

Prevalence, Primary Health Care Diagnosis, and Challenges Encountered by Health Care Workers in the Control of Schistosomiasis, in the Tiko Health District, South Western Cameroon

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ABSTRACT

One approach to the control of schistosomiasis recommended by the World Health Organization (WHO) is for endemic countries to integrate schistosomiasis control measures into their primary health care (PHC) services. Assessment of their capacity to accommodate such control measures is of utmost importance. This study had as objectives to assess the capacity of the PHC system in the Tiko Health District to diagnose schistosomiasis and to evaluate health care workers' perspectives of potential challenges to schistosomiasis control in the district. A total of 13 primary healthcare facilities were randomly selected and their laboratory records on schistosomiasis diagnosis were evaluated for quality (availability, documentation of key aspects and presentation), diagnostic methods used and parameters recorded (egg counts, haematuria). At each institution, more than 60% of health personnel participated in a survey in which a semi-structured questionnaire was used to collect data. A total of 170 healthcare workers working at various stations (laboratory, pharmacy, nurses, out-patient section) were interviewed. Out of the 13 health institutions, only 8(61.5%) had any data on diagnosis of the disease and used the sedimentation technique for diagnosis. One institution used the Syringe Filtration Technique (7.7%) in the diagnosis of *S. haematobium* and recorded the presence or absence of haematuria. No institution recorded key parameters like egg count for any patient. Five (38.5%) of the institutions, found mainly in the suburbs, had no laboratory services. Most of the healthcare workers (46.5%) were of the opinion that lack of knowledge of the disease is a major setback in the implementation of control. With respect to the different professions, it was observed that amongst the medical doctors (83.3%) and nurses (58.2%) this opinion was more popular. Pharmacy technicians (67.7%) and community directed distributors (52.2%) cited the poor sanitary conditions of homesteads as the greatest challenge in the implementation of any form of control. The primary healthcare system of the Tiko Health District lacks the capacity to accommodate control measures; all the hospital laboratories fall short of WHO recommendations for diagnosis of the disease. The control of schistosomiasis in this health district is likely to be hampered by several factors ranging from poor sanitation, poor knowledge of the diseases, lack of commitment of stakeholders and poor diagnostic techniques and reporting methods.

Keywords: Control, diagnosis, perspectives, primary health care.

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I. INTRODUCTION

Schistosomiasis is a neglected tropical disease (NTD) with more recent data estimating the number of people infected globally at 200 million [1]. More focused data have been published that present evidence of the serious nature of liver disease, [2] female genital schistosomiasis [3] and the effect on anaemia and pregnancy outcomes [4], [5]. In the past decade, with the London Declaration of 2012 to combat NTDs, there has been expectancy within the corps of medical

personnel for policy makers to begin implementation of control measures. Notwithstanding the challenges, there is an evident recommitment by WHO to achieve global elimination by 2030 and this has sparked debates on the best control strategies given the available funding. Schistosomiasis control methods are long established and mass drug administration (MDA) of Praziquantel has emerged as the main control option [6], [7] though an integration of several approaches will definitely have greater impact on the disease burden. The option of MDA has mostly been implemented in high-risk areas with moderate to high endemicity especially

when the resources are not readily available [8]. However, including low risk areas in any national control program is important for basically two reasons; firstly, it's a disease that is rapidly spread by migration and secondly, it takes a short time for a few people to transmit the disease given that there is an exponential reproduction of the cercariae in the snail host [9].

Another consideration in MDA is the target population. The decision on whether to use a community wide or school-based approach for MDA is complex. The latter method is usually preferred because of limited drug donations and also for the fact that the age group concerned (5-14 years) is more vulnerable to infection and disease. However, a school-based approach is only effective if school enrolment is high as a recent study [10] concludes. Fortunately no resistance to praziquantel has been reported so far [11] and what is now needed are global funding sources to make the funds available [12]. Exploring and integrating other approaches to chemotherapy is of the essence at this point if elimination is the goal [13].

