

## **Entomology for Onchocerciasis: Current Guidelines and Gaps**

**Session Date & Time:** Monday, November 18; 1:00 PM – 4:00 PM

**Session Location:** MGM Grand Ballroom Salon B

**Session Description:** Entomological evaluation is an essential component of onchocerciasis elimination programme activities. Understanding the location of active breeding sites is important for identification of 1<sup>st</sup> line villages, longitudinal monitoring, transmission evaluations for stopping mass drug administration, and post-treatment surveillance. Vector control is also an important complementary strategy that programmes may use to facilitate the elimination of transmission. Despite this critical function, little has been done to update entomological guidance or improve techniques to ensure that programmes are making decision on high quality data. In this session, presenters will discuss:

1. The purposes and current best practices of entomologic evaluations from mapping through post-elimination surveillance (10 min + 5 min discussion)
2. Advances in techniques for vector control, fly capture, and fly analysis (20 min + 10 min discussion)
3. Current WHO guidelines and gaps in those guidelines (15 min + 10 min discussion)

This will be followed by the break-out session which will include:

1. Presentation of 2 or 3 case studies from the field to spur discussion (e.g. Hotspot in Ethiopia, Breeding sites in Hypoendemic areas of Malawi)
2. Identification of key research questions for # 2 and #3

**Session Chairs:** Daniel Boakye and Paul Cantey

**Session Rapporteur:** Kira Barbre

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**KEY DISCUSSION POINTS**

What key findings and data did the group identify via presentations? What issues were raised in discussions?

- Vector borne diseases require three factors: vector, human, and parasite. Preventive chemotherapy only addresses two of these factors (human and parasite). Entomology for onchocerciasis is neglected.
  - o Vectors are good indicators for impact assessment and recrudescence because they are more efficient at picking up parasites compared to humans.
  - o Even when no microfilaria can be found in a person's skin snip, a small portion of flies who feed on that person can become infected.
  - o Even when no infected individuals have been identified in a community, infective flies have still been found.
- World Health Organization (WHO) guidelines are meant to be the minimal standard; programs may often need to do more than is required by the guidelines. Guidelines do not cover all possible situations. National onchocerciasis elimination committee (NOEC) and consultations with WHO should be used to supplement guidelines, particularly when there are gaps.
  - o The xenomonitoring manual has not been updated since 2002. Dr. Nwoke is currently working on an updated version.
  - o WHO 2016 guidelines for xenomonitoring start when programs are ready to do an assessment for stopping mass drug administration (MDA). There are not specific guidelines for xenomonitoring during treatment; xenomonitoring is suggested as a potential strategy for post-elimination surveillance.
  - o Questions not addressed in guidelines include: how to calculate ATP in parous flies versus all flies, how to identify breeding sites in forest or hypoendemic areas, how to assess seasonal streams, how ivermectin treatment affects black fly results, what the maximum area affected by a single breeding site is, how to appropriately use black fly traps, how to use slash and clear for vector control, and how to verify vector elimination.
- Xenomonitoring should be conducted before deciding to treat, during treatment, when deciding to stop treatment, during post-treatment surveillance, and during post-elimination surveillance.
- It is essential to map all breeding sites before doing an entomological or epidemiological evaluations

- Mapping smaller or seasonal breeding sites may be a challenge. Some breeding sites may only exist for a few months out of the year. This might necessitate multiple assessments throughout the year.
  - Detailed maps and satellite imagery can be helpful but should not replace physical inspections. They cannot adequately capture local circumstances such as pollution and temperature.
- It is important to map for breeding sites in areas previously considered to be hypo-endemic. Although it was previously believed that treating meso- and hyper-endemic areas would eliminate infection in hypo-endemic areas as well, this does not appear to be the case. Hypo-endemic areas can have their own breeding sites. In this case, treatment of meso- and hyper-endemic areas may not affect endemicity in the nearby hypo-endemic areas.
- Esperanza window traps (EWT) were originally created to be used in xenomonitoring but have also worked in some settings for community-directed vector control.
  - EWT outperforms HLC in number of flies collected. When fully optimized, traps have captured 20x more flies compared to human landing collection, and they also require less person time to run.
  - Currently, EWT can be made with locally-sourced materials for about \$15 per trap.
  - When deployed in areas where people gather, EWT can substantially reduce fly bites.
    - When deployed around an outdoor classroom, EWT led to a 90% reduction in fly bites.
    - When deployed around agricultural fields, EWT led to a 50-70% reduction in bites.
  - Performance of EWT varies widely by trap placement. It is not clear what distinguishes a high-yield placement spot from a placement that gathers fewer flies.
- The recrudescence of onchocerciasis in the Comoé river basin in Burkina Faso shows that any residual transmission of onchocerciasis may lead to recrudescence when biting rates are high. Cross-border migration of flies and humans likely also played a role.
- The Galabat-Metema cross-border focus on the Sudan/Ethiopia border passed the WHO criteria to stop MDA for onchocerciasis. However, one hotspot on the Ethiopia side was identified. The decision was made to stop treatment in the rest of the focus and conduct 4x a year treatment in the hot spot, along with intense xenomonitoring. The group agreed that this was the correct decision because it avoided unnecessary treatment and has the potential to produce excellent data to inform responses in similar areas.

**KNOWLEDGE GAPS IDENTIFIED AND RECOMMENDED NEXT STEPS**

What data and tools need to be generated to address the issues raised by the group? What operational research and other actions need to be taken to address the knowledge gaps identified by the group?

- How many vector collection sites are needed to determine that a transmission area can stop MDA? How do programs determine the size of the transmission areas represented by each breeding site? Should vector collection sites be dispersed across the entire area or only in first-line communities? Operational research is needed.
- What are strategies or best practices to prevent, detect, and treat recrudescence? How can we differentiate recrudescence of transmission from imported infection, especially when migration may play a role in recrudescence? Operational research to determine thresholds for restarting treatment after cessation of MDA is needed.
- Hot spots will be a challenge for programs.
  - It may be unwise to stop MDA in only a portion of a transmission zone when transmission is occurring within close proximity to the area, but distant breeding sites are unlikely to have fly populations that intermingle. It may be an option to stop MDA when an area is surrounded by a buffer zone) in which transmission is not occurring or has been interrupted. For example, if there is a zone that is equal to 2 times the average flight distance of the local vector where treatment is continue but where evaluation indication lack of transmission. Operational research to determine how program could establish buffer zones would allow programs to stop in some areas and focus resources those areas with continued transmission.
  - Intensive study of the hotspot in Ethiopia, including entomological indicators, could provide value information to the many other programs considering a similar approach to stopping MDA.
  - Hotspots may also provide an opportunity to examine the role of systematic non-compliance in maintaining transmission.
  - An alternative strategy for hotspots would be a test and treat strategy, but that would require an individual diagnostic for patent infections that is sensitive in populations treated with ivermectin (e.g. detection of adult worms).
- More work on identification of breeding sites in hypoendemic areas is needed. These breeding sites are not well-mapped and may be more challenging to identify because they are often small and/or only exist seasonally. What are the environmental characteristics that are conducive to these sites? Can satellite imagery be used to assist in identifying these sites?