Public Health Reviews

Questionnaires for rapid screening of schistosomiasis in sub-Saharan Africa

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Abstract New initiatives are aiming to reduce the global burden of schistosomiasis, mainly through the large-scale application of chemotherapy. To target chemotherapy effectively, rapid assessment procedures are needed for identifying high-risk communities that are foci for the disease. In this review, we examine the development and validation of simple school questionnaires for screening communities for *Schistosoma haematobium* and *S. mansoni* rapidly and inexpensively. The focus is on sub-Saharan Africa, where 85% of the current schistosomiasis burden is concentrated.

For more than a decade, the questionnaire approach has been validated in 10 countries, with 133 880 children interviewed in 1282 schools, and with 54 996 children examined for *S. haematobium*. The questionnaires were well accepted, highly reliable, and of low cost. The success of the questionnaires is explained by the fact that *S. haematobium* infections were easily perceived through the presence of blood in urine.

Evidence from 48 258 children interviewed in 545 schools indicated that reported blood in stools and bloody diarrhoea are valuable indicators for community diagnosis of *S. mansoni*. However, the diagnostic performance of the questionnaires for *S. mansoni* was weaker than for *S. haematobium*, and although these results are encouraging, the questionnaires need additional validation. Recently, questionnaires were extended from community to individual diagnosis and showed considerable promise. Questionnaires are now available for promptly defining the magnitude of schistosomiasis in a large area, which will allow limited resources for morbidity control to be allocated optimally.

Keywords Schistosomiasis haematobia/diagnosis; Schistosomiasis mansoni/diagnosis; Risk assessment; Questionnaires; Africa South of the Sahara (*source: MeSH, NLM*).

Mots clés Schistosomiase urinaire/diagnostic; Schistosomiase intestinale/diagnostic; Evaluation risque; Questionnaires; Afrique subsaharienne (*source: MeSH, INSERM*).

Palabras clave Esquistosomiasis haematobia/diagnóstico; Esquistosomiasis mansoni/diagnóstico; Medición de riesgo; Cuestionarios, Africa del Sur del Sahara (*fuente: DeCS, BIREME*).

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Introduction

Schistosomiasis is a widespread parasitic disease of the tropics that places an enormous toll on the public health of affected regions. Of the 200 million people infected worldwide, 85% of the burden is concentrated in Africa south of the Sahara (*1, 2*). In most epidemiological settings, the intermediate host snails cannot be controlled by cost-effective interventions, and in the absence of a vaccine, schistosomiasis control largely relies on chemotherapy, with praziquantel as the drug of choice (*1*). An important feature of the disease is its focal distribution (*3*). This results in a patchy distribution of risk, and communities across a region or country do not attach the same importance to schistosomiasis. Praziquantel is therefore not required everywhere and proper targeting is crucial, given the limited resources and the many other problems facing primary health care systems in sub-Saharan Africa.

The first step in targeting health interventions is to map the disease geographically and rank it according to the risk of infection and morbidity. In 1987, the first attempt to systematically map schistosomiasis on a global scale resulted in the *Atlas of the global distribution of schistosomiasis* (*4*). A more recent effort using geographical information systems highlighted the scarcity of data for Africa (*5*), and underscored the need for a rapid and inexpensive epidemiological assessment tool that can be fully integrated within existing administrative systems. Such a tool, relying on simple school questionnaires, was developed more than a decade ago for *Schistosoma haematobium* and has since been validated in a variety of ecological, epidemiological, and sociocultural settings across sub-Saharan Africa. More recently, the approach was extended to *S. mansoni* and its validity assessed in several large-scale studies.

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This article is a comprehensive review of the experiences and evidence from sub-Saharan Africa with questionnaires for rapidly screening for schistosomiasis. The questionnaires can be used at both community and individual levels, and this approach allows communities with a high risk of schistosomiasis to be identified. Resources for controlling the parasite can thus be allocated in a more cost-effective way (*6*). We also discuss how this tool will contribute to a more sustainable and integrated system of control of schistosomiasis.

