

Vector Control in Humanitarian Emergencies Workshop<sup>1</sup>  
UN Foundation Office, Washington, DC  
27 September 2019

***Mission Statement***

To reduce human suffering and death from vector-borne diseases in Humanitarian Emergencies by:

- a) improving delivery, uptake, integration and evaluation of existing vector surveillance and control tools;
- b) facilitating the development of an evidence-base and uptake of supplementary and emerging tools.

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<sup>1</sup> Note, this workshop is a follow-on Industry Dialogue to the inaugural RBM Vector Control in Humanitarian Emergency meeting [<https://endmalaria.org/sites/default/files/Vector-Control-Humanitarian-Emergency-meeting-report-.pdf>]

## Executive Summary

Forcibly displaced persons now total more than 70.8 million; many are at increased risk for vector-borne diseases, malaria throughout much of Africa, leishmaniasis in Syria, Turkey and Iraq, dengue in Yemen and Bangladesh. While some are in settled camps where standard IRS, ITNs, and larviciding can be deployed, many others are mobile, in makeshift shelters and situations where these are not practical; there is a gap where nascent tools can play a life-saving role. Much of the high-burden malaria population in Africa are in these complex operating environments; we will not reach global malaria targets unless we address these ever-expanding challenges. There is urgent need to open dialogue among industry, approval and procurement agencies and implementing partner to expand use of existing vector surveillance and control tools and facilitate the development of new tools and processes for communities burdened by vector-borne diseases beyond the reach of current strategies.

With support from the UN Foundation, the RBM Vector Control Working Group convened a one-day workshop with 32 partners, including 10 from industry, to discuss and plan collaborative steps to improved use of existing tools; and develop, field trial, approve, register and deploy of additional vector surveillance and control tools.

The full range of vector-borne diseases must be included, sandflies and leishmaniasis, *Aedes*-borne and arboviruses, filth flies and diarrhea, rodents, fleas and rickettsia, as well as nuisance pests. There is a need and an opportunity for better coordination, tactically across the emergency response WASH, Shelter and Nutrition Clusters and strategically between the development and relief communities. Cyclone Idai, displacing 1.8 million people in Mozambique in March 2019, presents an example of natural disaster response where a functioning Ministry of Health and the emergency response agencies need to engage, as PAHO has frequently facilitated in the Americas.

Morning discussions focused on improved use of existing tools through the *Integrated Vector Management* framework, i.e. community engagement/policy and advocacy; cross-sector collaboration; entomological assessment/ decision-making; control methods; and capacity building. Several partners, including Industry, have significant technical capacities and resources that can be shared as “best practices” across agencies in emergency response.

Afternoon discussions focused on nascent tools, engaging industry for development of class-level *Preferred Product Characteristics* and product-specific *Target Product Profiles* that include testing, approval, registration and procurement. The first industry panel discussion included manufacturers of treated military uniforms; EPA-approved materials, including blankets; pest control products for mosquitoes as well as rodents and flies; consumer products and spatial repellents; LLINs and other treated materials. Discussion and recommendations highlighted approval processes and data requirements for trial deployment, beyond safety and entomological efficacy (e.g. EPA approval); especially important in complex operating environments where it may be impractical or unethical to conduct randomized trials with singular interventions rather than combinations, with epidemiological endpoints.

The second industry panel focused on procurement, the UNICEF procurement systems; potential resources from the Global Health Action Plan accelerator themes; better collaboration to facilitate national registration; testing, approval and policy recommendations, including modifications to existing testing protocols for emergency contexts, e.g. testing IRS products on plastic sheeting; logistics and the challenges of stockpiling. Discussions explored Global Fund Catalytic Funding; conducting a market and gap analysis of products and create a funded, pooled procurement mechanism with forecasted needs and pre-positioning of products.

Next steps include establishment of a platform for best practice exchange; closer collaboration with industry, funding, research and implementing agencies; for *PPC* and *TPP* development; and a concerted advocacy effort, including briefs to the RBM CEO and WHO DG; and an RBM “thematic briefing document”, highlighting the urgent need to improve implementation of current tools and adapting the current system of product development, testing, approval and procurement to meet the unique vector and pest control needs of these ever-expanding populations.

## Objectives

- Introduce the Vector Control in Humanitarian Emergencies Initiative including sharing experiences and challenges.
- Establish linkages among participants to address improved service delivery, efficiency and development of new tools.

**Organizers:** The RBM Partnership to End Malaria Vector Control Working Group and the United Nations Foundation.

**Participants:** Invitees from across the RBM VCWG partnership, including international agencies, relief agencies, donors, academia, industry and product development consortia. List provided in Annex II.

**Background:** Forcibly displaced persons, including internally displaced, refugees and those affected by natural disasters now total more than 70.8 million individuals. Many suffer or are at increased risk for vector-borne diseases: e.g. malaria throughout much of Africa, leishmaniasis in Syria, Turkey and Iraq, dengue in Yemen. While some displaced persons may be settled into camps where standard vector control tools such as Indoor Residual Spraying, Insecticide Treated Nets or larviciding can be deployed, many others are mobile, in makeshift shelters and situations where these are not practical. There is therefore a gap where other tools, either under development or without a specific policy recommendation, can play a life-saving role. Given ever expanding humanitarian, emergency and fragile operating contexts, there is an urgent need to evaluate expanding the use of existing vector control tools and facilitate the development of new tools and processes for contexts beyond the reach of current strategies.

Implementing agencies, including the MENTOR Initiative, MSF and UNICEF have come together under the auspices of the RBM Partnership to End Malaria to form the RBM Vector Control in Humanitarian Emergencies work stream. An inception meeting was held in Basel, Switzerland in September 2017, hosted by Swiss Tropical and Public Health Institute with participants from UNHCR, WHO, Global Fund and the London School of Hygiene and Tropical Medicine. Since the inaugural meeting, there have been several conference presentations and bi-lateral partner discussions, but there have been delays in establishing information-sharing platforms for improving current tools, and limited success in developing the necessary partnerships to facilitate the development of new and improved tools suited for Humanitarian Emergencies and outdoor transmission more generally.

With support from the UN Foundation, a one-day workshop was held on Friday, 27 September at the UNF offices in Washington DC. Catchmaster and the Swiss Agency for Development and Cooperation (SDC) through the Swiss Tropical and Public Health Institute (Swiss TPH) /GlobMal project, Phase 2, also provided generous financial support.

**Goals:** Following-up from inaugural September 2017 Basel meeting and subsequent bi-lateral discussions, develop plans and actions to:

- Improve delivery, uptake, integration and evaluation of existing vector surveillance and control tools in humanitarian emergencies, including those due to natural disasters.
- Facilitate the development of an evidence base for uptake of supplementary and emerging tools in surveillance and control of vector-borne diseases in humanitarian emergencies.

## Desired Outputs

- Establish platform for information exchange for existing surveillance and control tools and to facilitate bringing new vector control tools to the field best suited for humanitarian emergencies, considering three phases of “acute emergencies”, “transition communities” and “protracted emergencies” with established camps.
- Strengthened network for improved implementation of vector-borne disease control training and mentoring, planning, implementation, and assessments among partners and across the clusters, especially, Health, Water & Sanitation (WASH), Shelter and Non-food Items.
- Involve partners in industry, policy, implementation and product development consortia in development of *Preferred Product Characteristics* for the particular needs of vector control in humanitarian emergencies and outdoor transmission more generally (e.g. among vulnerable mobile populations).
- Develop partnerships among manufacturers, implementing partners, researchers and product development consortia with a focus on *Target Product Profiles* and adapting specific existing tools or developing new tools for vector surveillance and control in humanitarian settings.

### Note on terminology

- *Preferred Product Characteristics* provide high-level strategic guidance on desired efficacy and safety thresholds to help guide development of product classes based on public health need and existing data.
- *Target Product Profile* is a technical, product-specific tool that summarizes a development program using labeling concepts that will focus and stage-gate development efforts. TPPs state intended use, target populations and other desired attributes of products, including safety and efficacy-related characteristics.

## Meeting notes

### Welcome and opening remarks

Valentina Buj (UNICEF) and Elizabeth Ivanovich (UNF) opened the workshop noting that there were now more than 71 million displaced persons around the world, many of whom are affected by vector-borne diseases and other pests. Especially now, given continued conflicts and political unrest, natural disasters and other climate-related events, while at the same time considering malaria elimination, this is a critical time for us to consider the impact of vector borne diseases on displaced populations around the world.

### Setting the scene

#### Humanitarian contexts needs and gaps Richard Allen, MENTOR

The contextual changes of complex emergencies and natural disasters directly impacts vector-borne disease. The top five killers in humanitarian emergencies include Diarrhea, Malaria, Malnutrition, Measles, and Pneumonia. The top two are partially or completely vector-borne, diarrhea often associated with filth flies and malaria exclusively transmitted by vector mosquitoes.

This is not a malaria meeting, but rather we are taking a broader stance and looking across vector-borne diseases, including sandflies and leishmaniasis, Aedes-borne diseases, filth flies, rodents and fleas, as well as nuisance pests. Often a singular focus on malaria takes away from other potential health responses

We must direct our focus when designing vector control tools and responses and have good understanding in the particular context, where we are working, how does the vector behave, what is their larval habitat and their adult habitats; when and where are they feeding? We need to develop product profiles that address these specific criteria related to the vector, but also to the changing human circumstances: how has the context changed? How are people living in this setting? Why are people more vulnerable in these areas? Often this is related to poor shelter and increased exposure to insect bites; proliferation of vector habitats, e.g. sandflies in crumbled building; vector mosquito larval habitats; rodents and flies with poor sanitation; malnutrition; isolation from health services; insecticide resistance.