Diagnosis is an indispensable assessment tool in any disease control program. The relevance of diagnosis in control is not subject to the approach used for chemotherapy and so has been emphasized by many authors. The most expedient diagnostic systems are often easy to implement, cheap, and have a rapid response, but they tend to generate false negatives due to low sensitivity [14]. Unfortunately, the most sensitive diagnostics are often technically demanding, somewhat complicated, and usually costly. Both categories of diagnostic tests have a place. When it comes to monitoring the impact of control programs at the later stages, when parasite prevalence and intensity are greatly reduced, there is a critical need for high sensitivity [14]. This is also true for areas with low endemicity where low egg intensity can lead to false negatives which are a major hazard to effective control because of the huge amplification that takes place in the snails [15]. Amongst the microscopy-based methods, the syringe filtration technique (SFT) surfaces as the most sensitive but its application in most rural settings endemic for the disease is apparently non-existent. When control is envisaged in any endemic area, can data generated by the readily available sedimentation technique be relied upon for decision-making?

Decision makers have at times been reluctant to allocate funding for the treatment of schistosomiasis because the cost benefits of treatment have been inconclusive. A body of evidence is emerging that makes the argument for treatment stronger than ever before; Toor and colleagues [10] found that in low- to moderate-transmission settings with good school enrolment, school-based treatment is sufficient for achieving elimination. However, community-wide treatment is projected to be necessary in certain high-transmission settings as well as settings with low school enrolment [10]. These challenges necessitate the introduction of the horizontal approach to chemotherapy to complement on-going control programs. This has been a major recommendation by WHO [16] whereby control activities are integrated into the primary health care system (PHC). Managing this disease at the PHC would involve education, diagnosis and treatment of those exposed to infection [17]. Previous studies have shown that the integration of schistosomiasis control measures into

routine PHC services significantly reduced the prevalence and intensity of schistosomiasis infection [18], [19]. Besides, the integration of the PHC system into control has led to higher population coverage in Sudan [20]. It is suspected that elimination will not be possible if this is not included as part of control [21].

The Tiko Health District which only recently [22] has been identified as a focus for schistosomiasis, has a moderate to high endemicity of the disease [23], [24]. A national control program for other NTDs (soil transmitted helminths, lymphatic filariasis and onchocerciasis) exists within this health district and the main approach for implementation is school based treatment with Mebendazole and community-based treatment with Albendazole and Mectizan. Donor organizations like Sight Savers and USAID were the main contributors to the national NTD fund [25]. These funding bodies withdrew their funds in 2018, just when schistosomiasis was first reported in the district. The capacity of the PHC facilities to integrate schistosomiasis intervention measures such as diagnosis and treatment remains unknown. This study sought to assess data quality and diagnostic methods for schistosomiasis in the health institutions of this district and to identify the challenges to future control of the disease from the perspective of medical personnel in the aforementioned institutions. This would provide substantial information to influence policy in the public health sector as schistosomiasis control is envisaged.

II. METHODS

A. Study Design

The study combined both a retrospective (chart review) and a cross-sectional survey. In the retrospective study, laboratory records were accessed and evaluated for quality of data on schistosomiasis. For the cross-sectional study, a semi-structured questionnaire was administered to consenting medical staff to obtain their perspectives on the disease and the challenges for future control.

B. Study Institutions and Study Area

This study was carried out in the Tiko health district (THD). This health district is composed of eight health areas with health facilities in each. These are the CDC Central pharmacy, CDC Cottage Hospital, PMI Tiko, Integrated Health Centre Tiko, CMA Mutengene, Integrated Health Centre Mondoni, Integrated Health Centre Mudeka, Muquo Health Centre, Misselele Health Centre and CDC Misselele. There are other hospitals which do not represent health areas but are part of the district like the Tiko District Hospital and the Baptist Hospital Mutengene which play a big role in provision of quality health care to the people of this district and the neighbouring towns. There are a few private clinics in this District that were not included because comparatively not many people visit them. THD comprises eight health areas (Holforth, Kange, Likomba, Mutengene, Mondoni, Mudeka, Misselele and Tiko town) and is inhabited by a heterogenous population of 124, 423 inhabitants [25] distributed in 28 villages. Tiko has a population density of 241 inhabitants per sq.km and a population growth of 2.9%. The coordinates of the THD range from altitude 18m, latitude 9°32' 2" N to 9° 40' 9" N to altitude 220m, longitude 9° 25'

7° E to 9° 55' 7" E, with a surface area of 4840 square kilometres (sq.km). The mean temperature is 27.9 °C, the relative humidity 83.1% and average rain fall of 4,524 mm. This area is characterized by the presence of a local seaport that allows for fishing, import as well as export of goods with neighbouring countries. The rich volcanic soil encourages farming activities and industrial agriculture. The Mungo river flows at the boundary of three communities; Mondoni native, Mudeka (Mungo) and Misselele.

