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Research Article

Urogenital Schistosomiasis: Survey Among Aged 10 and Above in the Tambacounda Health District (Senegal)

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Abstract

Introduction: This study focuses on the persistence of urogenital schistosomiasis (8%) in the Tambacounda Health District, despite mass treatment efforts with Praziquantel targeting individuals aged 5–14 in 2023. The main objectives are to evaluate the current prevalence of the disease, identify factors contributing to its persistence, and assess the acceptability of implemented preventive measures. *Methods:* A descriptive and analytical study was conducted in August 2024, targeting individuals aged 10 and above. Data collection was performed using Kobo Collect, and analysis was carried out with R 4.4.1. Binary logistic regression was applied to identify factors associated with the occurrence of urogenital schistosomiasis. *Results:* Preventive measures were accepted by 83.47% of participants, while 14.6% reported a history of hematuria, but only 7.5% presented hematuria during the survey. Urine dipstick testing detected hematuria in 22.5% of participants, and 5.7% tested positive for *Schistosoma haematobium* eggs, corresponding to a prevalence of 1.98% among individuals aged 10–14 and 7.44% among those aged 15 and above. Therapeutic coverage was high among individuals aged 10–14 (88.12%). In multivariate analysis, the factors significantly associated with the occurrence of urogenital schistosomiasis were knowledge of the disease (ORa = 6.32 [1.61–31.8], p = 0.026), seeking medical care (ORa = 10.87 [2.83–48.1], p < 0.001), experiencing side effects after treatment (ORa = 43.71 [2.9–70.7], p = 0.003), and positive results on the urine dipstick test (ORa = 118.44 [11.12–126.12], p < 0.001). *Conclusion:* The Tambacounda Health District remains endemic for urogenital schistosomiasis despite mass treatment campaigns targeting individuals aged 5–14. Recommendations include strengthening health education, systematic urine dipstick screening, and implementing two rounds of Praziquantel treatment.

Keywords

Urogenital, Schistosomiasis, Tambacounda, Senegal

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1. Introduction

Urogenital schistosomiasis (UGS) is a parasitic disease caused by the trematode *Schistosoma haematobium*, which infects the urinary tract and surrounding tissues [1]. Transmission occurs primarily through contact with contaminated freshwater, where the cercariae, the parasite's larvae, penetrate the skin causing dermatitis [2]. In the chronic phase, symptoms include hematuria, pelvic pain, and recurrent urinary infections, which can lead to severe complications such as chronic bladder lesions [3].

Endemic mainly in sub-Saharan Africa, urogenital schistosomiasis affects more than 700 million people across 78 countries, with particularly high prevalence in 51 of these countries, where nearly 90% of global cases and deaths occur [4, 5]. The diagnosis of urogenital schistosomiasis is made by microscopic examination of urine, and treatment relies on the use of Praziquantel [3].

The World Health Organization (WHO) classifies the endemicity of schistosomiasis into three categories: low when the prevalence is below 10%, moderate when it ranges from 10% to 50%, and high when it exceeds 50% [6]. In 2013, mapping in Senegal revealed that 59 out of 72 districts were endemic for schistosomiasis, with high endemicity in the regions of Tambacounda and Kédougou. Despite annual mass distribution of Praziquantel, which reaches over 80% coverage in these districts, the disease remains highly prevalent [7]. In 2017, a study recorded an average incidence of 28% of schistosomiasis at the regional hospital in Tambacounda from 2017 [8].

In 2023, an impact assessment of urogenital schistosomiasis treatment revealed a low prevalence of 8% for the district, with variations ranging from 0% in 10 of the 15 surveyed health posts to 91% at the Bohé Baldédji health post [9]. This situation highlights the complexity of controlling urogenital schistosomiasis and underscores the need to understand the factors underlying its persistence despite mass treatment with Praziquantel.

