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RESEARCH ARTICLE

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## IDENTIFICATION OF URINARY SCHISTOSOMIASIS IN CHILDREN IN THE NINTH DISTRICT OF THE CITY OF N'DJAMENA

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### ABSTRACT

Schistosomiasis is a widespread parasitic disease. It is a major public health problem in Chad, especially among rural populations. This study was conducted in the 9th district of the city of N'djamena. Its purpose was to assess urinary schistosomiasis infection in children aged 5 to 12 years. Urine samples were collected from children aged 5 to 12 years who attended consultations at the five centers. The urine samples were examined using the filtration technique. Three hundred and nine (309) samples were examined, revealing the respective prevalences of *S. haematobium* of 77 (7.80%); 47 (4.26%); 43 (6.38%); 55 (9.09%) and 87 (8.04%) in the five centers, for an overall prevalence of 309 (7.44%), with an infection rate of 8.01% among boys compared to 6.45% among girls, and children aged 5-7 being the most affected at 9.78% compared to those aged 8-12 at 6.45%. These prevalences are significant between genders and centers. However, there is no significant variation in *Schistosoma haematobium* infestation between age groups. This study assessed the level of schistosomiasis endemicity in this area. It is appropriate to consider combating this disease in the 9th district of the city of N'Djamena.

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## INTRODUCTION

Schistosomiasis is a parasitic disease caused by flatworms (*Schistosoma*) that live in the blood vessels. The mode of transmission (urinary or fecal) involves intermediate hosts (freshwater mollusks). Due to its prevalence, it ranks first among waterborne diseases and second behind malaria, hence its importance in public health in tropical and subtropical regions of the globe (Rougemont et al. 1989). As a disease that mainly affects rural areas, schistosomiasis primarily strikes those who cannot avoid contact with contaminated water, either for professional reasons (farmers, fishermen) or because they have no other source of clean water for drinking, washing clothes, or bathing. Children aged 5 to 12, who are less resistant and who often play or swim in contaminated water, are the most heavily infected (WHO, 2004; Traoré, 1994). It has major health and socio-economic repercussions in developing countries, where it is a significant public health problem (Tchuem, 2006). It is endemic in 78 countries (WHO, 2013), where 800 million people are at risk of infection (Aubry, 2014). Eighty-five percent of these people are infected, and most are located in sub-Saharan Africa (Sangho et al., 2009). More than 200 million people are affected by the disease (Chitsudlo et al., 2000); mortality due to schistosomiasis is estimated at around 800,000 deaths per year (Aubry, 2014). In Chad, schistosomiasis is endemic with a prevalence of 75% (Massenet,

1995). The most affected areas are hydro-agricultural development zones located on the banks of ponds and lakes. Few studies have been conducted on schistosomiasis among school-age children in Chad. Recent studies on schistosomiasis have revealed that several children in the city of N'Djamena have been affected, with a prevalence of 49.36% (Said, 2011). As for schistosomiasis, populations living on the banks of the Chari River are particularly affected, especially in the 9<sup>th</sup> district of the city of N'Djamena. In most areas endemic for schistosomiasis in Chad, little data has been reported and, as a result, the epidemiological situation remains poorly understood. It is within this context that this study will be conducted on urinary schistosomiasis among school-aged children in the 9th district of the city of N'Djamena. This study will enable us to generate scientific results that can convince decision-makers to better understand the scope of urinary bilharzia in order to improve patient care and conduct mass treatment in the ninth district of the city of N'Djamena, located on the banks of the Chari River. These results may inform the national program to combat this infection to review its strategy.

## MATERIALS AND METHODS

### Study area

**Geographical location of the 9th district of N'Djamena:** The 9th district is located at 12.0493° or 12° 2' 57" north latitude and

15.0919° or 15° 5' 31" east longitude, at an altitude of 295 meters (968 feet) in the southeastern part of N'Djamena, the capital of Chad. It is a developing area, composed of neighborhoods such as Toukra, Diguel East, and Nguéli. It borders districts 7 and 8, with increasing urbanization.

centrifugation method. The method used in our study was centrifugation, which is why urine was examined using centrifugation and sedimentation to detect *S. haematobium*. The patients' urine was collected and first examined to identify the presence of visible hematuria (macrohematuria), then the sample was centrifuged.

