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Community-Based Control of Schistosomiasis and Soil-Transmitted Helminthiasis in the Epidemiological Context of a Large Dam in Cote D'ivoire

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<http://dx.doi.org/10.5772/53494>

1. Introduction

Parasitic diseases, among which schistosomiasis and soil-transmitted helminthiasis (ankylostomiasis, ascariasis and trichuriasis), affect more than two billion people through the world (WHO, 2012). These diseases occur mainly in tropical regions, are real public health problems, and have a negative impact on socioeconomic development (WHO, 2008).

Côte d'Ivoire, located in West Africa, is not spared. Many parasitic diseases exist in this country. Schistosomiasis is widespread (Doumenge et al., 1987; N'Goran et al., 1997; N'Guessan et al., 2007; Raso et al., 2005; Utzinger et al., 2000; WHO, 2011) with prevalence generally higher in communities around the water projects built to solve the problems of electrical safety and / or food (Steinmann, 2006). As for soil-transmitted helminthiasis, there is very little data on the prevalence and intensity in Côte d'Ivoire. But according to the WHO, they are common throughout the territory [WHO, 2010.3]. The available data show that the prevalence of hookworm infection may reach 100% in endemic communities in Côte d'Ivoire, 71.6% of ascariasis and trichuriasis 24%. Concerning soil-transmitted helminth infections, hookworm is the main parasite of our study area with 50% prevalence and less than 10% for other affections (N'Guessan, 2003).

In this study, we seek lasting solutions to fight against schistosomiasis and soil-transmitted helminthiasis in the ecoepidemiological context of a large dam. Our results can be extrapolated in similar epidemiological settings elsewhere in Côte d'Ivoire, and other African countries. To this end, our investigations were conducted in the locality of Taabo-village straddling the area of forest and savannah woodland. The set of two areas represents 2/3 of

the different vegetation types encountered in this country. Parasitological monitoring conducted, in such eco-epidemiological context, for two consecutive years of annual mass treatment revealed a high prevalence of urinary schistosomiasis among school children. Prevalence ranged from 94% to 74% at the beginning to the end (N’Goran et al., 2001). Moreover, the evaluation of reinfection of *Schistosoma haematobium* in various eco-epidemiological systems has shown that it is faster in the context of large dams. The high prevalence and limited reductions after mass treatments could be explained by the almost continuous transmission of this parasite (N’Goran et al., 2001; N’Guessan et al., 2007).

The example of Taabo-village located near the large dam Taabo where urinary schistosomiasis is a real public health problem is remarkable (N’Goran et al., 1997 and 2001). Given the importance of this disease at Taabo-village, which approach control could put important pressure on large and sustained transmission of *S. haematobium* and hope to significantly reduce the morbidity due to urinary schistosomiasis?

In this perspective, a preventive approach and the fight against disease caused by schistosomiasis and soil-transmitted helminthiasis as recommended by the World Health Organization (WHO, 2003, 2004 a and 2004b) were implemented. We believe that the communication for behavior change associated with the ongoing management could allow a significant decrease in the prevalence and morbidity of these diseases. To do so, parasitological surveys were conducted in schools before and after a control action to assess the epidemiological situation. Then, teachers and Community Health Workers (AUC) were trained to educate and support consistently the population. Finally, sociological surveys were conducted to determine the perceptions and human factors in risk associated with the endemicity of these diseases.

2. Methods

2.1. Study area

The Taabo dam is located in south-center of Côte d’Ivoire, on the river Bandama in degraded forest area. Its construction was completed in 1979 (Sellin B. and Simonkovich, 1982). It has a maximum depth of 34 m and a dam of 7.5 km long. The water reservoir is 630 million m³ and an area of 69 km². It is used to generate electricity. Taabo- village is 0.5

km far from the lake (Figure 1). This study area includes 3 929 inhabitants from the database collected in 2009 by the Demographic Surveillance System of Taabo (SSD).

2.2. Parasitological surveys

From the list of the two primary schools of the study site, a school was chosen according to the largest number of students. In the selected school, about 60 students at the rate of 10 per classroom from the first year of the primary (CP1) to the last year (CM2) were selected by lottery for the baseline survey and the second survey. Participation in the study was volun-

tary. Parents or guardians of selected children were invited to sign a written informed consent after explanation of the objective of the study and procedures by investigators.

