



Initiating NTD programs targeting schistosomiasis and soil-transmitted helminthiasis in two provinces of the Democratic Republic of the Congo: Establishment of baseline prevalence for mass drug administration



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ARTICLE INFO

Article history:

Received 14 September 2016

Received in revised form 5 November 2016

Accepted 16 November 2016

Available online 22 November 2016

Keywords:

Schistosomiasis

Soil transmitted helminthiasis

Kato-Katz test

POC-CCA test

Democratic Republic of the Congo

ABSTRACT

Background: Schistosomiasis (SCH) and soil-transmitted helminthiasis (STH) are widely distributed in the Democratic Republic of the Congo (DRC) and constitute a serious public health problem. As recommended by the World Health Organization (WHO), before launching mass chemotherapy to control these diseases, parasitological surveys were conducted in sentinel sites in six health zones (HZs) in Bandundu and Maniema provinces. Baseline prevalence and intensity of infection for SCH and STH were determined to establish the appropriate treatment plan using Praziquantel (PZQ) and Albendazole (ALB).

Methods: Parasitological surveys were conducted from April to May 2015 in twenty-six selected sampling units (schools) for baseline mapping in six HZs: Fifty school children (25 females and 25 males) aged 9–15 years were randomly selected per sampling unit. A total of 1300 samples (urine and stool) were examined using haematuria dipsticks, parasite-egg filtration and the point-of-care Circulating Cathodic Antigen (POC-CCA) assay for urine samples and the Kato-Katz technique for stool specimens.

Results: Three species of schistosomes (*S. mansoni*, *S. haematobium* and *S. intercalatum*) and three groups of STH (hookworm, *Ascaris* and *Trichuris*) were detected at variable prevalence and intensity among the schools, the HZs and the provinces. In Bandundu, no SCH was detected by either Kato-Katz or the POC-CCA technique, despite a high prevalence of STH with 68% and 80% at Kiri and Pendjua HZs, respectively. In Maniema, intestinal schistosomiasis was detected by both Kato-Katz and POC-CCA with an average prevalence by Kato-Katz of 32.8% and by POC-CCA of 42.1%.

List of Abbreviations: ALB, albendazole; CDC, centers for diseases control; DRC, Democratic Republic of the Congo; HRA, high risk adults; HZ, health zone; MDA, mass drug administration; NTD, neglected tropical diseases; POC-CCA, point of care circulating cathodic antigen; PZQ, praziquantel; RDT, rapid diagnostic test; RSA, Republic of South Africa; SAC, school age children; SCH, schistosomiasis; STH, soil transmitted helminths; USAID, United States Agency for International Development; WHO, World Health Organization.

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<http://dx.doi.org/10.1016/j.actatropica.2016.11.023>

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Comparative studies confirmed the greater sensitivity (and operational feasibility) of the POC-CCA test on urine compared to Kato-Katz examination of stool for diagnosing intestinal schistosomiasis even in areas of comparatively light infections. STH was widely distributed and present in all HZs with a mean prevalence (95% CI) of 59.62% (46.00–65.00%). The prevalence of hookworm, roundworm and whipworm were 51.62% (32.40–71.50%), 15.77% (0.50–39.60%) and 13.46 (0.50–33.20%), respectively.

Conclusion: This study provided the evidence base for implementing programs targeting SCH and STH in these Health Zones. Observations also reinforce the operational value and feasibility of the POC-CCA test to detect *S. mansoni* and, for the first time, *S. intercalatum* infections in a routine NTD program setting.

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1. Background

Neglected tropical diseases (NTDs) are a subset of infectious diseases that pose public health problems worldwide. Of the seventeen NTDs currently listed by the World Health Organization (WHO) as occurring in the poorest and most underserved populations globally (Liese et al., 2014), seven (lymphatic filariasis, onchocerciasis, schistosomiasis, trachoma and soil transmitted helminthiasis [STH, caused by ascaris, trichuris and hookworm]) are targeted for control or elimination through 'preventive chemotherapy' regimens of mass drug administration (MDA) once or twice yearly. Schistosomiasis and STH are responsible for a large proportion of the NTD burden in the tropical and subtropical regions of the world, with WHO estimating that 249 million people now require preventive chemotherapy for Schistosomiasis and up to 1 billion for STH infections (WHO, 2015).