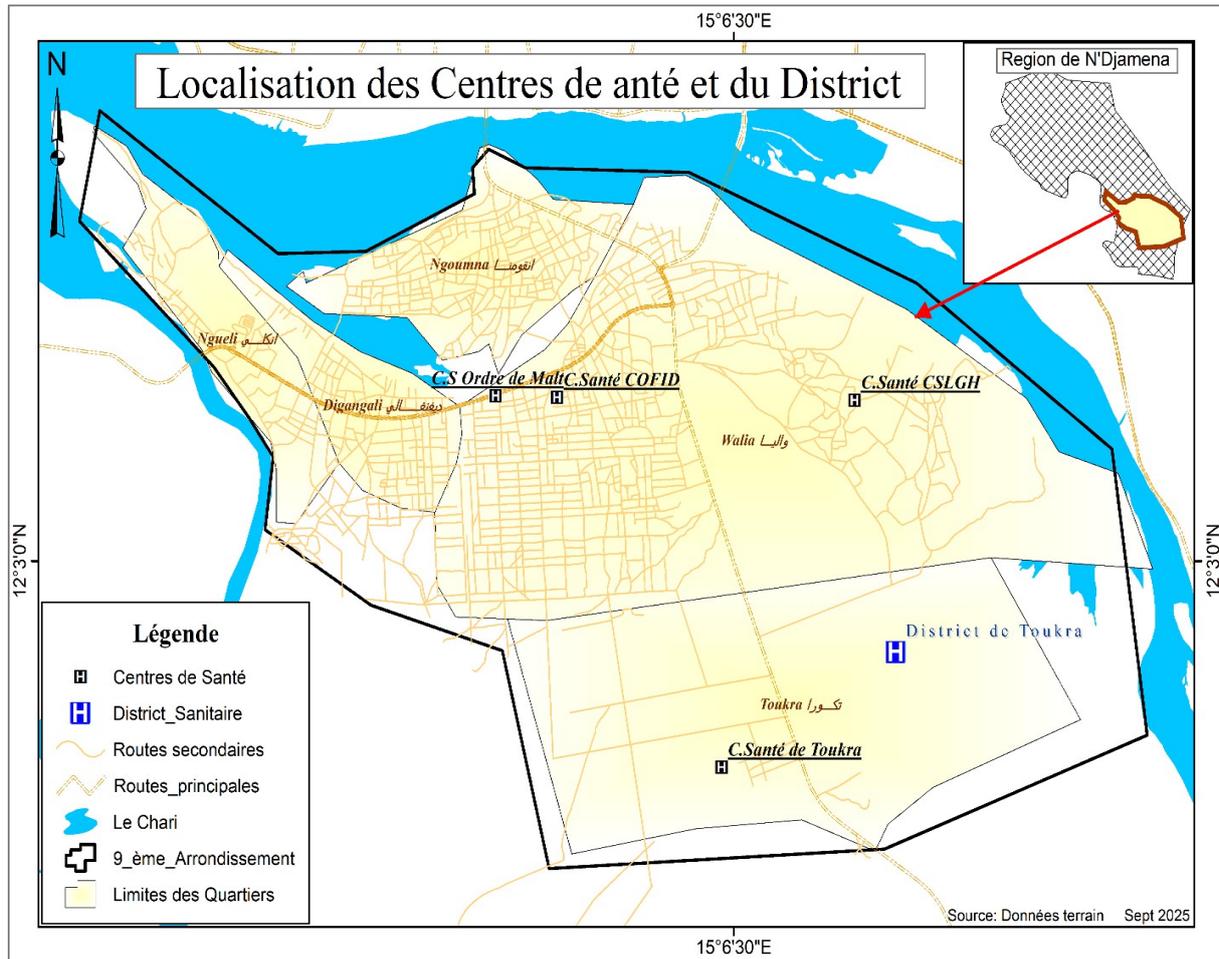


Figure 1. Map representing the study area

**Study population:** The study population consists of a sample of children from the mother and child hospital and health centers in the 9th district of the city of N'djamena. Children admitted to health facilities in the 9th district are considered, mainly those referred to the laboratory for urine sampling, as these children are easily mobilized and particularly exposed to this infection through activities such as swimming during hot hours and prolonged play in the water.

