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The **MINISTER OF PUBLIC HEALTH** and The **MINISTER OF BASIC EDUCATION**

TES CONFERENCE 2017

TOWARDS ELIMINATION OF SCHISTOSOMIASIS

a paradigm shift

Hotel Mont Fébé
Yaoundé - Cameroon

22 - 23 March 2017



**REPORT &
RECOMMENDATIONS**

The background of the entire page is a photograph of a conference. In the foreground, a man in a dark suit, white shirt, and patterned tie is walking towards the camera. He is wearing glasses and has a name tag on his lapel. He is holding a white document or folder. To his right, another man in a suit is partially visible, also walking. In the background, other people are standing near white display boards. The entire image is covered with a semi-transparent teal overlay.

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Words of Thanks

The TES Conference 2017 was held at the Hotel Mont Fébé in Yaoundé, Cameroon from March 22 to 23, 2017. This first Conference organized on Schistosomiasis in Cameroon, entitled “*Towards Elimination of Schistosomiasis: a paradigm shift*”, brought together scientists, experts, donors, policy makers, non-governmental development organizations and students from all over the world to share and learn from each other’s experiences and perspectives. The Conference provided a platform to access all that is new, evolving, challenging, successful and exciting in schistosomiasis control and elimination.

The presence of the Minister of Public Health, high level health authorities, WHO Representative, Senators, Members of Parliament, Vice-Rector of the University of Yaoundé I, and key NTD stakeholders, at the opening session highlighted the high-level commitment for Schistosomiasis control/elimination in Cameroon.

We thank all participants who contributed to the success of this premier gathering. We are particularly grateful to members of the Organizing Committee, chairs of the different sessions, keynote speakers, presenters, TES Conference Secretariat, and our sponsors.



Prof. Louis Albert Tchuem Tchuente

Chair of Organizing Committee

Président du Comité d'Organisation



Opening Session



Closing Session

Summary Recommendations

In line with the WHO NTD Roadmap and the WHO-AFRO 2014-2020 Regional Strategy on NTDs, the meeting fully endorsed the integrated **PHASE** strategy for the control and elimination of schistosomiasis:

- Preventive chemotherapy
- Health education
- Access to clean water
- Sanitation improvement and
- Environmental snail control and focal mollusciciding.

Following discussions and in reference to current constraints and available resources, the TES Conference 2017 put forward **four recommendations for priority interventions**:

- 1 To expand general access to praziquantel treatment** supplemental to current school based preventive chemotherapy campaigns by **extending to pre-school-aged children & adults** and **increasing the availability of medicines in health centres** and treatment stations throughout the year. This is to ensure that all those who seek treatment can receive it. Specific mention is made to management of female genital schistosomiasis, encouraging gender equity.
- 2 To complete precision mapping** to provide high resolution information, at the local level (i.e. by individual school), to better focus and tailor preventive chemotherapy. This is to all demographic groups (pre-school-aged children, school-aged children and adults) at-risk to ensure the minimum of annual treatment. Where deemed necessary, to introduce biannual treatment as intensification of current preventive chemotherapy campaigns.
- 3 To intensify multi-sectoral actions** which consolidate control and elimination of schistosomiasis that specifically up-scale and foster sustainability of PHASE activities. These may need to be adapted and optimised at the local level to ensure both acceptability and feasibility.
- 4 To encourage community ownership of the programme** with appropriate communication and health education tools that nurture a closer partnership between local and national stakeholders engaged in cross-sectoral actions disease (Ministries of Education, Water & Energy, Agriculture, etc.).

Background and Statistics

Shifting from morbidity control to elimination of Schistosomiasis raises new challenges and points for consideration that were addressed during the TES Conference 2017 with colleagues, experts and stakeholders from endemic countries and the international community.

The Conference had a broad agenda that appealed to all participants involved in schistosomiasis research, control and elimination. The meeting was centered around four main sessions focused on a range of tracks, each of which was chaired by renowned experts in the field.

The four main sessions focused on:

- 1) **Control and elimination of schistosomiasis.**
- 2) **Morbidity, Female Genital Schistosomiasis (FGS) and Treatment.**
- 3) **Schistosomiasis surveillance, M&E and diagnostics.**
- 4) **Integrated Strategies for Schistosomiasis Control and Elimination.**

As a side event of the TES Conference 2017, we organized a one-day intensive training workshop to stimulate publication writing from our junior researchers, and to strengthen their knowledge in bioinformatics and epidemiology.

Conference Participation

- 14 Countries: *Cameroon, Australia, China, Congo, Denmark, Gabon, Germany, France, Israel, Netherlands, Nigeria, Switzerland, United Kingdom, United States.*
- 79 registered Participants, *including 29 Students.*
- 28 Oral presentations.
- 14 Posters.
- 23 Scholarships awarded.



Training Workshop Participation

- 5 Countries: *Cameroon, Australia, Denmark, Nigeria, United Kingdom.*
- 90 registered Participants.

Highlights of the Opening Session

Welcome word

Prof Louis-Albert Tchuem Tchuente, Conference Chair, welcomed all participants to Cameroon and thanked all partners and sponsors for their contribution which permitted this unprecedented event to hold



Partners' remarks

Dr Jutta Reinhard-Rupp, Merck, who was delighted to be in Cameroon for the first time, highlighted the partners' intention of assisting in the elimination of schistosomiasis (SCH). She hoped that during this interactive conference, participants will not only share good practices, but will also make recommendations and actions for SCH elimination, moving forward. She was of the notion that combining efforts with limited resources and knowledge sharing will abet the elimination of SCH.



