Shrinking the Map for Schistosomiasis

Session Date: Saturday, October 27

Session Time: 9:00am – 12:00pm

Session Location: Rex, 8th Floor

Session Description: As national NTD programs aim for NTD Roadmap goals, it is critical for the scale of the problem i.e. the at-risk population, to be identified with precision. For schistosomiasis, knowledge and data on infection at a broad geographical scale often exist to guide delivery of preventive chemotherapy (PC) at a district, or equivalent, level. Yet, unlike the other PC-NTDs, a more targeted approach is required due to the focality of schistosomiasis transmission. By shrinking the map, NTD programs would optimally allocate their resources to achieve a more rapid and sustained impact on schistosomiasis. The session will (i) explore current spatial sampling strategies used to inform interventions for schistosomiasis, (ii) introduce innovative ideas using geostatistical and mathematical modelling to support shrinking the map and (iii) identify priority operational research required to develop evidence-based guidance for NTD programs on a standardized spatial sampling method for optimizing interventions and tracking progress to global goals.

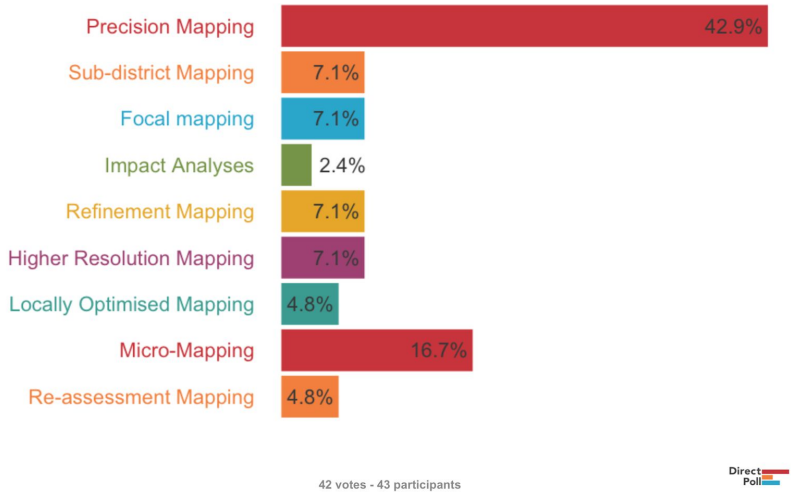
Session Chairs: **Fiona Fleming**, Schistosomiasis Control Initiative, Imperial College London
Louis-Albert Tchuem Tchuenté, National Programme for the Control of Schistosomiasis and STH, Ministry of Health, Cameroon

Session Rapporteur: Russell Stothard

KEY DISCUSSION POINTS

The session endeavoured to highlight the key gaps to enable us to shrink the map for schistosomiasis (SCH) and thus determine accurate global estimates of those at risk of infection and subsequent optimal allocation of resources for targeting and tracking interventions.

The session commenced with a basic online poll to capture perceptions on terminology for shrinking the map, the (non-rigorous) results are illustrated below.



Five presentations subsequently provided illustrative examples of the sessions aims and a strong background for the breakout group-work.

Professor Louis-Albert Tchuem-Tchuenté (Ministry of Health, Cameroon) highlighted the need for precision mapping as evidenced from a recent PLoS NTDs paper that documented the changing nature of schistosomiasis mapping from 1985, 2010, and 2018 perspectives. Points to note were that mean prevalence and highest prevalence sometimes conflicted with best allocation of preventive chemotherapy treatment algorithm; a greater number of geographical points surveyed, e.g. all villages, improved the cartographic resolution with significantly improved interpretation and in elimination settings where very high resolution is warranted to pinpoint where all necessary interventions (i.e., WASH, Health Education & Snail Control) could be targeted appropriately.

Dr Pauline Mwinzi (ESPEN, AFRO) gave an update from WHO-AFRO mapping initiatives, data that are now available via the ESPEN portal. Interrogating these data and investigating the changes in preventive treatment allocations using either mean prevalence or highest prevalence highlighted shortfalls in current mapping. For example, it was shown that using the latter would increase the number of implementation units and with it a threefold increase of people needing treatment. It was recognised that up-to-date demographic data was needed to better quantify the populace at risk.