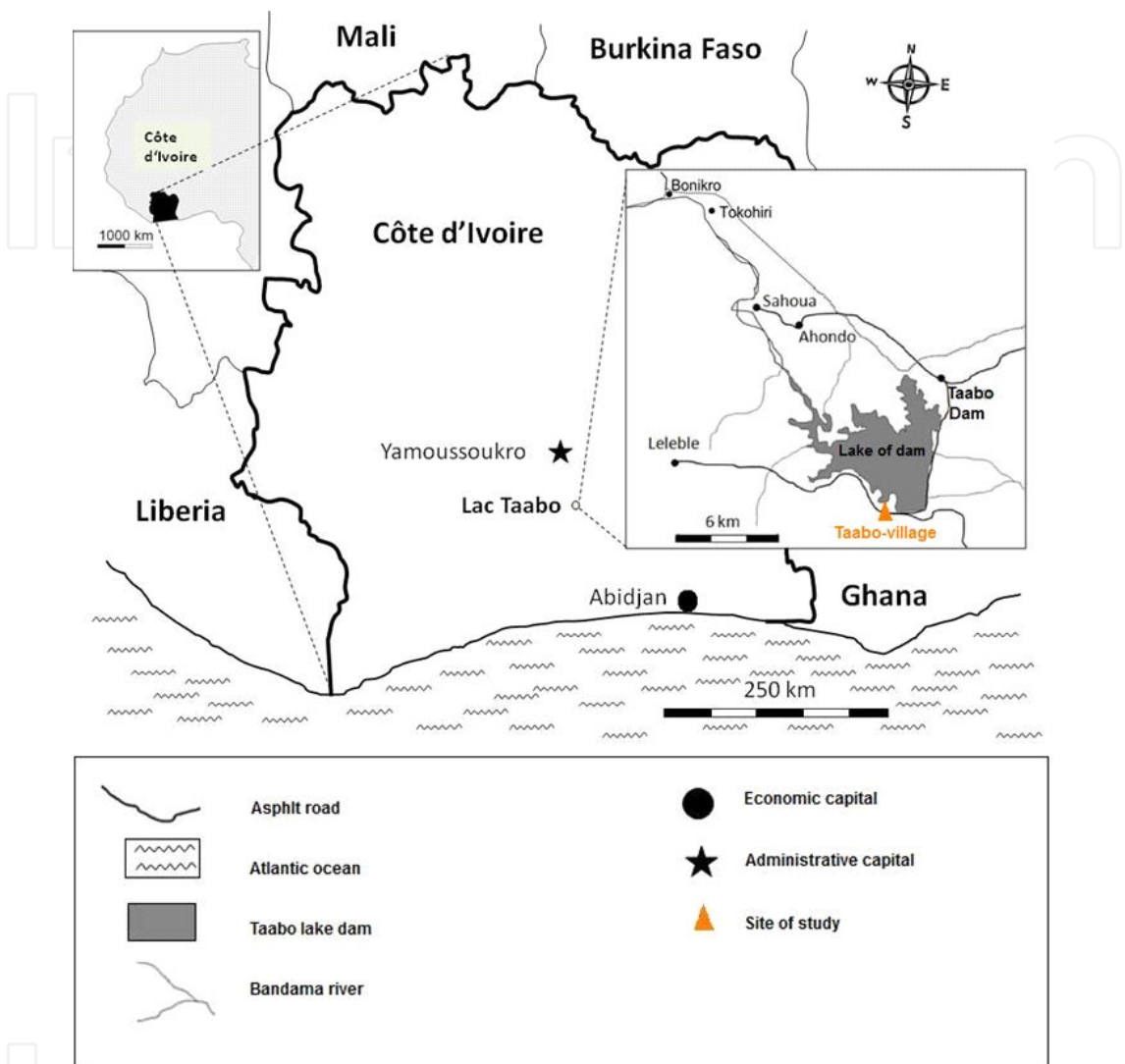


Figure 1. Overview of the study area

The selected school children participated in parasitological surveys conducted in April 2008 before treatment and on May 2009 after one year. In 2008 as in 2009, each student gave a urine sample and a stool sample. These samples were taken between 10 a.m and 2 p.m.