Questionnaires for diagnosing *Schistosoma haematobium* infection at a community level

The presence of blood in urine (haematuria) has been associated with *S. haematobium* infection since ancient times, but its use as an indirect indicator for this parasite was first investigated only two decades ago, in a study that simply asked community members living in Ghana and Zambia about their history of haematuria. These studies showed that haematuria was promising as an indirect indicator, but there was considerable variation in its diagnostic performance between the two settings (*7*).

Urinary schistosomiasis as illness was well perceived and correlated with infection in a rural community of the Kilombero District in the United Republic of Tanzania in the mid-1980s (*8, 9*). As a result, a district-wide study that emphasized rapid and inexpensive community diagnosis was initiated in 1986. The study aimed to identify high-risk communities, rather than infected individuals, because the highest priority for control was to target praziquantel chemotherapy in areas at greatest risk. A simple questionnaire that asked respondents whether they had experienced any of eight symptoms and eight diseases common in the area was developed and administered to all primary schools through the existing education system (*10*). The key features of this questionnaire are described in Box 1 (*11, 12*). Within six weeks, 75 of 77 schools returned completed questionnaires with a total of 6772 children interviewed. A mobile laboratory team then visited 56 schools for parasitological validation.

A comparison between the questionnaires and the parasitological data revealed a striking correlation. The percentage of positive answers to the two key questions "Did you have blood in urine during the last month?" and "Did you suffer from schistosomiasis during the last month?" showed significant positive associations with the prevalence of *S. haematobium* (for both questions: $r = 0.90$, $P < 0.0001$). The questionnaire showed a good diagnostic performance, with a moderate positive and a high negative predictive value. It identified most schools where *S. haematobium* was of high importance and correctly excluded those schools where the parasite was less of a problem (Table 1). The questionnaire approach was also rapid and cost 20-fold less than standard parasitological examinations.

In 1988, the questionnaire approach was successfully replicated in the neighbouring district of Kilosa. In this study, biomedical validation of the questionnaires was carried out by teachers who were trained in reagent-stick testing during a one-day workshop. The questionnaire showed an excellent diagnostic performance with high predictive values (Table 1). The study confirmed that the questionnaire approach was rapid and low-cost (*14*).

Table 1. **The performance of questionnaires for screening for *Schistosoma haematobium* infections at the community level**

Country (district)	Parasite prevalence %	Questionnaire return rate[a]	No. of children interviewed	No. of children examined	Best question (threshold[b] as %)	Diagnostic performance %				Reference
						Sensitivity	Specificity	PPV[c]	NPV[d]	
Cameroon	63.6	106/113 (94)	8281	6151[e]	Blood in urine (20)	98	35	75	88	*13*
United Republic of Tanzania (Kilosa)	60.5	164/168 (98)	15 073	5750[f]	Schistosomiasis (35)	90	91	88	93	*14*
United Republic of Tanzania (Magu)	57.8	134/155 (86)	29 233	3928[g]	Blood in urine (30)	89	80	92	75	*15*
Malawi	56.6	85/113 (75)	7201	4841[e]	Schistosomiasis (30)	93	46	67	85	*13, 16*
Zimbabwe	46.1	110/121 (91)	16 063	5647[e]	Schistosomiasis (25)	92	57	71	87	*13, 17*
Nigeria	43.7	58/60 (97)	3033	2479[f]	Blood in urine (40)	73	96	89	90	*18*
Zambia	34.8	87/93 (94)	7875	4833[e]	Blood in urine (20)	71	73	52	85	*13*
Côte d'Ivoire	24.6	124/136 (91)	12 479	5959[e]	Blood in urine (33)	87	96	87	96	*19*
United Republic of Tanzania (Kilombero)	21.4	75/77 (97)	6772	4469[g]	Blood in urine (25)	100	82	31	100	*10*
Democratic Republic of the Congo	20.2	136/160 (85)	19 362	2495[e]	Blood in urine (15)	86	86	71	94	*13, 20*
Congo	18.3	58/58 (100)	5590	5842[e]	Blood in urine (7)	93	82	64	97	*13*
Ethiopia	17.5	28/28 (100)	2918	2602[h]	Pain when urinating (8)	75	58	64	70	*13, 21*