Dr Hugh Sturrock (UCSF) reported on the development of mapping software that could help identify potential hotspots and those areas where further exploratory mapping and targeted geographical sampling are needed. Using climate data and automated geospatial models posterior probability and sliding window scaling options, the software could embellish existing mapping information and help programme managers utilise resources in a more cost-effective manner to develop a more reliable implementation map. The software development is ongoing and hoped to be of use to schistosomiasis and other NTD programme managers who will be tasked to use it within a real-time implementation setting.

Dr Penelope Vounatsou (Swiss TPH) discussed predictive mapping and attempts to quantify changes in endemicity adjusting with environmental, WASH, and chemotherapy variables. Using estimates of spatial focality it was evidenced that *S. mansoni* is more geographically restricted and focal than *S. haematobium*. She was also able to estimate the numbers of people needing treatment using demographic information at 100m^2 resolution.

Dr Rachel Pullan (LSHTM) investigated the performance of various sampling platforms in correctly allocating preventive chemotherapy at the level of the community and the implementation unit. Using a simulation approach with data from previous surveys, artificial disease landscapes were explored with different sampling and treatment strategies. Four main components were explored: mean prevalence, variation in

prevalence (both spatially structured and random), the rate at which spatial correlation decays with distance, and the size of the intervention unit. There are some interesting trends; changing scales and geographical resolutions each play important roles in the number of over and under-treatments.

Following the presentations, participants were split in to groups to address two main questions and to aid their discussions they were provided with either scenarios depicting a variety of endemicities and status of SCH control; or anonymised MoH case-studies from countries with mature schistosomiasis/NTD control programmes who have performed mapping at a sub-district level.

1. **How epidemiologically precise do we need to be for shrinking the SCH map and what are the optimal design considerations?**
2. **What are the operational and financial implications of targeting schistosomiasis control following sub-district mapping?**

KNOWLEDGE GAPS IDENTIFIED

The following gaps in knowledge and tools were identified and recorded as priorities to address by the groups:

- At what stage(s) of program should the SCH map be shrunk to best inform program decision-making?
- There is a critical need to use existing data to better understand focality of transmission
- Tools are required for identifying hot spots of persistent infection (e.g., ecological mapping tools)
- What programmatic interventions should be implemented for each context identified (e.g., for hot spots and foci with low prevalence e.g. behavior change interventions, molluscicide, treatment frequency, target age-groups, WASH etc.)?
- Do current World Health Organization survey designs for the mapping of schistosomiasis optimally capture spatial distribution?
- Is sampling in schools representative of the endemic population (e.g., children may travel to schools from different communities, non-attending school-age children, at-risk adults)?
- There are a lot of uncertainties around the reliability of current mapping data for schistosomiasis (e.g., how reliable were the prevalence measurements when using different diagnostics, are sample sizes adequate, etc.?).
- There is currently a lack of guidance/protocols for mapping at different implementation unit levels (e.g., district, sub-district, community, ecological area) and the subsequent programmatic decision-making and interventions required, thereafter.
- Accurate and available population data are critical to inform sampling strategy development and treatment needs.
- There is a lack of data on snail population distribution and abundance.
- There are no rapid diagnostic tests for mapping the distribution of schistosomiasis in low-prevalence/elimination settings.

RECOMMENDED NEXT STEPS

These were the recommended operational research and other actions identified as being critical to ensure the knowledge gaps are addressed to shrink the SCH map:

Operational Research

- Determining the optimal survey design(s) for mapping at each critical decision-making stage of a program, dependent on program goal
- Analyses needed on the costs of treating vs. mapping at different spatial scales which determine the cost savings of sampling at a sub-district level and targeting of treatment

- Defining the optimal age-groups to be sampled for mapping and how to sample each (i.e., purposive or systematic random sampling of adults?); is there a school enrolment threshold below which you would need to do a community house-to-house survey, of **all** children <15 years?
- Identifying the optimal diagnostics to be used for mapping at each decision-making stage, per program goal
- Qualitative understanding of the operational feasibility of targeting schistosomiasis control

Actions

- Using existing multi-country schistosomiasis epidemiological data from both before and after PC within geostatistical and mathematical models to determine alternative spatial sampling strategies
- A multi-country operational research study to test model predicted spatial sampling strategies in a range of transmission settings and their epidemiological outcomes. The results can be compared to existing sampling strategies outputs, feasibility and costs.
- To develop a standardized spatial sampling strategy, or strategies, and process to inform geographically precise schistosomiasis interventions during different program phases for national NTD programs