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The road towards sustainable control of schistosomiasis in the Democratic Republic of Congo: Pre-assessment of staff performance and material resources in endemic regions

Sylvie Linsuke[1*,#], Liliane Mpabanzi[2,#], Sabin Nundu[1], Faustin Mukunda[3], Pascal Lutumba[1,4], Katja Polman[2]

[1]*National Institute of Biomedical Research (INRB), Department of Epidemiology, Kinshasa, Democratic Republic of the Congo*

[2]*Biomedical Sciences Department, Institute of Tropical Medicine, Antwerp, Belgium*

[3]*National Control Program against Schistosomiasis and Intestinal Parasites (PNLB/PI), Ministry of Health, Kinshasa, Democratic Republic of the Congo*

[4]*Department of Tropical Medicine, Faculty of Medicine, University of Kinshasa, Democratic Republic of the Congo*

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ABSTRACT

Objective: To improve knowledge and practice of health staff as well as the availability of material resources for diagnosis and management of schistosomiasis in two endemic provinces of DRC (Kinshasa and Bas-Congo).

Methods: Structured interviews were performed using questionnaires with staff from 35 healthcare facilities in 9 health zones (HZ) of Kinshasa and 2 HZ in Bas-Congo.

Results: Schistosomiasis was reported to be present in all the included HZ. Health staff knew the most important symptoms of schistosomiasis, but advanced symptoms were more accurately reported in Bas-Congo. Knowledge of symptoms related to schistosomiasis such as anemia (P = 0.0115) and pollakiuria (P = 0.0260) was statistically different in both two provinces. Kato-Katz technique and urine filtration were unavailable in both provinces. Parasitological diagnosis was mostly performed using the direct smear method. PZQ was available in 70% of the health facilities, all situated in Bas-Congo. Diagnosis and treatment mostly relied on symptoms and cost more in urban area than in rural.

Conclusions: Though knowledge on schistosomiasis among health staff appears sufficient, substantial efforts still must be made to improve the availability of diagnostic tools and treatment in the health facilities in DRC.

1. Introduction

Schistosomiasis is a poverty-related chronic helminthic disease affecting 78 countries [1]. More than 230 million individuals need treatment over the world: among them, 220 million are in the African region [1,2]. One hundred thirty millions of people are symptomatic with 105 million bearing complication and 4.4 thousand of people die due to the disease [3]. Most of the schistosomiasis cases are found in sub-Saharan Africa, with *Schistosoma haematobium* (*S. haematobium*) and *Schistosoma mansoni* (*S. mansoni*) being the main species infecting humans [1,4].

The Democratic Republic of Congo (DRC) is one of the largest countries in Africa and one of the poorest countries worldwide. Years of war have left the country's health system in total disarray. Since a long time, schistosomiasis has been known to be endemic in certain provinces of DRC [5]. However, recent figures to support these data are not available. Indeed, the most recent national prevalence data available were generated over 30 years ago [6]. In 2009, the Ministry of Health adopted a national plan against neglected tropical diseases including schistosomiasis [7]. The main objective of the national plan regarding schistosomiasis is to reduce morbidity and mortality

*Corresponding author: Sylvie Linsuke, National Institute of Biomedical Research (INRB), Department of Epidemiology, Kinshasa, Democratic Republic of the Congo.
E-mail: sylvie_lin2003@yahoo.fr

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[#]These authors equally contributed to the paper.

of schistosomiasis. Efficient and sustainable implementation of this program requires an urgent update of the data on schistosomiasis in the DRC. The present study was conducted to assess the current knowledge of health staff on symptoms related to schistosomiasis and the available options for diagnosis and treatment of schistosomiasis at all levels of the primary health care system in the provinces of Kinshasa and Bas-Congo in the DRC.

2. Materials and methods

2.1. The DRC's health system: organizational framework

The health system in the DRC comprises three levels, namely the central level, the intermediate or provincial level, and the peripheral or operational level (Figure 1) [8]. The central level consists of the Ministry of Health and the Directorate-General. This level has a regulatory function. The intermediate level fulfills a technical supporting role by monitoring the application of guidelines, strategies and policies. The last level of the Congolese health system is the peripheral level which is divided into health zones [8,9]. Each health zone is divided in health area which is covered by at least one health center or health post.