Prof Tiewu Jia, representing WHO/AFRO, expressed joy for being in attendance and was able to appreciate fully the progress made by Cameroon in the fight against SCH. He hoped that the conference will contribute towards several disease control milestones.

Keynote presentation



Prof Louis-Albert Tchuem Tchuente set the scene by presenting the meeting objectives with the main being to provide a platform for discussion on the recent breakthroughs and challenges in shifting from control to elimination of SCH. He offered an overview of schistosomiasis control / elimination in Cameroon, which encompassed an introduction to the innovative Atlas of Schistosomiasis and Soil-Transmitted Helminthiasis in Cameroon and the importance of precision mapping for SCH elimination. In this inaugural presentation, he stressed on the commitment the Cameroon government has made in curbing the burden of SCH, which was recently highlighted in the World Bank's report – Winning the War on Worms. The significant impact of control interventions like National Deworming Campaigns was illustrated such as the case of Yaoundé which has seen a decline in SCH prevalence. However, reinfection continues to pose a great threat to the total elimination of SCH.



Opening speech

H.E. The Minister of Public Health, André Mama Fouda in his opening remark said he was honoured to preside such an unprecedented event which brings together experts from diverse countries. He recognized the significant progress made in the fight against NTDs in Cameroon. While informing the audience that the National Deworming Campaign commenced on Tuesday, 21 March 2017, he was of the notion that a paradigm shift was needed and expected Cameroon to benefit from the success of other countries such as China.

Highlights of the Conference

Session 1. Control and elimination of Schistosomiasis

This session was chaired by Dr Jutta REINHARD-RUPP and Prof Roger MOYOU-SOMO



Prof David Rollinson (United Kingdom) presented on **Schistosomiasis elimination: progress and challenges**. He began by exhibiting some important statistical background concerning sanitation, drinking water, and PZQ treatment needs. Roughly one-third of the world's population still lack access to proper toilets as 663 million people depend on unimproved water sources. Schistosomiasis is a chronic disease affecting over 240 million people with more than 90% of cases in Africa. In 2012, 163 million people in sub-Saharan Africa were infected with *Schistosoma* species and PZQ treatment needs per year can be estimated at 370 million doses. This background was important because it showed the existing challenges faced when moving towards elimination of schistosomiasis. But despite all of this, elimination is possible when organizations and governments are working together. He highlighted some success stories of control to elimination activities in Santa Lucia (Martinique and Guadeloupe), Morocco and China which are associated to both biological and chemical interventions, as well environmental management and health education. The case of the ZEST project (Elimination of Schistosomiasis Transmission) was stressed, as it offers example to the numerous interventions used to further schistosomiasis elimination. Despite all of these, hot spots still persist even with good coverage and biannual treatments, as reinfection is current due to the dependency some villages have on local water bodies. Prof Rollinson concluded his presentation with a short but precise remark, to achieve elimination; we need "Better Science, Better Tools and Better Delivery". Portion of moderate and heavy infection was 3.3%, 12.2% and 3.8% respectively for *S. haematobium*, *S. mansoni* and *S. guineensis*, a significant reduction from 21.2%, 22.1% and 36.4% at the baseline respectively. In order to control and eliminate schistosomiasis in Cameroon, the national deworming program must maintain effective MDA coverage with PZQ and extend deworming to all communities at the endemic area.

Calvine Dongmo (Cameroon) presented on the **Impact of the Annual Mass Drug Distribution of PZQ on SCH transmission in Cameroon**. She clarified that several epidemiological factors

(climatic, environmental, ecological, ethological, geographical conditions and population density) facilitate the establishment and development of schistosomiasis and geohelminthiasis in some regions of Cameroon. Schistosomiasis is distributed in Cameroon, with 3 out of 4 African *Schistosoma* species endemic in the country. Subsequently, in order to reduce the burden of the disease, the National Control Program was launched in 2004. The main intervention of the program is the annual Mass Drug Administration (MDA) of PZQ for school-aged children in moderate and high risk communities. She carried out a study to assess the impact of repeated treatment with PZQ on the infection level of schistosomiasis in school-aged children. 19 sentinel sites were selected in 3 regions of the country for parasitological surveys. 50 school children were randomly selected per site, and urine and fresh stool samples were examined using urine filtration and Kato-Katz technique respectively. The results emphasized the decrease of SCH infection in all sentinel sites used in her study. She had as recommendation, maintaining the effective MDA coverage with PZQ and extending deworming to all communities in endemic areas, if the National Control Program envisions SCH elimination in Cameroon.

Daniele Sah Ngoua (Cameroon) presented on the **Impact of Systematic School-Based Deworming Program on Schistosomiasis Endemicity Level and Morbidity in the Schistosoma mansoni Focus of Worro, Bafia Health District, Cameroon**. As the previous presentation, she wanted to determine the prevalence of schistosomiasis in Yoro Health District to evaluate the efficacy of the deworming program in reducing the endemicity level of the disease. She conducted a descriptive study which enabled her to obtain a socio-demographic profile of children in the area, and some parasitological surveys to identify *S. mansoni*-infected children. The results showed that, from 2003 to 2016 there has been a small decrease in the SCH prevalence. However, the parasite load remains elevated which leads one to question the possible development of resistance to PZQ.

