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Schistosomiasis Control in Burkina Faso: Knowledge, Attitudes, and Practices of Populations in Four Villages

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Abstract

Schistosomiasis is Africa's second most common parasitosis in terms of morbidity and mortality. Humans have been identified as being primarily responsible for the persistence and dissemination of the disease within their environment. The aim of this study was to assess the theoretical and behavioral knowledge of an at-risk population in the control of schistosomiasis.

This was a descriptive cross-sectional study conducted from September 2021 to January 2022 in four villages in Burkina Faso: Pana, Vy, Bourzem, and Zam. The study population consisted of individuals aged 7-59 years, who were recruited from randomly selected households; any eligible person in each household who consented to participate was surveyed. A questionnaire was used to collect information on knowledge about schistosomiasis, attitudes, and practices at the individual level, as well as control behavior.

A total of 527 participants were surveyed in the villages. The mean age was 26.76 (+/-14.22) years. The sex ratio was 0.84. More than half of the participants (59.27%) had never attended school. The symptoms of schistosomiasis were unknown to 42.13% of the participants. Bathing in contaminated water was known as a way of contamination by 29.22% of participants. Among the participants, 40.55% were aware of mass treatment campaigns, however, 43.19% of them found them ineffective. More than half (51.16%) of those using the village water point did not know that they were at risk of contracting the disease. Of the 20.89% of participants with a history of schistosomiasis, 22.22% used traditional medicines.

The inadequate knowledge of the study population shows their vulnerability to the disease. The approximate attitude and practices highlight the socio-cultural specificities that influence the adoption of good practices in the control of the disease.

Keywords: Schistosomiasis, knowledge attitudes, and practices, Burkina Faso

1. Introduction

Schistosomiasis or bilharzia is a disease resulting from infection by parasitic worms of the genus Schistosoma belonging to the class Trematodes. It is Africa's second most common parasitic disease in terms of morbidity and mortality (Abdel-Wahab et al., 1994). Since their description at the end of the 19th century, human schistosomiasis, which was initially found throughout the tropics, saw its geographical distribution change in the early 1950s (Chitsulo et al., 2000). This change was marked by an increase of urinary and intestinal forms in the African region (Engels et al., 2002), resulting from the modification of the environment for agricultural purposes (Zongo, 2010).

Humans, through their actions, have been identified as being primarily responsible for the maintenance and spread of the disease within their functional environment (Zongo et al., 2013). In addition, ignorance of bilharzia prevention may be a key factor in maintaining the disease. In Africa, health education is increasingly being integrated into the disease control strategies. Knowledge about schistosomiasis control in at-risk populations not only helps to identify the level of the disease vulnerability at the individual level (Essi & Njoya, 2013) but also to protect others sharing the same ecosystem. Unfortunately, in some African countries, there is still a high level of ignorance about health promotion. For example, in 2019 a study in Togo that assessed knowledge, attitudes, and practices of bilharzia showed that 57.3% of the population at risk did not know the symptoms of the disease, 40% did not know the mode of transmission and 18.20% frequented the local river water, marigots and dams (Djagadou

et al., 2019). These results reflect the situation in West Africa where school enrolment rates remain low.

This study on the knowledge, perceptions, and practices of populations at risk in Burkina Faso aims to measure the understanding, customs, and practices of the population in terms of schistosomiasis control, and also to identify the obstacles to the adequate implementation of the control strategy and to better orientate the educational interventions of populations at risk. Indeed, the level of knowledge of the population makes it possible to determine its level of vulnerability to schistosomiasis. This assessment identifies the need for education of the target population, and the best channel to address this need. The assessment of attitude and practice type provides insight into the perceptions, beliefs, and motivations of the population regarding the threat of schistosomiasis. It highlights the socio-cultural specificities that influence the adoption of good practices by the target population. The analysis of these data, together with the context and the environmental and socio-demographic characteristics of the population, can help explain the prevalence rates of schistosomiasis in the study area and highlight the health promotion needs of the population.

2. Material and Method

2.1 Study Framework

It was a descriptive cross-sectional study conducted from September 2021 to January 2022 in four villages belonging to four regions of Burkina Faso: Vy in the Boucle du Mouhoun region, Pana in the Hauts-Bassins region, Bourzem in the Centre-Sud region, and Zam in the central plateau region. The choice of these regions was mainly based on the prevalence of the disease provided by the national schistosomiasis control program. Each of these villages had a parasite prevalence of 10% or more (Burkina Faso NTD MP2016-2020).

2.2 Study Population

The study population consisted of individuals aged 7–59 years, regardless of sex, living in the household for at least 6 months, and present at the time of the survey. This population included school-age children, but also working adults. Individuals were selected from households randomly selected from a sampling frame; the head of the household was surveyed, as well as any person aged 7-59 in the household who wished to participate in the study. People with mental disabilities were not included in the study. A minimum sample size of 400 individuals was determined by the formula $n = N / (1+N)e^2$ with a margin of error of 5%. According to the 5th General Census of Population and Housing in Burkina Faso, the average size of a household in rural areas is 6.2, and people aged 7-59 years represent about 70% of the population; thus, each household could have an average of 4.34 people in this age group. This resulted in a minimum number of households to be surveyed equal to 93, distributed as follows in the villages Vy (n = 32), Bourzem (n = 12), Zam (n = 26), and Pana (n = 23).

2.3 Data Collection and Analysis

Data was collected using an individual questionnaire for eligible participants. This tool, which included several questions, made it possible to collect information on knowledge about schistosomiasis, attitudes, and preventive and curative practices at the individual level. It also allowed for the collection of information sources on schistosomiasis as well as behaviors related to the control of this disease. The quantitative data were entered, processed, and analyzed in Epi Info version 7 software.