**Sampling:** The study was conducted on children aged 5 to 12 years, regardless of gender, who were sent to the laboratory for urine analysis. This was a randomized study conducted between June and August 2025. The sample size was determined using the following formula:

$K \times N1 / T = E1$  (sample 1),  $K \times N2 / T = E2$  (sample 2), where the total number of patients in the 9th arrondissement is  $E1 + E2 = K$ . Sample 1 is the group of boys examined, which is 237, and sample 2 is the group of girls examined, which is 72, with  $K = 309$  being the total number of patients examined.

**Parasitological tests:** In the laboratory, we performed two parasitological tests on the urine samples: a macroscopic examination consisted of observing the macroscopic appearance of the urine through a transparent container in order to identify the appearance of the urine through its color. Normal urine is more or less dark yellow and translucent with no suspended particles, while cloudy urine is abnormal, non-translucent, and contains clots or suspended particles. The microscopic examination consisted of identifying *Schistosoma haematobium* eggs using a microscope. All children consulted for urine tests came to the laboratory where they were given containers for collection. Urine is examined using the standard filtration or

The centrifugation method was used to examine the samples in our study. It involves examining the sedimentation sediment from 24-hour urine samples after removing chemicals that interfere with the reading. The collected urine is placed in a centrifuge and spun at 1,500 rpm for 3 to 4 minutes. The sediment remaining at the bottom of the tube is removed and placed between a slide and cover slip, then examined for eggs using a 40x objective lens on an optical microscope. To ensure the quality of the tests, a double reading is performed by two experienced laboratory technicians. All children who test positive are treated with praziquantel.

**Data processing and analysis:** Statistical analysis was computerized using Excel software. It was mainly based on the use of cross-tabulation tables and reference tests such as chi-square. Tables based on sample characteristics and patient characteristics were used to present the results. The data were processed using World 2019 and the graphs were produced using Excel. The chi-square ( $X^2$ ) test was used to compare prevalence values between genders, ages, and health centers, while the Kruskal-Wallis K test was used to compare the means of the different parasite loads between the above-mentioned groups. The tests are significant for  $p < 0.05$ . The document was entered using World 2019 software.

## RESULTS

A total of 309 children were sampled in five (5) centers for analysis of *schistosomiasis haematobium*, of which 23 were positive, or 7.44%, with the most affected center presenting 9.09% of cases. The number of infections observed differs significantly from the expected

values in several centers. The  $\chi^2$  value was 10.79 with a p-value of 0.0290. As  $p < 0.05$ , the difference in the distribution of *Schistosoma haematobium* infection cases between the five centers is statistically significant. The infection rate among boys is 8.01% compared to 6.45% among girls. This difference is not significant ( $p=0.9345 > 0.005$ ), which means that we cannot conclude that gender has an influence on the *S. haematobium* infection rate in this population. Among girls, the  $\chi^2$  test = 36.2670 with  $p < 0.0001$  suggests that there is a significant variation in the infection rate between centers among girls. This means that girls are not evenly distributed across centers. Gender has no significant overall influence on the prevalence of *S. haematobium* ( $p < 0.05$ ), but among girls specifically, location appears to have a significant impact on the risk of infection ( $p < 0.0001$ ).

The p-values are  $> 0.05$ , indicating that the differences observed between centers are not statistically significant for either age group. This means that there is no significant association between age group and *S. haematobium* positivity. Although children aged 5-7 appear to be slightly more affected (9.78%) than those aged 8-12 (6.45%), this difference is not statistically significant. High prevalence of infestation was found among boys (100%) compared to girls (33.33%). In contrast, low prevalence of infestation was observed among girls (14.29%) compared to boys (66.67%) (Figure 2). The distribution of high prevalence of infestation is 100% among children aged 8 to 12 and 66.67% among children aged 5 to 7. Low prevalence is 28.57% among children aged 5 to 7 and 40% among children aged 8 to 12 (Figure 3).

