Epidemiology of Schistosomiasis in Two High-Risk Communities of South Côte d’Ivoire with Particular Emphasis on Pre-School–Aged Children

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Abstract. Schistosomiasis control efforts mainly target school–aged children. We studied the epidemiology of schistosomiasis in two high-risk communities in south Côte d’Ivoire, placing particular emphasis on pre-school–aged children.

INTRODUCTION

Schistosomiasis remains of considerable public health importance in sub-Saharan Africa.1–4 It is widely acknowledged that schistosomiasis infection prevalence and intensity curves show peaks in children aged 6–15 years, and then, prevalence and intensities decline gradually with age.5,6 Hence, the current global strategy emphasizes preventive chemotherapy (i.e., regular administration of the anthelmintic drug praziquantel), which is primarily targeted to school–aged children. Conversely, pre-school–aged children (below the age of 5 or 6 years) and adolescents/adults (16 years and above) are often neglected from preventive chemotherapy. Justification for the exclusion of the latter age group is given by the lower frequency of water contact compared with school–aged children and the development of an acquired protective immunity against schistosomiasis.7–9 With regard to pre-school–aged children, they are thought to be at low risk of schistosomiasis because of infrequent contact with freshwater bodies. Moreover, there is a paucity of pharmacokinetic data, including Kato–Katz, urine filtration, reagent strips, and urine circulating cathodic antigen cassettes. Risk factors for schistosomiasis were determined by focus group discussions and a structured questionnaire. The prevalence of Schistosoma mansoni in the two study villages among the pre-school–aged children (age < 6 years) was 20.9% and 25.0%, whereas several-fold higher prevalences were found in school–aged children (58.7–68.4%) and adolescents/adults (59.5–61.7%). The prevalence of S. haematobium in the three age groups was 5.9–17.3%, 10.9–18.4%, and 3.8–21.3%, respectively. Most participants had light-intensity infections. Mothers’ occupations and older siblings play important roles in the epidemiology of schistosomiasis in pre-schoolers. In the current epidemiologic settings, more attention is warranted on pre-school–aged children and adolescents/adults for successful schistosomiasis control.

MATERIALS AND METHODS

Ethical consideration and treatment. Ethical clearance was obtained from the Ministry of Health and Public Hygiene of Côte d’Ivoire (reference no. 4248/2010/MSHP/CNER). Village authorities were informed, and after they had agreed, the objectives, procedures, and potential risks and benefits of the study were explained to the heads of households by three of the authors (J.T.C., Y.K.N., and E.K.N.). Written informed consent or fingerprints (of illiterate people) were obtained from participants aged 16 years and above and parents or legal guardians on behalf of children (age < 16 years).

At the end of the study, free anthelmintic treatment was offered to the whole population in both villages (i.e., praziquantel, 40 mg/kg body weight using a dose pole against schistosomiasis; albendazole, 400 mg against soil-transmitted helminthiasis). For children aged < 6 years, praziquantel was given according to their weight using crushed 600-mg tablets; results on the efficacy and safety of crushed praziquantel tablets have been reported elsewhere.10,14

Population census and sample size calculation. A detailed census was carried out in June of 2011 as follows. After...
discussions with village authorities, four community members in each of the two villages were trained to conduct the census. All households were visited, and sociodemographic characteristics were collected (e.g., name, age, sex, relationship with household head, and main activity of each individual). The primary source for obtaining the children’s age was their birth certificate. In cases where birth certificates were not available, we checked the children’s vaccination card, which includes the birth date. The age of children without any of these two official documents was declared by the mothers. Unique identifiers (IDs) were attached to all households and the individual inhabitants. As a household, we considered a structure where people regularly share their food (most commonly, the household was a male household head, a woman, and the parents’ children). The village census revealed 931 and 783 individuals in Azaguie M’Brome and Azaguie Makouguï, respectively. Among them, there were 209 children below the age of 6 years in Azaguie M’Brome and 158 children below the age of 6 years in Azaguie Makouguï.

Sample size calculation for pre-school-aged children was done as follows. First, we assumed a prevalence of Schistosoma (either S. mansoni or S. haematobium) of 20% among pre-school-aged children (i.e., approximately one-quarter of the 80% S. mansoni infection prevalence observed in school-aged children in Azaguie in 2010). Second, we allowed for a relatively low compliance rate (70%) because of the difficulty of obtaining stool and urine samples from pre-school-aged children. Third, we considered an α-error of 5%. Thus, we needed approximately 300 pre-school-aged children. Because the total number of pre-school-aged children in the two villages was only slightly higher, we decided to invite all of them. For the sample size in the older age group (≥ 6 years), one-quarter of the total population was selected in each village (drawing every fourth household member using random number lists). Whenever the selection fell onto a pre-school-aged child, we selected the next individual until we reached the required sample size.

