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Challenges of schistosomiasis control and elimination and the Way Forward in sub-Saharan Africa: Literature review and status

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Abstract

There are more than 200 million people infected worldwide and 20 million of these suffer serious health consequences, mostly children and adolescents in Sub-Saharan Africa (SSA). A literatures review was conducted to look for challenges for control and elimination of schistosomiasis and the ways forward in Sub-Saharan Africa (SSA). A global effort of controlling schistosomiasis has documenting visible results in controlling in some parties of low endemic regions and reducing prevalence and intensity of infection in some parts of African regions. However, the burden is still high and causing high morbidity and continuous as public health problem in most of Sub-Saharan Africa (SSA) countries, because of different challenges. This challenges are: Inadequate treatment coverage; complexity and variability of transmission dynamics; not considering current recommended treatment strategy ;low compliance to anti-schistosomiasis drugs ;water harvesting and Sanitation problems; poor community awareness and Behavioral change ; use of less sensitive diagnostic tools; lack of snails controlling as integration; high co-infections rate with other parasitic and non-parasitic infectious disease; vaccination luck of vaccine against schistosomiasis; Polices of the countries and Population movement and migration; poor mapping quality and uncertainties and risks of climate change in the region. They're for scalping treatment coverage by considering complexity and variability of transmission dynamics; improving mapping quality and uncertainties and generally, integrated, intersectorial approach that goes beyond deworming is the ways forward for sustainable control of schistosomiasis. This actually needs long last more founding for out and in and political commitment of the endemic regions.

Key words: Schistosomiasis, challenges, control/elimination, ways forward, Sab-Saharan Africa (SSA)

Introduction

Schistosomiasis is the world leading parasite disease next to malaria. There are more than 200 million people infected worldwide and 20 million of these suffer serious health consequences, mostly children and adolescents in Sub-Saharan Africa (SSA). This

is a poverty-related disease due to lack of clean water exposing at least 600 million people who have contact with infected water for laundry, body hygiene or recreational purposes, when the cercaria stage of the penetrate the skin of people causing infection. Among the five major human important

species of schistosomes, the three common species of schistosomes: *S. haematobium*, *S. japonicum*, and *S. mansoni* cause the bulk of an estimated global burden of 4.5 million disability-adjusted life years (DALYs), and approximately 85% of them are concentrated with in SSA, where it is second to malaria of the parasites in importance for human health (Hotez and Kamath, 2009). The distribution of schistosomiasis is linked to the distribution of the fresh water snail intermediate host. Different recent studies in SSA show avarice prevalence of schistosomiasis which is significantly different among different countries, among different regions within a country, source population and time of the study. Accordingly the review of different articles from different SSA countries shows that the prevalence of schistosomiasis is ranging from 8.2% (7.4% *S. haematobium* and 0.8% *S. mansoni*) among students attending at elementary schools in Amibera District (Awoke et al, 2013) to 89.9% of *S. mansoni* infection among school children in Sanja Town, northwest Ethiopia (Worku et al, 2014) during 2013's and 2014's. A recent studies conducted during 2016/2017 showed the prevalence is 22.7% in Nigeria (Dawaki et al., 2016); and 63% in Abay valley of western Ethiopia (Assefa et al, 2017). The commonly preventive and controlling method practiced in SSA is Preventive chemotherapy which is targeted toward school-aged children in endemic areas (WHO, 2013). Recently compressive and integrated approaches are advocating, although it is facing different challenges (WHO, 2015; Tambo et al., 2017; Negussu et al., 2017). The summary of the global update of preventive chemotherapy implementation in 2015 revealed a significant improvement in the treatment coverage, reaching for schistosomiasis up to 41.8 and 40.8% for school-aged children at the global and African regional levels, respectively (WHO, 2013). However, we are still very far from the target, and in recent times, resurgence in some parts of and Africa are indications that the disease continues to evolve (natural or manmade evolution) and increase the public health significance in terms of the burden on children and economic cost of any local community and nationwide control programs in most developing countries. so, that the new impetus towards schistosomiasis elimination requires some modification, adaptation and even change of strategies (Lo NC, 2016), which concomitantly raises new challenges and points for consideration (Niessen, 2016). The main objective of this paper is to highlight the progress made and reviews the main challenges and requirements for control and

elimination of schistosomiasis in sub-Saharan Africa.