Many of the solutions for Vector Control in Humanitarian Emergencies include those that respond to outdoor transmission. As stated earlier, there are 71 million displaced persons and estimates that 1/3 of the Africa population sleep outside during parts of the years. The global health community is not investing in new solutions for areas where the burden of disease is the greatest.

Our objective is to reduce human suffering from vector borne diseases in complex operating environments. This includes engagement and facilitation of dialogue with the private sector for developing and bringing to market new tools that are critical in these contexts.

In contexts where there are shelters, tools include treated tarpaulins or plastic sheeting, treated curtains, wall lining, treated eaves or vents in tenting material. In contexts where shelter cannot be altered or supplied, this may include Attractive Targeted Sugar Baits, treated blankets and sheets and curtains. We must integrate at the implementation level to combine the use of tools to fit the setting and increase the efficacy of vector-borne disease control.

Vector Control in Humanitarian Emergencies presents both a great challenge and opportunity. The tool design need and regulatory environments differ depending on the vectors being targeted. Current “conventional tools” can offer reasonable control in some contexts but are not an absolute sustainable solution; current tools are not adequate for remote populations who are in transit and not living in shelters. We are still flooding Humanitarian Emergency settings with tools that are not working, for example pyrethroid LLINs in South Sudan where there is proven pyrethroid resistance

WHO prequalification does not have a regulatory process for vector control outside of malaria in humanitarian emergencies; there is no recommendation for vector control for in humanitarian settings at this time. There are several products that have been approved by “Stringent Regulatory Authorities” that have passed safety and entomological efficacy trials that should and can be used in these situations.

Finally, there is a need and an opportunity to coordinate across the WASH, Shelter and Nutrition Clusters. With WASH there are several situations where mosquito vector larval habitats are created with inadequate surface water management around water tap stands and roads; likewise, solid waste and excreta disposal have the determining impact on rodent and fly control and domestic water storage on Aedes. The Shelter Cluster has an opportunity to include features, such as insecticide treatment of tents

and tarpaulins, that will reduce the threat of vector-borne diseases; the Shelter Cluster can also help to minimize malaria vector larval habitats created with brick pits and borrow pits used in construction.

#### **Perspectives from OFDA** Sonia Walia, OFDA

USAID's Office of US Foreign Disaster Assistance (OFDA) is the humanitarian office of USAID. USAID/OFDA supports malaria prevention and treatment as part of a primary healthcare program, whereas in standard "development" programs malaria is often a vertical program. OFDA ensures that Primary Health Care is prioritized and that prevention and treatment of malaria is also included in the work no matter where the emergency is taking place. Because there are limited resources, OFDA needs to prioritize health programming that will have the most impact in an emergency. Malaria is one of the top three causes of mortality and morbidity in humanitarian settings and therefore should be part of every response. Often, the security situation complicates the response that can be provided. As shown by integrated community case management (iCCM) it is easier to integrate malaria treatment services into primary healthcare while it is more difficult to integrate prevention services, as many of the prevention activities may not be fit for people on the move, such as indoor residual spraying. So how do we find the right intervention for the context, where it is very insecure and people are often moving? OFDA aims to integrate Health, WASH and Nutrition in emergencies as often these activities are siloed and we need to reconsider how activities are being implemented as treatment of disease (malaria) is part of the acute malnutrition

#### **Natural disaster scenarios** Molly Robertson, PATH

**Context:** Cyclone Idai, March 14-15, 2019 with landfall in central Mozambique. This "Climate Emergency" produced flooded rivers causing entire communities to be displaced. There were 29 Internally Displaced Persons camps including 1.8 million people impacted; 93 health centers totally or partially destroyed. There fears of a large malaria outbreak and an urgent call for malaria prevention interventions.

Rapid resource mobilization allowed for the distribution of LLINs into the impacted areas: 500,000 LLINs were sent to IDP camps. In some areas net distribution was paired with a cholera vaccine campaign and in some areas LLINs were distributed simultaneously with food supplies. The distributions worked well where they were implemented.

Simultaneously, IRS was implemented in the four most affected districts. This included training and equipping 520 Spray Operators. The program was launched on 25 April, about 6 weeks after the Cyclone event. There were no issues with community acceptance with IRS or LLINs in Mozambique.

**Challenges:** Coordination of emergency relief partners with h NMCP was a challenge because there was a delayed recognition that malaria posed a serious issue. A malaria task force was created to identify gaps, secure funding and to focus interventions. Drone mapping of rehabilitation areas was used for IRS planning.

Efforts were made to ensure the "Cluster System" recognized the importance of vector control and to highlight the particular needs of the vector control response effort, specifically warehousing and shipping of commodities. Although there was a very large demand for LLINs among the populations, including during the cholera vaccinations when people who came for the vaccination were promised nets, there was limited space for LLIN storage and distribution. In some difficult to reach areas there was a need to use helicopters, but sometimes difficult for Ministry of Health officials to access.

Logistics were the major challenge with storage centers easily overwhelmed and more space needed for LLINs, insecticides and equipment. While there does not appear to have been an overall increase of malaria in the region, climate change will continue to create natural disasters such as Cyclone Idai.

Lessons learned include the need for increased funding for surveillance efforts and the need to generate information for future response efforts. Also, the improved use of information technology for coordination and implementation, including the use of programs such as “WhatsApp”<sup>2</sup> and drone technology for mapping and targeting.

**Discussions:** PAHO has a working group on vector control in Humanitarian Emergency settings. There are opportunities to build links with this group moving forward including sharing of best practices as many of the challenges faced in these situations are vector-borne diseases. PAHO is launching a regional malaria elimination program and several of the contexts include humanitarian emergencies.

Puerto Rico showed that nothing can prepare you completely for a Category 5 Hurricane, but more needs to be done. Focusing only on treatment services in favor of prevention services places undue burden on the health system.

PMI commented that commodities are fixed at the country level but within the 27 country programs, they have flexibility to reallocate/resources to address complex operating environments and humanitarian emergencies. Entomological monitoring is happening in all PMI-supported country programs and IRS is implemented in 14 countries. The biggest assets are the in-country teams. PMI can support IRS in a refugee/displaced persons camp if that’s what’s needed. PMI may also be able to shift resources around to address stockouts. There is a need to discuss stockpiles between donors and manufacturers. Usually there is no pre-positioning or stockpiles.

PMI does not develop products but is eager to pilot and evaluate new tools as appropriate and while PMI doesn’t focus on humanitarian settings they are interested in how to utilize tools most efficiently, for example to make IRS more cost-effective. PMI is not in the not in development stage but are in evaluation, to try to generate evidence for regulatory approval and policy recommendations. Operational Research is of interest as evidenced by the recent call for expressions of interest. Piloting feasibility includes spatial repellents, to understand if they are useable and scalable.

In the Mozambique example the use of LLINs was perceived to be high, although there was no systematic analysis of usage. There were some challenges in coordinating strategies for the cyclone response with those standing strategies of the NMCP, there could have been more of this done in advance, but was accomplished through a coordinating task force.

There were several concerns about the functioning of the current cluster system. The primary concern is that there often seemed to be a lack of understanding about malaria and vector control. Diarrheal diseases (and fly control) and Aedes-borne diseases often come as combined threats, with or without malaria. Multiple vector borne diseases can be controlled by a relatively small expansion of malaria-focused Integrated Vector Management (IVM) plus more targeted WASH actions; controlling vector borne diseases though IVM and WASH will have a bigger impact in reducing illness and deaths in these situations.

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<sup>2</sup> <https://www.unicef.org/innovation/stories/whatsapp-pilot-helps-tsunami-response>

## Improved use of existing tools in the IVM framework

IVM includes five core elements: community engagement; cross-sector collaboration; capacity-building; evidenced-based decision-making; and multiple tools, multiple vectors. The session was split into two panel discussions.

### ***Integrated Vector Management - Implementation***

#### **Panel Moderator - UNICEF**

UNICEF is a \$4 billion agency working across the several silos of humanitarian development work. Funding is often a driver of a siloed approach because of the reliance on measurable outcomes, for example, how many mosquito nets were delivered. But commodities are only helpful if they are being used properly. There needs to be more focus on behavior change communications and strategies rather than just on the commodities themselves. There needs to be emphasis on how many nets are being used rather than just how many nets are being delivered. How do we cut across silos or clusters and put the many health pieces together?

#### **Community engagement - CRS**

Community-driven approaches have guided the humanitarian response strategy. With regard to “shelter” – referred to homes, the UK Shelter Forum<sup>3</sup> - identified the fact that we focus too much on providing living space but not on the quality of that living space. The Shelter Cluster understands the importance of thinking about new cross-cutting approaches that address WASH and Health Cluster Issues who emphasize success on preventative measures. Traditionally Shelter focuses more on response, not as much on prevention. The collaboration of all cluster sectors will have the maximum impact. CRS has developed tools around community-based disaster reduction, including the risk- assessment process; building resilience within communities; and behavior change - understanding the triggers and barriers that need to be targeted by BCC. There is a danger that each sector is too concerned with their own messaging, resulting in communities to be overwhelmed by messages and therefore they "tune out".

