Epidemiology, of bilharzias (schistosomiasis) in Uganda from 1902 until 2005

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Abstract
Background: Schistosoma mansoni was observed and reported in Kuluva hospital Arua District in north western Uganda as early as 1902. S. mansoni is widely distributed in Uganda along permanent water bodies.
Objective: To review the literature on schistosomiasis in Uganda, since 1902.
Method: The core literature for this short review was searched from reports and publications by the British colonial Ministry of Health Districts Medical officers and Entomologists. Additional information was obtained from Makerere University Medical School library archives, London School of Hygiene and Tropical Medicine library archives, University of Antwerp, and post independence publications on schistosomiasis in Uganda in various journals.
Results: Since it was first detected in 1902 Schistosoma (S) mansoni is more widely distributed in Uganda than S. haematobium. However Schistosoma mansoni and S. haematobium are of public health importance in Uganda and the importance of migrants and fishermen in disseminating infections into non-infested areas and intensifying infection in areas already infested have been reported.
Conclusion: S. mansoni has been on the increase in Uganda whereas S. haematobium is localized in sporadic foci in the north of Uganda. Treatment with praziquantel the drug of choice in Uganda used in schistosomiasis control programme has reduced development of severe schistosomiasis.

Introduction
The ancient Egyptians recorded comprehensive clinical accounts of bilharzias as laid down in the papyrus Pfister1. Ebers and Hearst Ruffer proved the presence of Schistosoma ova in mummies and Canopic jar of mumified viscera2. The first published record of the causative agent was after the post-mortem discovery of the worm in the mesenteric veins of a patient in Kasr el Aini Hospital in Cairo by Theodor Bilharz3. The first published account of the taxonomy of the genus Bilharzia was by Meckel Von Hemsbach two years after Weinland named the genus Schistosoma (Meckel Von Hemsbach 1856, Weinland 1858)4, 5. Three species of Schistosoma are known to be parasitic to man. Schistosoma (S.) haematobium, (Bilharz 1852)6 while Brumpt named Schistosoma (S.) mansoni in 1931 (Brumpt 1931)7. Cort in 1919 was the first to identify cercariae of the Japanese blood flukes, Schistosoma japonicum in Katsurada (Cort 1919)8. Bhalerrao in 1934 observed the occurrence of Schistosoma japonicum in Katsurada in India (Bhalerrao 1934)9. Schistosoma mansoni and S. haematobium occur in Uganda. Besides these two schistosomes, S. intercalatum has been reported in 10 countries mainly in central and West Africa, but also in Northern Uganda10.

This short review will cover some of the fundamental work on schistosomiasis in Uganda from 1902 and show steps taken after, by the Uganda Ministry of Health to control the transmission and morbidity of schistosomiasis in Uganda.

Schistosome infections in Uganda.
Schistosoma mansoni was first observed and reported in Kuluva hospital Arua District north western Uganda by Aldo Castallani and G.C Low in 1902 in a hospitalised patient with sleeping sickness10. McConnelly 1923, Rawson & Gopal 1924 noted a high incidence of S. mansoni in the West Nile11, 12.

Nelson was the first to make a complete assessment of the prevalence, distribution and importance of schistosomiasis as a health problem in Uganda, especially in West Nile13. He found that the prevalence and intensity of infection was highest immediately along the banks of the River Nile and decreased with altitude and distance from the Nile. Schwetz also made a similar observation that altitude
and distance influence the distribution of Bilharzia in Lake Bunyonyi in Kabale in Western Uganda10.

Nelson further observed that enlarged spleens and anaemia were a common clinical feature among children around ten years old with high intensity of infection. In a broader perspective, Webbe and Jordan advanced the knowledge of schistosomiasis in East Africa, which included Uganda, Kenya and Tanzania15. In the seventies, studies by Ongom documented the epidemiology and consequence of S. mansoni infection among Jonam in a fishing village of Panyagoro and Panyimur in West Nile15,16.

In Lango district, now Lira district, Schwetz reported vesical Bilharzia in the community living in Aloi, Ayer along River Acwa17. Haematuria was common among both adults and children in this community. Rosanelli reported cases of S. haematobium in Pader district, formerly (East Acholi district) along River Odek, a tributary of River Acwa. These areas are all neighbouring Lira district where S. haematobium is present according to Rosanelli17. Many studies in Northern Uganda were in the former West Nile district where S.mansoni infection is hyperendemic12,18. Bradley investigated the role of fishermen in disseminating S. mansoni in Lolui Island in Lake Victoria as an important epidemiological aspect19. Prentice studied the epidemiology of S. mansoni among Caucasian immigrants and indigenous Ugandans living near the shore of Lake Victoria and Entebbe 20. In 1961, Barnley and Prentice showed a prevalence of S. mansoni to be (14%) in immigrants living in Entebbe and Kampala with definite history of swimming in Lake Victoria 20, 21, 22.