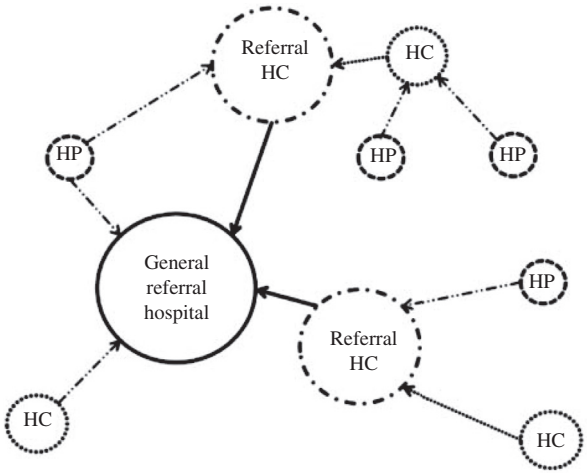

Figure 1. Tertiary health system level in the DRC.

The DRC is currently divided into 515 health zones with 393 general referential hospitals and 8504 health areas with at least one health center.

The provinces of Kinshasa and Bas Congo comprise 35 and 31 health zones, respectively. The health centers are usually better staffed than health posts which are typically run by nurses. Health centers are fairly well equipped, and small laboratory tests can been run and sometimes small surgeries can be performed [9].

2.2. Study area and selection of health zones

The present study was carried out between 2009 and 2011 in the provinces of Kinshasa and Bas Congo. The provinces cover an area of 63885 km^2, with Bas-Congo accounting for 53920 km^2. The city-province of Kinshasa is densely populated (677 km^2) whereas in the Bas-Congo the population density is only 84 km^2. In 2012, the population of these provinces was estimated at 12 million inhabitants, of whom 4.1 million lived in the Bas-Congo [10]. Both provinces are known to be endemic for schistosomiasis [5,11]. A sample of 9 health zones was randomly selected in Kinshasa. The two health zones in Bas-Congo (Kimpese and Nsona Mpangu) were selected based on a pilot study conducted in 2010 showing high prevalence of schistosomiasis in schoolchildren from both health zones (unpublished data, Dr Linsuke).

2.3. Interviews and data collection

Structured interviews with health staff were performed at different levels of the health care system, using an adapted version of a questionnaire developed for comparable studies in Northern Senegal and Mali [12,13]. In each health zone, the 'médecin chef de zone', who is the head of the health zone, was interviewed. The heads of health zones were asked about the presence (yes/no) of schistosomiasis cases in their health zones and how it was perceived by those who suffered from related symptoms. They were also invited to propose possible measures towards improved schistosomiasis control in their health zones. In the respective health facilities, interviews were conducted with the doctor or the nurse in charge of the general medicine department as well as with at least one laboratory technician. If the person in charge was not available, the interviews were conducted with the second in-command. Respondents were asked presence or absence of schistosomiasis, symptoms they considered to be related to infection with *S. haematobium* or *S. mansoni*. If *S. haematobium* or *S. mansoni* infection was reported not present in the studied area, further questions were not asked. If the infection was reported present, the interview continued with questions about the use and availability of diagnostic tests as well as prescription and availability of treatment. Availability of materials was studied by direct observation. Adequate functioning and use of the materials by the health staff was also studied by direct observation. Consultation fees as well as prices for diagnosis and treatment were also recorded.

2.4. Ethical consideration

The present study came from "Epidemiology and control of schistosomiasis in Democratic Republic of Congo (DRC) of today" research project. The protocol of this project was approved by the WHO Committees (project ID A61119) and the Ethical Committees of the School of Public Health, Kinshasa; DRC (reference number: ESP/CE/025/2007). In addition, the study also received clearance from the Ministry of Public Health. The head of health zone was informed about the study and the oral consent was obtained from the all participants.

