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Research Article

Urogenital Schistosomiasis: Survey Among Caregiving Mothers and Children Aged 1 to 10 Years 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 among 5-14-year-olds in 2023. The objectives of this study are to evaluate the current prevalence of the disease, identify the factors contributing to its persistence, and assess the acceptability of preventive measures implemented. *Methods:* We conducted a descriptive and analytical study in August 2024. The target population consisted of mothers or guardians of children under 10 years old. Data were collected using Kobo Collect, and analysis was performed with R 4.4.1. Binary logistic regression was used to identify the factors associated with the occurrence of urogenital schistosomiasis. *Results:* The majority (93.5%) accepted preventive measures, and 9.2% showed hematuria. Among 5-10-year-olds, 84.44% received treatment. Urine test strips were positive for 14.2% of them, and 6.1% were carrying Schistosoma haematobium eggs. The prevalence of urogenital schistosomiasis in 5-10-year-olds was 7.88%, compared to 3.7% in those under 5 years old. The factors significantly associated with the occurrence of urogenital schistosomiasis were: seeking healthcare for children by mothers or guardians (ORa = 5.6 [1.11; 32.8]; p = 0.04) and positive urine test strips (p = 0.004, ORa = 71.13 [17.84; 49.49]; p = 0.004). *Conclusion:* This study highlights the persistence of urogenital schistosomiasis in the Tambacounda health district, despite mass treatment campaigns. Although the acceptability of preventive measures is high, these results underscore the need to strengthen prevention, awareness, and treatment strategies.

Keywords

Schistosomiasis, Urogenital, Mothers, Guardians, Children, Tambacounda, Senegal

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1. Introduction

Schistosomiasis, or urogenital bilharzia, is a parasitic disease caused by the trematode *Schistosoma haematobium*, which infects the urinary tract and surrounding tissues [1]. Transmission primarily occurs through contact with contaminated fresh water, where the furcocercariae, the larval form of the parasite, penetrate the skin causing dermatitis [2]. In the chronic phase, symptoms include hematuria, pelvic pain, and recurrent urinary infections, and can lead to severe complications such as chronic bladder lesions [3].

Endemic primarily in sub-Saharan Africa, urogenital bilharzia affects over 700 million people in 78 countries, with particularly high prevalence in 51 of them, accounting for nearly 90% of global cases and deaths [4, 5]. Diagnosis of urogenital bilharzia is made through microscopic examination of urine, and treatment, both curative and preventive, mainly relies on Praziquantel [3].

The World Health Organization (WHO) defines the level of endemicity for bilharzia as follows: low if the prevalence is less than or equal to 10%, moderate if it is between 10% and 50%, and high if it is greater than or equal to 50% [6]. In Senegal, mapping in 2013 revealed that 59 out of 72 districts were endemic for bilharzia, with high endemicity in the regions of Tambacounda and Kédougou. Despite annual Praziquantel distribution campaigns reaching over 80% coverage in these districts, the disease remains highly prevalent [7]. In 2017, a study showed an average incidence of 28% of bilharzia at the Tambacounda regional hospital in 2017 [8].

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

The high persistence of the disease is exacerbated by factors such as poor hygiene, open-air urination practices [4, 10], and disruptions caused by the COVID-19 pandemic, which reduced access to appropriate preventive treatments [11]. This situation emphasizes the urgent need to adapt prevention and control strategies to local specificities in order to improve the effectiveness of interventions and better understand the barriers to the acceptability of recommended preventive measures by local populations.

Therefore, it is crucial to assess the prevalence of urogenital bilharzia in the Tambacounda health district, focusing particularly on children under 5 years and those aged 5 to 10 years. Additionally, it is important to identify the determinants and factors associated with its persistence, as well as assess the acceptability of preventive measures against urogenital bilharzia by mothers or caregivers of these children. Furthermore, the acceptability of preventive measures would vary according to 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 urinary bilharziasis in the Tambacounda health district, identify the determinants and factors associated with this prevalence, such as hygiene conditions and practices in freshwater zones, and evaluate the acceptability of the recommended measures in place, considering 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 km ², resulting in a density of 29.85 inhabitants per km ². The district had a Level II hospital, a reference health center, 5 secondary health centers, 28 health posts, and 27 health huts [12]. In 2023, an impact evaluation of urogenital schistosomiasis treatment revealed a low overall prevalence of 8%, with variations ranging from 0% in 10 of the 15 health posts surveyed to 91% in Bohé Balédji [9].