Highlights of the Conference

Dr Bonnie Webster (UK) presented on *S. haematobium* group; Genetics, Epidemiology and Biological complexities – impact of control. She informed that there are 25 recognized species of the *Schistosoma* genus that infect humans, livestock and wildlife. Through her expertise in medical parasitology, Dr Webster has played a fundamental role in developing techniques used to collect and store individual larval trematodes for genetic analysis. These techniques are revolutionary as they enable the analyses of genes to genomes which is of medical and veterinary importance. There will always be a need to identify species, discover cryptic species distribution and unravel the evolution of this genus so as to better understand these parasites and the disease they cause. This knowledge on specific host associations is what is still lacking. Schistosomes are not uniform parasites but are diverse within and between species, and hybridisation may impact control and increase host ranges. It is for this reason that more detailed research into the role of different snail species in transmission of the different schistosome species is needed, as it will aid mapping and targeted interventions.

Dr Romuald Issaka Ngassam (Cameroon) presented on *Prevalence and Intensity of Infection with S. mansoni* Infection in Four Villages in the Adamawa Region of Cameroon after Repeated Mass Treatment with PZQ. The evaluation of treatment effect is essential for schistosomiasis control and this is based on sensitive diagnostic tools. In his study, he compared the diagnostic performance of urine-circulating cathodic antigen (CCA) cassette assays and the standard Kato-Katz (KK) for the detection of *S. mansoni* parasite. Four villages were selected for the study, which were all located in the Adamawa Region of Cameroon. Stools and urine of school-aged children were collected in December 2014 and KK/CCA laboratory tests were made. Chi-2 and Kruskal-Wallis methods were used to respectively compare the prevalence of infection and mean EPG. His study results indicated that CCA assay performs much better than Kato-Katz in detection of *S. mansoni*.

Dr Jean Claude Dejon Agobé (Gabon) presented on *Schistosoma haematobium* Infection Associated With *Plasmodium falciparum* Infection Burden in School-Aged Children Living in the Vicinities of Lambaréné, Gabon. Participants were informed on the epidemiology of malaria and schistosomiasis in that part of Gabon, whereby, there is an overlap in the geographical distribution of both diseases. The presence of helminths affect cellular and humoral immune responses to malaria parasites in children. Evidence shows that increased helminth burden is associated with increased malaria parasitaemia. He informed on the longitudinal study he carried out which assessed the effect of *Schistosoma haematobium* on the clinical and parasitological aspect of malaria in school-aged children. Results obtained showed that *S. haematobium* is not evenly distributed with respect to the locality, however, this schistosome was found to increase the risk of infection with *P. falciparum* when infected with hookworms and/or *T. trichiura*. Children infected with *S. haematobium* developed early malaria event than those who were uninfected. Suffice it to say, that *S. haematobium* alone does not increase the risk of being infected with *P. falciparum* parasite whereas, when associated with *Trichuris* worm and hookworm, the risk increases.

Prof Russell Stothard (United Kingdom) discussed on *Developing an Intensified Intervention Framework and Appropriate Environmental Surveillance Framework to Guide the Interruption of Schistosomiasis Transmission*. He focused on the historical context of the schistosome lifecycle, the conceptual thinking and key aspects of environmental transmission, the development of a useful framework with pilot implementation, and proposed a future outlook towards 2020 surveillance and beyond. It is essential that we properly understand schistosomiasis, because if we do not understand it we cannot control it. There is growing momentum in the schistosomiasis community to change tactics from averting morbidity to interrupting transmission, but the question remains, when and how do we do this? Prof Stothard



Highlights of the Conference

enlightened on Dr Robert T. Leiper's legacy and tremendous work on schistosomiasis control which has influenced some of the COUNTDOWN project's work around control of NTDs. Better understanding of disease maps will help comprehend the geographical scale of the disease and where it occurs, as disease distribution does not necessarily always indicate schistosome transmission. These parasites spend a lot of time in the human host, which can lead to an infected person, hyper-infecting themselves. There is a rise in DNA diagnostic platforms but this will require increased resourcing, and at disease-specific levels, it will be good to integrate e-DNA into WASH related interventions. He highlighted tools needed for elimination such as antigen/antibody assays, increased WASH, selective PZQ treatment. Moving towards 2020 surveillance and beyond, the use of statistical modelling will help optimise sample-size by location. Drivers of national policy change include: advocacy for increased PZQ supplies; accelerate towards public health goals; and increased health system engagement.

Dr Jerome Boissier (France) presented on *May Hybrid Schistosomes Impair Schistosomiasis Control?* He offered insight into the distribution of hybrid schistosomes in Africa, which can hinder schistosomiasis control. Recently, there has been a buzz around hybrids. In Senegal and France, there have been evidence showing the presence of *S. bovis* and *S. haematobium* hybrids in both humans and animals. There are questions around the sensitivity of hybrid schistosomes to drug treatment but some results from Senegal indicate that the reduced PZQ sensitivity may explain the reason for the widespread of *S. haematobium* and *S. bovis* in Senegal.