Methodology:

A search of relevant literature was performed through electronic search engines: PubMed: <http://www.ncbi.nlm.nih.gov/pubmed/>; GoogleScholar: <http://scholar.google.com/>; African Medical Journals (WHO Regional Office for Africa): <http://indexmedicus.afro.who.int/Journals/Indexj.htm> and Free Medical Journals: <http://www.freemedicaljournals.com/>; national schistosomiasis survey data, peer-reviewed publications on schistosomiasis control in Africa, and countries schistosomiasis surveillance reports, Demographic and Health Surveys (DHS); using of different key words and phrases Articles which written in English version and published recently in peer-reviewed journals were identified and reviewed. Most relevant articles that are not free for this review were accessed via World Health Organization-Hinari Journals of Medicines and Health sciences. After the searched fully articles and abstracts were screened and those relevant to the objective of the review were reviewed.

Schistosomiasis controlling and elimination challenges: In order to accomplish these goals of schistosomiasis control and elimination, the operational objectives of the strategic plan must be met. These include scaling up activities aimed at controlling and eliminating schistosomiasis in all endemic countries, and ensuring that an adequate supply of praziquantel and resources is available to all countries. However, most of the African Region seem will not eliminate schistosomiasis transmission by 2025 due to different challenges (WHO, 2013). The following are some of the facing challenges:

Water harvesting and Sanitation problems: A major factor associated with the rise of schistosomiasis is water development projects, particularly manmade lakes (hydroelectric power) and irrigation schemes, which can lead to shifts in snail vector populations (patz et al., 2000). On the other hand, water stagnation for weed growing due to inadequate water will sustain the life of the snails to complete the life cycle of schistosomiasis (boelee and Madsen, 2006). Many surface irrigation systems in Africa create a favorable snail-breeding condition that facilitates the transmission of schistosomiasis (WHO, 2004). For instance, there was an introduction of *S. mansoni* to Mauritania and Senegal after construction of huge Dam on Senegal River (Gryseels et al., 2006), and koka dam in Ethiopia (kloos et al., 1988), and an increment in the

prevalence of schistosomiasis in Egypt, as a result of the Aswan High Dam (Malek, 1975). Environmental changes linked to water resource development like water harvesting for irrigation and sanitation problems have facilitated geographical expansion of schistosomiasis to areas where it was not endemic before in Africa (Gryseels et al., 2006). For instance, there is an introduction of *S. mansoni* in to upper awash valley in Ethiopia, following the establishment of irrigation schemes of Wonji sugar factory and the prevalence was subsequently increased (Kloos et al., 1988; Simonsen, 1990). In addition, though it is believed that deworming decrease worm load and prevalence significantly in the weeks after treatment, but in SSA sustaining low worm load and low prevalence is difficult due to inadequate access water and sanitation facilities (Negussu et al., 2017).

Poor community awareness and Behavioral change: Schistosomiasis can be controlled using three key approaches which include improved sanitation, health education and mass treatment with praziquantel and promotion of hygiene, access to safe water, and sanitation improvement and environmental management. However, the successes of these control initiatives involving the community depend on the level of the communities' uptake of the program, which is dependent on the community knowledge and practices towards the disease. However, different studies from different African countries show that still the community knowledge and practices towards the disease is poor (Odhiambo et al, 2014; Dawaki et al., 2015) and effective community mobilization and sensitization also remain a challenge (Negussu et al., 2017). The misconceptions that schistosomiasis was caused by drinking unclean water and eating contaminated food were reported by most studies across Sub-Saharan Africa (Musuva et al., 2014; Kabatereine et al., 2014). The study in Africa also, reveals that knowledge about the cause, transmission, symptoms and prevention of schistosomiasis among the rural population of Africa was inadequate, which is a challenge for control and elimination of schistosomiasis in the region (Atroosh et al., 2015).