**Table 1. *Schistosoma haematobium* infection for the five centers**

Centers	Number examined	Number infected (%)
Center 1	77	6(7.80)
Center 2	47	2(4.26)
Center 3	43	3(6.38)
Center 4	55	5(9.09)
Center 5	87	7(8.04)
<b>Total</b>	<b>309</b>	<b>23(7.44)</b>
$\chi^2$		1079
p-value		0.0290

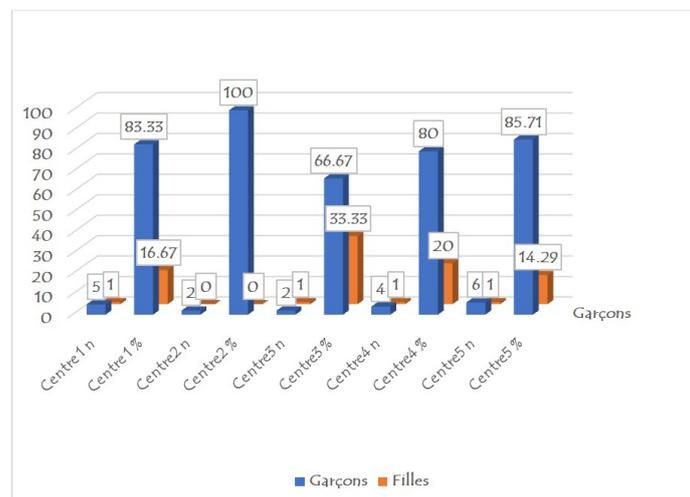
**Table 2. Parasitological examinations for *Schistosoma haematobium* by gender**

Centers	Number of boys examined	Sh positive (%) of boys	Number of girls examined	Sh positive (%) of girls
Center1	60	5(8.33)	17	1(5.88)
Center2	36	2(5.55)	11	0(0.00)
Center3	36	2(5.55)	7	1(14.28)
Center4	45	4(8.88)	10	1(10.00)
Center 5		6(10.00)	27	1(14.29)
<b>Total</b>	<b>237</b>	<b>19(8.01)</b>	<b>72</b>	<b>4 (6.45)</b>
$\chi^2$	0.8291		$\chi^2$	36.2670
p-value	= 0.9345		p-value	< 0.0001

Sh : *Schistosoma haematobium*

**Table 3. Parasitological examinations of Sh by age group**

Centres	Number examined aged 5-7 years	Sh positive (%) From 5-7 years old	Number examined aged 8-12 years	Sh positive (%) From 8-12 years old
Center1	23	4(17.39)	54	2(3.70)
Center2	12	1(8.33)	35	1(2.85)
Center3	11	0(0.00)	32	3(100%)
Center4	15	2(13.33)	40	3(7.50)
Center5	31	2(6.45)	56	5(8.92)
<b>Total</b>	<b>92</b>	<b>9 (9.78)</b>	<b>217</b>	<b>14(6.45)</b>
$\chi^2$	2.7602		$\chi^2$	22.307
p-value	= 0.5987		p-value	= 0.6934