[a] Number of questionnaires completed/number of questionnaires returned by schools. Figures in parentheses are percentages.
[b] The threshold is the percentage of ''yes'' replies to the question that will classify the school as being at high risk, according to the questionnaire.
[c] PPV = positive predictive value.
[d] NPV = negative predictive value.
[e] Reagent-stick testing by teachers; diagnostic performance calculated at a microhaematuria level of 1+ (1+ or above are positives)''.
[f] Reagent-stick testing by teachers; diagnostic performance calculated at a microhaematuria level of 2+.
[g] Urine filtration by research team.
[h] Reagent-stick testing by research team; diagnostic performance calculated at a microhaematuria level of 1+.

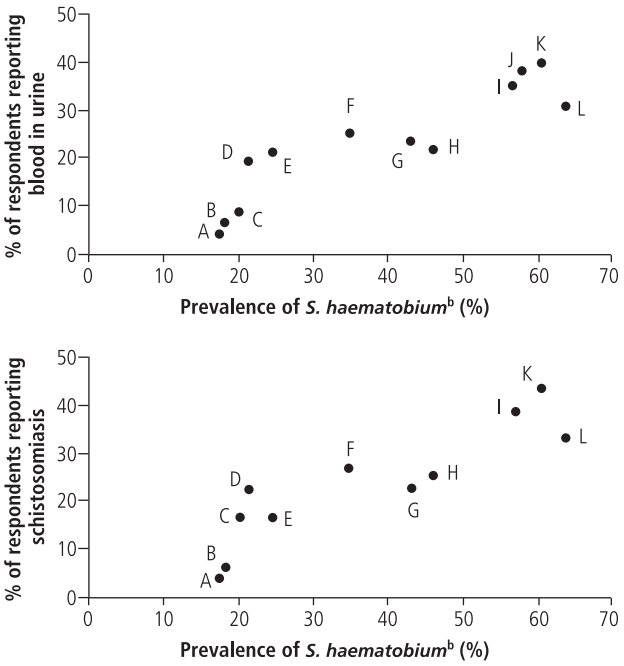
Between 1990 and 1992, a multicountry initiative was carried out to validate the questionnaire approach more extensively. The initiative was supported financially by the United Nations Development Programme/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR), and it used a standardized questionnaire in areas that were endemic for *S. haematobium* and that had many different ecological and sociocultural features. The participating countries were Cameroon, Congo, Democratic Republic of the Congo, Ethiopia, Malawi, Zambia, and Zimbabwe (*13, 16, 17, 20, 21*). More recently, similar questionnaires were validated in Côte d'Ivoire (*19*), Nigeria (*18*), and in the Magu and Muheza districts of the United Republic of Tanzania (*15, 22, 23*).

In summary, a total of 133 880 children were interviewed in 1282 schools, and 54 996 children were screened using urine filtration and/or reagent-stick testing. In all countries except one, questionnaires proved to be accurate, well accepted, operationally feasible (school return rates: 75–100%), and of low-cost (Table 1). Positive predictive values ranged from 31% to 92% (median: 71%) and negative predictive values from 75% to 100% (median: 89%). The school system proved to be outstanding for this task, despite sociopolitical crises and conflicts in some of the countries. Ethiopia was the only country where the diagnostic performance of the questionnaire was deemed insufficient for large-scale application (although the results for the question "Did you have pain while urinating?" were moderately good). This was explained by the low awareness of schistosomiasis (the study population had recently immigrated from non-endemic highlands) (*13, 21*).

At country level, there was also a strong relationship between the overall prevalence of *S. haematobium* and the percentage of positive answers to "Did you have blood in urine?" and "Did you have schistosomiasis?". Regression analysis of 12 studies carried out in Africa revealed a highly significant correlation between the overall prevalence of *S. haematobium* and the prevalence of reported blood in urine ($r = 0.90$, $P < 0.001$; Fig. 1a), as well as reported schistosomiasis ($r = 0.88$, $P < 0.001$; Fig. 1b).