2.4 Ethical Aspects

This study received approval from the Burkina Faso Health Research Ethics Committee following its deliberation N° 2021-02-035 of 03 February 2021, renewed on 5 March 2022. The study also received authorization to collect data from the regional health directorates of these regions. Written informed consent was obtained for each participant. Interviews were conducted in local languages (Dioula/Bouamou for the village of Vy, Dagara for Pana, Mooré for Zam, and Bissa for Bourzem) by trained interviewers.

3. Results

3.1 Socio-Demographic Characteristics of the Population

The socio-demographic characteristics of the study population included the geographical area of residence of the participants, their gender, their age, and their highest level of formal education. Five hundred and twenty-seven participants were surveyed in the four villages. Almost half of the respondents (48.01%) came from the village of Vy and less than fifteen percent resided in Bourzem. The age of the participants ranged from 7 to 59 years with an average of 26.76 +/-14.22 years. The most represented age group was 10–20 years with (34.35%) of the participants. More than half of the participants (56.93%) were under 30 years old. There were more female participants (54,27%) corresponding to a sex ratio of 0.84. More than half of the study population had never attended school, 28.19% had completed primary school, and less than one percent had attended university.

Table 1. Socio-demographic characteristics of the study population

Caracteristics	Frequency	%	Wilson 95% Conf Limits	
Geography area (N=527)				
Pana	118	22.39%	19.04%	26.14%
Vy	253	48.01%	43.77%	52.27%
Bourzem	73	13.85%	11.16%	17.06%
Zam	83	15.75%	12.89%	19.11%
Gender (N=527)				
Male	241	45.73	41.52	50.00
Female	286	54.27	50.00	58.48
Age groups (N=527)				
0 - <10	39	7.40%	5.46%	9.96%
10 - <20	181	34.35%	30.42%	38.50%
20 - <30	80	15.18%	12.37%	18.50%
30 - <40	113	21.44%	18.15%	25.15%
40 - <50	77	14.61%	11.85%	17.88%
50 - 59	37	7.02%	5.14%	9.53%
Level of education completed (N=518)				
Primary	146	28.19%	24.48	32.21
Secondary school	39	7.53%	5.56	10.13
High school	16	3.09%	1.91	4.96
University	5	0.97%	0.41	2.24
Never attended school	307	59.27%	54.98	63.41
Don't know	5	0.97%	0.41	2.24

Participants aged between 10 and 19 years constituted the most represented class for both women and men (Figure. 1). The extreme ages were least represented in both sexes. There was also a relatively low number of participants aged 20 to 29. The first age group (0–10 years) included only school-age children, i.e. those at least 7 years old. Despite a majority of women in the study population, men outnumbered women in four of the six age groups. Women were in the majority among the oldest participants and among those aged 20–29.

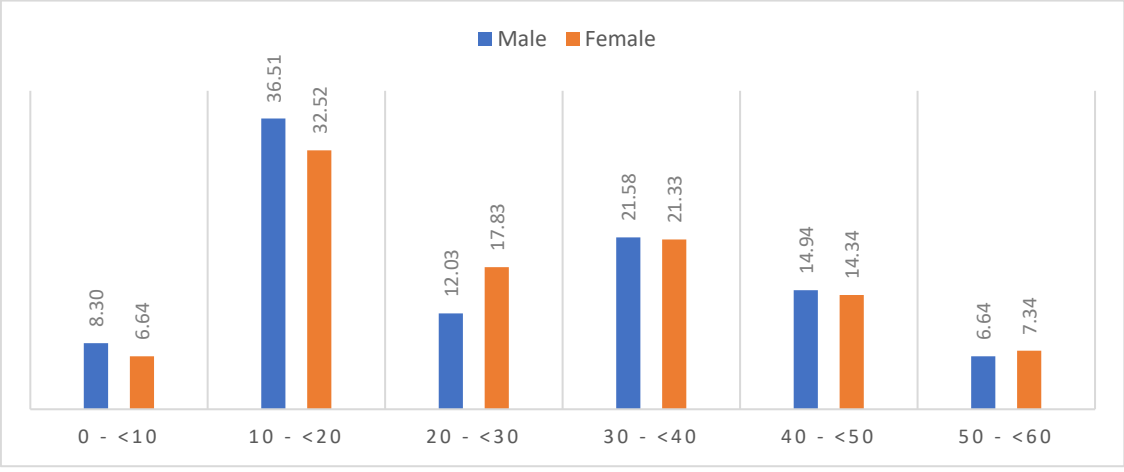

Figure 1. Distribution of participants by age and gender

Participants who had never attended school represented 59.27% with a majority of female participants (64.77%). More than half of the participants who had attended school (54.37%) were male (Figure 2). In the study population, a high proportion of participants had a primary level of education. This proportion declined as the level of education increased and almost canceled out at university. This was observed in both the male and female groups.