**Figure 2. Distribution of the prevalence of *Schistosoma haematobium* infection by gender**

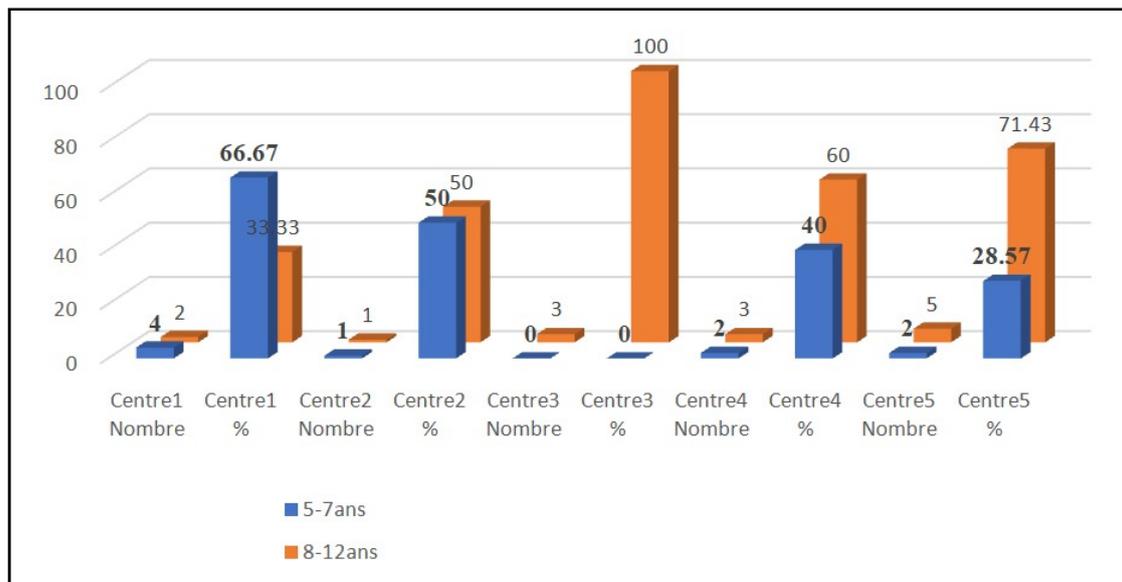


Figure 3. Distribution of the prevalence of subjects with SH by age in health centers

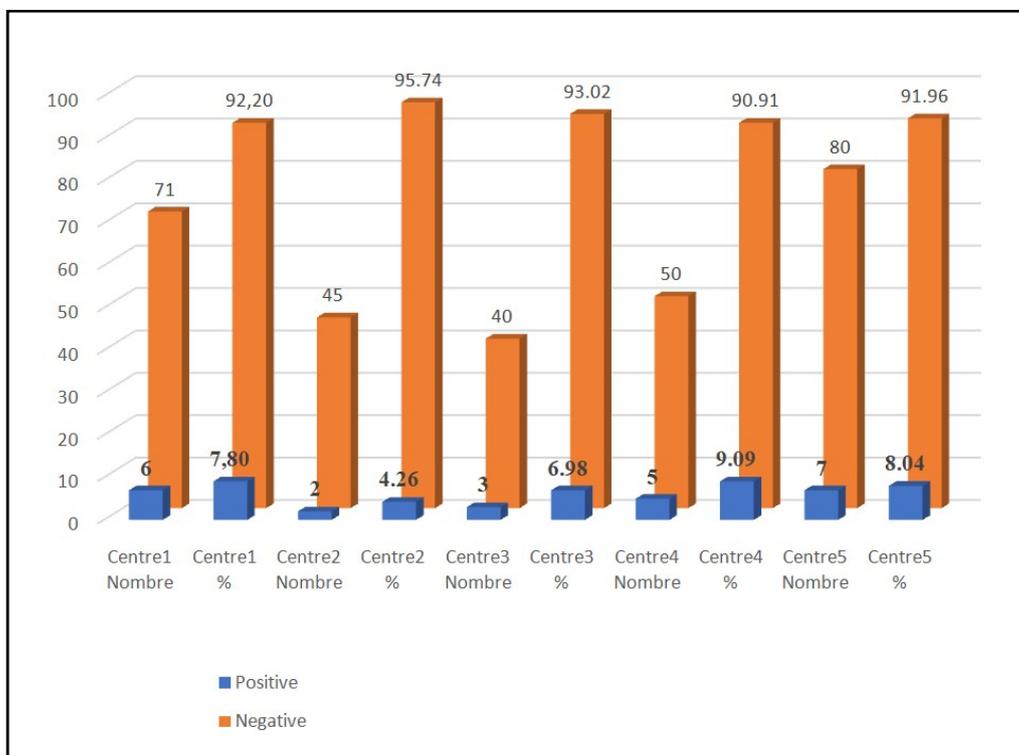


Figure 4. Distribution of the prevalence of subjects infected with SH by health center

In our study, the prevalence of subjects infected with *S. haematobium* is high in center 4, at 9.09%, and low in center 2, at 4.26% of infected subjects. On the other hand, the prevalence of uninfected subjects is high in center 2, at 95.74%, and low in center 3, at 40%.

## DISCUSSION

In our case study, out of 309 children sampled, we found a predominance of males, with 76.70% boys and 23.30% girls. Our prevalence is higher than that reported by Jean-Paul et al (2017). Boys are more infected (29.03%) than girls, which means that boys are much more exposed through farming and playing in stagnant water, while girls are busy with domestic work. Contrary to Ibikounlé et al (2013), who found that boys and girls were equally affected, with 32.76% of boys and 32.81% of girls, this confirms the existence of *schistosomiasis haematobium* in our study centers. According to Dr. Serge Mayaka, cited in Saïd Abderahim (2011), boys are more infected with bilharzia than girls, at 54% versus 46%.