#### **Community engagement, policy and advocacy - Nothing But Nets**

NBN supports policy mobilization through leveraging UN Foundation’s relationships with UN agencies, USAID and PMI, the Global Fund and the Private Sector. NBN advocacy has addressed the funding gaps for the humanitarian work on a small scale. Recent successes with Global Fund and PMI created opportunities for Global Fund catalytic funding<sup>4</sup> that can stimulate and support development of new tools and technologies for malaria. NBN can advocate for policy recommendations with the US Government and USAID/PMI, Global Fund, WHO and other UN Agencies. NBN is cognizant of the challenges for Private Sector companies in the WHO prequalification and is willing to be a leading voice to advocate for the up-take of new tools and technologies for vector control in Humanitarian Emergencies.

#### **Cross sector collaboration: (WASH, SHELTER NFI) – Peter Maes, MSF**

There is clear evidence that cross-sector collaboration is critical to improve the quality of the response in Humanitarian Emergencies given the challenging environment in which they tend to occur.

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<sup>3</sup> <http://www.shelterforum.info/category/united-kingdom/>

<sup>4</sup> <https://www.theglobalfund.org/en/funding-model/before-applying/catalytic-investments/>



Unfortunately, the competing priorities, personal experience, short decisional time spans and general set-up of the response mechanisms can stand in the way of an inter-disciplinary holistic collaboration. In many Humanitarian Emergency situations, the focus can be on immediate priorities and through specific and very narrow "keyholes" or perspectives.

These silos can be observed on interpersonal level between medical doctors, entomology, environmental health and logistical experts. An concrete example can be a situation where culturally women would experience pressure to avoid going to the toilets during the day, but rather during the nighttime and were assaulted - leading them to be expelled from the family and having to look for survival in sex work ending up in medical infrastructures seeking medical attention for STIs/HIV. A medical doctor can that take the clinical perspective and prescribe the required treatment and move on to the next patient. A medical doctor can then also take the Public Health approach, find out the root causes, and in discussion with Environmental Health engineers have child latrines build next to the women's latrines in fenced areas so that latrines can be used by women and children any time of day and thus improve safety. Latrines attract flies and next step could be to design them such they act to reduce fly infestation which would impact on disease transmission (e.g. bloody diarrhea ) and improve further the life expectancy. Another common example is domestic water storage that if not managed properly can be ideal larval habitats for *Aedes aegypti* (this was a major driver of dengue outbreaks in the Cambodian refugee camps in the 1980s). Badly drained water points were important breeding sites for *Anopheles species* in 2018 in Ntuta Refugee Camp, Tanzania. Another example was from Baringo county in 2018 in Kenya where droughts and absence of natural predators because on environmental degradation drove the snake population inside shelters. The focus of the response was on anti-venom where provision of mosquito nets to protect the population from snakes at night would have been an interesting intervention as well given the malaria burden at that time in the county.

These silos can also be observed on an institutional level between the shelter, health and wash cluster. Modular housing designed by IKEA did not include elements to reduce mosquitoes, including insecticide-treated eaves and other insecticide-treated materials. There is however a question if a commodity includes insecticides it may require different shipping and storage procedures. There is the same issue for tents – can they be pre-treated with insecticide either on the material itself or in the vents? What about insecticide impregnated blankets that are often provided in the first phase of an emergency? There clearly is room for a more integrated approach.

We can also observe incompatibilities in the procurement mechanisms of humanitarian organizations which are because of their administrative set-up and mutual accountability processes do piecemeal (country by country and project by project) orders, with siloed commercial processes driven by budgets leading to missed opportunities as commercial companies prefer one easy big and centralized order.

How do we break silos between diseases, governments, and within the cluster system? Are our conversations about vector borne diseases and insecticide pre-treatment of shelter materials or blankets on the radar of the Shelter Cluster? We need greater collaboration for the combined strategy of responses. This may include improved inter-cluster reporting structures rather than creating conversations between the clusters. The humanitarian response efficiency/ time is always an obstacle for response efforts and there is limited staff for all the many working groups.

Too often we used to go to meetings that are topic specific: Malaria people go to malaria meetings and WASH people go to WASH meetings. This meeting and other initiatives are however breaking with that

trend. The WHO and UNICEF are now developing new guide for Malaria Control in Humanitarian Emergencies where they make a specific point to gather inputs from other sectors and clusters. As part of this handbook there will a guide or checklist for cross-cluster collaboration that partners should consider (e.g. during the distribution of shelter kits, there is a need to include rope for hanging mosquito nets).

### **Discussion**

There were several comments on collaboration across clusters. We need to determine what inter-cluster tools can support the implementation across the sectors and to develop communications and clearly defined roles and responsibilities. WASH and Shelter are two clusters to better link their outputs with health outcomes. There is a need to generate interest amongst partners in these clusters and build capacity. There is also a need to increase donor awareness.

The critical need of working with local authorities was noted, with the comment that if we are sometimes challenged to understand how to engage clusters, this could be even more confusing for local authorities. International NGOs have a seat at the table within many of the clusters and they can support the cross communication that is necessary.

### **Capacity-building - UNICEF**

There are several capacity-building opportunities, with an emphasis of using the UNICEF-WHO Malaria Control in Humanitarian Emergency handbook as a foundation. These include several different types trainings by partners, including USAID/OFDA, MENTOR, MSF and UNICEF. We also need to explore inclusion of the training resources of the manufacturers, many of whom have training for their specific tools, but may also have more generic resources they can provide to capacity-building.

### ***Integrated Vector Management – Tools***

#### **Panel Moderator – ALMA**

There are innovative opportunities to making use of the private sector in malaria prevention during natural disasters. For example, during the Idai response in Mozambique, it was easier to efficiently channel mobilized resources from donors through the private sector - something that would have probably taken much longer using other normal channels. There were challenges around surveillance during the Mozambique response with multiple parallel reporting systems for NGOs, WHO and the country reporting system. This created confusion in surveillance and stock delivery but also led to the delay in getting routine reporting and stock functional again. For both issues, we need to reflect and determine what can be done differently.

#### **Entomological assessment and decision-making - Hudson**

We need to step away from malaria for a moment and think more broadly about the needs in responding to humanitarian emergencies, it may be more than just mosquitoes but involve snakes, rodents, bugs and other insects. We must consider different assessment approached for the short-term (2-3 months) vs long term-surveillance. What is the first thing that needs to be done when you first get on the ground? Often there are very limited emergency vector control plans and there is an urgent need to determine what vectors pose the largest threat. In addition to vectors themselves sometimes other mosquitoes, especially floodwater mosquitoes can be a major nuisance, but are often not part of the

public health response. After the initial assessments and short-term surveillance, there may be separate long-term solutions that can be addressed by continuing vector surveillance.

Remote sensing and GIS technologies can greatly improve entomological surveillance. The BMGF-supported work by University of South Florida demonstrated that by using “spectral signatures” of water bodies determined by satellite or drone one could determine mosquito larval habitats with 95%-97% accuracy.

It was noted that Remote Sensing and mapping is now widely used in emergency response, including through the UNICEF Office of Innovation.<sup>5</sup> Similarly it was noted that there opportunities to partner with telecommunication agencies to track human mobility that could help predict where diseases will arise and spread and help with planning and commodity logistics.

#### **“Family” vector control kits – UNICEF**

UNICEF provided information on the trail of a “family kit” of several household malaria vector control products that were introduced into communities in Kenya with step-by-step photo-based instructions, similar to what one might receive to assemble furniture. The study aimed to evaluate the feasibility, acceptance, and potential impact of an innovative approach to vector control designed to help protect vulnerable people from vector borne diseases in crisis settings. Products included an LLIN, a passive spatial repellent (the SCJ “Shield”), topical repellents, mosquito coils, curtains, larvicides for domestic water containers and an aerosol. These kits were designed to provide three weeks three weeks of containment within the household. After this process the more formal/traditional vector control can take over. The family kit with pictogram instructions was tested in a trial with entomological indicators measured by pyrethrum spray collections, window exit traps and light traps. The purpose of the Family Vector Control Response Kits were generally well understood, and they were used effectively. Adult mosquito reductions with the Spatial Repellent (Shield™), aerosol and mosquito coils were significant. Curtains also provided a positive effect in reducing mosquito numbers. Overall, the kits reduced mosquito numbers and provided sustained control for 1-2 weeks, sometimes longer. Initial results are encouraging and further studies needed to compare longer lasting tools (singularly and as kits) to confirm results.

#### **Vector Control methods (IRS, ITN, LSM) – US President’s Malaria Initiative<sup>6</sup>**

PMI supports 27 national programs in Africa and the Greater Mekong Subregion to implement comprehensive malaria diagnosis and treatment, entomological monitoring and prevention services including LLINs across all countries and IRS in 17 countries. There are several cross-cutting tools already being supported by PMI that can be applied to Complex Operating Environments and Humanitarian Emergency settings. PMI may be able to engage with new tools to help identify the gaps and the needs; operational research on improved housing for vector control will be starting soon. PMI supports the scale-up of new innovations so that data can be generated at a large scale to demonstrate efficacy and feasibility for scale-up.

#### **Vector Control methods (WASH, other vectors, rodents, filth flies) - MENTOR**

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<sup>5</sup> <https://www.unicef.org/innovation/stories/unicef-innovation-fund-graduate-asr>

<sup>6</sup> <https://www.pmi.gov/>

Vector surveillance and control activities should look more to collaboration with the WASH Cluster, where much of the funding is managed. Waste control is a huge piece of the response that needs to be addressed; there is a very clear link with vector control, flies, mosquitoes and rodents.