**Field procedures.** The geographic coordinates of all households where at least one pre-school-aged child was registered and water contact points were recorded using a handheld global positioning system (GPS) device (Garmin GPS map 62 ST; Bucher+Walt SA, St-Blaise, Switzerland).

Pre-school-aged children were asked to provide two stool and two urine samples over consecutive days. The day before sample collection, children’s mothers/guardians were given two empty containers, one for stool collection and one for urine collection. Filled containers (small portion of stool and 10 mL urine) were collected and labeled with unique IDs, and mothers/guardians were issued new empty containers for sample collection the next day. Given the difficulty of collecting biological samples in this age group, mothers/guardians were allowed to obtain samples from their young children at any time of the day (usually in the early morning hours). To have comparable data, stool and urine samples from older participants (school-aged children, adolescents, and adults) were also collected in the morning hours.

**Laboratory procedures.** Stool and urine samples were transferred to a laboratory in the Azaguie health center. Diagnostic work-up was completed on the day of sample collection. Duplicate Kato–Katz thick smears, using 41.7-mg templates, were prepared on microscope slides from each stool sample. Hence, our diagnostic approach consisted of quadruplicate Kato–Katz thick smears (two stool samples each subjected to duplicate Kato–Katz). The slides were allowed to clear for at least 30 minutes before microscopic examination for eggs of S. mansoni and soil-transmitted helminths by an experienced laboratory technician.

Four hundred eighty-eight urine samples were examined as follows. First, the samples were visually inspected and classified into clear, cloudy, or bloody (macrohmematuria). Second, microhmematuria was determined using reagent strips (Combur-test; Roche Diagnostics, Basel, Switzerland) using a semiquantitative assessment scheme: negative, 1+ (approximately 5–10 erythrocytes/μL urine), 2+ (approximately 25 erythrocytes/μL urine), 3+ (approximately 50 erythrocytes/μL urine), and 4+ (approximately 250 erythrocytes/μL urine). Third, urine samples were subjected to a circulating cathodic antigen (CCA) cassette test (Rapid Medical, Pretoria, South Africa) for S. mansoni diagnosis. Fourth, samples were subjected to a filtration method. In brief, samples were vigorously shaken, 10 mL were filtered using small-sized filters (aperture = 20 μm; Sefar, Heiden, Switzerland), samples were placed on a slide, and S. haematobium eggs were enumerated under a microscope by an experienced laboratory technician.

**Questionnaire survey and focus group discussions.** A structured questionnaire was administered to mothers/guardians of pre-school-aged children to determine risk factors for schistosomiasis. Before administration, our questionnaire was pre-tested with six women not otherwise involved in the study. The interviews were conducted in the local language (Abbey) by trained enumerators. Mothers/guardians’ education and profession, knowledge about schistosomiasis, recent history of migration, personal hygiene, common playing and recreational activities (placing particular emphasis on water activities of their children), and access to healthcare were determined.

Subsequently, in each village, based on the parasitological data, one focus group discussion (FGD) was done with mothers/guardians of Schistosoma-infected pre-school-aged children, and a second FGD was done with mothers/guardians of non-infected children. The FGDs were built around additional activities (placing particular emphasis on water activities of their children), and access to healthcare were determined. The interviews were conducted in the local language (Abbey) by trained enumerators. Mothers/guardians’ education and profession, knowledge about schistosomiasis, recent history of migration, personal hygiene, common playing and recreational activities (placing particular emphasis on water activities of their children), and access to healthcare were determined.

**Statistical analysis.** Parasitological and questionnaire data were entered twice into an Excel spreadsheet, transferred onto EpiInfo 3.2 (Centers for Disease Control and Prevention, Atlanta, GA), and cross-checked. All analyses were carried out in STATA version 10 (Stata Corp., College Station, TX). Participants with complete parasitologic data (i.e., quadruplicate Kato–Katz thick smears and duplicate urine filtration for all participants and an additional two urine CCA tests and two reagent strips) were included in the final analysis. Means and proportions of interest were calculated, and comparisons were done using Kruskal–Wallis and Pearson’s χ² tests.