The search for eggs of *Schistosoma haematobium* in each urine sample was performed by the standard filtration of 10 ml of urine on a filter Nytrell®, then the analysis of the filter under a microscope after coloration with lugol (Plouvier et al., 1975). The eggs of *Schistosoma haematobium* were identified and counted.

The stools were examined by the Kato-Katz technique, which involved analysis of 41.7 mg of stool under a microscope after plating and clarification by malachite green (Katz

et al., 1972). The readings of the slides were made after 30 to 60 min for clarification in order to observe hookworms in addition to other helminths. The eggs of *Schistosoma mansoni* and soil-transmitted helminths (*Ancylostoma spp*, *Ascaris lumbricoides* and *Trichuris trichiura*) were detected and counted by species. The intensity of infection was expressed as number of eggs per gram of stool. After microscopic examination, a quality control was used to check the consistency of results. Prevalences and intensities of parasites were classified into three categories: mild, moderate and heavy according to WHO classification (WHO, 2004 and 2004a).

2.3. Training of teachers and community health workers (CHW) for awareness and treatment

During a workshop held in 2008 at Taabo city, two teachers and one community health worker (CHW), selected per locality and by their authorities, attended a course of half a day. They were trained to use the awareness tools and prevention on the one hand and on the other hand administration of praziquantel against schistosomiasis and mebendazole against soil-transmitted helminthiasis. Then they received the tablets, treatment forms and media for awareness and health education.

2.4. Awareness and treatment

The awareness, prevention and control studies were conducted in the two primary schools by two teachers among the school-age populations and by a CHW among the other community members. Everyone was aware of the opportunity to treat himself according to his convenience because drugs were available to them from teachers and CHW. Treatment (praziquantel and mebendazole) cost per student was 100 CFA francs in schools and 150 CFA in community during the first year. At the end of the study, all parasitized individuals were treated with praziquantel and/or mebendazole for free for ethical reasons.

2.5. Sociological survey

The sociological survey concerned on the one hand the school-age children (children attending school or not) and on the other hand the general population, particularly the heads of households. The selection of children attending school was done by a reasoned choice of 12 students per class from the first year elementary classes (CE1) to the last year of primary school (CM2). As for children who do not attend school, they have been chosen unintentionally on the ground during the investigation. Based on the estimated number of households, the quota of households to be interviewed has been determined. This survey was made after the awareness and treatment. The majority of respondents are farmers and students, the survey took place when they were free i.e in the morning (from 6:00 to 10:00) and in the evening (from 16:00 to 20:00). We collected qualitative information from focus group and quantitative information by questionnaire.

2.6. Data analysis

The data were analyzed using STATA software, version 9 (Stata Cooperation, College Station, Tx, USA). The various parasites were collected in two groups of diseases: schistosomiasis and soil-transmitted helminthiasis. For each condition, the prevalences and intensities of infection were calculated for each survey. the 2008 data were compared with those of 2009 by comparison test of two proportions unrelated. The treatment results of the sociological survey have been analysed by the same test.

3. Results

Both parasitological surveys were conducted in Taabo-village 1 primary school, successively in 2008 and 2009. The age group of school children who participated in the survey is between 6 and 15 years. The urine and feces analyzes of 114 school children have identified 62 (54.4%) school children infected. Among schoolchildren examined, 42.1% are infected with schistosomes and soil-transmitted helminths by 28.9% (Table 1). At the baseline, 37.5% of school children were carriers of at least one parasite against 70.1% a year later. The school children infected in the second survey appeared to be significantly ($P < 0.0001$) more numerous than those of the baseline survey, regarding schistosomiasis ($P < 0.0001$). For soil-transmitted helminths difference is not significantly ($P = 0.131$). Considering prevalence of the parasitic species, *Schistosoma haematobium* attained 41.2% as judged by urine analysis, and *Ancylostoma spp.* (27.2%) excreted in the feces. *Trichuris trichiura* (2.6%) and *Schistosoma mansoni* (0.9%) were rarely observed following stool analyses. Based on prevalence, urinary schistosomiasis is the main parasite of Taabo-village.