All individuals residing in the Tambacounda department, present in the targeted households and who provided informed consent to participate in the study, were included.

2.2. Study Type, Period and Population

We conducted a descriptive and analytical study from December 1 to 31, 2024. The target population of this study consists of the inhabitants of the Tambacounda health district.

2.3. Inclusion and Non-inclusion Criteria

2.3.1. Inclusion Criteria

Mothers or guardians, along with children under 10 years old residing in the department and who provided their informed and voluntary consent, were included in the study.

2.3.2. Non-inclusion Criteria

Mothers or guardians, as well as children under 10 years old, who do not reside in the department, those absent, those who declined to participate, and those with circumstances preventing their participation.

2.4. Sampling

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

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

Z is the value corresponding to a 95% confidence level, which is 1.96;

p is the estimated proportion of the population with the characteristic, here set at 30%, taking the average of the prevalence found in the impact evaluation [9] and that from the district mapping [7];

E is the desired margin of error, set here at 5%.

This calculation gives a sample size of n = 336. Adding the cluster effect (1.5) results in n' = 336 × 1.5 = 504, and with a 10% non-response rate, n" = 554. The final sample size was set at 576 individuals, divided into 24 clusters of 24 people each, with one cluster per village or neighborhood, consisting of 12 boys and 12 girls, with 6 individuals in each age group (1-5 years, 5-10 years, 10-14 years, and 14 years and above). A two-stage stratified sampling method was used to ensure representativeness. Twelve health posts were randomly selected, and for each, 2 villages or neighborhoods were randomly chosen, providing 48 individuals per health post. In each village, households were randomly selected, and all individuals present in the selected households were included. For individuals under 10 years of age, mothers or guardians were interviewed, while those aged 10 and above were interviewed directly. This article only includes data collected from mothers or guardians of children under 10 years old, totaling 288 expected individuals.

2.5. Data Collection

The data collection took place from August 15 to 31, 2024. Data were collected using a structured closed-ended questionnaire via Kobo Collect. Interviewers conducted face-to-face interviews with mothers or guardians and children under 10 years old selected for each health post. Responses were directly recorded on the forms, and each interview 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 of the study was the presence of urogenital schistosomiasis, diagnosed through microscopic examination of *Schistosoma haematobium* eggs using the filtration technique. This technique involves passing a urine sample through a fine filter to capture *Schistosoma haematobium* eggs. After filtration, the filter is examined under a microscope to identify the eggs, thereby confirming the infection. It is a simple and effective method for diagnosing urogenital schistosomiasis. The independent variables included knowledge, attitudes, practices, acceptance of preventive measures, as well as clinical, paraclinical, and therapeutic data.

2.7. Data Analysis

The data were extracted from Kobo Collect and analyzed using R software version 4.4.1.

Descriptive analysis was used to assess knowledge, attitudes, practices, acceptance of preventive measures, as well as parasitological data and treatment follow-up.

Factors associated with the presence of urogenital schistosomiasis were examined using Chi ^{2} or Fisher's tests for categorical variables in bivariate analysis [15-19].

Binary logistic regression was used to model the relationship between the dependent variable (the occurrence of urogenital schistosomiasis) and independent variables. This approach helped identify factors associated with the disease at a significance threshold of 0.5% [15-19].

2.8. Ethical Considerations

The protocol was approved by the National Committee for Ethics in Health Research (CNERS) under No. 179/MSAS/CNERS/SP on July 15, 2024 [20] and received administrative authorization from the Directorate of Planning, Statistics, and Research under No. 1062 on July 16, 2024 [21].

A training session on ethical considerations was provided to interviewers to ensure proper conduct. Informed consent was obtained from mothers or guardians by explaining the study's objectives, procedures, risks, and benefits.

3. Results

3.1. Descriptive Study

A total of 261 mothers or guardians were surveyed.

3.1.1. Distribution According to Socio Demographic Characteristics, Knowledge, and Attitudes Toward Urogenital Schistosomiasis

There was an almost balanced gender distribution, with 48.3% male participants. Regarding education, a majority (62.1%) were not educated. Concerning age, most participants (69%) were between 5 and 10 years old, while 31% were under 5 years old. Data show that 52.8% of participants were aware of urogenital schistosomiasis, and the majority (93.4%) of those aware had received information about the disease. Knowledge of the main symptoms was low (43.7%), as was knowledge of transmission modes (27.5%). Regarding curative treatment, 33.37% were aware of its existence, while knowledge of preventive measures was noted in only 26.8%. Among those aware of the disease, 83.4% were willing to talk about it, 90.8% intended to seek care for their children in case of suggestive symptoms, but only 28.4% would prevent their children from accessing freshwater sources (Table 1).