The intensity of S. mansoni was expressed as eggs per 1 g stool (EPG) and categorized into light (1–99 EPG), moderate (100–399 EPG), and heavy (≥ 400 EPG) infections. The intensity of S. haematobium infection was grouped into light (1–49 eggs/10 mL urine) and heavy (≥ 50 eggs/10 mL urine) infections.

We used a logistic regression model to assess significant associations between a Schistosoma infection and sex, age, village, and mothers/guardians behavioral factors. For both Schistosoma species, a baseline model was established,
with infected pre-school–aged children defined as cases. Sex (as binary variable), age (as categorical variable), village (as binary variable), and mothers/guardians’ behavioral factors (as binary or categorical variable) were incorporated into the model. A backward elimination approach was used, and non-significant associations \((P > 0.2)\) were removed one at a time. Adjusted odds ratios (ORs), including 95% confidence intervals (CIs), were calculated.

To establish village-specific schistosomiasis risk maps for pre-schoolers, the geographic coordinates of each household inhabited by at least one child younger than 6 years and the water contact points indicated by the mothers/guardians were transformed into a universal transverse mercator (UTM) system and transferred into ArcView 3.2 (ESRI, Redlands, CA). Pre-school–aged children were stratified into schistosome-free, single species infection with either \(S. mansoni\) or \(S. haematobium\), or coinfection with both schistosome species.

### RESULTS

**Study adherence.** Figure 1 shows that 783 individuals were selected from both villages: 429 (54.8%) in Azaguie M’Bromé and 354 in Azaguie Makouguié. In Azaguie M’Bromé, there were 209 pre-school–aged children and 220 participants aged 6 years and above. In Azaguie Makouguié, there were 158 pre-schoolers and 196 older participants. Overall, 242 and 259 individuals had complete parasitologic data (i.e., quadruplicate Kato–Katz thick smears and two urine filtrations and for pre-school-aged children, two additional CCA cassette tests and two reagent strips) in Azaguie Makouguié and Azaguie M’Bromé, respectively.

**Demographic characteristics.** Table 1 summarizes the demographic characteristics of the study population stratified by pre-school–aged children (< 6 years), school–aged children (6–15 years), and adolescents/adults (> 15 years). Overall, the age of the pre-school–aged children ranged from 3 months to

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**Figure 1.** Flowchart detailing the study participation and adherence of pre-school–aged children and older participants (6 years and above) to submission of stool and urine samples for the diagnosis of \(S. mansoni\) and \(S. haematobium\) in Azaguie, south Côte d’Ivoire, in mid-2011 (\(M =\) males; \(F =\) females).
5.5 years, with a mean of 3.2 years. There were slightly more young girls than boys, but the difference was not statistically significant (130 versus 114; P > 0.05). Study participants from both villages showed similar age and sex profiles. For instance, the mean age of the three study groups in Azaguie Makouguie was 2.9 years (pre-school-aged children), 9.1 years (school-aged children), and 38.1 years (adolescents/adults), whereas the respective mean ages in Azaguie M’Brome were 3.3, 9.4, and 38.2 years. Regardless of the age group considered, no statistical difference was found between sexes in both villages (P > 0.05).

In Azaguie Makouguie, more than two-thirds of the mothers/guardians of pre-school-aged children were engaged in subsistence farming. Trading local goods was the second main occupation, which was reported by 27.5% of the interviewees. In Azaguie M’Brome, among the 122 mothers/guardians interviewed, 59 (48.4%) and 38 (31.1%) were engaged in subsistence farming and local trading, respectively (Table 2).

**Infection with S. mansoni.** Figure 2 shows the prevalence and intensity of S. mansoni infection stratified by age group and study village. According to quadruplicate Kato–Katz thick smears, the overall prevalence of S. mansoni was 42.7%, with a prevalence of 46.3% in Azaguie Makouguie and 39.4% in Azaguie M’Brome (no statistical difference between villages; P = 0.324).