The intensities of infections reported in Table 2, indicate that whatever the year, the majority of the population is infected with schistosomes i.e more than 75% have a mild infection (< 50 eggs in 10 ml of urine for *S. haematobium* and < 100 eggs in 1 g of stool for *S. mansoni*) (WHO, 2004). Heavy infections (≥ 50 eggs in 10 ml of urine for *S. haematobium* and ≥ 400 eggs in 1 g of stool for *S. mansoni*) appear to be solely due to *S. haematobium*. As for those who are infected by soil-transmitted helminths, they all have a mild infection (Table 2). It is of note that the intensities of infection of these parasites remained invariant after treatment.

Awareness, prevention and treatment were made by two teachers from the school age population and a community health worker (CHW) to other members of the community. In the general population of Taabo-village, the number of infected individuals is estimated at 70% and yet only 12% were treated between 2008 and 2009 (Table 3). This low rate indicates that there was no enthusiasm in general; however it was more encouraging in schools where 32.9% were treated against 8.2% in the village.

The sociological survey involved 176 people including 78 school-age children and 98 adults. The quantitative information reported in Table 4 indicate that schistosomiasis and soil are considered as diseases by over 65% of respondents. However, the majority states that these parasites do not have serious consequences on their health and more than 95% confirms that

they are not dreadful. The concept of illness and fear is determined by a set of characters which are: immobility, pain, costly treatment, lack of effective remedy, contagiousness, disability, lack of knowledge of symptoms and rapid death. To fight against the parasites, the most common practice (19.4%) is the association of pharmaceutical products and plants. In the control project against the diseases in question, the community generally wants to organize neighborhood with awareness as major roles (35.7%) and environmental health (18.4%). According to the qualitative data, people think that these ailments do not require treatment because they are supposed to heal over time. Also they do not know the mode of contamination which they think would be done by drinking dirty water from the lake, spanning the urine of a schistosomiasis patient, or by bathing in the lake water.

	Taabo-village 1		TOTAL
	2008	2009	
Number of subjects examined	56	58	114
Number of parasitized individuals	21	41	62
Prevalence %	37.5	70.1	54.4
Schistosomiasis			
Number of parasitized individuals	13	35	48
Prevalence (%)	23.2	60.3	42.1
S. haematobium			
Number of parasitized individuals	12	35	47
Prevalence (%)	21.4	60.3	41.2
S. mansoni			
Number of parasitized individuals	1	0	1
Prevalence (%)	1.8	0	0.9
Soil-transmitted helminths			
Number of parasitized individuals	13	20	33
Prevalence (%)	23.2	34.4	28.9
Ancylostoma spp.			
Number of parasitized individuals	13	18	31
Prevalence (%)	23.2	31.0	27.2
T.trichiura			
Number of parasitized individuals	0	3	3
Prevalence (%)	0	5.1	2.6

Table 1. Prevalence of schistosomiasis and soil-transmitted helminths before (2008) and after deworming (2009) in Taabo lake dam in south-center of Côte d'Ivoire

Schistosomiasis	Soil-transmitted helminths			
	Infection intensities (%) in years			
	2008	2009	2008	2009
Light infection	76.9	77.1	100	100
High infection	23.1	22.9	0	0

Table 2. Percentages of intensities of schistosomiasis infection and soil-transmitted helminths in the Taabo lake dam in south-center of Côte d'Ivoire

	Population		
	Workforces	Treated	Treated Percentage
Attending school	598	197	32.97
Not attending school	3 331	275	8.25
Total	3 929	472	12.01

Table 3. Percentage of treated population to Taabo-village of 2008 – 2009

They use water from Lake dam for all daily activities including laundry, washing dishes, cooking, bathing, swimming and even sometimes for drinking when drinking water is inaccessible. Fishing takes place in the lake, and the water is also used to irrigate nurseries of coffee and cocoa.