The persistence of the disease is exacerbated by factors such as poor hygiene, outdoor urination practices, activities in freshwater environments [4, 10], and disruptions caused by the COVID-19 pandemic, which limited access to preventive treatments [11]. This situation emphasizes the urgency of adapting prevention and control strategies to local conditions to improve the effectiveness of interventions and better understand the barriers to the acceptability of the preventive measures proposed to the population.

It is therefore crucial to evaluate the prevalence of urogenital schistosomiasis in the Tambacounda health district, focusing particularly on the age groups under 10 to 14 years and over 14 years. Additionally, it is important to identify the determinants and factors associated with its persistence and to evaluate the acceptability of preventive measures against urogenital schistosomiasis by these individuals. Moreover, the acceptability of preventive measures may vary between health posts and be influenced by awareness, cultural perceptions, and access to care in these different areas.

The objectives of the research are to determine the prevalence of urogenital schistosomiasis in the Tambacounda health district for those aged 10 and older, identify the determinants and factors associated with this prevalence such as hygiene conditions and practices in freshwater areas, and evaluate the acceptability of the recommended preventive measures, taking into account awareness, cultural perceptions, and access to care within the district.

2. Methodology

2.1. Study Framework

Our study was conducted in the Tambacounda health district, which had a population of 340,805 inhabitants in 2024, covering an area of 11,416 km², with a population density of 29.85 inhabitants per km². It had a level II hospital, one reference health center, five secondary health centers, 28 health posts, and 27 health huts [12].

In 2023, the impact assessment of urogenital schistosomiasis treatment revealed a low overall prevalence of 8%, with variations ranging from 0% in 10 of the 15 surveyed health posts to 91% at the Bohé Baldédji health post [9].

2.2. Study Type, Period, and Population

We conducted a descriptive and analytical study during the August 2024. The target population for this study consisted of the inhabitants of the Tambacounda health district.

2.3. Inclusion and Non-inclusion Criteria

All individuals aged above 10 years residing in the Tambacounda department who were present in the targeted households and had given their informed consent to participate in the study were included.

Excluded from the study were individuals aged above 10 years but not residing in the department, absentees, refusals, and those with circumstances preventing their participation.

2.4. Sampling

The sample size was calculated using Swartz's formula [13, 14]: $n = Z^2 \times p \times (1 - p) / E^2$, where:

1) Z is the value corresponding to a 95% confidence level, which is 1.96;
2) p is the estimated proportion of the population having the characteristic, set at 30% by averaging the prevalence rates from the impact assessment [7] and those found during the district mapping [9];
3) E is the desired margin of error, set at 5%.

This calculation gave a sample size of n = 336. Adding the cluster effect, which was set at 1.5, gives n' = 336 × 1.5 = 504. With an additional 10% for non-respondents, we obtain n'' = 554. The final sample size is set at 576 individuals, distributed into 24 clusters of 24 people each, with one cluster per village or neighborhood, consisting of 12 boys and 12 girls, and 6 individuals in each age group (1-5 years, 5-10 years, 10-14 years, and 14 years and older). A two-stage stratified survey was used to ensure representativeness. Thus, 12 health posts were selected by simple random sampling without replacement, and for each of them, 2 villages or neighborhoods were randomly selected, with 48 individuals per structure. In each village, households were chosen randomly, and all individuals present in the selected households were included in the study. For individuals aged 1 to 10 years of age, mothers or guardians were interviewed, while individuals aged 10 years and older were interviewed directly. This article includes only the data collected from mothers or guardians of children under 10 years old, with an expected 288 individuals.

2.5. Data Collection

Data collection was carried out using a structured closed questionnaire via Kobo Collect. The interviewers conducted face-to-face interviews with mothers or guardians and individuals aged 10 years and older in the 4 selected villages for each health post. Responses were recorded on forms, and each session lasted about 15 to 20 minutes.

The urine samples (50 ml) from children under 10 years old were collected in the morning, with the consent of the mothers or guardians and the assent of the children, following aseptic procedures. The samples were transported to the laboratory, where the filtration method was used for analysis. The results were then assigned based on microscopic examination.