In most settings, a second questionnaire aimed at teachers was distributed with the questionnaire addressed to children. In the United Republic of Tanzania, a third questionnaire was addressed to community leaders (*10*). The questionnaires for teachers and community leaders inquired about priorities among health problems, as well as the priority of health among other issues in the community. This simple approach clearly demonstrated the proposed link between schistosomiasis endemicity and its priority for control (*13*, *24*). Interestingly, the threshold at which schistosomiasis became a top health priority (rank: 1–3) was around an infection prevalence of 50%, which is also the high-endemicity threshold suggested by WHO (*25*).

Fig. 1. **The relationship between the overall prevalence of *Schistosoma haematobium* and the prevalence of reported blood in urine and reported schistosomiasis**[a]



[a] Data are shown for 12 studies carried out in 10 countries of sub-Saharan Africa: A = Ethiopia (*15, 16*); B = Congo (*15*); C = Democratic Republic of the Congo (*15, 18*); D = United Republic of Tanzania, Kilombero District (*10*); E = Côte d'Ivoire (*19*); F = Zambia (*14, 15*); G = Nigeria (*20*); H = Zimbabwe (*15, 17*); I = Malawi (*15*); J = United Republic of Tanzania, Magu District (*21*); K = United Republic of Tanzania, Kilosa District (*13*); L = Cameroon (*15*).

[b] Prevalence of *S. haematobium* was assessed by reagent-stick testing, (with a 1+ positivity threshold) by previously trained teachers (in B, C, D, E, F, G. H, I, L) or by a research team (in A); by urine filtration carried out by a research team (in J, K).

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Questionnaires for diagnosing *Schistosoma haematobium* infection in individuals

Recent studies investigated whether the questionnaire approach could be adapted for diagnosing *S. haematobium* in individuals, to see if chemotherapy could be targeted more selectively. Recent evidence from Egypt, Ghana, Nigeria, and the United Republic of Tanzania suggested that reported blood in urine and reported schistosomiasis were also useful indicators for individual infection status (*10, 15, 22, 23, 26–29*). Although questionnaires alone missed a significant proportion of infected children, most of those missed had light infections, so this might not be a problem for a morbidity control programme.

Two studies carried out in the United Republic of Tanzania observed that girls were more likely to be missed than boys (*15, 23*). This confirmed previous reports of under-reporting of blood in urine and schistosomiasis by girls at school level from Cameroon, the Democratic Republic of the Congo, and Malawi (*13*), and from the island of Pemba, United Republic of Tanzania (*30*). As a result, the sensitivity and specificity of questionnaires may differ by sex (*15, 23*), just as it may differ by age and overall endemicity. These factors need to be taken into account when planning large-scale screening, and appropriate questionnaire cut-offs should be selected.

Finally, it is unclear how the questionnaire approach would work over time. For example, once the children become aware that receiving treatment depends on the answer to a single question, the potential for response bias is obviously high.

Schistosoma mansoni illness

For intestinal schistosomiasis due to *S. mansoni* there are no simple, sensitive, and specific signs or symptoms. Several epidemiological and hospital-based studies have been carried

out in sub-Saharan Africa to relate clinical symptoms and perceived morbidity indicators to *S. mansoni* infection. Study participants were usually interviewed with a standardized clinical questionnaire, followed by the examination of one or more stool specimens to assess infection intensity. These studies found that *S. mansoni* infections (especially those which were moderate and heavy) were frequently associated with abdominal pain, blood in stool, (bloody) diarrhoea, colicky cramps, hepatomegaly, and splenomegaly (*31, 32*). The most consistent finding was the association between a recent history of blood in stools and an *S. mansoni* infection, especially in individuals with more than 100 eggs/g stool (*33–44*).