	Reactions et reponses to questions	Workforces	Percentages
Knowledge of diseases			
Schistosomiasis	Know	128	72.7
	Do not Know	48	27.3
	Serious	39	22.2
	Less serious	137	77.8
soil-transmitted helminths	Know	115	65.3
	Do not Know	61	34.7
	Serious	55	31.2
	Less serious	121	68.8
Communities attitudes	Non dreadful schistosomiasis	168	95.5
	Dreadful schistosomiasis	8	4.5

	Reactions et reponses to questions	Workforces	Percentages
	Non dreadful soil-transmitted helminthes	172	97.7
	Dreadful soil-transmitted helminthes	4	2.3
Practices in communities	None	2	2.1
	Never infected	61	62.2
	Pharmaceutical products	10	10.2
	Medicinal Plants	6	6.1
	Pharmaceutical products + Plants	19	19.4
Control Project	By neighborhood	57	58.1
	Combination	2	2.1
	Gender	9	9.2
	No answer	30	30.6
Role in participation	Decision making	10	10.2
	Environmental health	18	18.4
	Awareness	35	35.7
	Supervision	5	5.1
	No answer	30	30.6

Table 4. Results of sociological surveys conducted in Taabo-village community near the dam Taabo in south-center of Côte d'Ivoire.

4. Discussion

Parasitic diseases highlighted in the locality of the Taabo-village are schistosomiasis and hookworm. Schistosomiasis was the predominant parasitosis. It was followed by ankylostomiasis. This classification is different from the distribution observed in Africa south of the Sahara where ankytosmosomiasis is top of the list (Hotez et Kamath, 2009). The prevalence of these parasitoses are moderate overall. However, a high prevalence of *Schistosoma haematobium* in the order of 60% was recorded at the end of the study in 2009 where no case of *S. mansoni* infection was observed. The study area is an environment with a high prevalence of urinary schistosomiasis as already reported by N'Goran and colleagues more than 20 years ago (N'Goran et al., 1987).

The high prevalence of 60.3% recorded only a year later, does not demonstrate that reinfection is fast because we have not reviewed all of the students selected in 2008. Rather

we made another sample because we adopted a population-based approach to see how the home would evolve in real conditions when the population was aware and had medicines at their disposal. On the contrary, this result reveals that the treatment did not have a great influence on morbidity indicators such as the prevalence and intensity of infection. It is explained by the fact that only 12% of the population was treated. Thus, for the treatments have a significant impact, they must extend at least 75% of the school age population and for a long-term as recommended by the WHO (2012). Based on the categories of prevalences and intensities of infection, we offer an annual treatment of the entire community with praziquantel in the case of schistosomiasis. As for soil-transmitted helminthiasis, albendazole may also be distributed once a year. However, all children of preschool and school age and women of childbearing age and adults at risk should be given priority in accordance with the recommendations of the WHO (WHO, 2004.9; 2010.3). For ongoing management, it would be appropriate after the annual mass distribution campaign to make anthelmintics available to the public through the channels of teachers and community health worker.

It should be noted that while anthelmintics were made available to the Taabo village's population, very few people were treated. There was no enthusiasm for the treatment for the simple reason that these parasites are considered by the majority of the population as non-serious illnesses and less dreadful. For this population it is not necessary to observe measures of prevention and fight as they think diseases are supposed to heal over time. We think that these perceptions are a major obstacle to control actions by chemotherapy.

To develop an appropriate approach of prevention, we must attract the attention of the population through advocacy and health education as suggested by Monday (Useh, 2012). This awareness action and the population's education aim to significantly alter his perception of the severity of these infections, the effectiveness of existing treatments anthelmintics and the risk behaviors. Emphasis will be placed on the causes of the outbreak of schistosomiasis, the consequences associated with schistosomiasis and soil-transmitted to the modes of transmission of these parasites and the importance of seeking treatment for infections. However, awareness sessions will be done with the involvement of opinion leaders such as religious and customary authorities and groups of associations. Awareness must be held at school in the village, in places of worship and preferably on Sunday, which is the market day or the gathering of this farming population. These control actions will take place between December and February which is the rest period for farmers.

Instead of preventing people from visiting the lake shore, we suggest people to collect water for their domestic activities early in the morning i.e before 10 am or in afternoon after 2:00 p.m. The interval between 10 am and 2 p.m corresponds to the maximum period of cercariae emission in water during which people would better avoid attending it. Moreover, the authorities should ensure that drinking water is accessible and that latrines are available. To reduce transmission, we recommend people not to urinate and defecate in the lake or to defecate far away from the lake.