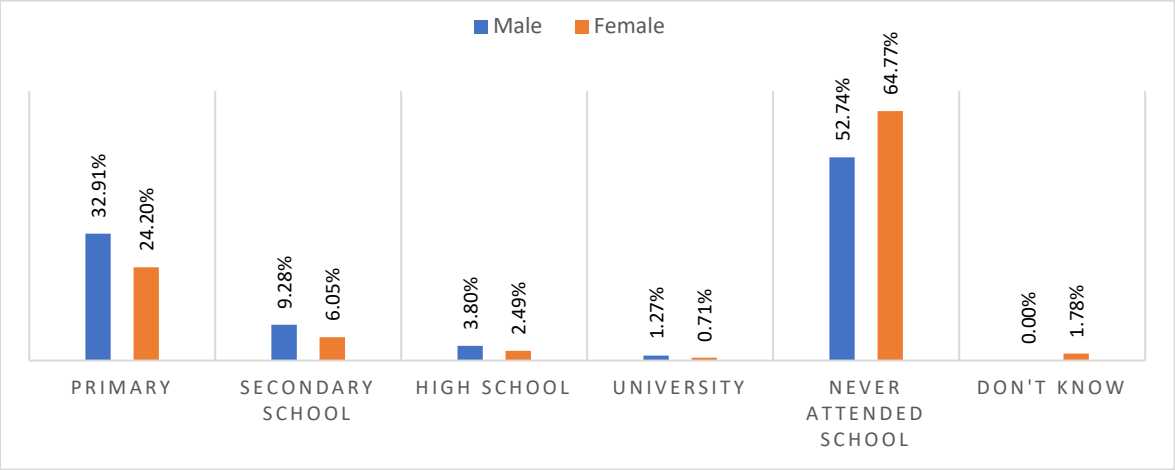

Figure 2. Level of education of participants by gender

Participants' occupations were classified into several categories, the most representative of which are shown in Table 2 below. More than half of the participants (51,05%) were farmers. Three of the four villages included in this study had a water point close to their homes. This allowed them to grow off-season crops, garden, and raise small and large livestock. Primary and secondary school students came second with (17,90%).

Table 2. Participants' occupations

Occupation Type (public/private/self). n (%) p <.0001 (n=525)	n	%
Agriculture	268	51,05
Students	94	17,90
Housewives	39	7,43
Trade	40	7,62
Mineral extraction	6	1,14
Manufacturing/processing of food products	8	1,52
Fishing	7	1,33
Inactive	46	8,76
Other	17	3,25

Others included: Publishing/printing, construction, hotels, NGOs, parking, wood/coal production, health/social work, construction/vehicle repair, land transport, education (teachers, school directors)

3.2 Knowledge of the Population at Risk of Schistosomiasis

The results on the population's knowledge about the risks were structured in nine categories as presented in Table 3. The questions that helped to collect knowledge were translated into local languages, using the various names of the disease according to the village. The majority of participants (82.47%) knew that schistosomiasis is a disease. The intestinal form was named by 21.63% of participants and the urinary form by 55.03%. However. Both forms were named simultaneously by 36.21% of the participants (Table 4). However, almost two out of five participants (39.47%) were unaware of the forms of the disease in Burkina Faso. The symptoms were also unknown to a large proportion of the population

Table 3. Distribution of respondents according to schistosomiasis knowledge

	Frequency	%	Wilson 95% Conf Limits	
Perception of schistosomiasis as a disease (N=519)				
Don't know	58	11.18	8.74	14.18
No	33	6.36	4.56	8.80
Yes	428	82.47	78.96	85.50
Different forms of the disease in Burkina Faso*				
Urinary	290	55.03	50.76	59.22
Intestinal	114	21.63	18.33	25.35
Hepatic	1	0.19	0.03	1.07
Cutaneous	6	1.14	0.52	2.46
Don't know	208	39.47	35.39	43.70
Mode of the schistosomiasis transmission*				
Drinking contaminated water	242	45.92	41.71	50.19
Eating certain foods	45	8.54	6.44	11.24
Washing in a canal or river water	154	29.22	25.50	33.24
By contagion	16	3.04	1.88	4.87
Walking barefoot on the urine of a sick person	52	9.87	7.60	12.71
Symptoms of urinary schistosomiasis *				
Pain on urination	188	35.67	31.70	39.85
Oliguria	77	14.61	11.85	17.88
Frequent urge to urinate heavily and frequently	28	5.31	3.70	7.57
Blood in the urine	220	41.75	37.61	46.00
Other :	6	1.14	0.52	2.46
Don't know	182	34.54	30.60	38.69
Symptoms of intestinal schistosomiasis*				
Abdominal pain	109	20.68	17.44	24.35
Diarrhea	63	11.95	9.46	15.00
Constipation	7	1.33	0.64	2.72
Blood in the stool	131	24.86	21.36	28.72
Weight loss	24	4.55	3.08	6.69
Other	2	0.38	0.10	1.37
Don't know	289	54.89	50.57	59.04
Existence of treatment for schistosomiasis (N=520)				
Yes	208	40.04%	35.94%	44.28%
No	45	8,54%	6.66%	11.25%
Don't know	267	51.42%	47.16%	55.66%
Schistosomiasis as preventable disease (N= 520)				
Yes	272	52,37	48,13	455,95
No (why?)	27	5,38	3,86	7,28
Don't know	220	42,31	38,22	46,16

Preventive measures related to schistosomiasis*				
Vaccination	65	12.33	9.80	15.42
Hygienic and dietary measures				
1= Do not eat certain foods	60	11.39	8.95	14.38
2= Do not drink unsafe water	214	40.61	36.50	44.85
3=Do not wash in the waterhole	169	32.07	28.23	36.17
4=Don't know	93	17.65	14.63	21.13
5=Other to be specified ;	1	0.19	0.03	1.07
Other	5	0.95	0.41	2.20
Source of information related to schistosomiasis*				
On the radio	126	23.91	20.46	27.73
On television	38	7.21	5.30	9.74
At school	96	18.22	15.15	21.74
At the health center	153	29.03	25.32	33.05
From friends and acquaintances	177	33.59	29.69	37.72
No information	42	7.97	5.95	10.60

* More than one answer selected.