New solutions and tools include treated shelters. Access to these shelter helps to create environments with reduced threat of vector borne diseases. Few of these necessary tools have a WHO prequalification listing. We are stymied in the policy process by the requirements for epidemiological randomized controlled trial endpoints, which are often very expensive and difficult to determine or justify in acute emergency settings. We need to move past singular intervention – “silver bullets” and to think instead of combinations of tools that can be used, packages of smaller tools that work in unison with each other.

### Improving evidence base for new tool development

#### ***Preferred Product Characteristics and use scenarios*** Jane Bonds, consultant to WHO

Dr. Jane Bonds, consultant to WHO Global Malaria Program presented on the *Preferred Product Characteristics* (PPCs) identified as a key tool for WHO to articulate identified unmet public health needs that could be met by the development of new products; stimulate development of relevant products; and potentially smooth the passage of products that meet PPCs through the WHO evaluation and policy-making processes.

In making the distinction with industry-owned Target Product Profiles (TPPs), the WHO Global Malaria Programme proposes to collect and lead review of existing TPPs owned by partners to inform development of PPCs that are anticipated to be at a higher-level and to incorporate a number of more specific TPPs. WHO will use PPCs to have a joint scientific dialogue with product developers to inform performance criteria and evidence required to inform formulation of a policy recommendation and a prequalification assessment.

WHO will develop an overarching document that defines the requirements of the setting, as opposed to describing the tool itself. There will be separate documents for:

- Protective equipment: Insecticide-treated nets, clothing, tarpaulins, tents, or sheets.
- Residual Spraying: Indoor Residual Spraying (IRS), Exterior Residual Spraying (ERS), Chemicals, formulation types, application techniques.
- Repellents: Both Personal and Spatial repellents working on a community level.
- Push and Pull technologies and Attractive Toxic Sugar Baits (ATSB).
- Larviciding: Chemicals, Application Equipment, Packaging: Will likely look like a PPC for a stable situation.
- Space sprays: Chemicals, Application Equipment: (WHO does not have a policy for space sprays).

Dr. Bonds requested partners to contact her or Dr. Kolaczinski at WHO to share areas of expertise and feed into the PPC process.

***Industry Panel Session One: development of PPC and evidence base for nascent tools: treated blankets and other materials, shelters, spatial repellents; ATSBs, etc.***

### **WarmKraft** – treated uniforms

Ron Lack represented WarmKraft and described their treated military uniforms, currently with permethrin.<sup>7</sup> WarmKraft treats 100% of Marine Corps combat uniforms and 70% of the uniforms for the Air Force and Army. They produce 100 thousand units per week and 3 million units per year. While the military is their major business, there is also a limited commercial business for treated garments.

### **Pulcra Chemical** – treated materials<sup>8</sup>

Dave Pearce describe the EPA-approved “Skintex MRIII” microencapsulated permethrin treated materials.<sup>9</sup> The treated blankets have been run through several field trials with entomological endpoints showing the product continues to provide effective bite protection even when there is permethrin resistance.

### **Catchmaster**<sup>10</sup> - vector and pest control

Stan Cope introduced “Catchmaster”, part of the specialty adhesive company, AP&G who began marketing pest control products in 1978. The company has a lot of flexibility to turn around quickly for private labeling. It is important in an emergency situation to include other vectors and pests such as flies, rodent and nuisance mosquitoes. Catchmaster is expanding mosquito vector control products and now own an Attractive Targeted Sugar Bait (ATSB).

Dr. Cope also highlighted US Department of Defense resources, with 120 uniformed medical entomologists with a series of research facilities in Peru, Thailand, Cambodia, Kenya, as well as several research, development and testing facilities in the US. The DoD public health entomologists have strong expertise in disaster relief and humanitarian assistance and represent an excellent resource for capacity-building and training.

### **SC Johnson** - spatial repellents

Tom Putzer represented the SC Johnson “Base of the Pyramid” program<sup>11</sup> whose mission is to enable mosquito-borne disease prevention by delivering affordable offerings that are tailored to the world’s poorest 4 billion people. SCJ is relatively new to Humanitarian Emergencies, but there is interest and flexibility as a family company and not beholden to stakeholders. SCJ is currently pursuing WHO prequalification listing for a spatial repellent. They are also working with partners in several countries to test and trail spatial repellents as well as topical repellents including Cambodia and Rwanda. These products are seen as supplementary to ITNs and IRS and not necessarily a replacement.

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<sup>7</sup> <http://www.perimeterinsectguard.com/about-us/>

<sup>8</sup> [www.skintexmr3.com](http://www.skintexmr3.com)

<sup>9</sup> [https://www3.epa.gov/pesticides/chem\\_search/ppls/053263-00031-20081114.pdf](https://www3.epa.gov/pesticides/chem_search/ppls/053263-00031-20081114.pdf)

<sup>10</sup> <https://catchmaster.com/>

<sup>11</sup> <https://www.scjohnson.com/en/our-purpose/social-responsibility-news/health-and-well-being/bop/how-sc-johnson-works-to-enable-better-lives-at-the-base-of-the-pyramid>

## Vestergaard - ITN/LLIN

Melinda Hadi spoke on behalf of Vestergaard,<sup>12</sup> a major supplier of the PermaNet 2.0, deltamethrin treated LLIN and the Permanent 3.0 deltamethrin plus piperonyl butoxide (PBO) net, the first PBO combination net developed to overcome metabolic resistance to pyrethroids. Vestergaard also has the

Deltamethrin treated screening for livestock pests marketed under the brand name ZeroFly. Note that ZeroFly was also the brand name of the deltamethrin-treated tarpaulin for emergency shelter that is no longer being produced. Vestergaard has extensive experience with the WHO Pesticide Evaluation Scheme and now the prequalification pathway. In Humanitarian Emergency situations we need to identify criteria for what one is trying to deliver, what would it take to implement and how much it would cost. An example is the non-mesh Dumuria mosquito net, designed for use by outdoor sleepers in the Sahel region that has received a high level of acceptance, including for the privacy these non-mesh nets afford.

## Discussions

There was extended discussion on problem solving. Some of the tools we need may already exist, and the question is how to make them more usable? Why create another approval process for existing tools? Who will buy these products so they can be scaled up? We can't create systems around malaria alone but need to look at the needs for vector and pest control more generally. The large "bulk procurers" need awareness of new tools that are available.

What is needed to show a product could be effective and scaled up? Developing these products could be a huge financial risk for private companies and collectively we need to address the bottlenecks in the development, approval and procurement process.

There is often a 'Sunken Cost Fallacy' especially with regard to malaria control – i.e. because we have already invested so much already in specific strategies, we continue to do so, even if not ideally suited to certain contexts. We can reframe the issues through new channels and start to think of the tools from other diseases that can be used for malaria. We need to look at products to control vectors of Neglected Tropical Diseases (e.g. sandflies, *Aedes*) where there is safety and entomological efficacy data but often a lack of epidemiological data to support them. If we remove "malaria" from the equation there are several other approved vector and pest control tools that might be available.

WHO prequalification is necessary for procurement by USAID, Global Fund and other UN Agencies. There have been some exceptions within USAID with the procurement of the first PermaNet LLIN and pirimiphos-methyl 300 CS for IRS before these were fully approved by WHOPES. The process may seem onerous but one needs to complete to cater to these those implementers. There are complementary approval processes where country-level stakeholders need to be engaged.

There are several testing and regulatory bodies, 'Stringent Regulatory Authorities' like the US EPA, WHO and the individual country National Regulatory Authorities. In addition, the individual manufacturers often have safety, entomological efficacy and quality control testing and procedures that often go beyond the regulatory requirements. It is important to understand the regulatory needs and markets for non-malaria products which do not have a clear WHO pathway. Prequalification is not the only process.

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<sup>12</sup> <https://www.vestergaard.com/>

There needs to be connections with the funders and the implementers within these humanitarian settings.

The US EPA has an “Emergency exemption” process for agriculture and public health pests and vectors.<sup>13</sup> There were suggestions that there be similar emergency approvals by WHO. Emergency stocks would allow for more rapid delivery, but these have been difficult to fund and manage in the past.

There are ethical questions for conducting trials, such as randomized control trials, in humanitarian settings. There are ethical parameters for this operational research that may be different in humanitarian settings.<sup>14</sup> We can also learn from products that were approved for use during the Zika outbreak.<sup>15</sup>

The studies need to be done in the field with communities, but studies done in many of the emergency situations may not be able to meet the current WHO requirements for epidemiological endpoints. If this is difficult would it be possible to find surrogate settings that mimic the way people live in a humanitarian emergency setting? On the other hand, we need to pilot new products in the field to see where they work. Often immediate “effectiveness” is not the issue, but rather the appropriate and continued use of these tools. Cognizant of this need, several RCT of potential acute phase interventions have been evaluated during the ‘transition phase’ of emergencies in which the required level of epidemiological monitoring could be done (see Annex 1 for examples of insecticide treated blankets, plastic sheeting, topical repellents, tents as well as ITNs and IRS in emergencies). Whether this series of case studies would constitute adequate evidence to meet the requirements for policy recommendations is not yet clear.