2.5. Data analysis

The obtained data were entered into the Epi info® software (version 3.5.3). Schistosomiasis was assumed to be absent if the respondent in the facility was either unaware of schistosomiasis in the area or did not know whether schistosomiasis was present in the coverage area. To describe the knowledge of the health staff on schistosomiasis, proportions were calculated for each group according to the number of respondents by health areas. To estimate the median costs for treatment of schistosomiasis, the fees paid by the patient himself at the clinic were considered. These fees comprise the consultation's fees and, when applicable, the fees for further diagnostic tests and costs of treatment. Other costs such as transportation were not taken into consideration in the present study. Fisher Exact Test were used to compare proportions in the

knowledge of the health staff on schistosomiasis and availability of diagnostic tests in both provinces. We used the K-sample equality of medians test in this study to compare the median costs of diagnosis and treatment of schistosomiasis in both provinces. The threshold of P-values < 0.05 was considered for significance.

3. Results

All eleven heads of health zones were interviewed. A total of 35 health facilities were visited, 9 in Kinshasa and 26 in Bas-Congo. These comprised 5 general referential hospitals, 22 health centers, 6 health posts, 1 referral health center and 1 private clinic. Twenty-six health facilities had diagnostic laboratories, of which 9 in Kinshasa and 17 in Bas-Congo. Apart from the heads of health zones, 37 practicing clinicians (10 medical doctors, and 27 nurses) as well as 26 laboratory technicians were interviewed.

3.1. Presence, knowledge of symptoms and management of S. haematobium infections

In Kinshasa, 5 heads of health zones (5/9, 56%) reported the presence of *S. haematobium* in their health zones, 2 heads of health zones in Kinshasa had no information on the presence of *S. haematobium* in their health zone, and in 2 health zones *S. haematobium* was reported absent. In Bas-Congo, both heads of health zones confirmed the presence of *S. haematobium*. In both provinces, the heads of the health zones indicated that hematuria was perceived as a serious symptom by the population of their health zones. Hematuria was also mentioned as a major symptom related to *S. haematobium* by 100% of the other health staff at different levels in both provinces. Dysuria as a symptom caused by *S. haematobium* infection was mentioned by 78% and 79% of the respondents in Kinshasa and in Bas-Congo, respectively. Pollakisuria was mentioned only by 33% of respondents in Kinshasa in contrast to 75% in Bas-Congo (Table 1). Anemia, a symptom less directly linked to *S. haematobium* infection, was reported more often as a symptom of *S. haematobium* infection in Kinshasa than in Bas-Congo (100% *v.s.* 54%).

Table 1
Knowledge of symptoms related to schistosomiasis infection among health staff in Bas-Congo and Kinshasa [*n* (%)].

Symptoms	Bas-Congo (n = 28)		Kinshasa (n = 9)		P-value
S. haematobium infection					
Haematuria	28	100.0	9	100.0	0
Dysuria	22	78.6	7	77.8	0.9796
Nephritic colic	21	75.0	4	44.4	0.0971
Anemia	15	53.6	9	100.0	0.0115*
Pollakiuria	21	75.0	3	33.3	0.0260*
Oliguria	9	32.1	1	11.1	0.2319
Fatigue	17	60.7	6	66.7	0.7365
Oedema	13	46.4	3	33.3	0.5090
S. mansoni infection					
Abdominal disconfort	27	96.4	8	88.9	0.4154
Blood in stool	26	92.9	9	100.0	0.3913
Diarrhoea	21	75.0	9	100.0	0.0953
Anemia	21	75.0	9	100.0	0.0953
Asthenia	17	60.7	6	66.7	0.7365
Hepato-splenomegaly	20	71.4	6	66.7	0.8053
Ascite	17	60.7	3	33.3	0.1633
Hematemesis	19	67.9	5	55.6	0.5205

* = Significant P-values.

All health staff mentioned PZQ as treatment of choice. In Kinshasa, PZQ was only available in one health facility, and the health staff mentioned that they often ran out of stock. In Bas-Congo, PZQ was available in 20 health facilities all year round, while 4 facilities reported intermittent availability of PZQ. Two facilities did not have PZQ in their standard stocks.