C. Sample Population and Administration of Questionnaire

The medical staff in the various health institutions constituted the main population of the survey, including the community directed distributors (CDDs) and the personnel involved with the national NTD program. A record of the number of staff for each institution was gotten and a sample size was calculated based on that record, making sure to include at least 60% of the total staff. The availability and willingness to participate in the study were the determinants for participants' recruitment into the survey. A semi-structured questionnaire was administered to consenting staff to get their perspectives of the control of the disease and the challenges to future control.

D. Assessment of Hospital Laboratory Data

A retrospective study was conducted during which laboratory data on schistosomiasis was accessed and was evaluated for quality (availability, documentation of key aspects and presentation), diagnostic methods used and parameters recorded (egg counts, haematuria etc).

E. Ethical Considerations

This study was carried out with the approval of the regional delegation of public health for the South West Region Buea, Cameroon. An authorisation to carry out research in the Tiko health district was issued. An institutional and ethical approval was obtained from the ethical review board of the institutional review board of the Faculty of Health Sciences, University of Buea. Each participant gave a signed informed consent before being enrolled into the study.

F. Data Analysis

Quantitative data (hospital laboratory data) was analysed using descriptive statistics and results were presented in tables and charts. Qualitative data was analyzed using thematic analysis and involved summarizing the perceptions of medical personnel on the disease and constraints to future control of schistosomiasis in the Tiko Health District.

III. RESULTS

A. Hospital Laboratory Data Assessment

The diagnostic methods used in the diagnosis of schistosomiasis and parasitological parameters recorded in the various health institutions are presented in Table I. Out of the 13 health institutions involved in the study, only 8(61.5%) had any data on diagnosis of the disease. Five (38.5%) of the institutions, found mainly in the suburbs, had no laboratory data. Only one institution (Maflekumen Labs) used the Syringe Filtration Technique (7.7%) in the diagnosis of *S. haematobium* and recorded the presence or absence of

haematuria. All the other institutions used the Sedimentation technique in this diagnosis (92.3%). Two institutions diagnosed *S. mansoni* using the sedimentation/concentration technique. None used the kato-katz technique for the diagnosis of *S. mansoni*. No institution recorded the egg count for any patient and so there was no estimate of the intensity of the infection. The age, sex and number diagnosed were however recorded in all the institutions that had laboratory data. No hospital had any data on prevalence.

B. Number of Children (5-20years) Diagnosed from 2015-2020

The first cases of hospital-based diagnosis of schistosomiasis in the Tiko health district were recorded in the Baptist Hospital Mutengene in 2015 (2 cases) and 2016 (1 case). In 2017, five of the institutions recorded their first cases of *S. haematobium* and one recorded a case of *S. mansoni* (CMA Holforth). The greatest number of positive individuals (241) diagnosed in one year were recorded in 2018 and another case of *S. mansoni* was recorded by CMA Mutengene. The CDC central clinic was the only institution that recorded an average of more than 25 cases yearly from 2017 to 2020. The others had about 5 on average.

C. Prevalence of Community Based Studies

The prevalence of *S. haematobium* in different areas of the Tiko Health District since the disease was first diagnosed, has been determined by three different studies as shown in Table III. Reference [22] had a prevalence of 38% in children 5-20 years, for one health area (Likomba). Reference [23] on the other hand worked with school age children in 3 health areas (Likomba, Tiko and Holforth) and had a prevalence of 16.6%. A much wider epidemiological study [24] which covered four of the health areas of the District had a prevalence of 31-50% in individuals 5 years and above. Only Anguh and colleagues used the sedimentation technique to determine prevalence.