Table 1. *Distribution of mothers or guardians according to socio-demographic characteristics, knowledge, and attitudes toward urogenital schistosomiasis (UGS).*

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
1. Distribution by sex		
Yes	126	48,3
No	135	51,7
2. Distribution by education		
Yes	99	37,9
No	162	62,1
2. Distribution by age		
Under 5 years	81	31
5 to 10 years	180	69
4. Knowledge of UGS		
Yes	122	52,8
No	139	59,2
5. Information on UGS		
Yes	114	43,7
No	147	56,3
6. Knowledge of main symptoms		
Yes	101	38,7
No	160	61,3
7. Knowledge of modes of transmission		
Yes	64	24,5
No	197	75,5
8. Knowledge of curative treatment		
Yes	88	33,7
No	173	66,3
9. Knowledge of prevention methods		
Yes	70	26,8
No	52	73,2
10. Wiling ness to discuss the disease		
Yes	247	94,6
No	14	5,4
11. Intention to seek care		
Yes	237	90,8
No	24	9,2
12. Intention to allow freshwater exposure		
Yes	74	28,4
No	197	71,6

3.1.2. Distribution According to Practices and Children According to Clinical, Paraclinical, and Therapeutic Characteristics

Data revealed that 29.9% of participants allowed their relatives to access freshwater sources, and a history of hematuria was reported in 9.2% of individuals. Regarding communication about the disease, 83.33% had spoken about it to someone, and the same percentage had sought care. Preventive measures were widely accepted (93.5%). At the time of the survey, only 0.8% showed hematuria. Treatment coverage for schistosomiasis among children aged 5–10 years was 84.44%, with side effects rarely reported (5.56%). Test results indicated that 14.2% of urine dipsticks were positive, and 6.1% of microscopic examinations detected *Schistosoma haematobium* eggs. Finally, the disease prevalence was 3.7% among children under 5 years and 7.88% among those aged 5–10 years (Table 2).

Table 2. *Distribution of Mothers or Guardians According to Practices and Children According to Clinical, Paraclinical, and Therapeutic Characteristics.*

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
1. Allowed to frequent Freshwater		
Yes	78	29,9
No	183	70,1
2. Discussed the Disease with Someone		
Yes	20	7,7
No	241	92,3
3. Sought medical care		
Yes	20	7,7
No	241	92,3
4. Acceptability of preventive measures		
Yes	244	93,5
No	17	6,5
5. Notion of previous hematuria		
Yes	24	9,2
No	237	90,8
6. Hematuria at the time of the survey		
Yes	3	1,1
No	258	98,9
7. Treatment for schistosomiasis (5 to 10 years)		
Yes	152	84,44
No	28	15,56
8. Existence of side effects		
Yes	8	5,56
No	144	94,44
9. Urine test strip results		
Yes	37	14,2
No	224	85,8
10. Presence of schistosoma haematobium		

Variables	Absolutes frequencies (n)	Relatives frequencies (%)
Yes	16	6,1
No	245	93,9
11. Prevalence by Age Group:		
Under 5 years old	3	3,7
5 to 10 years old	13	7,88

3.2. Analytical Study

3.2.1. Factors Associated with Urogenital Schistosomiasis in Bi Variate Analysis

In bivariate analysis, factors significantly associated with urogenital schistosomiasis (UGS) were: having sought care (OR=6.95 [1.93–22.4], p=0.004), a history of hematuria (OR=5.43 [1.53–16.9], p=0.009), hematuria at the time of the survey (OR=34.86 [3–408], p=0.004), and positive urine dipstick results (OR=64.6 [16.5–44.6], p<0.001) (Table 3).