2.6. Operational Definition of Variables

The dependent variable was the presence or no of Schistosoma haematobium eggs in the characteristic microscopic examination for urogenital schistosomiasis (UGS), using the filtration technique [1].

The independent variables were related to knowledge, attitudes, practices, the acceptability of preventive measures, and clinical and therapeutic data.

2.7. Data Analysis

Descriptive analysis was used to assess knowledge, attitudes, practices, the acceptability of preventive measures, as well as clinical and therapeutic data. Chi-squared or Fisher's tests were used in bivariate analysis to examine factors associated with UGS for categorical variables. Logistic regression was used to identify factors associated with the occurrence of urogenital schistosomiasis at a significance level of 0.5% [15-19].

2.8. Ethical Considerations

The protocol received approval from the National Ethics Committee for Health Research (CNERS) under Nº. 179/MSAS/CNERS/SP on July 15, 2024 [20] and the administrative authorization from the Directorate of Planning, Statistics, and Research (DPSR) under Nº. 1062 on July 16, 2024 [21]. Informed consent from mothers or guardians was obtained by explaining the study's objectives, procedures, risks, and benefits.

3. Results

3.1. Descriptive Study

A total of 316 individuals aged 10 to 72 years were surveyed.

3.1.1. Distribution According to Sociodemographic Characteristics, Knowledge, and Attitudes Towards UGS

There sample (316 individuals, aged 10–72 years) and was predominantly composed of women (63.9%) and individuals aged 15 and older (68%), with a majority having some level of education (56.6%). Knowledge of UGS is relatively low (46.8%), although most of those informed are familiar with the main symptoms (75.68%). Knowledge of transmission modes (59.46%) and curative treatment (63.51%) is moderate, as is knowledge of preventive methods (54.73%). A large majority of participants are willing to discuss the disease (73.7%) and intend to seek care if needed (81%). However, 53.5% of participants do not intend to expose themselves to freshwater sources. (Table 1).

Table 1. *Distribution according to socio-demographic characteristics and knowledge of urogenital schistosomiasis (UGS).*

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
1. Distribution by sex		
Male	114	36.1
Female	202	63.9
2. Distribution by education		
Yes	179	56.6
No	137	43.1
2. Distribution by age		
Under 5 years	101	32

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
5 to 10 years	215	68
4. Knowledge of UGS		
Yes	148	46.8
No	168	53.2
5. Information on UGS		
Yes	129	87.16
Np	19	12.84
6. Knowledge of main symptoms		
Yes	112	75.68
No	36	24.32
7. Knowledge of modes of transmission		
Yes	88	59.46
No	60	40.54
8. Knowledge of curative treatment		
Yes	94	63.51
No	54	36.49
9. Knowledge of prevention methods		
Yes	81	54.73
No	67	42.57
10. Wiling ness to discuss the disease		
Yes	233	73.7
No	83	26.3
11. Intention to seek care		
Yes	256	81
No	60	19
12. Intention to allow freshwater exposure		
Yes	147	46.5
No	169	53.5

3.1.2. Distribution According to Attitudes, Practices, Medical History, Clinical, Paraclinical, and Therapeutic Characteristics

The results show that 71.74% of participants have discussed their illness with someone, and 95.65% sought medical care. Also 42.1% reported frequenting freshwater sources, while 87% accepted preventive measures. A history of hematuria was reported by 14.6% of participants, but only 2.2% had hematuria during the survey. Urine test strip results were positive in 22.5% of cases, and therapeutic coverage was particularly high among the 10-14 age group (88.12%). Only 3.37% experienced side effects from the treatment. Microscopic examination revealed the presence of *Schistosoma haematobium* eggs in 5.7% of participants, with a prevalence of 1.98% in the 10-14 age group and 7.44% in those aged 15 and older (Table 2).