We reanalysed the data of these previous studies and found the diagnostic performance of reported and/or observed blood in stool had a low-to-moderate sensitivity (7–66%, median: 16%) and usually a high specificity (54–96%, median: 94%). These factors resulted in a moderate-to-high positive predictive value for blood in stool (20–88%, median: 64%) and in general a moderate negative predictive value (32–95%, median: 59%) (Table 2). There was considerable variation in the results, which may have stemmed from factors such as the overall prevalence and intensity of infection, individual disease perception and the reference diagnostic techniques used for validation. In two studies, a significant association was also found between reported bloody diarrhoea and *S. mansoni* (*45, 46*). For practical applications, the low sensitivity of this approach is a concern, although it remains to be seen what percentage of heavy infections can be detected.

Questionnaires for diagnosing *Schistosoma mansoni* in a community

Given the findings on *S. mansoni* above, and in view of the wide distribution and public health significance of *S. mansoni*, it was essential to develop and validate questionnaires for rapidly screening for this species. In the first study, in an area of the Democratic Republic of the Congo with mixed *S. haematobium* and *S. mansoni* infections, the correlation between the prevalence of reported blood in stools and *S. mansoni* was moderate, with an adjusted correlation coefficient of 0.33 ($P<0.02$) (*13, 20*). Interestingly, the adjusted correlation coefficient was much better for reported schistosomiasis ($r = 0.61$, $P<0.001$). Consequently, reported schistosomiasis gave a better diagnostic performance at community level than reported blood in stools (Table 3).

Following a promising pilot study carried out in 10 schools in Ethiopia (*49*), a large-scale study was initiated in the Gondar region, which found an excellent diagnostic performance for both reported blood in stools and schistosomiasis (*44*) (Table 3). Another study was carried out in 30 schools of the Morogoro rural district of the United Republic of Tanzania (*26*), but since only two schools had an *S. mansoni* prevalence above 10%, the results are not reported here.

A series of studies were carried out in western Côte d'Ivoire, in an area known to be endemic for *S. mansoni*. A pilot study in three villages investigated common signs and symptoms by conducting focus group discussions with the most heavily infected children. Blood in stool and bloody

Table 2. **Diagnostic performance of reported and/or observed blood in stool and reported and/or observed bloody diarrhoea for identifying *S. mansoni* infection**

Reported and/or observed symptom and country (district)	*S. mansoni* prevalence %	No. of subjects	Diagnostic performance %				Reference
			Sensitivity	Specificity	PPV[a]	NPV[b]	
Blood in stool							
Côte d'Ivoire[c]	92.3	209	47	76	66	60	*38*
Uganda[d]	89.4	173	66	54	79	38	*33*
Ethiopia[e]	88.2	272	13	93	80	32	*36*
Kenya[f]	82.5	416	19	93	76	49	*34*
Zambia[g]	63.2	703	17	95	88	33	*37*
Ethiopia[g]	43.3	197	15	96	78	55	*35*
Egypt (Ismailia)[h]	42.9	6864	15	93	62	59	*43*
Egypt (Kafr el-Sheikh)[h]	39.3	1109	24	87	55	63	*40*
Egypt (Gharbia)[h]	37.7	1884	9	95	57	57	*41*
Egypt (Menofia)[h]	28.5	1477	18	94	55	73	*39*
Ethiopia[h]	20.9	8006	52	90	58	88	*44*
Egypt (Qalyubia)[h]	17.5	1059	7	96	27	81	*42*
United Republic of Tanzania[g]	5.8	4130	15	96	20	95	*26*
Bloody diarrhoea							
Sudan[i]	48.2	1748	39	83	68	59	*45*
Burundi[h]	32.8	6203	13	95	56	69	*46*

[a] See footnote c, Table 1.
[b] See footnote d, Table 1.
[c] Kato–Katz thick smears (4 stool specimens, 1 slide each); threshold for calculating diagnostic performance = 100 eggs/g stool.
[d] Concentration/filtration method (1 stool specimen, 2 slides); threshold for calculating diagnostic performance = 100 eggs/g stool.
[e] Kato–Katz thick smears (1 stool specimen, 1 slide); threshold for calculating diagnostic performance = 100 eggs/g stool.
[f] Kato–Katz thick smears (1 stool specimen, 2 slides); threshold for calculating diagnostic performance = 100 eggs/g stool.
[g] Kato–Katz thick smears (1 stool specimen, 1 slide); threshold for calculating diagnostic performance = 1 egg/g stool.
[h] Kato–Katz thick smears (1 stool specimen, 2 slides); threshold for calculating diagnostic performance = 1 egg/g stool.
[i] Concentration/filtration method (1 stool specimen, 1 slide); threshold for calculating diagnostic performance = 1 egg/g stool.