D. Major Constraints in the Implementation of Schistosomiasis Control

Table IV presents findings on the constraints reported in the implementation of schistosomiasis control in the THD. From the questionnaires that were completed by consenting medical staff, a summary was made on their perspectives on what the most challenging issues were that had to be overcome for effective control of the disease to take place. Overall, a lack of knowledge of the disease (LOK= 43%) by inhabitants of the district was identified as the greatest challenge in any future implementation of control. The next challenge identified was the poor sanitary facilities of the homesteads (PSF=28.8%), then the lack of commitment by stakeholders in the health sector (LOC=20.6%). Finally, very few of the personnel thought the disease was underdiagnosed and would pose as the greatest challenge in control (PD=4.1%). Nobody mentioned the cost of treatment as the greatest challenge that could be faced by a potential control programme. There was a difference in perspective amongst the medical staff as far as their professions were concerned. A great majority of the nurses (58.2%) and doctors (83.3%) thought lack of knowledge of the disease was the greatest challenge while majority of pharmacy technicians (66.7%) and community health workers (52.2%) thought lack of commitment by stakeholders was the greatest challenge.

TABLE I: SCHISTOSOMIASIS DIAGNOSTIC METHODS AND PARASITOLOGICAL PARAMETERS DOCUMENTED IN LABORATORY DATA OF HEALTH INSTITUTIONS IN THE TIKO HEALTH DISTRICT

Health Institution	Diagnostic methods and parameters					Documentation		
	SFT	ST	KK	Haematuria	Egg count	Age	Sex	No. diagnosed
Tiko District Hospital	-	+	-	-	-	+	+	+
CDC Cottage Hospital	-	+	-	-	-	+	+	+
Maflekumen Labs	+	+	-	+	-	+	+	+
CMA Holforth	-	+	-	-	-	+	+	+
IH/C Tiko town	-	+	-	-	-	+	+	+
Baptist Hosp. Mutengene	-	+	-	-	-	+	+	+
CDC Central Clinic	-	+	-	-	-	+	+	+
CMA Mutengene	-	+	-	-	-	+	+	+
CDC Misselele	-	-	-	-	-	-	-	-
Mudeka H/C	-	-	-	-	-	-	-	-
Misselele H/C	-	-	-	-	-	-	-	-
Mondoni IH/C	-	-	-	-	-	-	-	-
Moquo H/C	-	-	-	-	-	-	-	-

SFT = Syringe Filtration, ST = Sedimentation Technique, KK = Kato-katz

Amongst the lab scientists, equal proportions thought that poor sanitary facilities (35.5%) and lack of commitment by stakeholders (35.5%) were the greatest challenges for control of the disease. No medical doctor thought that poor sanitary facilities or lack of commitment was the greatest challenge to future control (Table IV). Fig 1 presents the perspective in the major constraint to control of schistosomiasis in the Tiko health district with respect to gender. The trend in the opinion was the same in both the female and male staff. The female medical staff were more in number than the male medical staff (about 95% of nurses were female). However, the proportion of females who thought that lack of knowledge of the disease will be the main challenge of a control programme was 49% (58) while 40% of the male staff thought in the same line. For both female and male staff, poor sanitary facilities followed in terms of proportion (female=27%, male=32%), followed by lack of commitment by stakeholders (female=19.5%, male=23%), and lastly poor diagnosis (female=4.2%, male=4.0%).

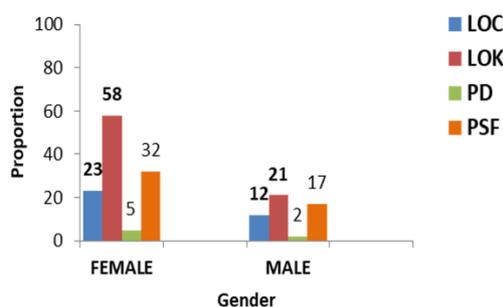


Fig. 1. Proportion of male and female medical staff with particular perspective of the major constraint to control of schistosomiasis in the Tiko health district.

TABLE IV: PERSPECTIVES OF MEDICAL PERSONNEL ON THE CONSTRAINTS TO IMPLEMENTATION OF CONTROL OF SCHISTOSOMIASIS IN THE TIKO HEALTH DISTRICT

Profession	Gender	LOK	LOC	PSF	PD	COT
Nurses	Male	5	3	3	1	0
	Female	52	13	16	5	0
	Total	58.20%	16.4%	19.30%	6.30%	0%
Doctors	Male	4	0	0	1	0
	Female	1	0	0	0	0
	Total	83.30%	0%	0%	16.7%	0%
Pharmacy Technicians	Male	2	0	1	0	0
	Female	1	0	5	0	0
	Total	33.30%	0%	66.70%	0%	0%
Laboratory scientists	Male	7	5	4	0	0
	Female	3	7	8	0	0
	Total	29.40%	35.30%	35.30%	0%	0%
CDDs and NTD coordinators	Male	3	4	9	0	0
	Female	1	3	3	0	0
	Total	17.40%	30.40%	52.20%	0%	0%
Total		46.50%	20.60%	28.80%	4.10%	0%

LOK=lack of knowledge of the disease, LOC=lack of commitment by stakeholders, PSF= poor sanitary facilities, PD=poor diagnosis.