Prof Louis-Albert Tchuem Tchuente (Cameroon) offered insight on *Moving from Control to Elimination of Schistosomiasis in Sub-Saharan Africa: Time to Change and Adapt Strategies*. He enlightened participants on the relevant steps required to interrupt transmission of PC-NTDs which entails: mapping, mass drug administration, surveillance, and verification. He is of the notion that, mapping is a key step in scaling up PC interventions as it allows for better understanding and location of those at risk of infection. Besides, mapping informs on the need for mass drug administration or other relevant interventions. Prof Tchuem Tchuente stressed on redefining disease endemicity and locality for eligibility for MDA, as a result of the differences that may arise when moving from using the current recommended mean district prevalence, to using the maximum school prevalence within the district. It is important to adapt treatment to transmission dynamics. Barombi Kotto and Loum were referenced as cases which illustrated decline of prevalence due to intensified interventions. However, due to a slackening of control efforts coupled with constant water contact, reinfections remain a threat. There are some challenges countries face when moving towards elimination which includes: moving from MDA-focused interventions to integrated interventions (PHASE approach), extending treatment to all populations, adapting treatment strategies to local transmission settings, improved diagnostic tool, and use of environmental interventions such as snail control.



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Session 2. Morbidity, Female Genital Schistosomiasis and Treatment

This session was chaired by Prof Russell STOTHARD



Prof Hermann Feldmeier (Germany) offered insight on ***Female-Genital Schistosomiasis-A Holistic Approach***. He commenced by enlightening on what is FGS, highlighting that it is frequent in *S. haematobium* endemic areas but may also be caused by *S. mansoni*. FGS is present in girls and persists in women of reproductive age and may affect all genital organs. A study in Tanzania illustrated that while urinary schistosomiasis was most prevalent in girls aged 15–19 years, FGS was most prevalent in women aged 30–34 years. There is a need for a new rationale for this disease as we know comparatively little about its geographical distribution, prevalence and age-specific incidence, and the risk factors for developing clinical pathology. Prof Hermann informed that there are studies which support the theory that urogenital schistosomiasis in women and men constitutes a risk factor for HIV infection. There have been recent achievements in the diagnosis of FGS through the use of computer analysis of colposcopy images and eosinophils-derived proteins in vaginal lavage however there is still no certain treatment for FGS as none of the studies performed so far were designed to determine the efficacy of praziquantel in FGS. However, regular treatment with PZQ at a young age could reduce the frequency of FGS and thus the risk of HIV infection.

Dr Elly Kourany-Lefoll (Switzerland) presented on ***The Paediatric Praziquantel Consortium-helping children with schistosomiasis***. She presented the problematic of Paediatric PZQ tablets. In fact, PZQ tablets in their current form are suitable for adults and children over the age of six. For children younger than six, it is currently not possible to properly treat schistosomiasis due to lack of appropriate PZQ dose. Due to this, Merck within the scope of a public-private partnership (PPP), is developing a formulation of praziquantel

for small children through collaboration from partners in the Paediatric Praziquantel Consortium formed in 2012. Two new innovative pediatric orodispersible tablets (ODTs) are currently underway: L-PZQ ODT Formulation 150 mg and Racemate PZQ ODT Formulation 150 mg. Clinical trials are in progress to test the effectiveness and safety of the drugs. Phase I studies in South Africa and Tanzania have already been completed while phase II trials began in 2016. As for Phase III, that will be done on *S. mansoni*-infected (trial 1) and *S. haematobium* infected (trial 2) children in Africa in 2018. Merck envisions launching this novel development in 2020. Through its work with partner countries, Merck fosters collaborative partnerships, supports capacity building and strengthens health infrastructures.

Dr Hermine Boukeng Jatsa (Cameroon) followed with a presentation on ***In vitro and in vivo efficacy of Sida pilosa Retz against Schistosoma mansoni-induced pathology***. She pointed out the fact that the intensive use of PZQ can cause possible development of drug-resistant strains of schistosomes. And one of the research priorities for SCH Control/ Elimination is the Development of new/alternative drugs to PZQ. WHO has authorized the use of medicinal plants as source of new drugs. She carried out research to evaluate the efficacy of plant extracts on *S. mansoni*. Results showed that despite the fact that *S. pilosa* n-butanol fraction (SpBF) was the most active fraction against *S. mansoni* adult worms in vivo, *S. pilosa* aqueous extract (SpAE) was more effective than SpBF in terms of schistosomicidal, antioxidant, anti-inflammatory and anti-fibrotic activities. In addition, these SpAE activities were comparable to those achieved by praziquantel. In her opinion, further research should be carried out to determine the appropriate use traditional plants as alternative treatment for schistosomiasis.

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Dr Amaya Bustinduy (UK), presented on ***"Improving Surveillance of Female Genital Schistosomiasis (FGS): Validating Home-Based Cervical and Vaginal Self-Sampling for Detection of FGS In Zambian Women With and Without HIV Seroconversion."*** Corresponding to Prof Hermann Feldmeier, she highlighted that all women of all ages are concerned with FGS even if at different degrees, as it affects about 45-50 million women worldwide. It is important to note that there exists a timeline of remarkable work done around FGS since 1994 which includes publication of the FGS Atlas in 2015, and 2017 welcomed the development of a novel community-based diagnosis of FGS. There is a strong body of evidence which confirms the association between FGS and HIV, as the likelihood of having HIV if already infected with FGS is 3-4 fold. The gold standard for FGS diagnosis albeit very costly, is the use of colposcopy. Other diagnostic techniques such as *S.*

haematobium DNA detection in vaginal lavage by use of PCR, and *S. haematobium* egg detection in urine by egg count can also be used, although less sensitive than the gold standard. There is a need to develop more community-friendly diagnostic techniques which will limit reliance on colposcopy which is seldom available in resource limited areas. Dr Bustinduy is of the notion that home-based diagnosis of FGS is an avant-garde concept, yet unrealistic for NTDs and her study entitled "BILHIV" in Zambia aims to provide evidence for this. The study wishes to increase surveillance and diagnosis of FGS in communities through use of home-based self-sampling methods by women recruited from the HIV incidence trial (PopART) study in Zambia. This study is of public health importance particularly for the reproductive life of young women, as it provides incidence data, thereby strengthening the knowledge of the association between FGS and HIV.