Normally, WHO requires epidemiological evidence from at least two well-executed randomized controlled trials before awarding new product class status to a new type of vector control intervention. An exception was set for PBO LLIN which attained recommendation on the basis of only 1 RCT given the pressing need for new classes of LLIN. A second exception was granted to intervention products for emergencies whereupon lesser evidence would be deemed acceptable on a case by case basis such as: non-randomized trial with control: before-and-after studies, cohort study, case–control study, cross-sectional study, time-series or interrupted time-series. This ‘leniency’ opens the door to many intervention studies done in emergencies to be considered as sufficient evidence.<sup>16</sup>

Companies are willing to take the path, which addresses needs but first there needs to be a clear understanding of the requirements for both the regulatory authority and the procurer.

In terms of evidence requirements, for the *Preferred Product Characteristics*, evidence is not the priority, evidence comes more into play with the *Target Product Profile*. The development of products for normal, stable, settings may differ for emergency settings. We need to be clear from WHO on two points: a) what level of information is required; and b) at what level do we have enough evidence that a

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<sup>13</sup> for example the use of *Beauveria bassiana* and pyriproxyfen for mosquito traps, granted to CDC and the State of Florida during the 2017 Zika emergency response <https://www.epa.gov/pesticide-registration/pesticide-emergency-exemptions>

<sup>14</sup> See for example Chapter Nine of the 2013 Interagency Handbook on Malaria Control in Humanitarian Emergencies for discussion on research ethics <https://www.who.int/malaria/publications/atoz/9789241548656/en/>

<sup>15</sup> See for example <https://www.who.int/csr/resources/publications/zika/vector-control/en/>

<sup>16</sup> Design of epidemiological trials for vector control products, Report of a WHO Expert Advisory Group.2017. [https://www.who.int/neglected\\_diseases/vector\\_ecology/resources/WHO\\_HTM\\_NTD\\_VEM\\_2017.04/en/](https://www.who.int/neglected_diseases/vector_ecology/resources/WHO_HTM_NTD_VEM_2017.04/en/)

recommendation can be made. Overall, the PPCs will be a documents that WHO are using it to help clarify the requirements and speed up the processes for prequalification.

It was felt that companies can not rely on the very large bulk tenders from Global Fund and USAID, these are not sustainable; there is a need to diversify to help stimulate innovation and engagement.

### Improving access to existing and new tools

*Procurement challenges and potential solutions:* Presented by Industry Representative – Jessica Rockwood, IPHA and BASF Consultant

The donor financing and procurement landscape for vector control includes the Global Fund, PMI, UNICEF, WHO and the World bank The Global Fund is the largest procurer with to 50% of funds used for procurement with PMI and other institutions account for the remainder – not including country financed procurements. The Humanitarian Emergencies Landscape for Vector Control may also include UNHCR, UKAid, IFRC, USAID/OFDA, the UN Foundation, MSF, MENTOR and several other implementing NGOs. Each may have a different process and requirements for procurement.

There are several old or reintroduced vector control tools in emergencies, including treated tarpaulins and LLIN retreatment kits that are no longer in production or have expired registrations due to the lack of a sustainable market. Emergency situations may have financing differences and shorter lead times with a demand for quicker deployment. Stockpiling or pre-positioning may place an undue burden on the supplier and requires a need for shared responsibilities. The product shelf life may add additional constraints to stockpiling. Pyrethroid resistance cannot be ignored, and new versions of these once proven products and vehicles for insecticide are needed.

BASF Interceptor® G2 offers an example of the impediments to new vector control tools in Emergencies. Initial trials in Benin in 2006 indicated chlorfenapyr is suitable for control of resistant mosquitoes, but it has taken more than 13 years to near market readiness with VCAG evaluation earliest 2022. A fast-tracking process is required. Moving forward we should consider:

- Market analysis.
- Gap analysis.
- Mapping and coordination of the implementing partners across sectors – WASH, Shelter, Health.
- A funded, pooled procurement mechanism with forecasted needs.
- Pre-positioning of products.

With regard to products that are currently off market:

- A catalytic fund for vector-borne diseases in emergencies, i.e., an up-front response to anticipate emergencies?
- A funded purchasing and licensing company that leases, packages and stocks off-market products based on forecasted demand? This would not be the case for current/new products that would require procurement and off-site storage once produced for pre-positioning.



**Industry Panel Session Two: access need and opportunities for improving use of existing tools and for bringing new tools to the field (testing, approval, registration, market forecasting).**

**Panel Moderator** - Innovation to Impact

Innovation 2 Impact has been working for the past 3 years on increasing access to new vector control tools. During this time, we have seen all aspects of the process of bringing a new tool to market from the R&D, to evaluation and finally country registration. These are complicated issues with no easy answers in the 'routine' control of vector borne disease but are exacerbated in emergencies. The path to market is very unclear due to the small and unpredictable nature of the market and the difficulty in proving epidemiological efficacy needed for a WHO recommendation. For anything to move forward drive of innovators needs to be met with flexibility and pragmatism by procurers and policy makers.

**Bringing products to Market** - UNICEF

John Thomas presented the UNICEF Supply Division Procurement Strategy. There are three basic modules: 1) Pre-positioned modules stored in the Copenhagen warehouse, 2) On Demand Modules available through Long Term Agreements with manufacturers, and 3) Local Procurement via local, Long Term Agreements. Examples were given of the module kits to respond to a cholera outbreak: a central reference kit, a periphery kit, community kit, hardware kit, investigation kit and laboratory kit. This type of modular approach provides more flexibility for the country office to procure just what they need; less logistics for shipping, storage, better supply-chain management especially for items with a limited shelf-life. The UNICEF Supply Division is looking to improve pricing and to apply norm-setting regulations that can be applied across the board. Insecticides are not stocked because they have different requirements.

**Bringing products to market** – Sumitomo

Lisa Goldman Van Nostrand spoke about Sumitomo Chemical, a member of the Sumitomo Group of companies founded around 1615.<sup>17</sup> For Sumitomo Chemical sustainability, it was the founder's precept that business must give back to society; we must balance profitability with corporate social responsibility. Sumitomo Chemical has core expertise in mosquito control technologies and has a full portfolio of consumer products<sup>18</sup>, many of which have never been applied to controlling malaria vectors. Sumitomo Chemical, as well as several other partners here, is a member of the ZEROby40 initiative<sup>19</sup>, a collaborative effort by manufacturers to innovate until malaria eradication is complete.

Even for a large-sized R&D company, innovations must be sustainable. Given the high cost of bringing a new innovation to scale, the RBM Advocacy and Resource Mobilization Partner Committee, Innovation and Access Workstream, co-chaired by Sumitomo Chemical, IVCC and GSK, has been analyzing the pipeline for malaria diagnosis, treatment and prevention innovations.<sup>20</sup> The workstream has found there are

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<sup>17</sup> <https://sumivector.com/>  
<https://www.sumitomo-chem.co.jp/english/>

<sup>18</sup> <https://www.sumitomo-chem-envirohealth.com/products/>

<sup>19</sup> <https://zeroby40.com/>

<sup>20</sup> <https://endmalaria.org/about-us-governance-partner-committees/advocacy-resource-mobilisation-partner-committee-armpc>

common innovation bottlenecks across malaria innovation categories, as well as across different diseases. It is important to look for cross-cutting solutions to address similar issues, such as for malaria and other vector-borne diseases.

The Global Action Plan for Health (GAP) signed during UNGA is an initiative of 12 multilateral agencies that play significant roles in health, development and humanitarian responses.<sup>21</sup> The plan has adopted seven accelerator themes and 46 proposed actions, including three related to vector control in humanitarian emergencies.<sup>22</sup> Led by WHO Chief Scientist and Wellcome Trust, the GAP agencies are acting to address bottlenecks at each stage, including delays after passing through the WHO prequalification process, national registration protocols. There is an appetite for change. Better data platforms are emerging that can help target packages of innovations where they are needed. For Humanitarian Settings, VCWG could link up to High Burden/High Impact (HBHI) initiative of RBM & WHO. If can use fast tracks/waivers to speed registrations for Humanitarian Emergency Settings, these could generate evidence and support the overall scale-up process.

### **Registration - Clarke Mosquito<sup>23</sup>**

As a registrant of chemicals used for public health purposes throughout the world, it is often challenging to ensure that products are easily and quickly available to use as part of integrated pest management programs and for use in emergency situations. Products are often developed due to global commercial potential. The typical process for a product that is intended for global use involves initial evaluation by WHO prequalification team and at least one other global pesticide evaluation entity such as U.S. EPA. The requirements for these dossiers are often the determinants of the guidelines followed to generate data. The objective is to use a standard dossier to register a product that has either gone through evaluation or is in the process of being evaluated for in-country registrations.

There are several challenges for manufacturers of vector control products to develop and register innovative products and technologies that may be useful in emergencies. The process of evaluation by WHO, U.S. EPA, and country regulatory authorities is lengthy and expensive. As the WHO evaluation process has evolved from WHOPES to prequalification, the collaboration with the registrant has streamlined the data development and evaluation components of the dossier. Despite this fact, data generation is the longest part of dossier development and can last several years. The WHO prequalification list is intended to be a procurement tool, however, many countries do not recognize WHO evaluation as a benchmark to expedite the review process for the dossier. Instead, countries perform an extensive evaluation of

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<sup>21</sup> <https://www.who.int/publications-detail/stronger-collaboration-better-health-global-action-plan-for-healthy-lives-and-well-being-for-all>

<sup>22</sup> These include “5) Innovative programming in fragile vulnerable settings and for disease outbreak responses 6) Research and development, innovation and access. Point 6 includes three global action points: Enable more coherent, effective support to countries by aligning approaches and tools and promoting action on public goods in the following areas: 1 Develop “global good access practices” for innovation in health, including principles such as impact, affordability, effectiveness, efficiency and equity. 2 Establish and maintain an annual global forum to coordinate and accelerate the late stage pipeline of critical medical and health products (including diagnostics, medicines, vaccines and **vector control**) to inform coordinated action. 3 WHO should provide a curated list of innovations that could be brought to scale, based on disease burden addressed, cost-effectiveness, affordability and scalability.