Regarding the other modes of contamination, the notion of sunlight came up most often: drinking water that has lasted in the sun, exposure to the burning sun, and consumption of hot water. Sexual contact was also mentioned as a mode of contamination.

Other sources of information such as the village crier, the church, and traditional healers.

Table 4. The two forms of the disease found in Burkina Faso (N=527)

		Intestinal		Total
		Yes	No	
Urinary	Yes	105 (36.21%)	185 (63,79%)	290 (100%)
	No	9 (3.80%)	228 (96.20%)	237 (100%)
Total		114	413	527 (100.0%)

The participants mentioned drinking contaminated water (45.92% of cases) and bathing in a contaminated water point (29.22%) as the main modes of contamination. In addition, other modes of contamination such as exposure to the sun or unprotected sex were cited as other modes of contamination.

The symptoms cited by the participants were accurate in less than half of the cases. However, the symptoms were unknown to 42.13% of the participants. Haematuria and urinary pain were mentioned by 41.75% and 35.67% of participants respectively as the main symptoms of the disease. For the intestinal form of the disease, the main symptoms were blood in the stool (24.86%) and abdominal pain (20.68%). Other symptoms such as general fatigue and redness of the eyes were mentioned.

In 40.04% of cases, participants thought there was a treatment, compared to 59.96% who thought there was no treatment or did not know. Out of those who said there was a treatment, 13.71% mentioned praziquantel. However, 44.35% mentioned the existence of a modern treatment available at the Social Promotion Health Centre or hospital (Figure 3).

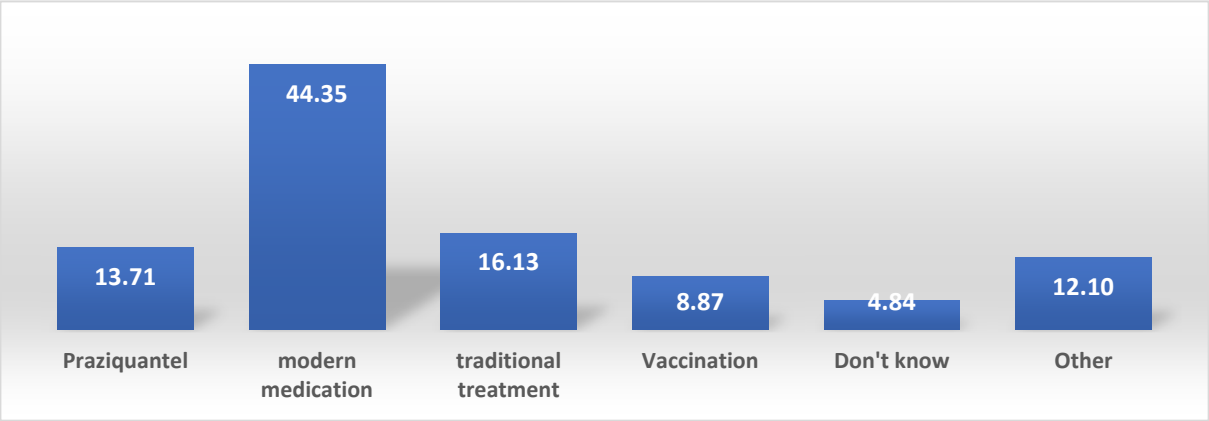

Figure 3. Therapeutic means are known by the participants

When asked if the disease is preventable, 52.37% said yes, while 5.38% said no and 42.31% did not know. Of those who said the disease was not preventable, the majority (85.71%) justified their answer by the fact that contact with water was unavoidable.

Vaccination was mentioned as a means of prevention against schistosomiasis by 12.33% of the participants. The hygienic-dietary means of prevention mentioned were:

- Avoid using dirty water (40.61%)

- Avoiding washing at water points (32.07%)

- Avoiding eating certain foods (11.39%)

The main source of information was friends and acquaintances in 33.59% of cases. Other sources of information were the health center (29.03%), the radio (23.91%), and the school (18.22%).

3.3 Perceptions that Influence the Behavior of the Population at Risk of Schistosomiasis

The perception of schistosomiasis control by was assessed through five questions as shown in Table 5. Less than half of the participants (42.31%) did not know that schistosomiasis was present in their village and 51.16% did not know that one can contract the disease by visiting the village water point or by drinking untreated water from the water point (48.46%).

When asked if the participants were aware of the praziquantel distribution campaigns, 40.55% said yes, of which 43.19% thought they were effective in controlling schistosomiasis.

Table 5. Participants' perceptions towards schistosomiasis control

Questions Freq		%	Wilson 95% Conf Limits	
Is schistosomiasis occurring in this village (N=520)				
Yes	300	57.69	53.40	61.87
No	35	6.73	4.88	9.22
Don't know	185	35.58	31.58	39.78
Is there a risk of catching schistosomiasis by going to the village water point? (N=518)				
Yes	253	48.84	44.56	53.14
No	45	8.69	6.56	11.43
Don't know	220	42.47	38.29	46.77
Is there a risk of being infected with schistosomiasis by drinking water from a village water source? (N=518)				
Yes	267	51.54	47.25	55.82
No	60	11.58	9.11	14.63
Don't know	191	36.87	32.83	41.11

Are you aware of praziquantel treatment campaigns? (N=513)				
Yes	208	40.55	36.38	44.85
No	170	33.14	29.20	37.32
Don't know	135	26.32	22.69	30.29
Do you think these campaigns are effective in the fight against schistosomiasis? (N=521)				
Yes	225	43.19	39.00	47.47
No	23	4.41	2.96	6.54
Don't know	273	52.40	48.11	56.65

3.4 Practices of the Population Regarding Schistosomiasis Control

The water point was used daily for various activities and 63.57% of the participants claimed to use it. Water point utilization varied by age group. All utilization levels remained higher than 55%. Higher use is by children under 10 years and lower by the 30-40 age group (Figure 4).