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

Variables	p value	ORb	$CI_{95\%}$
Aged 5 to 10 years	0.282	2.02	[0.6-7.31]
Male sex	0.359	1.83	[0.65-5.64]
Not educated	0.762	1.35	[0.47-4.49]
Knowledge of UGS	0.597	1.49	[0.53-4.38]
Not informed about UGS	0.432	1.71	[0.61-5]
Lack of symptoms knowledge	0.488	1.63	[0.57-4.65]
Lack transmission knowledge	0.551	1.45	[0.43-4.23]
Lack of knowledge of treatment	0.954	1.2	[0.39-3.41]
Knowledge of prevention	0.771	1.28	[0.38-3.71]
Frequent freshwater contact	0.09	2.49	[0.87-7.14]
Refusal of preventive measures	0.28	2.3	[0.31-9.51]
Talked about the disease	0.597	1.33	[0.05-7.55]
Seeking medical care	0.004*	6.95	[1.93-22.4]
History of hematuria	0.009*	5.43	[1.53-16.9]
Hematuria in the survey	0.005*	34.86	[3-408]
Not treated for UGS	0.669	1.42	[0.5-4.06]
Presence of side effects	0.475	1.95	[0.07-11.7]
Positive urine test strip	<0.001*	64.6	[16.5-44.6]

3.2.2. Factors Associated with Urogenital Schistosomiasis in Multi Variate Analysis

In multivariate analysis, factors statistically significantly associated with urogenital schistosomiasis were: mothers or guardians seeking care for their children (ORa=5.6 [1.11–32.8]; p=0.04) and positive urine dipstick results (ORa=71.13 [17.84–49.49]; p=0.004) (Table 4).

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

Variables	p value	ORa	$CI_{95\%}$
Aged 5 to 10 years	0.086	9.36	[0.73-120.1]
Male sex	0.311	2.51	[0.42-14.91]
Not educated	0.444	0.43	[0.5-3.71]
Knowledge of UGS	0.271	1.5	[0.54-4.16]
Not informed about UGS	0.22	1.7	[0.62-4.75]
Lack of symptoms knowledge	0.816	0.5	[0.17-46]
Lack transmission knowledge	0.812	1.43	[0.48-4.29]
Lack of knowledge of treatment	0.915	0.73	[0.221-87]
Knowledge of prevention	0.906	1.26	[0.42-3.76]
Frequent freshwater contact	0.453	0.51	[0.9-3]
Refusal of preventive measures	0.843	1.34	[0.8-23.76]
Talked about the disease	0.101	3.1	[0.8-11.92]
Seeking medical care	0.04*	5.6	[1.11-32.8]
History of hematuria	0.492	3.41	[0.7-17.18]
Hematuria in the survey	0.113	11.55	[0.24-56.5]
Not treated for UGS	0.492	1.42	[0.52-3.92]
Presence of side effects	0.061	1.75	[0.21-14.72]
Positive urine test strip	0.004*	71.73	[17.84-49.49]

4. Discussion

4.1. Socio Demographic Characteristics, Knowledge, and Attitudes Regarding Urogenital Schistosomiasis

The knowledge of urogenital schistosomiasis is insufficient, with only 52.8% of individuals having a good understanding of the disease. However, this is higher than the figures reported by Hambury et *al.* in South Africa in 2021 [22], Djagadou et *al.* in Togo in 2019 (42.7%) [23], and Folefac et *al.* in Cameroon with 35.4% in 2024 [24]. Although 43.7% of mothers or guardians are aware of the symptoms, the understanding of transmission modes remains low (27.5%), as does the understanding of treatment (33.7%) and prevention methods (26.8%). These results, although better than those found in Benin in 2023 by Agossoukpe et *al.*, where only 25.89% of individuals had sufficient knowledge of urogenital schistosomiasis [25], are still below the figures reported in Cameroon in 2024 by Folefac et *al.*, where 73% knew the symptoms, 74.3% understood the transmission modes, and 57.7% were aware of prevention methods [24]. These findings reveal gaps in awareness about the disease. They highlight the need to strengthen awareness and educational efforts to improve the understanding of transmission modes and prevention strategies for urogenital schistosomiasis. While all mothers or guardians aware of urogenital schistosomiasis would seek care for their children if symptoms appear, 83.33% would be willing to talk about the disease, and 70.5% would prevent their children from accessing freshwater sources. This positive correlation between knowledge and attitudes has also been noted in South Africa in 2021 by Hambury et *al.* [22]. These results also underscore the need to enhance awareness among mothers and guardians about urogenital schistosomiasis to optimize preventive practices.

4.2. Practices of Mothers or Guardians and Clinical, Paraclinical and Therapeutic Characteristics of Children

The data show that 29.9% of mothers or guardians allow their children access to a freshwater source, and 9.2% reported a history of hematuria. Knowledge gaps, negative attitudes, and risky water-related practices contribute to the transmission of schistosomiasis, particularly among schoolchildren and caregivers, highlighting the need for enhanced

education and addressing sociocultural barriers [26].