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Session 3. Schistosomiasis Surveillance, Monitoring & Evaluation and Diagnostics

This session was chaired by Dr Neil YOUNG and Dr Michael HSIEH



Dr Govert van Dam (Netherlands) presented on **CCA and CCA Detection in Schistosomiasis: ASSURED Diagnostic Tools to Be Employed When Moving from Control and Elimination**. Dr van Dam highlighted that it is very important to link the level of control to the form of diagnostics as the focus will determine the diagnostic preference. With the increased interest in mapping, it is important to utilize highly accurate diagnostic assays for intensified control and elimination of schistosomiasis. He informed that in all control activities as well as patient management, different characteristics are required for diagnosis. If the focus was on morbidity control, then the diagnostic preference will be on simplicity and low cost of the tool. However, when the focus proceeds from decreased prevalence towards transmission interruption and even further to elimination, then an increased accuracy of sensitivity and specificity is necessary. A CCA test applicable to serum or urine of all schistosome species has recently been developed which can be used in low-resource settings in Africa. The technique in addition to being sensitive than the standard Kato-Katz, makes use of very stable antigens and sampling handling is simple. There is a plethora of studies already carried out in low prevalence settings such as Zanzibar and China, which indicate the effectiveness of the test, as egg microscopy may miss up to 90% of active schistosome infections. CCA tests differentiates past exposure from active infection and shows present of (developing) worms. The question now remains; can we afford the use of CCA in large scale?

Dr Michael Hsieh (United States) presented on **Development of an Interleukin-4-inducing principle from Schistosoma mansoni Eggs (IPSE)-Specific PCR assay as a Quantitative Predictor of Schistosomiasis-associated Morbidity**. He informed that there is a plethora of diagnostic tools for schistosomiasis, however there is a need for better quality of egg-specific tools as the current gold standard –Kato-Katz– is labour-intensive and has poor sensitivity. The principle protein secreted from schistosome eggs is IPSE and the mRNA transcripts of this protein can be detected in the stool and urine samples as well as in other host tissues. *S. haematobium* and *S. mansoni* infected mice were used in his study and results indicated that there was a positive correlation between the increasing concentrations of IPSE RNA in the infected liver of the mice, and the number of eggs counted in stool. This is a promising quantitative egg-specific diagnostic method, which can be used to estimate the morbidity in field settings, however

further research needs to be carried out in infected hamsters.

Gwaldys Nelly Djomkam Chuinteu (Cameroon) offered further insight on the **Evaluation of Circulating Cathodic Antigen (CCA) Urine Tests for the Diagnosis of Schistosoma Guineensis Infection in Cameroon**. She reiterated that there are three species of the schistosome parasite found in Cameroon namely: *S. haematobium*, *S. mansoni*, and *S. guineensis* and albeit being the standard diagnostic tool, Kato-Katz technique has been shown to reveal insufficient results in low endemic areas. This prompted to the development of more sensitive diagnostic tools such as CCA which relies on the detection of circulating cathodic antigen. Her study was carried out in 4 study sites- Eseka, Edea, Ekondo Titi, and Nkoldongo-whereby urine samples were collected from 479 school-aged children. She observed from the study that in all study foci, the CCA test had a sensibility higher than a single or triplicate Kato-Katz, therefore this makes it an attractive method for detection of *S. guineensis* when specificity and sensitivity is required.

Dr Fiona Fleming (United Kingdom) presented on **Monitoring & Evaluation Framework: Schistosomiasis Control in Africa**. She began by providing an overview of the Schistosomiasis Control Initiative (SCI), and the assistance it provides to countries in the form of delivery of school-based and community-based treatment in order to control schistosomiasis and STH. WHO has developed an M&E framework for schistosomiasis control which will help to have a standard set of data across multiple epidemiological and political settings, demonstrate impact of investments, determine barriers and facilitators in achieving global goals, identify when next phase towards elimination is reached, and enable capacity development within countries. There are standard components involved in the M&E for schistosomiasis control which consist: mapping & reassessment, impact, performance, process, cost, and “complement interventions”. It is important to note that M&E is not stand alone, as it needs to work alongside complimentary interventions such as snail control, WASH and behaviour change communications in order for schistosomiasis to be eliminated as a public health problem. It is essential that valid diagnostic tools exist but these need to be easy to use in the field, require minimal technical skills and are affordable. But then the question posed is, if diagnostics are more expensive than treatment, then who do we mobilise for funding on diagnostics?