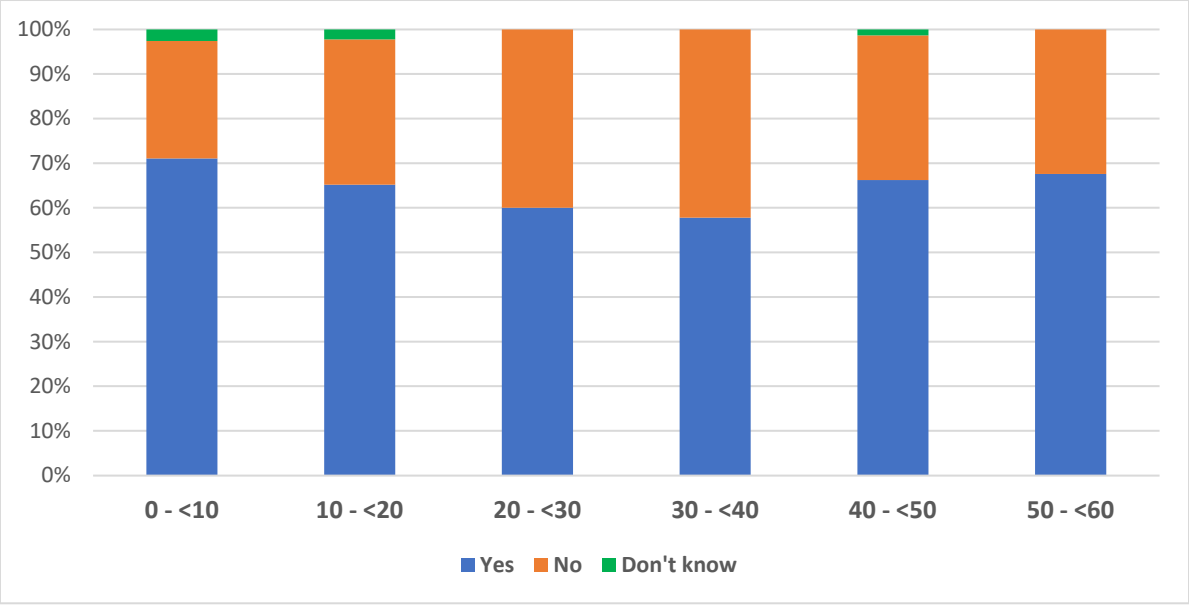

Figure 4. Visits to the village water point by age

The water point was used for washing/drinking (20.30%) and bathing (13.47%) (Table 6). However, it was found that the water point is crossed daily by the population to go to the field, to the pasture, to school, for rice growing, or for other market gardening.

Table 6. Reasons for visiting the waterpoint (N = 312)

	Freq	%	Wilson 95% Conf Limits	
Bathing	71	13.47%	10.82%	16.65%
Laundry/dishwashing	107	20.30%	17.09%	23.95%
Fishing	48	9.11%	6.94%	11.87%
Gardening	57	10.82%	8.44%	13.76%
Playing	29	5.50%	3.86%	7.79%

Of the 517 participants who gave an answer to the question "Have you ever contracted schistosomiasis?", 108

admitted to having already contracted the disease (Table 7), i.e. 20.89%, compared to 67.50% who thought they had never contracted it and 11.61% who did not know.

Table 7. History of schistosomiasis in the study population (N = 517)

Classe Age	Yes		No		Don't know		Total
	Freq abs	Freq rela	Freq abs	Freq rela	Freq abs	Freq rela	
0 - <10	9	8.33%	23	6.59%	6	10.00%	38
10 - <20	25	23.15%	130	37.25%	23	38.33%	178
20 - <30	14	12.96%	55	15.76%	10	16.67%	79
30 - <40	32	29.63%	71	20.34%	7	11.67%	110
40 - <50	18	16.67%	47	13.47%	10	16.67%	75
50 - 59	10	9.26%	23	6.59%	4	6.67%	37

The symptoms presented were (n = 108) muscle pain (13.89%), chills (14.81%), cough (4.63%), fever (37.04%), haematuria (39.81%), pruritus (20.37%), bloody diarrhea (8.33%), rash (2.78%). Following the onset of symptoms, 29.63% went to the clinic, and 22.22% resorted to traditional self-medication. (Table 9). Following the presence of symptoms, 27 participants informed their relatives. The latter had also used traditional medication (24/27) and visited the clinic (23/27). Of the 81 participants who showed symptoms and did not inform a relative, 8 (9.8%) were ashamed, 9 (11%) were afraid and 64 (79.01%) did not justify their decision.

Table 8. Actions taken following the occurrence of symptoms (N = 107)

What did you do when the symptoms occurred?	Freq	%
Told a friend or family member	27	25.00
Modern self-medication	17	15.74
Traditional self-medication	24	22.22
Clinic consultation	32	29.63
Consultation with a healer	7	6.48

Participants who had already received at least one mass distribution campaign represented 33.08% of the study population (CI95 29.16% - 37.24%). (Table 9).

Table 9. Beneficiaries of mass treatment with praziquantel (N=517)

Have you ever participated in at least one MDA campaign?	Freq	%	Wilson 95% Conf Limits	
Yes	171	33.08	29.16	37.24
No	279	53.97	49.66	58.22
Don't know	67	12.96	10.34	16.13

Participants aged 10–49 years, with a high proportion before 20 years, benefited most from the mass distribution of praziquantel (Figure 5). The mass distribution campaigns of praziquantel carried out by the national schistosomiasis control program, which began a little more than fifteen years ago, concern school-age children, and the recruitment of participants is done in schools. the first beneficiaries of these campaigns, who were school-age children at the time, are now adults.