It must be noted that the relatively low percentage of 23.2% of schistosomiasis, recorded at the beginning of the study has not yet been determined in this locality to our knowledge. This level of prevalence could be explained by the previous effect of control actions. We can mention as examples the mass treatment against schistosomiasis conducted in five primary schools around the dam of Taabo and in hyperendemic primary school of Tiassalé's district that Taabo-village is part of it (N'Goran et al., 1997 and 1998). In addition, control activities are performed in Taabo-village for only about a decade (Esse, 1997; N'Goran et al., 1997, 2001 and 2003). This is also probably the reason why the intensities of infection were mostly minor. Morbidity is less severe in the population examined. Indeed, the population examined would be concerned because it is often affected by the programs against schistosomiasis and soil-transmitted helminthiasis. It could be that the category of population such as adults that do not fall often in programs against these infections have more severe lesions. This was noted by Keita et al. Mali (Keita et al., 2009).

The prevention and control proposed above should extend at least 75% of the school age population and make long-term as recommended by the WHO (2012). We propose to this end a period of at least five years.

5. Conclusion

The results of this study allow us to identify an approach for prevention and sustainable fight against schistosomiasis and soil-transmitted helminthiasis in the context of a large dam in Côte-d'Ivoire. It is partly based on the awareness of the population in order to change significantly their perception of the seriousness of these infections and the effectiveness of existing anthelmintics treatments. On the other hand, the population will change habits in relation to periods of attendance at the lake and the discharge of excrement in the water. This fight will be the responsibility of community and must be sustained for a long term. This community approach of prevention and control proposed at the end of our study is most applicable in the context of eco-epidemiological of large dams, where soil-transmitted helminthiasis and schistosomiasis are generally a serious, but neglected, public health problem.

Acknowledgements

We specially acknowledge the Agence Universitaire de la Francophonie (AUF), which funded the research. The authors wish to thank Mr TP Gonety, Taabo Hospital Director and Dr. L. Adiossan the chief doctor of the said hospital for treatments supervision. We acknowledge inspector of primary teaching, principals and teachers of Taabo-village and the Head of this locality. We also acknowledge the laboratory technicians, KL Lohourignon, M. Traore, S. Diabaté, A.S. Brou, J. Brou, S. Kouadio, M. N'Cho, N. Kouadio and MG Gry for the quality of the work they have done and Mr Zahoui André for the translation from English.

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References

- [1] Doumenge JP, Mott KE, Cheung C, Villenave D, Chapuis O, et al. (1987). Atlas of the global distribution of schistosomiasis. World Health Organization, Geneva: 16:398.
- [2] Esse AMC. (1997). The impact of hydroelectric dams on the health of local populations: the case of urinary schistosomiasis in the region Taabo. Master's thesis, Science of Man and Society, University of Cocody, Abidjan, Ivory Coast. 30p
- [3] Hotez PJ & Kamath A (2009). Neglected tropical diseases in Sub-Saharan Africa: Review of Their prevalence, distribution and disease burden. *PLoS Negl Trop Dis*, 3, e412.
- [4] Katz N, Chaves A, Pellegrino JA (1972). Simple device for quantitative stool thick-smear in *Schistosomiasis mansoni*. *Revista do Instituto Medicina Tropical de São Paulo* 14:397-400.
- [5] Keita AD, Sacko M, Coulibaly SY, et al. (2009). Imaging of urological tumors in an endemic area of schistosomiasis in Mali. *J. Afr. Cancer* 1:135-140.
- [6] Useh MF (2012). Control of schistosomiasis in *Schistosomiasis*, In-Tech, ISBN : 978-953-307-852-6. DOI:10.5772/25326
- [7] N'Goran EK, Diabaté S, Utzinger J, Sellin B (1997). Changes in human schistosomiasis Levels the after the Construction of Two hydroelectric dams in wide central Ivory Coast. *Bull World Health Org* 75:541-545.
- [8] N'Goran EK, Utzinger J, Gnaka HN, Yapi A, N'Guessan NA, Kigbafori SD et al. (2003). Randomized, double-blind, placebo-controlled trial of oral artemether for the prevention of patent *Schistosoma haematobium* infections. *American Journal of Tropical Medicine and Hygiene* 68 (1): 24-32.
- [9] N'Goran EK, Utzinger J, N'Guessan NA, Muller I, K Zamble et al. (2001). Reinfection with *Schistosoma haematobium* following school-based chemotherapy with praziquantel in endemic villages in oven Highly Ivory Coast. *Trop Med Int Health* 6:817-825.