Highlights of the Conference

Session 4. Integrated Strategies for Schistosomiasis Control and Elimination

This session was chaired by Dr Fiona FLEMING and Prof Flobert NJIOKOU



Prof Jia Tiewu (WHO/AFRO) informed on **Snail Control and Schistosomiasis Elimination**. He began by defining some key words/expressions like control, eradication, extinction, elimination as public health problem and elimination. He shared some experiences and lessons based on criteria and indicators of control and elimination in China. Concerning the criteria and indicators, the participants learned about: Morbidity control, Transmission control, Transmission interruption, Elimination and Assessment procedure. Having conducted research in many countries in different continents, he noticed that a key factor for the high density of snails and subsequent intense transmission of schistosomiasis in canals is the abundance of aquatic plants, especially the submerged species. In addition, high densities of intermediate snail hosts were most frequently found in the numerous tertiary inverted siphons, especially near the tail end of the canals and in the downstream boxes. Using experiences from China, he proposed lining canals with cement, draining and filling swamps, using focal molluscicide applications as a means to reduce the intermediate host (snail) population. More so, taking environmental measures such as: aquatic plant removal, structural changes of irrigation canals or reservoirs, water management and system maintenance and changing agricultural practices will abet the interruption of transmission.

Dr Neil David Young (Australia) presented on **Genomic Tools to Support Schistosomiasis Research**. He developed this topic based on his works in China. He explicitly demonstrated that the eradication of schistosomiasis can only be successful through fundamental research and direct support from genomic/transcriptomic resources. Some research areas could focus on developing preventative and treatment chemotherapies; conducting epidemiological surveys; understanding parasite and host biology; intermediate host control; developing public health interventions; characterizing parasite population genetics/genomics; developing vaccines; and understanding host response to infection. There are new tools available which allow for better classification of schistosome proteins. There are questions around the effect of gene variation on transmission or epidemiology of schistosomes. Further work needs to be done to continue to improve the schistosome genomes and gene annotation.

Mr Noam Assouline (Israel) presented on **Community Engagement is Essential for Behavioural Change and Control of Schistosomiasis**. He introduced NALA (NTD Advocacy, Learning, Action), highlighting the organisation's comprehensive community-based programmes which constitutes: health education for behavioural change, drug administration and access to clean water and sanitation. He strongly believes that effective control can be possible only through the use of a combination of interventions which can be either behavioural, Bio Medical or structural interventions. In every community intervention, commitment from all players - school children, teachers, parents, Women's Volunteer Army, local authority and National Authority - is necessary as it allows for community ownership and political leadership, elements crucial for sustainability of interventions.

Mrs Alvine Christelle Kengne Fokam (Cameroon), presented on **Biomphalaria camerunensis (Gastropoda: Planorbidae) as an alternative host of Schistosoma mansoni in Southern Cameroon**. After describing the three species of *Schistosoma* found in Cameroon, namely *Schistosoma haematobium*, *S. guineensis* and *S. mansoni*, she showed the evolution between 1985 and 2012 and mentioned the ongoing implementation of WHO elimination interventions. She stated that in Cameroon, the intermediate host of schistosomes are *Biomphalaria pfeifferi* (in the northern part of the country) and *Biomphalaria camerunensis* (in the southern part of the country). Migration of the population from the North to the South of Cameroon due to reasons such as terrorism by Boko Haram and search of jobs can cause individuals infected with *S. mansoni* to migrate to areas in which *B. camerunensis* is found. Her study had as objective, to estimate the risk of occurrence of new Schistosomiasis foci in southern Cameroon due to susceptibility of *B. camerunensis camerunensis* to *S. mansoni*. Her results indicated that indeed, there is a high susceptibility of *B. pfeifferi* to *S. mansoni*, whereas the low susceptibility rate of *B. camerunensis camerunensis* combined with high cercarian production, suggests that this is not a negligible potential intermediate host. She recommends that the National Program for the Control of SCH and STH in Cameroon, pays attention to the risk of occurrence of new schistosomiasis foci in southern Cameroon, because of population migrations.

Highlights of the Conference

Dr Deguy D'or Luogbou Nzu (Cameroon) presented on **Detection of Hybrid *Schistosoma Haematobium* Group Species in Cameroon by PCR-RFLP of the Second Internal Transcribed Spacer ITS-2**. He informed that the ITS-2 RFLP-PCR is a simple and cost-effective molecular tool used to detect hybridisation between certain *S. haematobium* group species. It can also be used to identify potential *S. haematobium* / *S. bovis* and/or *S. guineensis* hybrids being excreted in human urine samples. Evidence from this study suggests that in certain areas of Cameroon *S. haematobium* is hybridising with closely related sister species.

Professor Louis-Albert Tchuem Tchuente (Cameroon) enlightened on **Precision mapping: An Innovative Tool and New Way Forward to Enhance the Elimination of *Schistosoma* in Cameroon**. He edited on the steps required to interrupt transmission of PC-NTDs constituting mapping, MDA, surveillance and verification, with mapping being the key step in the scale-up of PC interventions as it provides information on at-risk populations. There is a need to change the current treatment thresholds because morbidity is typically associated with increasing prevalence. Prof Tchuem Tchuente is of the idea that moving beyond conventional mapping towards precision

mapping is the way forward for SCH elimination.