Table 2. *Distribution according to attitudes, practices, medical history, clinical, paraclinical, and therapeutic characteristics.*

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
1. Allowed to frequent freshwater		
Yes	133	42,1
No	183	57.9
2. Discussed the disease with someone		
Yes	33	71.74
No	13	28.26
3. Sought medical care		
Yes	44	95.65
No	2	4.45
4. Acceptability of preventive measures		
Yes	275	87
No	41	13
5. Notion of previous hematuria		
Yes	46	14.6
No	270	85,4
6. Hematuria at the time of the survey		
Yes	7	2.2
No	309	97.8
7. Treatment for schistosomiasis (10 to 14 years)		
Yes	89	88.12
No	12	11.88
8. Existence of side effects		
Yes	6	6.74
No	83	93.26
9. Urine test strip results		
Yes	71	22.5
No	245	77,5
10. Presence of schistosoma haematobium		
Yes	18	5.7
No	289	94.3
11. Prevalence by age group:		
10 to 14 years old	2	1.98

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
15 years and above	16	7.44

3.2. Analytical Study

3.2.1. Identification of Factors Associated with UGS in Bivariate Analysis

In the bivariate analysis, the factors significantly associated with the presence of urogenital schistosomiasis were: lack of education (ORb = 3.60 [1.14–11.41]; p = 0.021), seeking medical care (ORb = 4.58 [1.55–13.58]; p = 0.006), a history of hematuria (ORb = 4.18 [1.44–12.1]; p = 0.008), a positive urine strip test (ORb = 21.52 [6.02–76.96]; p < 0.001), and treatment-related side effects (OR = 8.92 [1.5–53.13]; p = 0.04) (Table 3).

Table 3. Identification of factors associated with urogenital schistosomiasis (UGS) in bivariate analysis.

Variables	p value	ORb	$CI_{95\%}$
Aged 10 to 14 years	0.046*	3.72	[1.02-26]
Female sex	0.997	1.14	[0.4-3.3]
School education	0.013*	3.57	[1.3-11.16]
Knowledge of UGS	0.056	3.18	[1.1-11.7]
Informed about UGS	0.16	2.46	[0.851-9.1]
Knowledge of symptoms	0.144	2.76	[0.88-12.7]
Knowledge of transmission	0.214	3.7	[0.73-90.2]
Knowledge of treatment	0.13	3.34	[0.57-14.7]
Knowledge of prevention	0.382	2.09	[0.43-3.23]
Frequent freshwater contact	0.97	1.14	[0.87-7.14]
Preventive measures acceptance	0.668	2.83	[0.85-8.12]
Talked about the disease	0.105	2.7	[0.71-8.25]
Seeking medical care	0.006*	4.49	[1.54-12.3]
History of hematuria	0.008*	4.23	[1.45-11.6]
Hematuria in the survey	0.339	3.16	[0,12-20.8]
Treated against UGS	0.054	6.26	[1.26-15.2]
Presence of side effects	0.04*	9.32	[1.09-54.8]
Positive urine test strip	<0.001*	20.5	[6.42-94.9]

3.2.2. Factors Associated with UGS in Multi Variate Analysis

In multivariate analysis, the factors statistically significantly associated with the occurrence of urogenital schistosomiasis were: knowledge of the disease (ORa = 6.32 [1.61–31.8], p = 0.026), seeking medical care (ORa = 10.87 [2.83–48.1], p < 0.001), the presence of side effects after treatment (ORa = 43.71 [2.9–70.7], p = 0.003), and a positive urinary strip test (ORa = 118.44 [11.12–126], p < 0.001) (Table 4).

Table 4. Identification of factors associated with urogenital schistosomiasis (UGS) in multivariate analysis.