<sup>23</sup> <https://www.clarke.com/>

their own. Many country regulatory authorities also conduct Phase III efficacy trials which must be complete before a product can be registered. Importing unregistered product into the countries for trials can often take weeks or months, further delaying registration approval. Additionally, some countries depend on more than one regulatory authority (i.e. Ministry of Health and Ministry of Agriculture) to complete the review of dossiers; the review process in these countries can take up to five years.

In order to have more products and technologies available in emergencies, further collaboration between the WHO PQ team and country regulatory authorities is necessary. Industry depends on WHO to communicate with country regulatory authorities regarding products that have gone through evaluation, what data has been generated for those products, and how countries can avoid redundant reviews while still ensuring products are safe and efficacious in their relative situations. Expedited review processes for products in emergencies should be adapted by countries, particularly those with less developed infrastructures for evaluation of pesticide products. As with the I2I efforts to streamline the registration process in Africa, continued needs-assessments should be performed on a regional basis to create a standard structure for product availability, dossier preparation, and evaluation. This may be particularly helpful in emergency situations when several neighboring countries are impacted and experiencing similar concerns with vectors. Provisional registration approvals while Phase III field trials are occurring in countries can also provide access to products as the evaluation process continues. Overall, with continued collaboration with industry partners, WHO, country regulatory authorities, and procurement organizations, products that are crucial to vector control can continue to be developed and made available for use in emergency situations globally.

#### **Testing, approval and policy - Bayer<sup>24</sup>**

Justin McBeath was able to join remotely to speak on behalf of Bayer.

It is difficult to consider that companies are going to take new product classes through the WHO-PQ process for use patterns specific to Humanitarian Emergency situations.

We are however in a better position to modify label claims of existing intervention classes to better accommodate use situations relevant to emergency environments. Given the difficulties in running trials in humanitarian emergency settings which generate data relevant to support label claims it would be useful to consider what surrogates could be developed. Therefore, help us understand what additions should be made to testing protocols; for example in the development of IRS products should we routinely test residuality on plastic sheeting and tent materials. If, as someone mentioned in the meeting, sometimes only relatively short residual life is needed for such surfaces then this also should be clarified – we could develop reduced application rates to cover such short residuality and therefore also reduce the associated cost (why pay for full rate when half rate or less might fulfil the intended purpose). Gaps need to be well described in language which is meaningful for development of label claims. When there is a good understanding of the gaps and use scenarios we can assess inclusion of the relevant label claims in the development of new products. This group provides an ideal point to start developing those use scenarios and TPPs.

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<sup>24</sup> <https://www.vectorcontrol.bayer.com/>

## Logistics – PMI

Lisa Hare offered the PMI perspective on challenges around logistics for Vector Control in Humanitarian Emergencies. While PMI has limited engagement with these situations, it has extensive experience with supply chain management for vector control across a wide range of countries. PMI has extensive experience moving products from the Target Product Profile stage to deployment and use in the field and aims to foster a healthy market for innovation. PMI needs new products to fight insecticide resistance but has a set funding envelope. PMI works with other partners to de-risk the market for manufactures so that the price-point is reasonable, using a number of different tools including volume guarantees and advance commitments. PMI must work with others for these initiatives as PMI funding is annual and so multi-year commitments are often not possible. Stockpiles and pre-positioning are a challenge, including because of the shelf life of some insecticidal produces. Standardization is important to provide the needed supply chain flexibility to respond to sudden changes in demand. At one point, PMI procured were 87 different ITN types according to size, shape, color and material. Standardization not only provides flexibility but also can lower costs. A white net is less expensive than colored nets and there are ways to decrease the costs of packaging.

With lack of standardization across countries, it is sometimes not possible to divert products from one country to another. For example, 1.5m LLINs could have been diverted to respond to the Mozambique Cyclone earlier this year, but the packaging was in the wrong language with the logo of a different Ministry of Health. We need to make supply chains more responsive and agile. This may include further standardization.

## Discussion

How can we facilitate development of guidance in the absence of a WHO policy recommendation? Is there a way to support informed local decision-making? As each Humanitarian Emergency may have different contexts and needs there is a need for continuous recommendations for case-by-case emergency situations. The 2013 Interagency Handbook does list several interventions beyond ITNs and IRS. What role can RBM play?

How to de-risk innovation? Can we look at the Global Fund Catalytic Funding<sup>25</sup> for support? The IVCC is supporting development of several tools that could target outdoor populations and residual transmission and may have a role in emergencies. Emergencies are more than just residual transmission. They are a special category with unique needs for shelter, nutrition, health, camp structure and operations.

The WHO initiative on Preferred Product Characteristics is a good opportunity for the partners present to help guide the process and feedback is welcomed. A systematic review of interventions across a range of product prototypes that are already demonstrated to have impact on malaria transmission may initiate the evidence pathway from randomized controlled trial to WHO/PQ (Annex 1).

However, WHO's work will only focus on malaria vector control so this group must find ways to build on those PPCs and develop them for other diseases, vectors or product classes that may not be covered by this initiative. This could be a key output from the VCHE group.

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<sup>25</sup> <https://www.theglobalfund.org/en/funding-model/before-applying/catalytic-investments/>

Funding: Core funding for vector control in USAID/PMI or GFATM grants is generally aimed at non-emergency use. While efforts are always made to help in response to emergencies, this just redistributes products from other areas not bringing more resources to the table. Where appropriate, standardization of tools e.g. net specifications could help to provide flexibility in global supply systems.

Advocacy: We should approach the Assistant Director-General, Emergency Response, Dr Ibrahima Socé Fall, who has a long association with malaria and RBM to push forward recommendations for emergency settings. Instead of just approaching the traditional technical route we should look for high-level buy-in.

The ZEROby40 initiative may offer opportunities for advocacy; training resources; and engagement of the agriculture sector for improved surveillance tools (including remote sensing and GIS) as well as vector control tools.

### Establishing a platform and network for information, best practice exchange

Discussion led by UNICEF, RBM, MENTOR, MSF

#### ***Operational Research:***

PMI noted interest in operational research moving forward to drive innovation and evaluate new tools. It was also noted that the WHO Preferred Product Characteristics initiative and refreshed prequalification process offer opportunities. We need to highlight key tools that have been investigated but do not yet have WHO approval and thus can not be procured by many of the major agencies.

MSF has a strong operational research capacity with more than 150 articles in peer-reviewed journals.

What information can provide to manufacturing partners about things they can move forward to address gaps? We can highlight successes such as the Interceptor G2 deployment via the Unitaid New Nets Project.<sup>26</sup>

#### ***Advocacy: a call to action***

It was suggested that humanitarian emergencies be seen as a separate scenario than normal "status quo" work and there should be more direct engagement with the WHO Emergency Preparedness and Response division.

The group should develop a concise and clear "call for action" document with a set of statements that highlight key recommendations and submit directly to the WHO Director General and to the Assistant Director General for Emergencies, responding to public statements about malaria and a call to do things differently. There was also note of the increasing importance of climate emergencies that have created several of these emergency situations that should be highlighted. The "call to action" must be constructive and signal that there is already progress to move the process forward. It must be "solution oriented" providing responses to issues and addressing gaps.

Separately, there was a suggestion after the inaugural Basel 2017 meeting to submit a letter to Lancet.

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<sup>26</sup> <https://unitaid.org/project/the-new-nets-project-in-partnership-with-the-global-fund/#en>

The RBM Secretariat has recently published a series of thematic documents on climate change, gender and universal health coverage.<sup>27</sup> We should add a piece on malaria in humanitarian emergencies to the list for development in the next few months. This could then also be used for an advocacy brief for RBM leadership for use with other agencies, including WHO.

An endorsement from the American Mosquito Control Association would also be useful.

### ***Information exchange platform***

Currently the RBM Vector Control Working Group has a web platform that houses the Vector Control in Humanitarian Emergency initiative<sup>28</sup>. We can source funding and build this out, possibly to a separate platform that people can use and access information related to these issues.

## Recommendations for next steps

Participants submitted recommendations for next steps during the week following the meeting. These grouped below, nearly verbatim, under the four intended meeting outputs.