The Public Health importance of migrants from schistosomiasis endemic areas of Uganda in disseminating infections into non-infested areas and intensifying infection in areas already infested has been reported19,23. In most parts of Uganda, schistosomiasis was thought to be an occupational disease mainly of the rural poor communities. Nevertheless, recent studies indicate that urban schistosomiasis is emerging in water bodies within vicinities of some townships in Uganda 24,25. The fishing village of Kigungu in Entebbe is one of such water bodies. Many people have been acquiring schistosomiasis without knowing the source of their infections. These have resulted in unexpected increase in the incidence of S. mansoni observed in Entebbe and Kampala hospitals. However, it was established that the sources of major transmission foci were along the canoes landing sites in Entebbe and streams within Kampala 23,25,26.

The snails vectors which transmit the parasites were detected as early as 1950 by Prentice (a Senior Entomologist - Ministry of Health Uganda based in Wandegeya Vector Control Division) 20, 21, 22. The snails found were the Bulinus spp which transmit urinary Bilharziasis (Schistosoma haematobium) and the Biomphalaria spp which transmit intestinal Bilharziasis (Schistosoma mansoni) 27. The susceptibility of these snails (Biomphalaria spp) to Schistosoma mansoni were tested by Prentice 1950 in Wandegeya and repeated by Odongo-Aginya 1987 in Uganda Virus Research Institute Entebbe 25, 27. Schistosoma haematobium does not occur in Entebbe despite the fact that the snail intermediate host for the parasite, the Bulinus spp, do exist in most parts of the shore line in Entebbe 25, 26, 27.

The upsurge of Schistosoma mansoni in Entebbe

Schistosoma mansoni is the only species of Schistosome occurring in the fishing villages and recreational sites in Entebbe 24,25,26,27. Berrie, using faecal direct smear method in Entebbe Hospital found 6.5% of Katabi villagers with Schistosoma mansoni infections and 1.4% infection in Nakwogo28. In 1963, Bradley showed 14% (12 out of 86) of Schistosoma mansoni in immigrant population living in Entebbe29. Those infected had a history of sailing and swimming at the present Sailing Club. Billinghamurst reviewed hospital records at Mulago between 1955-1964 and found that 55 non-African had Schistosoma mansoni and over half of those admitted having swum in the Lake at Entebbe30. In the same year, a survey conducted in Primary Schools in Entebbe among African and Asian pupils showed that 8% infected children acquired the infection from Lake Victoria in Entebbe while in Bugonga fishing village 28 out of 190 (15%) were found infected with Schistosoma mansoni. These infections were higher among fishermen 17%. In 1969 a total of 66 people were studied at Kigungu and 13 (20%) were infected of which the majority were children 10 out of 13(77%) 10.

Recent studies of Bilharziasis in Entebbe and Kigungu indicated an up surge of the disease in all fishing villages around Entebbe 20, 21, 22, 23. In 1982 Kinoti of Nairobi University Department of Parasitology at the request of United Nation Development Programme (UNDP) and Uganda Ministry of Health made assessment of schistosomiasis in the entire Uganda 32. In Entebbe, at Kigungu, Kinoti studied 64 people and out of these 26 (40.6%) were infected. The study by Kinoti was one of the first after the colonial rule in Uganda and it revealed that bilharziasis is a much greater health problem.
in Entebbe fishing villages than it was previously believed. Bukenya studied 336 people in Kigungu village. In this study 42 people out of 335 (12.5%) were found to be infected. The majority of the people studied were between 30 and 40 years old.

In 1987 Odongo-Aginya and Mugish studied 358 migrants from Schistosorniasis mansoni endemic areas of Uganda living in Entebbe. High infection of 144 out of 358 (56.2%) were found among people from schisiosomiasis endemic areas of West Nile region living in various places along the fishing villages in Entebbe. This is one of the best ways of disseminating infections of bilharziasis to other area. A survey was conducted for the snail intermediate hosts and their susceptibility to the local strain of S. Mansoni, were tested.

In 1990 Lakwo and Odongo-Aginya compared the prevalence of S. mansoni among 520 people that is 260 people from each village of Nakiwogo and Kigungu in Entebbe. They found that in both villages infections were high, with Nakiwogo having 95 (36.5%) while at Kigungu 40 (15.4%) people were infected. The lower figure of infection in Kigungu was due to difference in the age group studied, older fisher men were studied in Kigungu. This might also explain why Bukenya and Abongomera (1985) recorded a lower infection rate at Kigungu. Their study was based on older people between 30-40 years old.