Variables	p value	ORa	$CI_{95\%}$
Aged 10 to 14 years	0.319	4.01	[0.26-61.52]
Female sex	0.793	1.31	[0.9-7.65]
School education	0.694	1.36	[0.3-6.16]
Knowledge of UGS	0.026*	6.32	[1.61-31.8]
Informed about UGS	0.798	2.54	[0.81-7.87]
Knowledge of symptoms	0.819	1.6	[0.3-89.8]
Knowledge of transmission	0.523	4.02	[0.6-28.9]
Knowledge of treatment	0.826	0.67	[0.2-24.5]
Knowledge of prevention	0.142	0.6	[0.2-5]
Frequent freshwater contact	0.093	3.62	[0.81-16.29]
Accepted prevention	0.186	3.01	[0.59-15.41]
Talked about the disease	0.879	1.25	[0.7-23.34]
Seeking medical care	<0.001*	10.87	[2.83-48.1]
History of hematuria	0.402	5.55	[0.1-30.48]
Hematuria in the survey	0.078	10.5	[1.13-29.12]
Treated against UGS	0.782	0.59	[0.1-23.65]
Presence of side effects	0.003*	43.71	[2.9-70.7]
Positive urine test strip	<0.001*	118.4	[11.12-126]

4. Discussion

4.1. Socio-demographic Characteristics, Knowledge, and Attitudes Regarding UGS

Knowledge of urogenital schistosomiasis (UGS) remains insufficient, with a rate of 46.8%, although it is slightly higher than the 42.7% reported in Togo in 2019 by Djagadou et *al.* [21]. Among those who were informed, 87.16% received information from healthcare workers, highlighting their central role in raising awareness. While symptom recognition is high (75.68%), understanding of transmission modes (59.46%), curative treatment (63.51%), and preventive measures (54.73%) remains moderate. These findings reflect similar gaps observed in Benin, where only 25.89% of participants had sufficient knowledge [23]. This emphasizes the

need to strengthen awareness campaigns to improve the prevention and management of UGS [21-23].

4.2. Attitudes, Practices, Clinical, Paraclinical, and Therapeutic Characteristics

Side effects following treatment were reported by only 3.37% of participants, a significantly lower rate compared to the 92% of children affected in Sulawesi as observed by Putri et *al.* [24]. This discrepancy may result from differences in study populations, treatment conditions, or methodologies. Although 95.56% of participants discussed their illness and 71.14% shared their experiences with others, 42.1% continued frequenting freshwater sources, a high-risk behavior for reinfection [5, 25]. Despite strong acceptance of preventive measures (87%), ongoing exposure to contaminated water highlights the urgent need for improved education on risky behaviors and more effective prevention strategies [9, 26].

A history of hematuria was noted by 14.6% of participants, though only 2.2% showed symptoms during the survey. Urine dipstick tests were positive in 22.5% of cases, and 5.7% of samples contained Schistosoma haematobium eggs. The prevalence of UGS was 1.98% in the 10–14 age group and 7.44% in those aged 15 and above. These prevalence rates are lower than in Nigeria (69%) [27], higher than in Tanzania (6.9%) [28], and similar to Cameroon (31.5%) [26], differences likely reflecting variations in environmental conditions, control program effectiveness, or diagnostic techniques.

Regarding treatment, 88.12% of participants received care for UGS, exceeding the 54.29% coverage observed in Benin by Agossoukpe et *al.* [23] but below the national target of 80% [14]. This emphasizes better treatment outcomes among younger individuals while highlighting the need for targeted efforts to boost coverage in older age groups.

4.3. Factors Associated with Urogenital Schistosomiasis (UGS)

Knowledge of urogenital schistosomiasis (UGS) is strongly associated with an increased risk of infection (ORa = 6.32 [1.61–31.8], p = 0.026), indicating that such knowledge is vital for early detection and diagnosis [29]. In our study, frequent contact with freshwater sources (ORa = 3.62 [0.81–16.29], p = 0.093) and the rejection of preventive measures (ORa = 3.01 [0.59–15.41], p = 0.186) were not significantly linked to the occurrence of UGS. However, similar connections between freshwater exposure and UGS were found in studies in Nigeria (Balogun et *al.*) [27] and Tanzania (Nazareth et *al.*) [28]. These discrepancies may be due to the relatively low prevalence of the disease (5.7%) in the study area, where freshwater sources may be less contaminated compared to higher-prevalence regions (26.34%) [30].