However, it should be noted that there is no significant relationship between being infected and gender, with  $p > 0.05$  for boys and  $p < 0.05$  for girls. In our study, 29.78% of children are aged 5-7 and 70.22% are aged 8-12, and the overall prevalence of *Schistosoma haematobium* infestations is estimated at 7.44%. This is not far from the 63.2% prevalence rate obtained by Ka (2002) in Diourbel in the Bambey district, but it is higher than the 57.6% prevalence rate found by Bruno Senghor in 2010. However, it is higher than the previous prevalence rates obtained in other localities in the Fatick region during the national survey conducted in 1996 by the Parasitology Department of the Faculty of Medicine and Pharmacy. Gigase (1988), cited by Saïd Ibrahim Saïd, also reported that the prevalence of urinary bilharzia infestations is estimated at 19.36%. These prevalence rates are much higher than those in our study, where the prevalence is 7.44%. This explains the low transmission rate in our study area, as children are supervised by their parents and playing in contaminated water is prohibited. The results of our study showed that the 5-7 age group is significantly affected by *Schistosoma*

*haematobium* infestation, with 9.78% of children in this age group infested, compared to 6.45% of children aged 8-12. These results are lower than those obtained by Ibikounlé et al. (2009), who showed a high prevalence of this disease, with a percentage of 38.73% compared to 21.53% for children aged 4 to 6. This confirms the presence of *Schistosoma haematobium* bilharziasis in the area. This predominance could be explained, on the one hand, by the high mobility of this age group and, on the other hand, by the high frequency of mollusk habitats through recreational activities. The fact that the 5-7 age group is more infected stems from the culture that widely uses this age group in domestic household chores. According to Bruno in Senegal, his research found that the prevalence of *S. haematobium* infection is lower in the 7-9 age group (44.3%) than in the 10-12 age group (64.4%). This result is significantly higher than our result, as it is average in the 5-7 age group with a prevalence of 9.78% but low in the 8-12 age group at 6.45%. However, the high proportion of *Schistosoma haematobium* infestation observed can be explained by the fact that most of the inhabitants of this locality live permanently near water and stagnant pools, regardless of the season. In any case, it should be noted that there is no significant relationship between infection and age, with a p-value of 0.5989 in children aged 5-7 and a p-value of 0.6934 in those aged 8-12, which is  $>0.05$  in both cases, as adults can also be infected with *Schistosoma haematobium*. According to Jean-Paul et al. (2017), 26.23% tested positive and 6.55% showed traces of hematuria, ranging in age from 5 to 14 years old, with a prevalence rate of 24.59%. Children aged 4-6 are often under the supervision of their parents, according to Etard et al cited in Ibikounlé (2013) and Boussinesq (2009). This shows that the prevalence of schistosomiasis in the 5-7 age group is higher in our study because children in this age group are less controlled by their parents. According to Gigase (1988) cited by Said Ibrahim Said, the group most heavily infected with bilharzia consists of school-aged children between 5 and 19 years old, while the age groups most affected by bilharzia in our site are those between 5 and 7 years old, which also falls within their age range. He also pointed out that this prevalence is high in the 11-14 age group (54.36%), but remains average in the 7-10 age group (45.63%). Contrary to our study, it is high in the 5-7 age group and low in the 8-12 age group (Moussa, 2017). During our field research in the 9th district of the city of N'Djamena, we identified a 23-year-old woman who had been diagnosed with trichomonas vaginalis at a health center.

## CONCLUSION

Our cross-sectional study, conducted between June and August 2025, found that 7.44% of children are infected with *Schistosoma haematobium*. The majority of these children are male. In this study, the age group most affected by *Schistosoma haematobium* is 5-7 years old, with a prevalence of 9.78%. The study was conducted in five centers, with the most affected center showing a rate of 9.09%. The development of a comprehensive strategy to combat *Schistosoma haematobium* infection will reduce transmission or even break the chain of transmission in the ninth district.

**Ethical considerations:** The protocol was presented to and approved by the faculty's bioethics committee, and research authorization was granted by the administration. The authorization was presented to the heads of the various health centers in the ninth district of the city of N'Djamena, explaining the purpose of the research.

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