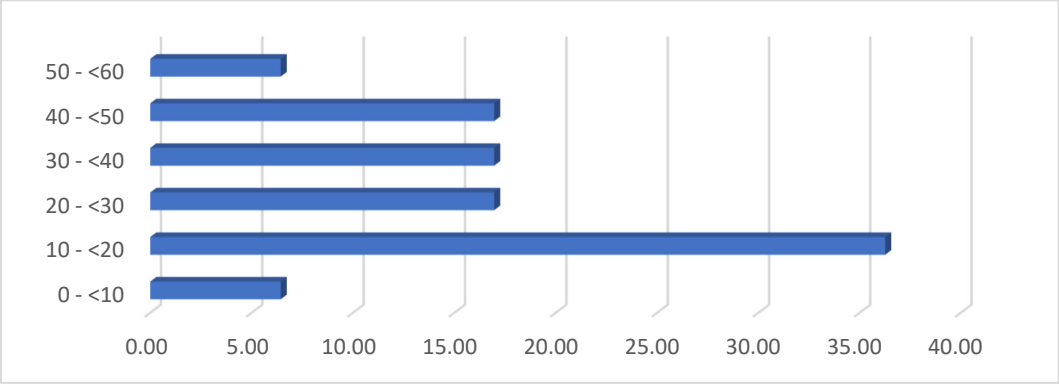

Figure 5. Distribution of participants who have already received mass treatment

4. Discussion

4.1 Socio-Demographic Characteristics of the Respondents

The study area was a group of four villages with globally the same socio-economic conditions characterized by unserviced housing, and limited access to drinking water and sanitation. With the exception of the village of Bourzem, whose nearest water point is about 5 km away in the canton of Foungou, all the other villages have one or more water points used daily by the inhabitants for domestic and agricultural activities. The participants included are people considered to be active and most at risk of contracting the disease. The study population is made up of school-age children, young and older adults. This population is the one that uses the water point the most, whether for work activities or for playing and swimming. According to the report of the 5th general population and housing census in Burkina Faso, women are the majority in the country (INSD, 2012). This is shown in the study sample and explains the predominance of women. On the other hand, when the study participants were recruited, the men were not often at home, often on the move for seasonal jobs. Individuals aged 10 to 20 years were the most represented for both men and women, with 34.35% and 56.93% of participants being under 30 years of age.

More than half of the participants (59.27%) had never attended school and 28.19% had reached primary school. The low school enrolment rate in rural areas such as those covered by the study reflects the national situation where farmers prioritize agricultural work and very often drop out of school children who had barely started primary school. With regard to occupation, 51.05% of the participants were engaged in agriculture and 17.90% were students.

4.2 Level of Knowledge of the Population at Risk of Schistosomiasis

Great care must be taken when analyzing a population's knowledge of disease. Without wishing to integrate all the sociological notions surrounding this term, it is a question here of finding a compromise between the individual and collective conception of the disease under study. Within the study population, the notion of disease was most often equated with the presence of one or more symptoms. Thus, 82.47% of the participants knew that schistosomiasis is a disease through haematuria, however, only 36.21% of the participants knew the two forms of the disease present in Burkina Faso. what can be qualified here as a low level of knowledge related to symptoms of schistosomiasis by at-risk populations, as reported in Lomé (Djagadou et al., 2019), with almost half of the participants (42.13%) not knowing the clinical manifestations of the disease, regardless of the form. For those who had an idea of the signs of the disease, the recurrent symptoms for the urinary form were haematuria (41.75%) and micturition pain (35.67%). The Katayama syndrome, characterized by fever, skin signs, pain, cough, etc., which appeared after an infesting bath, was not recognized by the participants. As for the intestinal form, the presence of blood in the stools (24.86%), abdominal pain (20.68%), and diarrhea (11.95%) were the major symptoms mentioned by the participants. This situation of low level of knowledge might not reflect reality if the participant has to define the disease considering only the construction elaborated from the medical profession, and omitting the social construction of the disease elaborated from the lay social representations and behaviors. The symptomatology of intestinal bilharzia is similar to that of other digestive parasites and may lead to confusion over common signs. People who are not aware of intestinal bilharzia in their village will attribute these symptoms to other diseases.

The association of haematuria with bilharzia has been reported in similar studies (Djagadou, 2019; Ould Ahmedou,

2013). As in these studies, participants recognized the presence of blood in the urine or stool as a disease or symptom of bilharzia. The presence of blood in the urine is thus an alarming and revealing sign of the disease. Pain in urination, which often accompanies haematuria, was recognized by the participants as the second most common symptom of bilharzia, as was the case in a study conducted in Mauritania (Ould Ahmedou, 2013). The notion of transmission through sex that emerged in this study was also mentioned by some authors such as Ahossi (2019). The presence of blood in urine could lead some people to think of the infectious risk that this discharge could carry contaminating germs for a sexual partner and transmit the disease. Although there is a logic to this reasoning, the lack of knowledge about the transmission cycle of the parasite leads to this assumption being maintained. Awareness of the issue should be raised by explaining to people that although eggs can be passed from one person to another by sexual transmission (Chohan et al., 2021), the eggs can only hatch inside an intermediate snail host.