In pre-school-aged children, based on a single Kato–Katz thick smear, the prevalence of S. mansoni was 14.3% (N = 35). Microscopic examination of quadruplicate Kato–Katz thick smears found 57 pre-school-aged children with S. mansoni eggs in their stool: 28 (25.5%) in Azaguie Makouguie and 29 (21.6%) in Azaguie M’Brome. More than twofold higher prevalence was found in school-aged children (Azaguie Makouguie: 68.4%, Azaguie M’Brome: 58.7%) and adolescents/adults (61.7% and 59.5%, respectively). Three-quarters of the infected pre-school-aged children had light infections (1–99 EPG), whereas only six pre-school-aged children had heavy S. mansoni infection (≥ 400 EPG): five in Azaguie M’Brome and one in Azaguie Makouguie. None of the children below the age of 24 months were found to be S. mansoni-positive in Azaguie Makouguie, but two such individuals (6.9%) were found in Azaguie M’Brome.

With regard to duplicate urine CCA cassette tests, including trace as positive results, 89 (81.7%) of the pre-school-aged children were found infected with S. mansoni in Azaguie Makouguie and 96 (72.2%) were found infected with S. mansoni in Azaguie M’Brome. Considering trace results as negative, the respective prevalences were 44.0% and 45.9%.

**Table 3** summarizes the groups’ arithmetic means of S. mansoni (and S. haematobium) egg counts. No difference was found in the arithmetic mean falcal egg counts of S. mansoni between males and females and between villages, regardless of whether analysis was done for pre-school-aged children or all age classes combined (all P > 0.05). However, village-specific analysis revealed that female school-aged children and adolescents/adults in Azaguie Makouguie had statistically significantly higher S. mansoni falcal egg counts (P < 0.001), whereas in Azaguie M’Brome, the falcal egg counts of males in both the school-aged (P < 0.001) and adolescents/adults groups were significantly higher compared with their female counterparts (P = 0.0008).

**Infection with S. haematobium.** Figure 3 shows the prevalence and intensity of S. haematobium infection stratified by age group and study village. In total, 62 individuals were found with S. haematobium eggs in their urine; hence, there was an overall prevalence of 12.4%. The prevalence of S. haematobium was considerably higher in Azaguie Makouguie compared with Azaguie M’Brome (19.0% versus 6.2%). Among 110 pre-school-aged children in Azaguie
S. haematobium

Makouguié and 134 pre-school-aged children in Azaguie M’Bromé, based on duplicate urine filtrations, 19 (17.3%) and 8 (5.9%) individuals were found with patent S. haematobium infections, respectively. The prevalence of S. haematobium was similar for males and females in both study villages (P > 0.05).

Visual inspection of urine among pre-schoolers revealed one case of macrohematuria in a 2-year-old child in Azaguie Makouguié; 19 (17.3%) and 14 (10.5%) pre-school-aged children had microhematuria in Azaguie Makouguié and Azaguie M’Bromé, respectively.

Among participants aged ≥ 6 years, 7 school-aged children (18.4%) and 20 adolescents/adults (21.3%) were found with patent S. haematobium infection in Azaguie Makouguié. In Azaguie M’Bromé, five school-aged children (10.9%) and three adolescents/adults (3.8%) were infected with S. haematobium. In both villages, most of the individuals had light S. haematobium infections (1–49 eggs/10 mL urine).

Figure 4 shows the spatial distribution of Schistosoma-infected pre-school-aged children as diagnosed by Kato–Katz (for S. mansoni) and urine filtration (for S. haematobium) and water contact points in Azaguie Makouguié and Azaguie M’Bromé. Schistosoma-infected pre-school-aged children were homogeneously distributed in Azaguie Makouguié. In Azaguie M’Bromé, Schistosoma cases were clustered among pre-schoolers living in households in close proximity to water contact sites.

Results from the questionnaire survey and FGDs. Table 2 summarizes the results obtained from the questionnaire administered to 202 mothers/guardians of pre-school-aged children in the two study villages. In Azaguie Makouguié, 22 of 80 mothers interviewed (27.5%) responded that their daily activities are strongly linked to water contact patterns, somewhat higher than in Azaguie M’Bromé (24/122, 19.7%).