IV. DISCUSSION

Schistosomiasis was first reported as endemic in the Tiko health district in 2018. Hospitals around this district had diagnosed the disease amongst a few inhabitants who came to consult upon observing blood in their urine. The first hospital record was in 2015 in the Baptist Hospital Mutengene with two cases that year. An essential aspect of the primary health care system (PHC) approach is the clinical care of patients who visit health care facilities with schistosomiasis related complaints [3], [17].

TABLE II: LABORATORY DATA ON THE NUMBER OF CHILDREN DIAGNOSED OF S. HAEMATOBIMUM FROM 2015 TO 2020 IN THE DIFFERENT INSTITUTIONS OF THE TIKO HEALTH DISTRICT

Health institutions	Year of diagnosis					
	2015	2016	2017	2018	2019	2020
Tiko District Hos	-	-	05	14	18	12
CDC Cottage	-	-	04	05	01	03
Maflekumen Lab	-	-	05	186	01	-
CMA Holforth	-	-	13	-	11	04
CMA Mutengene	-	-	-	-	01sm	-
IH/C Tiko town	-	-	-	01	02	-
Baptist Hosp.	02	01	01	01	03	04
CDC Central Clin	-	-	20	34	28	22
Total	02	01	50	241	65	45

s.m.= S. mansoni

TABLE III: DIAGNOSTIC TECHNIQUES, PREVALENCE AND AGE GROUPS OF SURVEYS CARRIED OUT IN THE TIKO HEALTH DISTRICT ON S. HAEMATOBIMUM INFECTION

Study	Technique	Prevalence	Age group	Study
[22]	Sedimentation	38%	5-20 years	Likomba
[23]	Syringe filter	16.6%	5-14 years	Likomba, Tiko town & Holforth
[24]	Syringe filter	31% - 50%	> 5 years	Likomba, Holforth, Holforth-Likomba

A closer look at this PHC system, with respect to diagnosis of schistosomiasis, leaves much to be desired. Hospital laboratory data showed that about 90% of the health institutions kept good record of age, sex and number diagnosed but overall, the state of hospital data on schistosomiasis was poor. A considerable number (38.5%) of Health institutions in this district had no data on diagnosis of the disease and had never done any test to that effect. A majority, (7;87.5%) of the hospital laboratories that had done the test used the sedimentation technique (ST) for diagnosis of *S. haematobium* which is known to have a low sensitivity [26]. Diagnosis of *S. mansoni* was never done upon request but the eggs were stumbled upon in stool examinations (direct smear) for soil transmitted helminthes. No record however, was kept on haematuria and no egg count was done. Unfortunately, this excludes any information about the intensity of infection which is directly related to the clinical manifestations of the disease [27], [28]. With further assessment of lab data on the diagnosis of the disease, it is evident that every patient for whom a test was requested, was positive for the disease. This is probably due to the fact that haematuria (the complaint for which the test was requested) is a clear indication of *S. haematobium* infection [27], though sometimes non-egg excreting individuals could still present with haematuria [29]. This notwithstanding, in the absence of the better syringe filter technique (urine analysis) and the kato-katz technique (stool analysis) which are the most sensitive microscopic methods, we can say unwaveringly that the disease will be under diagnosed at the level of the hospitals (Primary Health Care) if these institutions were integrated into control programmes [26].

At present, there is no hospital-based program to screen for the disease. Community based studies in the district [22]-[24] have reported high and moderate prevalence of 31% - 50%, 16% and 38% respectively in specific foci in the district. However, this may have been higher if patients did not consult at local pharmacies and purchase Praziquantel for their treatment. Examination of hospital records portrays little use of the primary health care system by the residents of the district for schistosomiasis related consultations. Only about 5 patients per hospital had received hospital based treatment annually since 2015. It would be exigent on the stakeholders in the public health sector to include sensitization of the community as part of this horizontal approach to control. With no community wide distribution of Praziquantel and only one school-based deworming exercise that took place recently in May 2021 (this involved only a few primary schools), the transmission rate will continue to soar.