The use of less sensitive diagnostic tools: Because of its simplicity and relatively low-cost, the Kato–Katz technique is widely used for epidemiological field surveys and is recommended by the WHO for surveillance and monitoring of schistosomiasis control programmes (Stothard et al., 2014). Though the specificity is high, the sensitivity of Kato–Katz in single stool sample examination is limited by day-to-day variation in egg excretion rates, thus leading

to measurement error in estimating the presence of infection. This is particularly accentuated in areas with high proportions of light intensity infections (DeVlas et al., 1997; Gryseels and deVlas, 1996). In the current era of preventive chemotherapy, the intensification of large-scale interventions and repeated mass deworming will significantly reduce the prevalence and intensities of schistosome infections (Savioli et al., 2015). As a consequence of the increase of low intensity infections, less intense infections will be often missed if single stool samples are examined by Kato–Katz method, resulting in significant underestimation of prevalence (DeVlas et al., 1997). Some studies recommended multiple stool samples in order to avoid underestimating the ‘true’ prevalence and transmission potential of the parasite. Indeed, it was demonstrated that Kato–Katz examination of three instead of one stool specimen increased the sensitivity of helminthes diagnosis, most notably for hookworm and schistosomes (Tchuem Tchuente et al., 2012). However, this has significant cost implications and it is highly time consuming. It is therefore, unlikely that control programmes can easily undertake for multiple sample collections on different days, at more geographical sites.

Lack of snails controlling as integrated approach: Snails are a crucial and necessary part of the life cycle that schistosomes depend upon for their development, multiplication and transmission. It follows that the distribution of the disease reflects in part the distribution of the genera and species of intermediate snail hosts that are compatible with the parasite. Without the presence of compatible snails, there can be no transmission; therefore, much attention should be focused on breaking the human–snail–human transmission cycle.

However, It has recently been stated that the control of the snail intermediate host is the missing link for control and elimination efforts in Africa (Sokolow et al., 2016) and it is also challenging to immediately incorporate in to the integration due to lack of skilled man power in the region (very few people left in Africa), who can correctly identify the snail intermediate host; it required to correctly identify ‘snail hotspots’ for targeted mollusciding and committed leadership (Elsevier Ltd, 2017).

Problems with mass deworming program: The ultimate goal of all schistosomiasis intervention efforts should be the elimination of the infection. Several programmatic steps are recognized for the control and elimination of schistosomiasis (Rollinson et al., 2013). These steps require specific interventions, including interventions for morbidity

control and those for infection prevention. It is recommended that schistosomiasis endemic countries progressively scale-up their objective from control of morbidity to elimination as a public health problem, and finally interruption of transmission. However, this population-based schistosomiasis treatment is not dramatically reducing parasite transmission in highly endemic areas and the target coverage rate of 75-100% among school-aged children at risk of morbidity by 2010 was not attained according to the 65th World Health Assembly faces different challenges in Africa (Fenwick and Jordan, 2016).

Challenge of reaching WHO's target of regular deworming coverage: Although significant progress has been made over the recent years to regularly implement MDA in several countries, the global achievement is still distant from the WHO's target of regular deworming of at least 75% of school-age children at risk. Indeed, it is estimated that the global coverage of schistosomiasis treatment in 2015 was only 28% (WHO, 2016). In many countries, school-based deworming interventions still cover only a minority of children considered to be at risk despite the low cost of preventive chemotherapy and their significant impact on health. Despite the increase in drug donation, the major constraint to controlling schistosomiasis continues to be the limited access to praziquantel. In 2015, only nine countries have reached the target threshold treatment of at least 75% of school-age children in the African Region (WHO, 2016).

Complexity and variability of transmission dynamics: does not consider current recommended treatment strategy: Schistosomes have a complex life cycle that requires a freshwater snail intermediate host and a vertebrate definitive host in which the parasites can undergo development. This ties transmission to landscapes where people and snails come together at the same water habitat. The success of the transmission depends on numerous factors, including biotic and abiotic features, such as climatic, physical and chemical factors that affect the survival and development of schistosome parasites and snail host populations (Sturrock, 2001), as well as socioeconomic and behavioral characteristics of the human community such as water contact behavior and the adequacy of water and sanitation, which affect the frequency and intensity of exposure to infected water (Fulford et al., 1998; Seto et al., 2012). The disease transmission is highly focally, and the endemicity varies significantly from one locality to another and from one country to another. It is well

known that the patterns and dynamics of transmission of schistosomiasis present tremendous complexity and variability between different foci and even within the same foci. The most significant determinants being water contact patterns, sanitation and hygiene levels, and the abundance and susceptibility of freshwater snail hosts. However, the current recommended treatment strategy does not consider these conditions (diversity of transmission dynamics, reinfection patterns and the special features of schistosomiasis transmission foci).