Professor Louis-Albert Tchuem Tchuente (Cameroon) presented on **Schistosomiasis Elimination: PHASE Approach and Research**. Regarding the PHASE approach, he informed that the WHO African Region has developed this approach as outlined in the Schistosomiasis Strategic Plan 2014-2020, as the effective means to move towards elimination in the region. Taking into account the different components of schistosomiasis transmission and the control/elimination interventions as well as challenges faced, the research priorities to optimise control strategies can be grouped into 5 major core themes. These entail: Intervention; Epidemiology and Surveillance; Environmental and Social Ecology; Data and Modelling; and Fundamental Biology. The development of these research areas in the African Region will require however, strengthening capacity building and development of partnerships; promoting interactions between researchers and control program managers; gaining from other countries' experiences in surveillance response, transmission, inter-sectorial collaboration and sustainability; transfer of technology; and funding.

Poster Session

Posters were displayed during the light lunch session where junior researchers and students had the opportunity to showcase their work and findings of SCH related research.



Writing and Training Workshop

The event took place on Friday 24 March 2017 at La Falaise Hotel - Yaoundé.

Workshop Agenda

Welcome & Introductions

09:00 – 10:30 - **Writing Workshop / PLoS NTDs** (Prof Louis-Albert Tchuem Tchuente)

- Manuscript preparation
- Elements of good writing
- Targeting academic journals

10:30 – 11:00 - **Bibliometrics** (Prof Russell Stothard)

- Tracking an article's impact and research uptake

11:00 BREAK

11:30 – 13:00 - **Epidemiology** (Dr Suzy Campbell)

- Basic measures in helminthology
- Data collection examples
- Designing an analysis (featuring Barombi Kotto)

13:00 LUNCH

14:00 – 15:30 - **Molecular Epidemiology** (Dr Bonnie Webster)

- Introduction to molecular biology
- Schistosome and snail material
- Techniques (DNA extraction, FTA cards etc.)

16:00 – 17:30 - **Molecular Phylogenetics** Dr Neil Young

- Retrieving sequence data
- Aligning sequence data
- Constructing phylogenetic trees

17:30 – 18:00 - Panel QnA Discussion & Close



Conclusion and Recommendations

Following discussions and in reference to current constraints and available resources, the TES Conference 2017 put forward **four recommendations for priority interventions**:

- 1 To expand general access to praziquantel treatment** supplemental to current school based preventive chemotherapy campaigns by extending to pre-school-aged children & adults and increasing the availability of medicines in health centres and treatment stations throughout the year. This is to ensure that all those who seek treatment can receive it; specific mention is made to management of female genital schistosomiasis, encouraging gender equity.
- 2 To complete precision mapping** to provide high resolution information, at the local level (i.e. by individual school), to better focus and tailor preventive chemotherapy. This is to all demographic groups (pre-school-aged children, school-aged children and adults) at-risk to ensure the minimum of annual treatment. Where deemed necessary, to introduce biannual treatment as intensification of current preventive chemotherapy campaigns.
- 3 To intensify multi-sectoral actions** which consolidate control and elimination of schistosomiasis that specifically up-scale and foster sustainability of PHASE activities. These may need to be adapted and optimised at the local level to ensure both acceptability and feasibility.
- 4 To encourage community ownership of the programme** with appropriate communication and health education tools that nurture a closer partnership between local and national stakeholders engaged in cross-sectoral actions disease (Ministries of Education, Water & Energy, Agriculture, etc.).

Closing Remarks

Prof Louis-Albert Tchuem Tchuente, in his closing remarks, expressed his immense joy for the presence of all experts and participants who contributed to the rich quality of interactive discussions during the course of the conference. The presence of the Ministry of Health, Rector of University of Yaoundé I and Senators emphasised the commitment for NTDs control by various stakeholders in Cameroon. He informed on the idea of hosting a 2nd TES Conference either in 2018 or every two years and this fed into ideas for a TES Conference for STH. He seized the opportunity to thank not only his team for all hard work, but also all sponsors and partners for their contribution in the success of TES Conference 2017. On behalf of His Excellency, the Minister of Public Health, Prof Tchuem Tchuente officially closed the 1st international TES Conference 2017.

7:00 - 9:00

REGISTRATION

9:00 - 11:00

OPENING CEREMONY

- Welcome word
- Partners' remarks (Dr Jutta Reinhard-Rupp, Prof. Jia Tiewu)
- **Setting the Scene (Prof. Louis-Albert Tchuem Tchuente)**
 - o Meeting Objectives
 - o Overview of Schistosomiasis Control / Elimination in Cameroon: Achievements, Challenges and Ways Forward
 - o Introduction of the Innovative Atlas of Schistosomiasis and Soil-Transmitted Helminthiasis Transmission in Cameroon
- **Opening speech by the Minister of Public Health (H. E. André Mama Fouda)**
- **Group photo**

11:00 - 11:30

HEALTH BREAK

Session 1

CONTROL AND ELIMINATION OF SCHISTOSOMIASIS (Chairs: Dr Jutta Reinhard-Rupp & Prof. Roger Moyou)

11:30 - 13:00

Schistosomiasis elimination: progress and challenges (Prof David Rollinson)

Progress in Schistosomiasis and STH Control in Cameroon (Prof. Tchuem Tchuente)

Impact of the annual mass drug administration of Praziquantel on Schistosomiasis transmission in Cameroon (Calvine Noumedem Dongmo)

Impact of the systematic school-based deworming program on schistosomiasis endemicity level and morbidity in the *Schistosoma mansoni* focus of Yorro, Bafia health district, Cameroon (Prof Roger Moyou)