Table 3. **Diagnostic performance of selected signs and symptoms for the diagnosis of *S. mansoni* infection at the community level**

Country	*S. mansoni* prevalence %	Questionnaire return rate[a]	No. of children interviewed	No. of children examined	Threshold or high-risk schools[b]	Questions (threshold[c] as %)	Diagnostic performance %				Reference
							Sensitivity	Specificity	PPV[d]	NPV[e]	
Côte d'Ivoire	54.4	121/134 (90)	12 227	5047[f]	50	Blood in stool (22)	88	58	73	79	*47*
						Bloody diarrhoea (14)	88	58	73	79	*47*
						Schistosomiasis (4)	71	58	73	79	*47*
Democratic Republic of the Congo	31.2	136/160 (85)	19 362	5806[g]	50	Blood in stool (19)	62	77	44	87	*20*
						Schistosomiasis (34)	62	89	62	87	*20*
Kenya	29.4	NA[h]	2913	2913[i]	50	Blood in stool (25)	60	78	43	88	*48*
Ethiopia	20.9	142/161 (88)	13 756	8006[g]	20	Blood in stool (15)	84	80	74	88	*44*
						Schistosomiasis (15)	77	98	96	87	*44*
						Bloody diarrhoea (25)	71	85	76	81	*44*

[a] See footnote a, Table 1.
[b] The threshold for high-risk schools is the prevalence level at which a school is said to be at high risk. These are the schools that the questionnaire aims to identify.
[c] See footnote b, Table 1.
[d] See footnote c, Table 1.
[e] See footnote d, Table 1.
[f] Kato–Katz thick smears (2 stool specimens; 1 slide each).
[g] Kato–Katz thick smears (1 stool specimen; 1 slide).
[h] NA = not applicable. Questionnaires were not distributed; the work was done by the research team in 46 schools.
[i] Kato–Katz thick smears (1 stool specimen; 2 slides).

diarrhoea were perceived as common symptoms, with three specific terms for these two symptoms known in the vernacular language. Comparisons between children's responses and their *S. mansoni* infection levels revealed that reported blood in stools showed the best diagnostic performance, especially for those children with more than 100 eggs/g stool (*38*). These findings were subsequently integrated into a large-scale screening. The percentage of positive answers to "Did you have blood in stool during the last month?" and "Did you have bloody diarrhoea during the last month?" were significantly associated with the prevalence of *S. mansoni* infection, but the diagnostic performance of these symptoms was only moderate (*47*).

Finally, a recent study in Kenya collected pairwise questionnaire and parasitological data from 46 schools. The results confirmed that reported blood in stools was significantly correlated with the prevalence of *S. mansoni* infection (*48*), but the diagnostic performance was only moderate (Table 3), in accordance with previous findings from Côte d'Ivoire (*47*).

In summary, 48 258 children were interviewed for the presence of *S. mansoni* in 545 schools, using simple questionnaires. The diagnostic performance of the questionnaires was weaker for *S. mansoni* than for *S. haematobium*, and although the results are encouraging, additional validation is needed before this approach can be used in a given setting.

Extensions of the questionnaire approach

The results described inspired more work in sub-Saharan Africa, South America, and Asia that focused on detecting high-risk individuals. It was suggested that questionnaires for *S. mansoni* screening might be improved by adding a wider range of risk factors for infection, such as migratory status, frequency and nature of water-contact patterns, and history of previous schistosomiasis treatment. This approach was undertaken in Brazil (*50–53*) and has recently been extended to Egypt (*29*), Côte d'Ivoire (*54*), and Kenya (*48*). The studies showed that the questionnaire approach had good potential for identifying infected individuals, but the questions were often very specific for a particular setting and their generalization remains questionable. Potentially useful, however, are recent findings from Kenya that schools located less than 5 km from the shore of Lake Victoria were at high risk for *S. mansoni* infection (prevalence >50%), whereas schools further away normally had lower infection prevalences (*48*).