Challenges of reaching hard to reach and vulnerable communities: For schistosomiasis, universal health coverage means that all people in need should benefit from the preventive chemotherapy and other control/elimination interventions. The Sustainable Development Goals (SDGs) are reinforced by the commitment of global leaders to ensure that "no one is left behind" from development progress over the next 15 years. However, equity is not currently achieved for NTDs; hundreds million of the world's most vulnerable, most disadvantaged people are still left behind, especially the poorest of the poor, who live in the remotest, hardest to reach parts of the countries or the world. Hard to reach and vulnerable communities include communities that are poorly served by local health services, roads and transport facilities, itinerant fishing and nomadic communities, seasonal migrants, periurban settlers and those unwilling to accept health interventions (systematic non-compliers) (Nalugwa et al., 2015; Pearson, 2016). There are also areas inadequately covered with preventive chemotherapy due to civil unrest and conflict as well as health system crisis caused by recent Ebola outbreak in West Africa (Hodges et al., 2011; Hotez, 2016).

Low compliance to anti-schistosomiasis drugs: Low patient compliance for free medication is another MDA impediment. Drug compliance is very low with many countries reporting <50% compliance (Ross et al., 2014; Fenwick and Jordan, 2016). It has been reported that up to 80% of those who ultimately take the drug suffer from transient side effects such as dizziness, syncope, vomiting and diarrhea (Ross et al., 2014). Once the side-effects are observed and reported by others in the community, compliance quickly drops. Again, if treatment is left in the hands of local untrained medical staff, compliance will surely reduce. Many of the current MDA programs in Africa utilize unpaid volunteers with no health background to deliver MDA to patients for schistosomiasis control (Elsevier Ltd, 2017).

Problem of co-infections with other parasitic and non-parasitic: Co-infection of schistosomiasis with other infectious and parasitic diseases such as malaria, geohelminths, HBV, HCV and HIV are common causing high burden on public health in SSA. Their co-infection is common in African countries, having increased morbidity (Abay et al., 2013; Getie et al., 2015). In primary school children, double or triple infections of schistosomiasis with either malaria or STHs are common (Mazigo et al., 2010). In this age group, malaria and hookworm infections cause and influence schistosomiasis related morbidities (hepatosplenomegaly and anemia) (Mazigo et al., 2010). Co-occurrence of *S. haematobium* / *S. mansoni* and HIV-1 infections among rural populations has been noted in Tanzania (Downs et al., 2011) and urogenital schistosomiasis was associated with HIV infection (Downs et al., 2011). The same holds for associations between hepatitis B virus (HBV) and hepatitis C virus (HCV) and *S. mansoni* infection (Berhe et al., 2007). As noted in previous studies, there is evidence that co-infections of HBV and HCV and *S. mansoni* are associated with deterioration of hepatic function (Berhe et al., 2007).

Lack of approved vaccines: Although schistosomiasis is treatable, reinfections are common in endemic areas. As exclusive use of the drug was not effective in prevention and controlling of schistosomiasis and the exclusive use of the drug may lead to the emergence of drug resistant strains, so, that development and deployment of a vaccine as part of an integrated approach or alongside chemotherapy would control, and possibly eliminate, schistosomiasis (Donald et al., 2008). However, there is currently no vaccine against schistosomiasis despite nearly four decades of efforts, although there are several candidate human schistosomiasis vaccines are in different per-clinical and clinical development at present (Gillespie et al., 2016). This is also, another challenge for schistosomiasis control.

Polices of the countries and Population movement and migration: Government commitment is still insufficient to permit the elimination of schistosomiasis, and while governments welcome the implication of NTD control programs in their countries, domestic financial support is still too limited to implement sustainable control programs, and schistosomiasis remains a neglected tropical disease (Mohammed, 2017). Several countries in Africa are suffering from political instability and civil, unrest, as well as epidemics of infectious diseases such as Ebola which leads to a breakdown of health delivery service (Fenwik and Jordan, 2016).

Poor mapping quality and uncertainties: The mapping of NTDs is a critical step in understanding where at risk populations live in order to target effectively available resources and to achieve maximum impact on disease burden (King, 2016). Without reliable mapping information, countries are not able to plan interventions. Accurate mapping of disease distribution is therefore a prerequisite for effective implementation of interventions to reduce the burden of schistosomiasis (Lai et al., 2015; Sousa-Figueiredo et al., 2015). Although, significant progress has been made in the mapping of schistosomiasis in the African region, the mapping of disease prevalence remained incomplete in many countries (WHO, 2014; Negussu et al., 2017), which is a challenge for deepen the understanding of the distribution of schistosomiasis and snails in the countries.