13:00 - 14:00

LIGHT LUNCH AND POSTER SESSION

14:00 - 16:15

Prevalence and Intensity of infection with *Schistosoma mansoni* infection in four villages in the Adamawa Region of Cameroon after repeated mass treatment with praziquantel (Dr Romuald Isaka Kamwa Ngassam)

Schistosoma haematobium infection associated with Plasmodium falciparum infection burden in school aged children living in the vicinities of Lambaréné, Gabon (Dr Jean-Claude Dejon Agobé)

Schistosoma haematobium group; genetics, epidemiology and biological complexities - impact on control (Dr Bonnie Webster)

Developing an intensified intervention framework and appropriate environmental surveillance framework to guide the interruption of schistosomiasis transmission (Prof Russell Stothard)

May hybrid schistosomes impair schistosomiasis control? (Dr Jerome Boissier)

Moving from control to elimination of schistosomiasis in sub-Saharan Africa: time to change and adapt strategies (Prof Louis-Albert Tchuem Tchuente)

16:15 - 17:00

Discussions

17:00 - 18:00

HEALTH BREAK AND POSTER SESSION

Session 2 MORBIDITY, FEMALE GENITAL SCHISTOSOMIASIS AND TREATMENT (Chair: Prof Russel Stothard)

8:30 - 10:30

Female-genital schistosomiasis - a holistic approach (Prof Hermann Feldmeier)
The Paediatric Praziquantel Consortium - helping children with Schistosomiasis (Dr Elly Kourany-Lefoll)
In vitro and in vivo efficacy of *Sida pilosa* Retz against *Schistosoma mansoni*-induced pathology (Dr Hermine Boukeng Jatsa)
Improving surveillance of Female Genital Schistosomiasis (FGS): Validating home-based cervical and vaginal self-sampling for detection of FGS in Zambian women with and without HIV seroconversion (Dr Amaya Bustinduy)
Epidemiological and ultrasonic profile of uro-genital schistosomiasis in Barombi Kotto (Prof Roger Moyou)

10:15 - 10:30

Discussions

10:30 - 10:45

HEALTH BREAK

Session 3 SCHISTOSOMIASIS SURVEILLANCE, M&E AND DIAGNOSTICS (Chairs: Dr Michael Hsieh & Dr Neil David Young)

10:45 - 12:15

CAA and CCA detection in schistosomiasis: ASSURED diagnostic tools to be employed when moving from control to elimination (Dr Govert van Dam)
Development of an interleukin-4-inducing principle from *Schistosoma mansoni* eggs (IPSE)-specific PCR assay as a quantitative predictor of schistosomiasis-associated morbidity (Dr Michael Hsieh)
Evaluation of Circulating Cathodic Antigen (CCA) Urine-Tests for the diagnosis of *Schistosoma guineensis* infection (Gwladys Nelly Djomkam Chuinteu)
An M&E Framework for Schistosomiasis (Dr Fiona Fleming)

12:15 - 13:00

Discussions

13:00 - 14:00

LIGHT LUNCH AND POSTER SESSION

Session 4 INTEGRATED STRATEGIES FOR SCHISTOSOMIASIS CONTROL AND ELIMINATION (Chairs: Dr Fiona Fleming and Prof Flobert Njiokou)

11:55 - 16:30

Snail control and Schistosomiasis elimination (Prof Jia Tiewu)
Genomic tools to support schistosomiasis research (Dr Neil David Young)
Community Engagement is Essential for Behavioral Change and Control of Schistosomiasis (Mr Noam Assouline)
Biomphalaria camerunensis (Gastropoda: Planorbidae) as an alternative host of *Schistosoma mansoni* in the Southern Cameroon (Alvine Christelle Kengne Fokam)
Detection of hybrid *Schistosoma haematobium* group species in Cameroon by PCR-RFLP of the second internal transcribed spacer ITS-2 (Dr Deguy D'or Luogbou Nzu)
Challenges associated with the use of Praziquantel for eradication of Schistosomiasis in Nigeria: the urgent need for vaccine development (Dr Amase Nyamngee)
Precision mapping: an innovative tool and new way forward to enhance the elimination of schistosomiasis in Cameroon (Prof Louis-Albert Tchuem Tchuente)
Schistosomiasis Elimination: PHASE Approach and Research Priorities (Prof Louis-Albert Tchuem Tchuente)

PANEL DISCUSSION, CONCLUSION AND WAYS FORWARD

16:30 - 17:30

PANEL DISCUSSION
CONCLUSIONS AND WAYS FORWARD

17:30 - 18:00

CLOSING OF THE CONFERENCE

List of Participants

TES Conference 2017

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- **Prof Louis-Albert Tchuem Tchuente**, National Programme for the Control of Schistosomiasis and STH/ Centre for Schistosomiasis and Parasitology
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- **Dr Georges Alain Etoundi Mbella**, Disease Control, Epidemics and Pandemics, Ministry of Public Health
- **Prof Anne-Cecile Zoung-Kanyi Bissek**, Health Operations Research, Ministry of Health
- **Prof Russell Stothard**, Liverpool School of Tropical Medicine, United Kingdom
- **Prof David Rollinson**, Natural History Museum, United Kingdom
- **Dr Mike Hsieh**, National Institute of Health, United States
- **Dr Jutta Reinhard-Rupp**, Merck, Switzerland

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