The Democratic Republic of the Congo (DRC) has a vast network of water bodies and a tropical climate that favors many parasitic and infectious diseases. In 2009 the Ministry of Health established a National NTD Program and started 'mapping' the seven preventive-chemotherapy diseases including Schistosomiasis and STH. The Schistosomiasis and STH mapping was completed in 2015 for 512 out of 516 health zones (HZs) in the country. This mapping strategy used the traditional Kato-Katz preparations of stool specimens to test for *S. mansoni* and STH, and hemastix or urine filtration to detect *S. haematobium* in the urine. The mapping showed moderate to low SCH/STH endemicity in all the studied HZs, with high prevalence of SCH (prevalence $\geq 50\%$) in 17 HZs scattered in the eastern, northern and western provinces. In total, 22,123,725 individual are at risk for SCH/STH is endemic in all the provinces, with 291 health zones having moderate to high prevalence (prevalence $\geq 20\%$) and 37,623,567 people being at risk (MPSMRM, 2014).

For control of Schistosomiasis, the current WHO guidelines depend on the level of infection assessed in school age children (SAC), with the recommendations that preventive-chemotherapy MDA be administered as: 1) annual treatment for SAC and high-risk adults (HRA) in highly endemic communities (prevalence above 50% in SAC); 2) every-other-year treatment for SAC and selected high-risk adults in moderate to high prevalence areas (10–49% in SAC); 3) treatment for SAC just twice during their primary school years in areas with lower prevalence (<10% in SAC) (WHO, 2006). In addition, before beginning the actual MDA phase of the NTD programs targeting Schistosomiasis and STH, WHO recommendations and Ministry of Health requirements call for baseline sentinel site assessments to be made in each implementation unit (the Health Zone in DRC). These sentinel sites are also intended to serve as reference for subsequent program monitoring of the Schistosomiasis and STH programs.

Accordingly, the DRC national NTD program has recently undertaken sentinel site surveys for Schistosomiasis and STH in the first six targeted HZ in order to determine the prevalence of infection for each. In addition to using the traditional Kato-Katz stool assessment technique, the program took advantage of this pro-

grammatic field opportunity to conduct a careful comparison of the Kato-Katz test with the new point-of-care, circulating cathodic antigen (POC-CCA) rapid diagnostic test (on urine specimens) that can detect both intestinal and urinary tract schistosomiasis. The present manuscript records the epidemiological, parasitological and comparative diagnostic data on schistosomiasis and STH infections following use of these tools in the six sentinel sites studied in two provinces (Bandundu and Maniema) to determine the appropriate, WHO recommended control strategy for those health zones.

2. Methods

2.1. Study area

The present sentinel site survey (Table 1) was conducted in four HZs (Kasongo, Lubutu, Obokote and Punia with a total population of 558,000) in Maniema province and two HZs (Kiri and Pendjua with a total population of 195,000) in Bandundu province (MPSMRM, 2014).

Maniema is the least populated (15 inhabitants per km square) and the most isolated province in the country. The province is crossed by the Congo River from the north spanning across Lubutu, Punia and Obokote to the South where Kasongo is situated. Bandundu is also sparsely populated with 27 inhabitants per km square. It is bisected by the Kasai River, which flows into the Congo River on the western boundary. Pendjua and Kiri are both part of the upper north HZs of the province. Pendjua is located in the middle of the Equatorial forest whereas Kiri is situated near lake Mai-Ndombe, the largest lake in the province (Fig. 1).

2.2. Study design and sample collection

The populations targeted by the survey were primary school children of ages 9 to 15 years. The administrative distribution and total populations of the Health Zones studied are given in Table 1. The study was done in the areas that had been mapped for SCH/STH 6 years earlier in 2009. Schools were selected based on existing mapping data or according to their proximity to water bodies. A total of 26 sampling units (schools) were surveyed in the six HZs assessed. Five schools were selected in each of the two HZs surveyed in Bandundu province, and four schools were targeted in each of four HZs in Maniema province. The targeted sample size per health zone was 250 school children. But only 4 schools were available per health zone in Maniema making a total sample size of 1300 participants. The study was conducted from April to May 2015. In each school, urine and stool samples were collected from 50 children. Equal numbers of participants (25 boys and 25 girls) were selected randomly via a random number generator at each site. School children of the 3rd grade were preferentially enrolled and then those in higher grades whenever the number of children in the 3rd grade was less than 50.

Urine samples were collected in 250 mL plastic bottles, and 10–20 g stool samples were collected in 50 mL plastic screw-cap

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