In China, a similar approach to screening for *S. japonicum* in schoolchildren showed a high sensitivity (86%) and specificity (98%), and the high-risk schoolchildren were identified by only three simple yes/no questions (concerning frequent water contact, frequent weakness, and frequent diarrhoea). If successfully validated in other endemic areas, this approach might be more widely applied in Chinese schistosomiasis control programmes (*55*).

Implications for schistosomiasis control

Questionnaires to screen for communities at highest risk of *S. haematobium* and/or *S. mansoni* infection in sub-Saharan Africa are well accepted and operationally feasible, and are faster and less expensive than standard parasitological diagnoses. They build directly on a community's perception of disease, involve the active participation of teachers and schoolchildren, and represent a first step towards involving the community in control activities. A ranked list of schools allows the schistosomiasis risk to be mapped and communities prioritized for control activities. From there, one approach is to decide on the number of schools or communities that will benefit from treatment, taking into account overall available resources. Another possibility is to define an intervention threshold, such as the prevalence of reported blood in urine of >30% (which

often corresponds to an *S. haematobium* infection prevalence of >50%). When prevalence exceeds 50%, all schools or communities would benefit from specific control measures, for example, universal treatment with praziquantel (*25*).

The evidence for using questionnaires to screen for *S. haematobium* is now compelling and guidelines have been developed for district health managers (*12*). Despite the extensive validation, it is still recommended that the diagnostic performance of questionnaires be assessed on a limited scale, either when the questionnaire has been significantly altered or when health authorities need to be convinced about the usefulness of this method (*12*).

The use of large-scale screening with questionnaires to diagnose *S. mansoni* infections in a community could now be considered, but should always be undertaken after a validation step in the selected setting. Blood in stools, bloody diarrhoea, and suffering from schistosomiasis are valuable markers and can be recommended for screening. Other questions that are relevant to the setting, such as the distance from the lakeshore in the Kenyan study (*48*), should always be considered.

A largely unexplored issue is the performance of the questionnaires in areas with mixed *S. haematobium*/*S. mansoni* infections since the answers to the question "Did you have schistosomiasis during the last month?" will be influenced by both infections. These areas represent a significant part of the African continent (*4*). This issue should always be explored first using available information, either from previous studies or from available health statistics. A simple way to investigate for mixed infections with questionnaires is to plot the answers to "Did you have schistosomiasis during the last month?" against those for "Did you have blood in urine during the last month?". In the presence of *S. mansoni* infections, the usual tight linear relationship will be altered by schools with a much higher percentage of reported "schistosomiasis" than would be expected, as has been demonstrated in the Democratic Republic of the Congo (*20*).

Using questionnaires for programme monitoring is another application that has yet to be explored. It is difficult to predict how well questionnaires can work for this purpose, since effective control through chemotherapy will affect the prevalence and morbidity patterns. On Pemba Island, for example, repeated treatment substantially reduced the level of measured and perceived haematuria over two years, and this followed a similar decline in infection rates (*56*).

Conclusions

We have presented the successful development of a rapid assessment procedure that has public health significance. It is important to highlight the long time required for thorough validation. Development and validation of questionnaires has taught us much about how schistosomiasis is perceived by affected individuals and communities, and confirmed that the priority given to the disease is highly dependent on endemicity and morbidity. Questionnaires are now readily available for rapidly screening for schistosomiasis. We believe that novel large-scale control initiatives will find this tool useful as a first step towards defining the distribution and magnitude of the problem, and improving the implementation of control measures by an evidence-based process of resource optimization. ■

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Conflicts of interest: none declared.