Regarding disease communication, 83.33% have talked about it with someone, and the same percentage sought medical care. Preventive measures are widely accepted by 93.9% of mothers or guardians. This demonstrates good awareness and a strong acceptability of preventive actions, although there is a need to intensify efforts to improve care and prevention, considering the persistence of the disease.

Among children aged 5 to 10 years, 84.44% received treatment for urinary schistosomiasis, while 15.56% did not. Agossoukpe et *al.* reported a lower therapeutic coverage of 54.29% in Benin [25]. This highlights the importance of continuing to strengthen treatment and follow-up efforts.

Side effects are rarely reported, with only 5.56%. This may also contribute to the high acceptability of preventive and therapeutic measures observed in the study. However, this low reporting rate could also indicate underreporting of side effects, either due to a lack of awareness of their recognition or reluctance to report them.

During the survey, 0.8% of participants presented with hematuria. Tests showed 14.2% positivity for urine test strips and 6.1% for the presence of Schistosoma haematobium eggs. The prevalence of the disease was 3.7% in children under 5 years old and 7.88% in those aged 5 to 10. This prevalence, although lower than that reported in Nigeria (69%) [27] and higher than in Tanzania (6.9%) [28], is comparable to the figures found in Cameroon (31.5%) [29]. These differences may reflect variations in environmental conditions, control programs, or diagnostic techniques used.

4.3. Factors Associated with Urogenital Schistosomiasis

In our study, freshwater exposure (OR = 0.51 [0.9-3], p = 0.453) and refusal of preventive measures (OR = 1.34 [0.8-21.7], p = 0.843) were not associated with urogenital schistosomiasis. However, a link between freshwater exposure and the occurrence of urogenital schistosomiasis was also noted in Nigeria by Balogun et *al.* [27] and in Tanzania by Nazareth et *al.* [28]. These results may be explained by the low prevalence of the disease (5.06%) in our study area, which could be related to the absence of contamination of freshwater, unlike health centers with high prevalence (31.5%) in South West of Cameroon [29].

While a history of hematuria (p = 0.492) and the presence of hematuria during the survey (p = 0.113) were not associated with the occurrence of urogenital schistosomiasis, the positivity of the urine test strip (ORa = 71.13 [17.84; 49.49], p = 0.004) was strongly associated. Indeed, the urine test strip demonstrated a strong ability to detect the disease in areas with high prevalence (≥ 50%), highlighting its utility for systematic and early detection of the infection in areas of high endemicity [30].

The lack of treatment for urogenital schistosomiasis was not significantly associated with the presence of the disease (OR = 1.42 [0.5; 4.06], p = 0.669). This may suggest that other factors, such as exposure to contaminated water, acceptance of preventive measures, and re-infestations, play a more crucial role in the infection [31].

4.4. Study Limitations

The main limitations of this study include a potential response bias that could affect the accuracy of self-reported data on knowledge and attitudes, as well as variability in diagnoses depending on the quality of the tests used. Furthermore, the study may not have accounted for certain influential factors such as specific environmental conditions or local cultural practices, and its cross-sectional design does not allow for the assessment of changes in knowledge or practices over time.

5. Conclusions

This study reveals a moderate prevalence of urogenital schistosomiasis among children under 10 years old in the Tambacounda health district, with disparities across health posts, indicating a persistent presence of the disease despite mass treatment campaigns with Praziquantel. The knowledge of mothers or guardians about the disease is generally good, especially regarding symptoms and curative treatment, but gaps remain concerning preventive measures. Risky practices, such as exposure to freshwater sources, are still prevalent in nearly one-third of participants, posing a major obstacle to effective disease control. The high acceptability of preventive measures, combined with the mothers' willingness to seek care promptly when symptoms appear, presents an opportunity to improve awareness strategies and enhance the effectiveness of interventions. It is crucial to continue adapting these strategies to local specifics, focusing on health education, access to infrastructure, and strengthening monitoring to sustainably reduce the prevalence of schistosomiasis in the region. Although this study provides crucial information, its limitations should be considered, and further research is needed to deepen the understanding of transmission dynamics and improve strategies for combating urogenital schistosomiasis.

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 doctor and researcher in public health. He is a specialist in infectious and tropical diseases, holding a master's degree in public health with a focus on epidemiology and a master's degree in community health with a focus on monitoring and evaluation. He has over 10 years of experience in public health and currently serves as the district medical officer for 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 completing his doctoral thesis in public health on 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

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

Dossolo Sanogo: General practice, Public health