The mentioning of contact (29.22%) or ingestion (45.92%) of contaminated water was the main means of contamination mentioned by the participants. A lack of knowledge about how a disease is transmitted exposes people to the risk of maintaining the infestation in the community. Participants in this study also mentioned other completely incorrect modes of infection, such as exposure to the sun or unprotected sex.

This low level of knowledge about schistosomiasis contrasts with the amount of information that reaches the population, either through the media or through the various information and awareness campaigns organized by the NTD program. This contrast could be due to several causes, including the inappropriate communicative approach, the inappropriate communication channel, and the lack of interest of the population in the issue of schistosomiasis. Increasing people's knowledge about the disease must be a major challenge to enable them to contribute effectively to the fight against the disease. The WHO strategy implemented at the national level for almost 20 years is based essentially on awareness raising, detection, and mass treatment of school-age children. Since we do not have data on the knowledge of the study population before the start of implementation, it is difficult to assess the positive or negative evolution of this population's knowledge.

Awareness campaigns and mass treatment of the population with praziquantel have been carried out in all villages in Burkina Faso, including those included in this study. Despite this, more than half of the participants (51.42%) did not know if there was a treatment for schistosomiasis. Of those who said there was a treatment, 13.71% named praziquantel. However, 44.35% of the participants said that there is a modern treatment but did not know the name. This rate is lower than that of Djagadjou (2019) who found 71.30% of respondents recognized a modern treatment for bilharzia. Traditional treatment was mentioned by 16.13% of participants. These results are also lower than those of Yao (2019) who found 61.15% of participants mentioned traditional medicine as the most effective means of treatment. The use of treatment would depend on several factors including conception, understanding of the disease, and financial means.

Prevention of the disease is an important part of the control. Of the respondents, 52.37% said that schistosomiasis is preventable. Of those who said the disease was not preventable, the majority (85.71%) justified their answer by the fact that contact with water was inevitable. The respondents were people living in rural areas and heavily involved in agricultural activities, exposing them to repeated contact with dirty water. This helps to understand the views of those who associate the avoidance of the disease with the avoidance of dirty water. Schistosomiasis control focuses mainly on the mass treatment of patients with praziquantel. However, an information campaign for behavioral change on hygiene and sanitation, as well as protection techniques, could lead this group to understand how to avoid contracting the disease without interrupting contact with water.

Vaccination was a means of preventing schistosomiasis in 12.33% of the cases, but none of the participants knew whether or not a vaccine against schistosomiasis existed. This could show the confidence that part of the population has in the ability of vaccines to prevent diseases. Several vaccines are available free of charge at the health centre and people use them to prevent some diseases. However, it would be interesting to point out here the need to carry out acceptability studies of a schistosomiasis vaccine, as there are some currently in development (www.pailifesciences.com/schistoshield). Avoidance of drinking dirty water was mentioned by 40.61% of the participants. Routine immunization available in first-level health centers has helped control several infectious diseases and increased people's confidence in vaccines. Thus, even without having seen a schistosomiasis vaccine, part of the population is willing to use it in the fight against the disease.

As for the sources of information about the disease, 33.59% got their information mainly from friends and acquaintances. The other sources of information were the health center (29.03%) and the radio (23.91%). The school came fourth with 18.22%. The transfer of information in rural areas such as those covered by this study is an essential factor for the successful implementation of a project or intervention. The population, which is the main actor in the expected change, must receive the right information through an appropriate vehicle and channel. In

their paper entitled "Information Dissemination in rural areas in developing countries", (Correa et al.,1997) specify the need to take into account traditional information channels, including their methods, in the dissemination of information at the community level. The transfer of information here refers to gathering points (markets, prayer places, health centers, schools, etc.). This transfer of information is done through information mediators who have some authority within the community.

The results of this study are different from those of Djagadjou (2019) and Ould Ahmedou (2013) who found the school as the main source of information, with 33.70% and 24.20% of cases respectively. This difference could be due to the fact that these studies involved a heterogeneous population made up of children and adults, unlike the two authors who worked on a population of school-age children.

Regarding knowledge about schistosomiasis and diseases in general, although Abdmouleh (2012) thinks that a distinction should be made between the analysis carried out on the basis of medical practices and norms and that referring to lay representations and behaviors, this study has only considered the first aspect. This medical assessment makes it possible to draw up targeted terms of reference for improving the knowledge of populations at risk and does not exclude a complementary sociological study that could take into account the socio-cultural sensitivities of populations at risk

4.3 Behaviour-Reinforcing Attitudes of the Population at Risk and Actual Actions Were Taken by an Individual in His or Her Usual Context in the Control of Schistosomiasis

One might think that the fact that an individual or population knows that they are exposed to a disease should lead them to adapt their actions to avoid contracting the disease. But some authors (Drabo, 2014) have shown that prevention practices obey the realities on the ground and contextual logic. More than half of the respondents (57.69%) knew that schistosomiasis was present in their village through relatives or acquaintances who presented with haematuria or moelena. The risk of contracting the disease by frequenting the village water point was also known by 48.84% of respondents, as well as by ingesting contaminated water (51.54%).