Résumé

Questionnaires pour le dépistage rapide de la schistosomiase en Afrique subsaharienne

De nouvelles initiatives visent à réduire la charge mondiale de la schistosomiase, essentiellement par l'application de la chimiothérapie à grande échelle. En vue d'un ciblage efficace de la chimiothérapie, il est nécessaire de disposer d'une méthode d'évaluation rapide pour identifier les communautés à haut risque qui constituent des foyers de la maladie. Dans le présent article, nous examinons l'établissement et la validation de questionnaires scolaires simples destinés à dépister de façon rapide et peu coûteuse les infections à S*chistosoma haematobium* et à *S. mansoni* dans la communauté. Ces questionnaires s'adressent surtout à l'Afrique subsaharienne, qui regroupe actuellement 85 % de l'ensemble des cas de schistosomiase.

Depuis plus de dix ans, l'approche par questionnaire a été validée dans dix pays, avec 133 880 enfants interrogés dans 1282 écoles et 54 996 examinés à la recherche de *S. haematobium.* Les questionnaires étaient bien acceptés, fiables et de faible coût. Le succès de l'utilisation des questionnaires s'explique par le fait que les infections à *S. haematobium* sont facilement perçues par la présence de sang dans les urines.

D'après les données recueillies auprès de 48 258 enfants interrogés dans 545 écoles, la mention de la présence de sang dans les selles et celle de diarrhées sanglantes sont des indicateurs valables en ce qui concerne le diagnostic des infections à *S. mansoni* dans la communauté. En revanche, la valeur diagnostique des questionnaires était moins bonne pour *S. mansoni* que pour *S. haematobium*, et malgré des résultats encourageants, les questionnaires auraient besoin d'un complément de validation. Récemment, des questionnaires ont été étendus au diagnostic individuel et semblent très prometteurs à cet égard. Il existe maintenant des questionnaires pour déterminer rapidement l'importance de la schistosomiase dans une région de grande étendue, ce qui permettra de répartir de façon optimale les resources limitées attribuées à la lutte contre la morbidité.

Resumen

Cuestionarios para el cribado rápido de la esquistosomiasis en el África subsahariana

Una serie de nuevas iniciativas tienen por objeto reducir la carga mundial de esquistosomiasis, principalmente mediante la aplicación de antibioticoterapia en gran escala. A fin de enderezar con precisión los esfuerzos de tratamiento antibiótico, se necesitan procedimientos de evaluación rápida para identificar las comunidades de alto riesgo que actúen como focos de la enfermedad. En el presente análisis examinamos el desarrollo y validación de cuestionarios escolares sencillos concebidos para el cribado rápido y económico de las comunidades en lo que respecta a la presencia de *Schistosoma haematobium* y *S. mansoni.* El centro de interés es el África subsahariana, donde se concentra el 85% de la actual carga de esquistosomiasis.

Durante más de una década, el método de los cuestionarios se ha validado en 10 países, habiéndose alcanzado la cifra de 133 880 niños entrevistados en 1282 escuelas, y de 54 996 niños examinados para detectar *S. haematobium.* Los cuestionarios tuvieron buena aceptación y fueron una herramienta altamente fiable y de bajo costo. Su éxito se explica por el hecho de que las infecciones por *S. haematobium* se detectaban fácilmente mediante la presencia de sangre en la orina.

Los datos aportados por 48 258 niños entrevistados en 545 escuelas muestran que las referencias a la presencia de sangre en las heces y de diarrea sanguinolenta son indicadores valiosos para el diagnóstico comunitario de *S. mansoni.* Sin embargo, la eficacia diagnóstica de los cuestionarios para *S. mansoni* fue menor que para *S. haematobium*. Aunque estos resultados son alentadores, es necesario validar mejor los cuestionarios. Recientemente se ha ampliado el uso diagnóstico de los cuestionarios del nivel comunitario al nivel individual, con resultados bastante prometedores. Disponemos ahora de cuestionarios que nos permiten determinar rápidamente la magnitud del problema de la esquistosomiasis en un área extensa, lo que permitirá asignar de forma óptima los limitados recursos disponibles para combatir la morbilidad.

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