### **Establish platform for information exchange for existing surveillance and control tools and to facilitate bringing new vector control tools to the field best suited for humanitarian emergencies.**

*VCWG should continue to play a role as a focal point/ convening point (whatever the right term is) for these discussions, but given the timing/frequency of this specific meeting, is this topic 'recognized' adequately within the existing workstreams/structure of VCWG.*

*Knowledge platform. I support the idea but suggest it is formalized with ToR or some outline on how it will be managed and "rules of engagement".*

*A repository of reports or case studies which provide evidence for entomological and especially vector control epidemiological impact would help to build the evidence for new product classes for emergencies and for development of PPC/TPPs. In addition to efficacy studies and quantitative data this repository should also include proven examples of deployment and implementation strategies. Good examples from grey literature should also be included.*

*The meeting was very useful. What will be the frequency? I think this should be bi-annually and rotate between Switzerland and other locations. It is a challenge to justify attendance for one day meetings if location is far as you understand. However, allowing possibility to attend at least one of the meetings physically (e.g. in Switzerland) would be tremendously useful.*

There were several recommendations for advocacy:

*RBM thematic briefing document about malaria and humanitarian emergencies should be developed.*

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<sup>27</sup> <https://endmalaria.org/resources/press-room>

<sup>28</sup> <https://endmalaria.org/our-work-working-groups/vector-control>

*Systematic review of successful evidence-based malaria vector control interventions in humanitarian emergencies and natural disasters. This review is being commissioned by WHO.*

*Diplomatic letter to the WHO DG as discussed at the end.*

*Notes to [the WHO DG] and a prominent journal as mentioned at the end of the meeting - just wanted to reiterate that [our company] is supportive of this approach.*

*A signed statement with specific contributions that organizations who attended the meeting committed to in response to the major bottlenecks discussed. This would be an important gesture in addition to letter to DG.*

**Strengthened network for improved implementation of vector-borne disease control training and mentoring, planning, implementation, and assessments among partners and across the clusters, especially, Health, Water & Sanitation (WASH), Shelter and Non-food Items.**

*Beyond malaria. It became apparent to us during the meeting that there's a need and opportunity in humanitarian + emergency settings to tackle diseases beyond malaria as a means to make more immediate impact, but also to establish evidence that may support use in malaria settings. Again, [our company] is supportive of this approach.*

*The humanitarian emergencies cluster system can prove very inefficient when it comes to coordination of delivery of malaria commodities. Recognizing malaria commodities as life-saving requires the support of WHO.*

*Engage leaders of the other clusters in conversations about the prioritization of malaria in relation to the work of their specific cluster.*

*Mapping and coordination of the implementing partners across sectors – WASH, shelter, health, etc.*

*PMI and OFDA to hold a follow-up meeting to establish a channel for coordination moving forward and to discuss specifics around strategy/policies/etc. as they relate to humanitarian emergencies. Develop an annex to be inserted in the malaria manual on the roles and responsibilities of different sectors in malaria control. This is related to the idea of having multi-sectoral meetings to aid malaria control/prevention. The challenge is that it is difficult to have these meetings amidst many other meetings partner staff have to attend. The checklist would be a great supplement for all sectors concerned to use for planning and response.*

*Given the need for strong ownership of these efforts and collaborative / coordinated implementation of activities, experts from these clusters should thus already be engaged in this consultation process, prior to finalizing the document.*

*PMI HQ is available to facilitate connections with in-country teams, as needed, who can provide on the ground expertise and coordination through existing relationships with NMCPs and other stakeholders.*

*From the Shelter perspective:*

- *To request the relevant global Clusters to form an inter-cluster technical working group (TWIG) to develop appropriate frameworks and guidance for improved collaboration and coordination.*
- *Collect and collate case studies and evidence to support and encourage inter-sector collaboration.*
- *How community-based approaches may contribute to vector control efforts and provide opportunities for sustainable longer-term solutions.*

### Financing, procurement and supply-chain management

*Channeling financial resources for response during humanitarian emergencies (not in areas of conflict) is a big challenge. Innovative ways - including channeling of such resources through private sector may prove efficient as long as the private sector entity has a history and good working relationship with the government.*

*Increased allocation to the Global Fund Emergency Fund (currently \$20m and must be reallocated at each funding round).*

*A catalytic fund for vector-borne diseases in emergencies, i.e., an up-front response to anticipate emergencies.*

*A funded purchasing and licensing company that leases, packages and stocks off-market products based on forecasted demand. This would not be the case for current/new products that would require procurement and off site storage once produced for pre-positioning.*

*Conduct a market and gap analysis of products and create a funded, pooled procurement mechanism with forecasted needs and pre-positioning of products.*

*Need continue the conversation with partners about in-country stockpiles between donors and manufacturers.*

*Supply Chain. It seemed like there are supply chain challenges due to inconsistent demand (and demand in different places with different language requirements, etc.).*

- *Inconsistent demand: central organizations (ex: UNICEF) to keep a certain amount of inventory on hand for emergency settings so burden does not fall solely on private sector to source. Not sure how realistic this is.*
- *Language restrictions: Governments to allow flexibility re: regulations on labeling etc. in emergency settings so we can move product from one area to another quickly.*

### Implementation

*Interventions need to be selected based on decision-making surveys defined in the national vector control plan, but therein lies the problem: there are very few national vector control plans written and even fewer that include this subject. This has two inherent problems. First those arriving to help respond to the event probably have no idea what the Plan is or how it was developed. Second, the national staff will most probably have to tend to their own problems and may not be available to help responders help them.*



*Insist that vector control in the aftermath of an emergency or disaster is NOT traditional vector control. It must not circumscribe interventions framed by "traditional" malaria or dengue vector control. It must not be circumscribed as an extension of an existing plan and expand existing interventions like the use of IRS and LLINs as the main interventions, though these need to continue. An emergency vector control program must address:*

- a. exploding populations of non-vector species like flood water mosquitoes, those generated in latrines, etc., as well as "traditional vectors" of malaria, etc.;*
- b. insects and vertebrates associated with unsanitary conditions, improperly maintained latrines, flooding or destruction of the lairs or food sources, etc.;*
- c. insects and vertebrates associated with overcrowding: body and head lice; bed bugs, other biting bugs, etc.;*
- d. flesh flies, filth flies, biting flies (stable flies, biting gnats, etc.); sand flies, tsetse flies, etc.;*
- e. rodents, increased contact with feral animals like cats, dogs, cattle, etc.*

*Insist that vector control program managers include an emergency vector control plan in their routine national vector control plans that identifies key items. These include:*

- a. vectors of medical and veterinary importance;*
- b. vector-borne diseases of medical and veterinary importance, including zoonotic conditions;*
- c. potentially problematic areas in the country: floodable areas, dams, livestock feedlots, etc.;*
- d. A list of all staff members, their position in the organization and their contact information;*
- e. An updated inventory of vector control materials used and registered in the country against vectors of medical and veterinary importance;*
- f. A list of agreements with in-country agencies or organizations coordinating vector control operations and those with neighboring countries;*
- g. A contact list with the names of the directors or ministers of public works, water, roads, education, communication, etc.*

*Establish and define the stages of a response: Initial & Long term. Determine the expected outcomes of the initial stage that could define when it would no longer be an initial phase and be considered a long-term intervention. The phase immediately following the event should concentrate on the effect of the event on what was present before it arrived and its impact on the area and population. It needs to focus its attention and determine:*

- a. the level of destruction on the existing program infrastructure and capacity;*
- b. the impact on the local staff and their families;*
- c. the extent of physical and/or chemical damage to the area protected by the program;*
- d. the extent of the damage to buildings and shelters, both public and private;*
- e. type of vermin (mosquitoes, sand flies, biting flies, rodents, snakes, etc.) and level of exposure to them;*
- f. a food protection program that keeps perishable items away from rodents, feral animals and human marauders;*
- g. personal protection clothing, bedding and shelter needs for survivors and domestic animals.*

*Identify the period after the event when control interventions should be directed towards protecting survivors and first responders, protection of food and sanitation, safe waste disposal, proper drainage and general sanitation on a long-term basis.*

*Establish a three- or four- day workshop with actual scenarios and situations where national vector control staff members can work on real and realistic situations.*

**Involve partners in industry, policy, implementation and product development consortia in development of Preferred Product Characteristics for the particular needs of vector control in humanitarian emergencies and outdoor transmission more generally (e.g. among vulnerable mobile populations)**

*Better understand the sensitivity of our current collection methods, in addition to the obvious need for a better method to monitor outdoor biting/resting mosquitoes.*

*Humanitarian emergencies are unique situations. In adopting new vector control tools, WHO needs to exercise flexibility. All is needed is a tool that kills vectors and is safe to humans and to the environment. There is therefore a need to advocate for support from WHO senior management in exercising such flexibility.*

*While there is perhaps an assumption that industry partners are already aware of the situation in the field, I think the real operational experts are those who use / implement the VC interventions and the communities who experience these humanitarian emergencies. It will be of great added value to engage them in these consultations directly.*

*PMI Vector Control and Supply Chain teams are available and willing to meet with manufacturers that are interested in innovating in the vector control for humanitarian emergencies space to see if/how potential products could have broader use.*

*We understand the value of the PPCs and TPPs for potential partners like [our company], but to what extent do we believe they will be received in the policy space? And if they aren't well-received, would there still be value in them if a policy would prohibit leveraging the output of PPCs and TPPs in humanitarian + emergency settings?*

*The main things are to get those PPCs drafted and out for consultation as soon as possible. The group should feed into them, because they need to be broader than just malaria. Also, the ones that [currently being developed by WHO] will likely not provide enough scope for all of the emergency needs, so there may be a need to develop some additions PPCs. Other than that, it's the issues around efficacy testing and linking that to donor funding requirements. Also, tiny market size, so how existing tools can be repurposed for emergency use.*

**Develop partnerships among manufacturers, implementing partners, researchers and product development consortia with a focus on Target Product Profiles and adapting specific existing tools or developing new tools for vector surveillance and control in humanitarian settings.**

*PMI is supporting operational research into new vector control tools around housing modification (specifically insecticide-treated eave ribbons and eave tubes) that may have implications/utility for vector control in humanitarian emergencies. PMI is happy to share/disseminate findings at an appropriate time as they become available and would welcome inputs from this working group on other tools that might have broader application to be considered for potential future OR studies.*