Despite the risk, the majority of the respondents (63.57%) claimed to frequent the village water point. For each age group, more than half of the participants were involved in this activity and this figure reached 71.05% for children under 10 years old. The water point is at the center of the population's activities; it is used daily for housework, rice growing and other market gardening, or simply crossed to go to the fields, to the pasture, or to school, as shown by the distribution of respondents according to the occupation (Table 2). The children also bathe and play in it whenever the opportunity arises. With this contrast between knowledge of the risk of contracting the disease and almost daily exposure, it would be wise to help the population. Adapting the behavior of at-risk populations in order to minimize the risk of contracting the disease must be taking into account certain realities related to their socio-cultural context. The causal relationship between attitude and behavior has been extensively studied and documented and it appears that attitude can be manipulated to bring about behavioral change and vice versa (Abdmouleh, 2007). The modification of people's behavior could thus be achieved here by persuasive manipulation. This study shows a high recourse of the population to inappropriate behavior in case of schistosomiasis symptoms (self-medication, traditional healer). By means of prevention and awareness campaigns on the dangers of self-medication and the risk of complications from poor management of schistosomiasis. The attitude of the population could be changed in favor of more appropriate preventive and treatment behavior as shown in Figure 6. In addition to concrete actions targeting geographical and economic accessibility of care, environmental sanitation with the fight against the intermediate host, the treatment of livestock, and the construction of latrines.

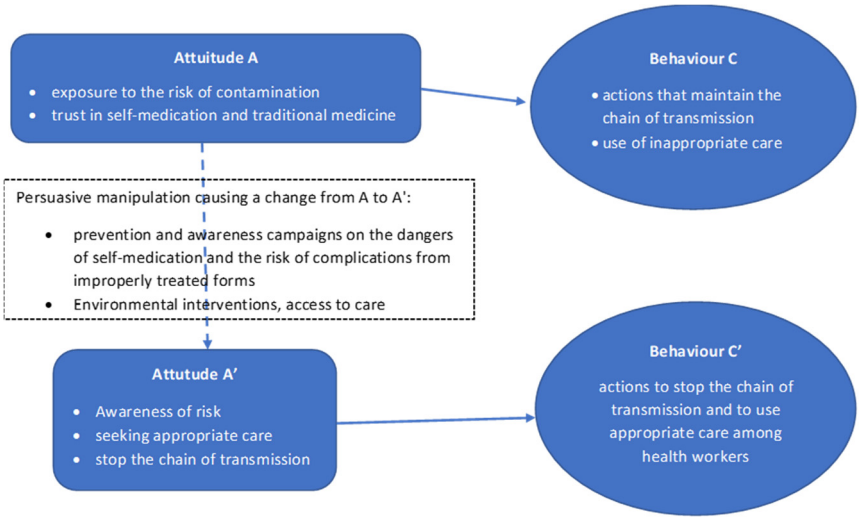

Figure 6. Changing attitudes to change behavior in schistosomiasis control (adapted from Abdmouleh, 2007)

The national control strategy based mainly on mass treatment with praziquantel is being implemented in the villages covered by this study. In this survey, 40.55% of the participants said that they were aware of the mass treatment campaigns, however, more than half of the participants (52.40%) did not think that these campaigns were effective in controlling the disease. The schistosomiasis control strategy documented by the World Health Organisation (WHO, 2022), in addition to the large-scale treatment of at-risk population groups, also relies on access to safe drinking water, improved sanitation, hygiene education, behavior change, gastropod control, and environmental management. Of all these interventions, which are certainly commendable, only the mass treatment of the population attracts people to the villages and therefore has a high profile. As a result, the population may think that the whole control strategy is limited to the distribution of praziquantel, omitting the other factors on which action should also be taken. This could explain their apprehension about mass treatment alone in the control of the disease. It would be benefic, as some authors said (Manjang, Ochola, & Elliott, 2022), to develop participatory approaches involving communities.

Research into the participants' history of schistosomiasis showed that 20.89% thought they had already contracted the disease and had presented with haematuria as their main symptom (39.81%). Following the onset of symptoms, 29.63% went to the clinic. Traditional (22.22%) or modern (15.74%) self-medication was the main recourse. Traditional self-medication was mainly root or leaf preparations. Of the participants who had already contracted the disease, 75% had not told their relatives because of fear or shame for some but for no apparent reason for most (79.2%). Fear of stigmatization or rejection can lead an individual to conceal his or her physical condition, thus directly or indirectly endangering his or her community. Increased access to relevant and quality information closely linked to the socio-cultural realities of our participants could help to reduce causes of deleterious behavior.

Mass distribution campaigns of praziquantel were periodically organized by the competent authorities throughout the country. However, only 33.08% of participants had already benefited from at least one mass distribution campaign of praziquantel, while 53.97% of all age groups said they had never benefited from one. The acceptability of praziquantel and modern treatments, in general, remains problematic for a large part of the population who prefer to rely on traditional medicine. This type of behavior contributes to maintaining the chain of transmission of the disease within the community. Despite national efforts to control schistosomiasis, the knowledge of the population is insufficient; their attitudes and practices to control this disease are globally inappropriate. it could be assumed that the decrease in prevalence as reported by some studies (Deol et al., 2019; Binder et al., 2020) seems to be more a result of the mass treatment strategy than a change in behavior. The measures to be implemented to improve the KAP of the population should take into account factors such as age, source of water supply, and history of schistosomiasis which have been identified by some authors (Li et al., 2019) as factors associated with KAP in schistosomiasis control.

5. Conclusion

This study on the knowledge, attitudes, and practices of the population at risk in schistosomiasis control provides valuable elements to be taken into account for the development of actions to be carried out in the communities at risk. It showed that there is a lack of knowledge among the population about schistosomiasis, as well as practices

and attitudes that contribute to maintaining the chain of transmission of schistosomiasis within the community.

In Burkina Faso, as in many other countries south of the Sahara, the deadline for the elimination of bilharzia, initially set for 2020, has been postponed to 2030 according to the new Roadmap for Neglected Tropical Diseases 2021-2030. This postponement, which could be seen as a failure of the disease eradication strategy, could also be seen as an opportunity for the country to update the implementation of the said strategy in the light of current knowledge and why not an opening towards other strategies such as vaccination.

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Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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