**Distribution of Schistosoma mansoni in Uganda**

It is clear that schistosomiasis mansoni has been building up in Entebbe and it is already a health problem in this area. It is apparent that a similar upsurge of Bilharziasis is going on in other part of Uganda. Recently described foci of schistosomiasis in Uganda are characterised by increasing prevalence and intensity of infection. New foci have been described in the northern part of Uganda along the non-seasonal large bodies of water with suitable ecological habitats for the gastropod hosts of schistosomes. More recently Kabatereine showed that S. mansoni was prevalent in 38 districts of Uganda and S. haematobium occurred in just two districts of the 38 districts. Presently, it is estimated that about four million Ugandans have bilharziasis and 17 million are at risk of getting the disease.

**Human water contact patterns in Uganda**

Human water contact activities in Uganda have been described mainly as recreational, domestic and economic. In the dry season the level of many water bodies are reduced and the fast flow of the meandering rivers and streams slacken occasionally forming small pools. This contributes significantly towards disease transmission. The human water contact during the dry seasons is especially high. The transmission situation is aggravated by refugee movement in Northern Uganda. However recent epidemiological figures from the Northern part of the country are lacking because of the insurgency which has impeded field survey for over two decades.

**Preparation for bilharzia control**

A detailed plan of action was developed by health and education officers from the original 18 selected districts. Advocacy at lower levels was achieved through workshops for district civic and political leaders, where programme objectives, implementation strategy and the required support were comprehensively discussed.

**Management of schistosomiasis in Uganda**

Uganda National Bilharzia Control Programme (UNBCP) was instituted to reduce the worm load in the school age children and the community at risk of infection with bilharzia by annual mass praziquantel (PZQ) chemotherapy. Target groups are identified by stool examination and PZQ administered to them according to the WHO guide line. In schools treatment is carried out by teachers and in communities by Community Drug Distributors, who are selected by the concerned communities and trained by the district trainers. The training curriculum includes treatment procedures, record keeping, action in case of unforeseen side effects, and drug accountability. Their participation is voluntary and unpaid.

**Health education in Uganda**

Public health education on schistosomiasis is of paramount importance. This holds especially true for the village level. Health committees and public talks, group focus discussions and other methods of health education have been practised in Uganda and their results have been published. As of late public radio calls have supplemented the panel of methods. The people were made aware of the disease and its transmission by water contact activities. Special emphasis was put on the health education of the primary school children whose school is situated near water bodies. In addition they were advised to avoid bathing at the lake.

**Sanitation.** The establishment of pit latrines in all of the homes of the country is encouraged and is under way.
Environmental control. Papyrus clearing of water sites in swamps and bush clearing by mobilized inhabitants is a cost-effective way of reducing the risk of disease transmission. The bush clearing along the lake has two positive effects. Firstly, the snail population is distinctly reduced. A lower number of snails mean a lower number of cercariae and therefore a diminished risk of infection. Secondly, it caused a change in the people’s behaviour and reduced the faecal contamination of the shore. The (UNBCP) is implemented by Vector Control Department in Wandegeya and assisted in the districts, by Director of Medical Services, the district vector control officers and district health educators in the Ministry of Health. 

Monitoring and evaluation
Monitoring and evaluation procedures were designed to assess different aspects of the programme, such as impact on health, coverage of the treatment campaign and success and challenges in implementation. The monitoring and evaluation began in 2003 with the collection of baseline data from a cohort of 4351 children and 1088 adults from 37 schools and nine communities. Stool samples, and questionnaires were used to measure reductions in prevalence, intensity and morbidity resulting from disease and were collected on an annual basis. Anthropometric measurements of the school-aged children, e.g. height and weight were also collected, as were finger-prick blood samples to assess their anaemia status through the measurement of haemoglobin levels.

Process monitoring and evaluation was carried out to assess awareness, perceptions and adherence to the implementation guidelines of the programme. Questionnaires were administered through independent external evaluators to all stakeholders involved in the activities of the programme. Programme costs, both in the district and overall in the country, have been monitored. The results indicated that aspects of the programme are cost effective and will therefore be used to progress to a more financial sustainable programme.

Discussion and recommendations
The control programmes in Uganda have been supported by funding from the Bill and Melinda Gates Foundation. This has helped the country to sustain the excellent start in eliminating the morbidity resulting from schistosomiasis. Potential sources of funding that could be expected to assist the active the programmes include those from the Ministry of Health. In addition other international agencies like the European Union, and international organisations such as WHO, the World Bank, the African Development Bank, the World Food Programme and UNICEF have contributed funding towards the control of bilharziasis.

Intensive health education is vital, but large-scale health education campaigns will serve no purpose if alternatives to current water contact practices are not available. Thus, efforts must continue to persuade donors, as well as national agencies, to increase the quantity of safe water supplies in areas endemic for schistosomiasis. Additionally, improved sanitation is required before elimination of these infections can be considered a possibility.

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