Seeking medical care was strongly associated with the occurrence of UGS (ORa = 10.87 [2.83–48.1], p < 0.001), emphasizing the impact of symptoms in driving individuals to seek care and highlighting the importance of screening and health education to improve early detection and treatment. Experiencing side effects from Praziquantel treatment (ORa = 43.71 [2.9–70.7], p = 0.003) was also associated with the persistence of UGS, underscoring the need for effective management of adverse reactions and additional treatment rounds.

Although a history of hematuria (p = 0.402) and its presence at the time of the survey (p = 0.078) were not found to be significantly associated with UGS, a positive urine dipstick test (ORa = 118.44 [11.12–126.12], p < 0.001) showed a strong correlation with infection. This suggests that the urine dipstick is a reliable diagnostic tool for detecting UGS, especially in areas with high disease prevalence (≥50%), and should be utilized for systematic early screening in such regions [31].

4.4. Study Limitations

The study may be subject to response biases, compromising the accuracy of the information provided. The diagnostic methods used may also underestimate the prevalence of infections. Furthermore, the assessment of knowledge and attitudes may not reflect actual behaviors, and the persistence of risky behaviors suggests that the interventions may not be sufficient.

5. Conclusions

This study reveals ongoing gaps in knowledge and behavior regarding urogenital schistosomiasis in the Tambacounda region, despite higher levels of awareness compared to other settings. While most participants are familiar with the symptoms and preventive measures, the risk of reinfection remains high due to continued exposure to contaminated freshwater sources. The positive associations between seeking medical care, urine strip test results, and side effects after treatment highlight the need for improvements in both healthcare access and the management of treatment side effects to promote better adherence. The findings stress the urgent need to enhance education, prevention, and treatment efforts, particularly among the most vulnerable groups, in order to reduce urogenital schistosomiasis prevalence. Finally, the limitations of the study point to the necessity of further research to refine strategies for addressing this endemic disease.

Abbreviations

UGS	Uro Genital Schistosomiasis
WHO	World Health Organization
COVID	Corona Virus Disease
*	Asterisk Indicates Statistical Significance
ORb	Brute Odds Ratio
ORa	Adjusted Odds Radio

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Author Contributions

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Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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Biography

El Hadji Cheikh Abdoulaye Diop is a medical practitioner and public health researcher, specializing in infectious and tropical diseases, community health, and preventive medicine. He holds a master's degree in public health with a specialization in epidemiology, a master's degree in project management, and another master's degree in community health, focusing on monitoring and evaluation. With over 10 years of experience in public health and preventive medicine, Dr. Diop currently serves as the district medical officer in the Tambacounda health district. His research focuses on the fight against cervical cancer, the prevention of infectious and tropical diseases, and digital health payment systems. He is also finalizing his doctoral thesis in public health, which examines the determinants of the persistence of urogenital schistosomiasis in the Tambacounda department.

Research Field

El Hadji Cheikh Abdoulaye Diop: Biostatistics and epidemiology, Infectious and tropical diseases, Health policy and healthcare management, Behavioral and community health, Non communicable diseases, Preventive medicine

Mamadou Makhtar Mbacké Leye: Biostatistics and epidemiology, Health economics, Health finance, Health policy and healthcare management, Behavioral and community health, Preventive medicine

Adda Ndew Dog: Biostatistics and epidemiology, Infectious and tropical diseases, Health policy and healthcare management, Behavioral and community health, Non communicable diseases, Preventive medicine

Ndèye Mbacké Kane: Negliged tropical diseases, Health policy and healthcare management, Behavioral and community health, Preventive medicine

Bayal Cissé Public health, Gynecology and obstetrics, Health policy and healthcare management, Non communicable diseases, Preventive medicine

Dossolo Sanogo: General practice, Public health