank you all!
- 18:04:31 Von Steve Harvey an Alle : Thanks, Konstantina - brilliant as always!!
- 18:04:37 Von Rosemary Lees an Alle : Thank you everyone for a really interesting meeting!
- 18:04:40 Von Carlos Chaccour an Alle : Thanks everyone!
- 18:04:49 Von Suki Misra an Alle : Thank you for a great session!
- 18:05:11 Von Vasanthan Paul John an Alle : Thank you all! Great presentations and discussions.
- 18:05:20 Von Frances Hawkes an Alle : Great meeting, thank you to all the organisers and presenters