Interestingly there was a hospital record of *S. mansoni* diagnosis: 2 cases in CMA Holforth and 1 case in CMA Mutengene in 2017 and 2019 respectively and they received treatment. Most probably these cases were visitors or migrants to this area. Untreated cases of this category of individuals in the community, will likely serve as a source of initial transmission in the presence of the right species of snails [30]. On the other hand blood in stool, which is a cardinal sign of gastrointestinal schistosomiasis, can easily go unnoticed or may not be present especially if the disease is not yet severe [31]. Presumably, *S. mansoni* is endemic in this area probably with a low prevalence. Green and colleagues [24] have established the absence of transmission of *S.*

haematobium in Mutengene (CMA, Mutengene), though there are hospital records of this species of *Schistosoma* in this health area; these cases are obviously from neighboring towns.

A survey of medical personnel in all health areas of the district gave us their perspective on the constraints that will likely be faced in implementing any form of control. Most of them (46.5%) were of the opinion that residents' lack of knowledge of the disease will be the major setback in the implementation of control which is one of the major risk factors identified in most studies on schistosomiasis [32]. This is a very critical aspect of control of schistosomiasis as it correlates directly with the degree of water contact. If sanitation is improved upon under WASH (water, sanitation and hygiene) programmes, infection rates will still remain high due to other factors not related to sanitation like recreation [33]. However, it was observed that only amongst the medical doctors (83.3%) and nurses (58.2%) was this opinion more popular. Pharmacy technicians (67.7%) and community directed distributors (52.2%) disagreed and cited do not want to bother and prefer the streams for their toiletry. The same proportion of laboratory scientists (35.5%) stated that lack of commitment by the stakeholders in the implementation of control and the poor state of sanitary facilities were the greatest drawbacks in control. This is probably due to their awareness of the poor state of schistosomiasis diagnosis in the hospitals that are primarily under the public health sector. Surprisingly, nobody thought the cost of treatment would be the most challenging factor in the implementation of control as they held the opinion that if every other challenge is addressed, there will be no need for continuous treatment.

Unfortunately studies addressing [the] cost of treatment have been inconclusive [34]. Finally, gender did not affect the perspective of the medical personnel as to which challenge was more pressing. Similar proportions of male and female practitioners had the same opinions on the aspects of control that would pose the greatest challenge. Many schistosomiasis endemic countries have failed to integrate schistosomiasis intervention measures into the PHC services primarily due to non-availability of drugs and sensitive diagnostic tools [35]. This appears to be the case with the Tiko Health District though the use of the sedimentation technique is an improvement on the direct wet smear used in some other countries [36].

Enhancing the diagnostic capacity at the PHC through point-of-care diagnostics is one opportunity that has been identified for case management [37]. As schistosomiasis control is envisaged, substantial funding should be directed towards equipping the health facilities with more sensitive diagnostic techniques as there are already trained personnel in these facilities. Hospital based screening could then be integrated into control programmes. This could be very cost effective as it would be part of their routine if Praziquantel were provided for the treatment of positive cases. Besides, should school enrolment be poor as is suspected to be in the area presently, this approach could be used to complement the school-based program [21]. If pre-control prevalence, school enrolment and specie of snails are determinants of which approach is best to achieve elimination [10], then only the first parameter has been evaluated in this health district.

V. CONCLUSION

Data from health facilities around the Tiko Health District and field studies in the same district, show that *S. haematobium* is endemic in some of the health areas of this health district. All the hospital laboratories that have data on the disease used the sedimentation (concentration) technique for diagnosis, falling short of WHO recommended methods for diagnosis of the disease. The control of schistosomiasis in this health district with mass drug administration with Praziquantel is going to be undermined by several factors ranging from poor sanitation, poor knowledge of the disease, lack of commitment of stakeholders and poor diagnostic and reporting methods. Based on hospital data for *S. mansoni* diagnosis, we recommend a survey to investigate the presence of *S. mansoni* in this Health District.

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AUTHORS' CONTRIBUTIONS

Edith Anguh assessed the laboratory data and carried out the survey. Nicholas Tendongfor conceived and designed the study and analyzed the data. Eric Akum Achidi supervised, reviewed, and provided inputs to the manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare that they do not have any conflict of interest.

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