3.2. Presence, knowledge of symptoms and management of S. mansoni infections

S. mansoni infection was recognized as a health problem in all the included health zones. According to 4 heads of health zones in Kinshasa and one in Bas-Congo, bloody diarrhea was perceived as a severe symptom for schistosomiasis by the population of their health zone. Abdominal discomfort was thought to be seen by the population as a very mild symptom according to the heads of health zones. Among the doctors and nurses, 93% in Bas-Congo and 100% in Kinshasa mentioned blood in stool as a symptom of *S. mansoni* infection. Diarrhea was also mentioned as a symptom by 75% of health staff interviewed in Bas-Congo and 100% in Kinshasa. Abdominal discomfort as a symptom related to *S. mansoni* infection was mentioned by 96% of respondents in Bas-Congo and 89% of health staff in Kinshasa. Symptoms related to an advanced stage of the infection such as ascites and hematemesis were mentioned by 61% and 68% of health staff in Bas-Congo. These symptoms were mentioned by 33% (ascites) and 56% (hematemesis) of respondents in Kinshasa (Table 1). As for *S. haematobium* infection, all health staff mentioned PZQ as treatment of choice.

Comparative analysis of the knowledge of the health staff about the symptoms related to schistosomiasis (Table 1) revealed that knowledge was not significantly different between the health staff working in Bas-Congo and Kinshasa areas except for anemia more cited in Kinshasa than Bas-Congo, 100% *v.s.* 53.6% (P = 0.0115) and pollakiuria more cited in Bas-Congo than Kinshasa, 75% *v.s.* 33.3% (P = 0.0260).

3.3. Cost, availability of material and expertise for diagnosis and treatment of schistosomiasis

Globally, the median costs of schistosomiasis case management (consultation, diagnosis and treatment) were more expensive in Kinshasa than Bas-Congo (Table 2). Consultation fees for children (2.7$ *v.s.* 1$) as well as the median price of urine sedimentation test (1.1$ *v.s.* 0.4$) were approximately three times higher in the province of Kinshasa than in Bas-Congo. Moreover, results of the K-sample equality of medians test for comparison of the median costs of diagnosis and treatment of schistosomiasis in those two areas showed that the median prices of consultation fees for children (P > 0.000) as well as urine sedimentation test (P = 0.001) and direct smear test (P = 0.002) were more expensive in Kinshasa than Bas-Congo area (Table 2).

Diagnostic tests were not widely used in either province. For *S. haematobium*, urine sedimentation and centrifugation were the most frequently used tests. None of the health facilities mentioned the use of urine filtration. Direct smear was the only diagnostic test used for *S. mansoni* (Table 3). In addition, dipstick (P = 0.0128), urine sedimentation (P = 0.0027) and direct smear tests (P = 0.0409) were only available in Kinshasa compared to Bas-Congo.

Table 2

Median costs of diagnosis and treatment of schistosomiasis in Bas-Congo and Kinshasa areas.

Variables	All	Bas-Congo	Kinshasa	*P*-value
Consultation fee (children)	1.1 (0.5–1.9)	1.0 (0.5–1.1)	2.7 (2.2–2.7)	0.000*
Praziquantel	0.2 (0.0–0.4)	0.2 (0.05–0.4)	0.0 (0.0–0.0)	0.220
Diagnostic tests *S. haematobium*				
Urine sedimentation	0.5 (0.0–0.5)	0.4 (0.0–0.4)	1.1 (0.5–1.1)	0.001*
Urine centrifugation	0.0 (0.0–0.5)	0.0 (0.0–0.4)	0.0 (0.0–1.1)	1.000
Dipstick	0.0 (0.0–0.0)	NA	0.0 (0.0–0.0)	0.054
Diagnostic test *S. mansoni*				
Direct smear	0.5 (0.3–0.5)	0.4 (0.3–0.5)	0.6 (0.5–1.1)	0.002*
Total cost	2.3	2.0	4.4	

Cost was estimated in USD: 1 USD = 930 Congolese Francs; NA: not applicable; Median cost with their IQR; * = Significant *P*-values.