*Implementation/assessment. For potential industry partners like [our company]. humanitarian + emergency spaces typically present very different contexts than what we're used to operating in. A*

*commitment from emergency relief organizations to help industry partners pilot implementation of new innovations (on whatever scale would be least burdensome to them) would make it easier for new partners to enter the space and make meaningful impact.*

*Develop a systematic review of intervention studies, especially randomised or controlled trials which provide evidence for malaria vector control effectiveness in acute or chronic humanitarian emergencies or post-conflict settings. Compilation of entomological and epidemiological evidence and systematic review or meta-analysis. Identification of interventions, implementation issues, target product profiles of potential commercial products.*

#### Approvals and registrations

*Establish a small group with relevant expertise in the settings of Humanitarian Emergencies to review product labels / use descriptions and develop clear list of needs for label adaptation of existing products in existing intervention classes. This should be one list then passed on to all suppliers for them to consider in their own planning.*

*For relief organizations that do not rely 100% on WHO-PQ listed products, develop a reference list of suitable/accessible products already registered with stringent regulatory authorities. Companies can do that but we would need to know the specific use situations and desired targets in order to identify the right products.*

*Use those two steps [above] to help clarify the remaining gaps and then develop clear use-descriptions for each of them (or is that already done?). Organize one-on-one discussions with suppliers to clarify what is already in the pipeline.*

*Suggest the UN agencies which rely on PQ listed products have their own discussions internally on why PQ listing (vs stringent regulatory authority registration) is so critical. What is behind the policy (specific for emergency settings)?*

*The challenge of new intervention classes and getting a product through to PQ listing, with the pre-requisite of a GMP Policy recommendation, is a massive topic and not one that I have any additional constructive comment beyond what was discussed in the meeting.*

*WHO Recommendation. A key challenge for us in this space is the lack of WHO recommendation and how that constrains procurers. It would be helpful to have a resolution or official mandate of some sort to allow for lifting of WHO recommendations as a constraint in emergency settings, where innovative new tools are vitally necessary.*

*One of the major concerns in the meeting was related to challenges regarding approval of products/tools for vector control in the Countries during emergencies. My recommendation would be that under the leadership of WHO we identify watch list countries that are prone to emergencies and seek for prior approval of products that are suitable for these different countries/contexts such that we are prepared to mobilize and ship in supplies when an emergency hits. Manufacturers could as well strategically identify and establish networks within these countries that can easily mobilize and distribute their products. The*

*local potential distributors could also help in getting the required approvals because they know how their own systems work.*

*It seems one important question resulting from the workshop is not only what quality of evidence already exists, but also what quality of evidence is needed for new tools. Neither question was explored in great detail, and this could provide an opportunity for input in the final recommendations/actions resulting from the workshop.*

## Annex I: Additional Reference Materials

from Mark Rowland, London School of Hygiene and Tropical Medicine. Due to technical difficulties these slides were not presented during the meeting

### WHO requirements for new vector control tools (2017)

- For new classes of vector control tool, WHO requires evidence from two randomized controlled trials with epidemiological outcomes
- For LLINs of non-pyrethroid AI and other VC tools, entomological data is not enough

#### Study designs recommended by WHO to assess the public health value of a new intervention or product

Level 1. Randomized controlled trial: <b>individual or cluster randomized</b>	Recommended
Level 2. Randomized controlled trial: <b>step-wedge, cross-over, factorial design</b>	Recommended
Level 3. Non-randomized trial with control: <b>before-and-after studies, cohort study, case-control study, cross-sectional study, time-series</b> or interrupted time-series	Recommended on a case-by-case basis
Level 4. Trials without a control or using a historical control group	Not recommended

Exceptional situations where level 3 design is warranted include humanitarian emergencies

### Evidence based intervention in emergencies

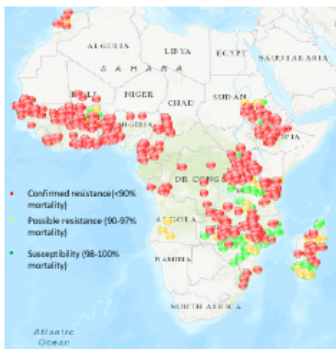
Control intervention	Study design	Disease	Intervention or control group	Incidence or prevalence	Odds ratio or Risk ratio	Effect size
<b>1. ITN (Pakistan)</b>	Household RT	Pf	I	3.8	0.39 (0.29-0.53)	61%
			C	9.9		
		Pv	I	13	0.58 (0.49-0.68)	42%
			C	22.4		
<b>2. ITN (Afghanistan)</b>  ITN vs no net control,  village randomised	Cross sectional surveys	Pf	I	1	0.41 (0.25-0.66)	59%
			C	2.4		
		Pv	I	0.7	0.50 (0.17-1.49)	50%
			C	1.3		
	Case-control  Passive surveillance in clinics	Pf	I	0.7	0.31 (0.21-0.47)	69%
			C	2.5		
		Pv	I	11.4	0.75 (0.66-0.85)	25%
			C	15.3		

Control intervention	Study design	Disease	Intervention or control group	Incidence or prevalence	Odds ratio or Risk ratio	Effect size		
3. Permethrin treated blankets and top-sheet vs no nets (Afghans/Pakistan)	Household RT	Pf	I	11.6	0.56 (0.41-0.78)	44%		
			C	20.7				
		Pv	I	13.0	0.74 (0.54–1.02)	26%		
			C	17.6				
4. Permethrin treated sheets vs placebo - Shukas (Kenya)	Individual RT		I	1.4	0.19 (0.05-0.77)	81%		
			C	7.5				
5. Permethrin treated blankets and top-sheet vs placebo (Afghans/Kabul)	Household RT	ACL Leishmaniasis	I. Permethrin blankets	2.5	0.33 (0.2 – 0.6)	67%		
			I. ITN	2.4			0.31 (0.2 – 0.5)	69%
			C	7.2				
6. IRS: pre-season (control) vs standard season spraying	cluster RT	Pv prev.	I	1.4	0.39 (0.19-0.79)	61% (1-OR)		
			C	4.3				
		Pv inc.	I	22.7	0.50 (0.47-0.52)	50% (1-RR)		
			C	45.6				
7. IT Plastic Sheeting vs untreated PS: walls + roofs	Cohort RT	Pf	I	63	0.40 (0.33-0.47)	60%		
			C	163				
ITPS vs untreated PS: roofs only	Cohort RT	Pf	I	133	0.85 (0.75-0.95)	15%		
			C	157				
8. Insecticide treated tents	Cohort RT	Pf	I	18%	0.34 (0.17-0.68)	66%		
			C	39%				

Control intervention	Study design	Disease	Intervention or control group	Incidence or prevalence	Odds ratio or Risk ratio	Effect size
9. Topical skin repellents 1	Household RT	Pf	I	3.7%	0.44 (0.25-0.76)	56%
			C	8.9%		
Topical skin repellents 2	Case control	All	Neither	23.1%	1	-
			T.R.	14.8%	0.50 (p=0.08)	36%
			ITN	8.6%	0.42 (p=0.017)	63%
			T.R. + ITN	6.5%	0.31 (p=0.007)	72%
10. Insecticide treated live-stock vs untreated live-stock	Cross over community trial	Pf inc	I and C		0.44 (0.22-0.86)	56%
		Pf prev	I and C		0.46(0.31-0.70)	54%
		Pv inc	I and C		0.69 (0.50-0.95)	31%
		Pv prev	I and C		0.60 (0.33-1.08)	40%

## Pyrethroid resistance : Major threat to malaria vector control

*LLINs and all other interventions in emergencies depend on pyrethroids*



Pyrethroid resistance from 2005 to 2018, from IR Mapper

Alternative active ingredients c.f. LLIN or new generation LLIN

PBO synergists

Pyriproxifen (insect sterilent and growth regulators)

New safe insecticides (chlorfenapyr, indoxacarb, OPs)

Repellents (but residual activity?)

Proven interventions in emergencies need new active ingredients and new testing

## Annex II: Participants

Name	Organization	Name	Organization
Gaby Zollner	AFPMB	Molly Robertson	PATH
Abraham Mnzava	ALMA	Andrea Dunne-Sosa	Project HOPE
Justin McBeath*	Bayer	Dave Pearce	Pulcra Chemicals
Stan Cope	Catchmaster	Konstantina Boutsika	RBM VCWG
Jamie Richardson*	CRS	Michael Macdonald	RBM VCWG
Nandita Chowdhury	Clarke Mosquito	Thomas Putzer	SC Johnson
Manuel Lluberas	Hudson	Lisa Goldman Van Nostrand	Sumitomo
Angus Spiers	Innovation to Impact	Dana McLaughlin	UN Foundation
Alexander Klosovsky	IOM	Elizabeth Ivanovich	UN Foundation
Christen Fornadel	IVCC	John Thomas	UNICEF
Jessica Rockwood	IPHA	Valentina Buj	UNICEF
Richard Allen	Mentor Initiative	Jen Armistead	USAID
Kunizo Mori	Mitsui	Lisa Hare	USAID
Peter Maes	MSF	Melinda Hadi	Vestergaard
Margaret McDonnell	Nothing but Nets	Ron Lack	WarmKraft
Sonia Walia	OFDA	Jane Bonds	WHO Consultant
Rainier Escalada	PAHO	Gagik Karapetyan	World Vision

\*via Skype. (In addition, there were several other partners from IRC, LSHTM, WHO, UNHCR contributing via Skype)