Table 3

<table>
<thead>
<tr>
<th></th>
<th>Azaguie Makouguié arithmetic mean</th>
<th>Azaguie M’Bromé arithmetic mean</th>
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<tbody>
<tr>
<td>S. mansoni (EPG)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>242 (54.0–121.2)</td>
<td>53.2 (32.6–73.8)</td>
</tr>
<tr>
<td>&lt; 6 years</td>
<td>110 (27.9–49.4)</td>
<td>24.9 (1.8–48.0)</td>
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<tr>
<td>6–15 years</td>
<td>118.0 (0.0–482.4)</td>
<td>112.3 (22.6–201.9)</td>
</tr>
<tr>
<td>&gt; 15 years</td>
<td>55.3 (7.9–213.7)</td>
<td>67.1 (38.7–95.5)</td>
</tr>
<tr>
<td>S. haematobium (eggs/10 mL urine)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>242 (3.0–12.4)</td>
<td>1.8 (0.4–3.1)</td>
</tr>
<tr>
<td>&lt; 6 years</td>
<td>110 (4.9–9.3)</td>
<td>4.9 (0.9–1.2)</td>
</tr>
<tr>
<td>6–15 years</td>
<td>3.2 (0.6–5.8)</td>
<td>5.4 (0.0–13.6)</td>
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<tr>
<td>&gt; 15 years</td>
<td>3.7 (0.0–8.4)</td>
<td>1.0 (0.9–1.9)</td>
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*Kruskal–Wallis test.
and clay. The FGDs confirmed that most of the mothers lack detailed knowledge about schistosomiasis, but they know that contaminated water exposes their children to health risks.

**DISCUSSION**

Studies going back as far as the 1960s documented that, in specific social–ecological settings, young children suffer from schistosomiasis before reaching school age.20–24 However, in view of peak infection prevalence and intensities usually observed in the school–aged population6 and ease of implementing preventive chemotherapy through the education system, schistosomiasis control is centered on school–aged children. The lack of pharmacological data and an appropriate formulation of praziquantel for pre-schoolers are important reasons why this age group is largely excluded from preventive chemotherapy.25,26 However, pre-school–aged children might be particularly vulnerable to the negative consequences of an early-life infection with *Schistosoma*, because they would not get treatment until entering school.27 Additionally, adolescents and adults are given far less attention than the school–aged population when it comes to schistosomiasis control. Indeed, World Health Assembly (WHA) resolution 54.19 sets clear treatment coverage targets for the school–aged population, but it remains comparatively silent on other age groups.

Recent studies confirmed that pre-school–aged children are at risk of schistosomiasis, but in-depth epidemiologic investigations are few.12–14,28,29 It has also been discussed whether preventive chemotherapy should be extended from school–aged to pre-school–aged children.27,30–32 However, there are a number of issues that must be addressed before policy recommendations can be made regarding the inclusion of preschoolers in preventive chemotherapy. First, what is the true extent of *Schistosoma* infection in pre-school–aged children in different epidemiologic settings? Second, what are the key risk factors that drive the epidemiology of schistosomiasis in pre-school–aged children? Third, can the prevalence and intensity of schistosomiasis in school–aged children serve as proxies for pre-school–aged children and adolescents/adults to better target control and enhance disease burden assessment?

The current study, pursuing a cross-sectional design, deepened our understanding of the epidemiology of schistosomiasis in two villages in south Côte d’Ivoire that are highly endemic for schistosomiasis but have not been subjected to large-scale

**Table 4**

<table>
<thead>
<tr>
<th>Association</th>
<th>Adjusted OR (95% CI)</th>
<th>P</th>
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<tbody>
<tr>
<td><em>S. mansoni</em></td>
<td></td>
<td></td>
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<tr>
<td><em>S. haematobium</em></td>
<td>9.4 (5.1–17.2)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Children ages &lt; 24 months (reference)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Age group (2–5 years)</td>
<td>8.8 (3.3–23.5)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Children accompanying their mothers to livelihood activities (reference)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Children stayed at home with their elders</td>
<td>2.3 (1.5–3.5)</td>
<td>0.017</td>
</tr>
<tr>
<td><em>S. haematobium</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>S. mansoni</em></td>
<td>11.7 (6.4–21.4)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Azagué M’Bromé (reference)</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Azagué Makouguié</td>
<td>3.6 (1.9–6.6)</td>
<td>0.008</td>
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Logistic regression was used to assess the association between schistosome (*S. mansoni* and *S. haematobium*) infections adjusted by age and village and the association between *S. mansoni* or *S. haematobium* as outcome and *S. mansoni* or *S. haematobium*, age (< 24 months and 2–5 years), and village (Azagué Makouguié and Azagué M’Bromé) as explanatory variable. Age category < 24 months was used as baseline for comparison with age category 2–5 years. Azagué M’Bromé was used as baseline for comparison with Azagué Makouguié. *S. mansoni* and *S. haematobium* infections results were expressed as binary variables (positive/negative).
administration of praziquantel before. We used a reasonably sensitive diagnostic approach with quadruplicate Kato–Katz thick smears for the diagnosis of *S. mansoni* and duplicate urine filtration for detection of *S. haematobium* eggs in all study participants. Additionally, in pre-school–aged children, a reagent strip was used for assessment of microhematuria, and a urine CCA cassette test was used for diagnosis of *S. mansoni*.