Table 3

Availability of diagnostic tests for schistosomiasis in Bas-Congo and Kinshasa areas [*n* (%)].

Diagnostic test	Bas-Congo (n = 26)		Kinshasa (n = 9)		*P*-value
S. haematobium					
Dipstick	0	0.0	2	22.2	0.0128*
Urine filtration	NA	–	NA	–	–
Urine sedimentation	11	64.7	9	100.0	0.0027*
Urine centrifugation	10	58.8	4	44.4	0.7382
S. mansoni					
Kato-Katz	NA	–	NA	–	–
Direct smear	17	100.0	9	100.0	0.0409*

n = number of facilities with diagnostic laboratories; NA: not available; * = Significant *P*-values.

4. Discussion

The present study evaluated the knowledge of health staff on schistosomiasis as well as the availability of the facilities needed for an adequate management of schistosomiasis in the endemic provinces of Kinshasa and Bas-Congo in the DRC. Most people could identify the main symptoms of infection with *S. haematobium* and *S. mansoni*. They were also familiar with the recommended treatment. These findings are similar to those from earlier studies conducted in Senegal and Mali [12–14]. The same observations were also described in Uganda [15]. In this area, the case management of schistosomiasis is very poor in health facilities and the diagnosis only relied on clinical symptoms. Most of the clinicians interviewed in Kinshasa were medical doctors and nurses of A1 level whereas in Bas-Congo the health centers and health posts were mainly managed by nurses and no medical doctor was available. Health staff in Bas-Congo, a province historically known for its relatively high schistosomiasis prevalence [5,11,16] were more accurate than those in Kinshasa in citing less common and more advanced, long term symptoms of *S. mansoni* infection such as ascites and hematemesis. This suggests that knowledge of symptoms is related to regular exposure to schistosomiasis cases rather than to educational level of the health staff.

The World Health Organization currently recommends the use of the Kato-Katz technique and urine sedimentation, centrifugation or filtration for laboratory diagnosis of infections with *S. mansoni* and *S. haematobium* respectively [17]. The present study showed that neither the Kato-Katz technique nor urine filtration was available in any of the health facilities included. Apart from direct smear, other diagnostic tests for schistosomiasis were not widely used in either province. Thus, because of this lack of sensitive tests recommended for the diagnosis of schistosomiasis, the burden of the disease could be underestimated in these environments. Also, some tests are only available in Kinshasa compared to Bas-Congo due to lack of adequate equipment. However, the literature on schistosomiasis in the DRC indicates that this disease is hyperendemic in Bas-Congo [5,11]. It would, therefore, be important to make available the adequate tools for the accurate diagnosis.

The health staff chose immediate treatment mainly based on symptoms. Though not specifically asked, informal discussions with health staff revealed that the lack of sufficiently trained personnel and adequate material hindered the use of the diagnostic tests even when considered necessary by the healthcare provider.

Median costs regarding diagnosis and treatment of schistosomiasis were higher in Kinshasa compared with costs in Bas-Congo. For many households, these fees are still likely to be too high, as 70% of the population of Bas-Congo and Kinshasa live in extreme poverty [8,18]. PZQ was reported to be scarce in all health facilities in Kinshasa. Moreover, though often available in healthcare facilities, it also appeared that PZQ was easier to find in pharmaceutical settings in Bas Congo than in Kinshasa (personal observations). The assessment of associations between symptoms and schistosomiasis remains a challenge as these areas are known for many other tropical diseases that often present with similar symptoms. It is therefore difficult to assess whether the clinicians did not prescribe PZQ due to lack of diagnostic confirmation of schistosomiasis or because the differential diagnose comprises many other diseases with similar symptoms.

In conclusion, the present study showed that the main symptoms of schistosomiasis are known among the health staff across all levels of the health system of Kinshasa and Bas-Congo province. Nevertheless, substantial efforts still must be made to improve the availability of diagnostic tools and treatment. Reinforcement of the wavering health system would be the first step on the challenging road towards sustainable control of schistosomiasis in a country fighting a heavy burden of schistosomiasis and many other neglected tropical diseases.

Conflict of interest statement

We declare that we have no conflict of interest.

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