Climate change: The transmission potential of most neglected tropical diseases in a particular location is partly dependent on abiotic factors affecting either free-living life stages and/ or those which occur in poikilothermic organisms such as snails and mosquitoes. As an exemplar, both the schistosome parasite and its intermediate host snails are very sensitive to water temperature (McCreesh et al., 2014). Increasing temperatures in freshwater bodies in sub-tropical and tropical areas may therefore alter the geographic distribution of schistosomiasis. There is some empirical evidence that this may be occurring already in Uganda, with transmission occurring at altitudes previously considered too cold (Rubaihayo et al., 2008). Climate change projections show increasing temperatures across Africa (Stocker et al., 2013), where the majority of people infected with schistosome parasites are located. What remains unclear is how this phenomenon might affect the transmission potential of schistosomiasis in different locations, given the non-linear relationship between water temperature and schistosome transmission (McCreesh et al., 2014). Perhaps because of the lack of research into this issue, the implications of climate change for schistosomiasis control and elimination have been largely ignored (Martens et al., 1995; McCreesh et al., 2014). *S. mansoni* infection risk may increase across much of eastern Africa as temperatures increase over the next few decades (McCreesh, et al. 2015). In most areas, the predicted increases are less than 20%. Temperature driven increases in risk may be much larger in Rwanda, Burundi, south-west Kenya, and eastern Zambia. The results also highlight areas where schistosome transmission may occur at new sites (McCreesh, et al. 2015). The results predict

changes in risk that are attributable to increasing temperatures only. Other climatic changes, such as changes in patterns of rainfall, flooding and droughts, will also have an impact on future schistosomiasis prevalence (needs investigation). Climate change may have a large effect on both the distribution and intensity of *S. mansoni* infection over coming decades. Temperatures are predicted to become suitable for increased transmission over much of eastern Africa over the next 20 years. This may lead to increased prevalence and intensities of infection in some areas, and is likely to reduce the effects of control and elimination programmes. In some areas, particularly in Rwanda, Burundi, south-west Kenya and eastern Zambia, increases in infection risk may be large. Schistosomiasis may spread to new areas, outside the current range of control programmes (McCreesh et al.2015).

The ways forward:

The need for more funding for integrated control:

In Africa, schistosomiasis control programmes mainly depend on external funds for MDA and often receive donated drugs. If funding ceases, consolidation of achievements made is generally not sustainable, with rapid reemergence of schistosomiasis as a result. With the intensification of interventions towards schistosomiasis elimination, there is a need to increase funding which will be long term for integrated control and the package should be delivered by health-care teams with disease specific expertise to support implementation of these interventions (Elsevier Ltd, 2017). More resources should be mobilized to develop greater multisectoral collaboration in an effort to combat schistosomiasis. All endemic countries should contribute by increasing their domestic investments to scale-up interventions and it needs to become an integral part of national health plans and budgets and rely less on foreign aid and charity (WHO, 2015).

The need for better diagnostic tools: Further efforts should be made to validate other detection tools. The choice of a specific diagnostic assay should be governed by the objective of the activity and according to the status of control (Stothard et al., 2014). As the accuracy of a given diagnostic technique may vary significantly according to schistosomiasis transmission level, tools should be adapted when moving from morbidity control to elimination of infection. Moving toward the surveillance and elimination phases requires more sensitive techniques such as antibody detection or

validation of other diagnostic techniques (Mohammed, 2017).

Scaling up treatment coverage to reached WHO target of deworming:

To reach the schistosomiasis elimination target, there is an urgent need to accelerate the extent of treatment to reach all individuals at risk. This extension of preventive treatment for schistosomiasis remains a serious challenge, and should be conducted at several levels. First, there is a need to accelerate the scaling up of mass drug administration to reach 100% geographical coverage and at least 75% of school-aged children in all endemic countries in the African region. Secondly, there is a need to extend treatment to the maximum number of out-of-school school-aged children, the main target group of preventive chemotherapy. However, most of out-of school children are not reached through this platform. Special efforts should be made to extend treatment to this group. Thirdly, there is a need to extend preventive chemotherapy to adult populations; especially high-risk populations such as fishermen, irrigation workers, and women are not treated during deworming campaigns (Tambo et al., 2017; Negussu et al., 2017).