Our study confirmed that pre-school–aged children are at risk of schistosomiasis. One boy, before reaching his first birthday (8 months), had a patent *S. mansoni* infection, which was revealed by the Kato–Katz technique. Considering urine CCA test results, the earliest infection with *S. mansoni* was found in a 3-month-old boy. Previous studies have highlighted such early *Schistosoma* infection in areas of high endemity. The negative health impact of such early infections has been emphasized. Our observation of CCA detected in the urine of a child as young as 3 months in the absence of *S. mansoni* eggs in fecal samples is in line with recent observations from a study in Uganda using different approaches for detecting *Schistosoma* infections in pre-school–aged children. It might be explained by CCA from the mothers' colostrums or CCA produced by the young developing stages of the worm before patency (hence, before egg production commences). New research is needed to further elucidate this issue, which will be important to clarify operational research and control issues and help interpret diagnostic results. First, assuming that infants receive CCA from their mothers' colostrums would jeopardize the use of urine CCA as a diagnostic assay in very young children. Indeed, based on positive urine CCA test results in the pre-school–aged population, one might suggest extending preventive chemotherapy to this age group. Second, if CCAs...
are accrued from juvenile worms, CCA might be an early indicator, allowing for efficient surveillance of schistosomiasis in endemic areas. However, because praziquantel is not effective against the young developing stages of *S. mansoni*, treatment must be scheduled accordingly.

Overall, between 5.9% and 21.6% of the pre-school-aged children investigated had patent *S. haematobium* (the prevalence could be underestimated because of our urine sample collection approach), and between 17.3% and 25.5% of the pre-school-aged children investigated had patent *S. mansoni* infections. Conversely, between 5.2% and 10.9% of the pre-school-aged children were coinfected, which is considerably higher than what would have been expected by chance (i.e., 1.0–5.5%). Our findings corroborate with recent results presented by Garba and others from highly endemic villages in Niger. The consequences of dual species infections in the same body of pre-school-aged children have yet to be investigated.

In the present study, most of the *S. mansoni* and *S. haematobium* infections in pre-school-aged children were of light intensity, which is in line with studies carried out elsewhere in sub-Saharan Africa. Nevertheless, we observed 12 (4.9%) pre-school-aged children heavily infected with either *S. mansoni* (≥ 400 EPG) or *S. haematobium* (≥ 50 eggs/10 mL urine). All of these children were above 3 years of age. To our knowledge, pre-school-aged children never received praziquantel treatment in the current study settings. Hence, the heavy infections observed in 12 pre-school-aged children above the age of 3 years are the likely result of very early infection followed by cumulative infections over time.

For both *Schistosoma* species, we observed specific age-prevalence curves and intensities in both study villages. Although it is commonly believed that the peak of *Schistosoma* infection prevalence occurs in children between 6 and 15 years of age (school age), age patterns in the intensity of infection are less clear cut, with variations generally attributed to the level of contact with contaminated freshwater bodies. In our study, considering the burden of schistosomiasis as expressed by arithmetic mean egg counts, we concur that, in both communities, pre-school-aged children, regardless of their sex, were similarly exposed to contaminated freshwater bodies. However, in school-aged children, adolescents, and adults, *S. mansoni* infection intensities were sex-dependent (higher risk in males), whereas for *S. haematobium*, no sex difference was observed. Hence, sociocultural factors might govern sex-specific water use. Additionally, setting-specific abiotic and biotic features govern the development of intermediate host snails. Taken together, the interplay of these factors could explain the observed age prevalence and intensities profiles.

In addition to our parasitologic investigations, we also determined risk factors for schistosomiasis in pre-school-aged children by conducting a series of FGDs with mothers and administering a structured questionnaire. Interestingly, we found no difference in common water use practices between mothers of *Schistosoma*-infected and non-infected children. Hence, no specific behavior of mothers could explain the difference in the infection status of pre-school-aged children. The questionnaire showed that, in both villages, most mothers left their young children at home with their elder siblings when pursuing daily livelihood activities in the fields, near water bodies, or at the market. Multivari-
REFERENCES