- [10] N'Goran KE, Utzinger J, Traore M, Lengeler C & Tanner M (1998). Rapid identification by questionnaire of the main foci of urinary bilharziasis in central Ivory Coast. *Med Trop* 58, 253-260. 25.
- [11] N'Guessan AN (2003). The fight against schistosomiasis in Côte d'Ivoire : epidemiological factors of complexity and control operational constraints. Thesis, University of Cocody in Abidjan, Ivory Coast.
- [12] N'Guessan NA, Acka CA, Utzinger J, N'goran EK (2007). Identification of high risk regions of schistosomiasis in Ivory Coast. *Bull Soc Pathol Exot* 100(2):119-123.
- [13] World Health Organization (2000). Ultrasound in schistosomiasis. A practical guide to the use of ultrasonography standardized for the assessment of schistosomiasis-related morbidity. WHO, document TDR/STR/SCH/00.1
- [14] World Health Organization (2001). Schistosomiasis and geohelminthiasis. 19th session of the 54th World health assembly. <http://www.who.int/mediacenter/factsheets/fs366/fr/>
- [15] World Health Organization (2003). Act against worms, Bull PPC, World Health Organization 1: 1-6.
- [16] World Health Organization (2004). Act against worms, Bull PPC, World Health Organization 4: 1-10.
- [17] World Health Organization (2004a). Fight against helminth infections among school age children. Guide for managers of control programs. World Health Organization, Geneva.
- [18] World Health Organization (2004b). Prevention and control of schistosomiasis and soil-transmitted helminthiasis. Report of a WHO expert committee. WHO Technical Report Series N° 912. World Health Organization Geneva.
- [19] World Health Organization, UNICEF (2004.9). Schistosomiasis and soil-transmitted helminthiasis: Action of prevention and control of 16/09/2012 (whqlibdoc.who.int/hq/2004/WHO_CDS_CPE_PVC_2004.9_fre.pdf)
- [20] World Health Organization (2008a). Act against worms. Bull PPC, World Health Organization 12: 1-8.
- [21] World Health Organization, UNICEF (2010.3). Communicable disease epidemiological profile Côte d'Ivoire. (2010.3 whqlibdoc.who.int/hq/2010/WHO_HSE_GAR_DCE_eng.pdf)
- [22] World Health Organization (2011). Schistosomiasis. Number of people treated, 2009. *Weekly Epidemiological Record* 9, 86:73-80.
- [23] World Health Organization (2012). Geohelminthiasis. Reminder N°366 of 19/8/2012 <http://www.who.int/mediacenter/factsheets/fs366/fr/>

- [24] Plouvier S, Leroy JC, Colette J (1975). About a simple filtration of urine in the diagnosis of urinary schistosomiasis in mass survey. *Med Trop* 35:229-230.
- [25] Raso G, Matthys B, N'Goran EK, Tanner M, Vounatsou P and Utzinger J (2005). Spatial risk Prediction and mapping of *Schistosoma mansoni* infections among school children living in western Côte d'Ivoire. *Parasitology* 131:97-108.
- [26] Sellin B and Simonkovich E (1982). Schistosomiasis and dams in Côte d'Ivoire. In : *From epidemiology to human geography. Works Tropical and Geographical Papers* 48:209-214.
- [27] Steinmann P, Keiser J, Bos R, Tanner M, Utzinger J (2006). Schistosomiasis and water resources development: systematic review, meta-analysis, and estimates of people at risk. *Infection.thelancet.com* 6:411-425.
- [28] Utzinger J, N'Goran EK, Ossey YA, Booth M, Traore M et al. (2000). Rapid screening for *Schistosoma mansoni* in western Côte d'Ivoire using a simple school questionnaire. *Bull World Health Org* 78 (3):389-397.

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