Adapting treatment to transmission dynamics: the need for alternative strategies:

To be efficient, preventive chemotherapy should be repeated more frequently in such hotspots, at least twice per year. However, the current recommended treatment strategy does not consider the diversity of transmission dynamics, reinfection patterns and the special features of schistosomiasis transmission foci. With the shift towards schistosomiasis elimination, there is a need to adapt treatment strategies to the different types of transmission settings. Urban schistosomiasis may also require more frequent interventions (Tchuem Tchuente et al., 2017).

Strengthening health education, environmental management and improved human sanitation:

Despite the public health impact of schistosomiasis in African endemic countries, the low political commitment and level of funding in sustained control and elimination still represents a major setback in upholding the hard won gains and achievements in schistosomiasis control into elimination phases. So, that Continuous community health education, awareness outreach and population social mobilization and engagement are needed in strengthening community resilience and participation in sustained schistosomiasis control and elimination activities (Tambo et al., 2017; Negussu et al., 2017).

Improving mapping qualities and uncertainties:

Accurate and up-to-date maps of different NTDs can help improve the precision of decision-making in NTD control. They can help increase the reliability of estimates of disease burden, for example, as part of the ongoing revision of the Global Burden of Disease study. The maps can also establish a baseline against which to measure the impact of NTD control efforts. Finally, they can provide an important planning tool for national control programmes. Considerable effort is required to develop an integrated NTD atlas, necessitating cooperation and collaboration of the different NTD communities. Because of the highly focal distribution of the disease, there is a need for more accurate mapping to deepen the understanding of the distribution of schistosomiasis and snails in the countries, which should guide programme decision making for mass drug administration. Furthermore, the maps should be dynamic entities that change with time as control progresses, necessitating refinement of tools for updating the original disease maps. As elimination moves forward there will likely be a need to map more geographic points, with an optimum to get to all schools within health unit (Sousa-Figueiredo et al.,2015). Ideally, knowledge of water contact sites and an understanding of local transmission should guide mapping decisions and interventions (Stothard, 2009).

Tackling reservoir hosts: Several species of schistosome are zoonotic and can naturally be transmitted between humans and vertebrate animals. In Africa, monkeys and baboons are known to be infected by *S. mansoni* in their ecological areas (Fenwick, 1969; Legesse M and Erko B, 2004). However, their potential reservoir role in the transmission of the disease and as an impediment to schistosomiasis control and elimination need to be further investigated. The complex population biology and transmission ecology between humans and animal reservoirs affect the success of control programmes, and magnifies the challenges of control and elimination. Indeed, to eliminate schistosomiasis, one must not only eliminate infection in the human population, but also prevent or eliminate transmission from animal reservoirs (Webster et al., 2016).

Knowing the impact of climatic change on schistosomiasis: Further studies on how climatic change phenomenon might affect the transmission potential of schistosomiasis in different locations and increasing surveillance conducting at those areas are needed. Increased surveillance of these areas would enable education and control programmes to be

promptly implemented in newly endemic areas, minimizing disease morbidity (McCreesh et al.2015).

Integrated approach: In line with the WHO NTD Roadmap and the WHO-AFRO 2014-2020 Regional Strategy on NTDs, The Towards Elimination of Schistosomiasis (TES) conference held in Cameroon from March 22 to 23, 2017, 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 put forward four recommendations for priority interventions: (I) 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 centers 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 (II) 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 (III) to intensify multisectoral actions which consolidate control and elimination of schistosomiasis that specifically up-scale and foster sustainability of PHASE activities. and (V) 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 crosssectoral actions disease (Ministries of Education, Water & Energy, Agriculture) (MOPH&MOBE 2017; Elsevier Ltd, 2017).

Conclusion

Schistosomiasis is still high and a public health problem in SSA. The distribution of schistosomiasis is varying, and the burden of disease is significantly different among the countries and within the country regions. Although, it not seems the object of schistosomiasis control and elimination in SSA will

meet with in planned time period, giving attention to the identified challenges and strongly working on the solutions forwarded and accepting the different recommendation given by experts will help for moving forward.

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