Spatial and Temporal Distribution of Urinary Schistosomiasis in Nigeria

BY

U.W. Ibor (Ph. D)

Department of Geography, Federal University Lokoja, Lokoja

uguruwisdom@gmail.com, uguru.ibor@fulokoja.edu.ng

ABSTRACT

Urinary schistosomiasis is one of the prevalent Neglected Tropical Diseases in Nigeria and empirical evidence on the distribution of the disease is necessary for effective control of the disease. This study therefore examined the spatial and temporal pattern of urinary schistosomiasis in Nigeria. Case registry data on urinary schistosomiasis were collected from National Bureau of Statistics for Twenty-four years. The map of Nigeria was produced in ArcGIS using the data of the reported cases for each state. The map was colour coded to show areas of low to high prevalence. The trend in schistosomiasis prevalence from 1981 to 2004 showed that 499,143 cases of schistosomiasis were reported. The highest reported case of schistosomiasis was in 1983 (41,889 cases), while the lowest was recorded in 2004 (4, 282 cases), which is 89.8 per cent decrease in the reported cases of schistosomiasis from 1983 – 2004. There was a significant linear trend in schistosomiasis prevalence ($t = -8.587$, $p<0.05$). Over the past 23 years, Nigeria experienced an average decrease of about 142, 694 cases of schistosomiasis. The northeastern region had the highest incidence of schistosomiasis, followed closely by the northwestern and north-central zones. The regions with the lowest reported cases of schistosomiasis were southwest, south-south and southeast. The study concludes that ongoing interventions are yielding results in lessening the prevalence of urinary schistosomiasis and calls for sustained efforts especially in the Northern part of the country to completely eliminate the disease.

Key words: Urinary schistosomiasis, Prevalence, spatial pattern and Endemic areas

1.0 Introduction

Urinary schistosomiasis is a prevalent parasitic disease, with an estimated 200 million people affected worldwide. While the distribution of infection has changed over time, with 80-85% of current prevalence now found in sub-Saharan Africa (World Health Organization, 2002), the pattern of distribution of the number of people infected is unknown. Furthermore, the report of the Joint Expert Committees on the Prevention and Control of Schistosomiasis and Soil-transmitted Helminthiasis, held at WHO headquarters in 2001, stressed that the impact of schistosomiasis must be reassessed taking into account mortality, severe morbidity specific to schistosomiasis (hepatic fibrosis, urinary obstructions), and 'subtle' morbidity (anaemia, growth stunting) to which schistosomiasis is a significant contributory factor (World Health Organization, 2001). In spite of the devastating effects of urinary schistosomiasis on human health, the geographic distribution of the disease is fairly unclear. Like many other Sub-Saharan African countries, Nigeria is one of the highly endemic countries where schistosomiasis has been unsystematically reported and large areas remain where the disease status is unknown.

Despite extensive literature on the prevalence of urinary schistosomiasis (Ibor, 2017, WHO, 2002; WHO, 2001; Ejezie, Gemade and Utsalo, 1989), there has been a knowledge gap on the spatial pattern of urinary schistosomiasis, and time prevalence has not been established adequately. Recent studies show that the prevalence of urinary schistosomiasis has increased in some communities (Ibor, 2017). However, information on the distribution of prevalence intensities is lacking and regional-based data on epidemiologic patterns are limited. Periodic assessment of the prevalence and distribution of schistosomiasis is important for monitoring changes in the epidemiological situation and progress in control efforts and for formulating future intervention strategies in endemic areas. This study therefore seeks to examine the spatial and temporal pattern of urinary schistosomiasis in Nigeria.

2.0 Materials and methods

2.1 Study Area

Nigeria is one of the countries where urinary schistosomiasis has been unsystematically reported, with approximately 20 million people, mostly children in need of treatment. Schistosomiasis is endemic in Nigeria as revealed by several prevalence studies but the degree of endemicity is replete with controversy. Cowper (1972) reported that although schistosomiasis has been known in Northern Nigeria from time immemorial, the disease may have been brought into the region by the migrating Fulani people. The proliferation of several irrigation projects all over the country has stabilized the infection in Northern Nigeria while in the West, rapid urbanization, supply of portable water and mass chemotherapy have combined to reduce the prevalence rates. The prevalence of severe pathological forms of the disease is very low and schistosomiasis is not associated with bacteriuria or hypertension in Nigeria, although isolated cases of ectopic lesions of the genitalis and uterus have been reported. The control of schistosomiasis in Nigeria is mainly by mass treatment with praziquantel through the school system, with an absence of any provision for pre and non-school aged children.

2.2 Methodology

The study used case registry data of schistosomiasis for 24 years collected from the National Bureau of Statistics to understand the spatial and temporal (yearly) trend in schistosomiasis. An attempt was made to find out whether or not the time factor (over 23 years) was important and significant in schistosomiasis prevalence. The test statistic for linear regression was used for the analysis. Linear regression is one of the most common tests for time series data and, in its basic form, assumes that data are normally distributed. Data on urinary schistosomiasis prevalence was taken as the number of all reported cases of urinary schistosomiasis from 1981 to 2004 (Table 4.1). Time was caliberated based on the number of years the disease was reported. The linear regression equation is defined thus:

$$Y = a + b1X1 \quad \text{……………………………………………egn (1)}$$

Where:

Y = dependent variable (Reported cases of urinary schistosomiasis)

a = intercept of the linear trend line

b1 = regression coefficient and

X = time (Number of years)(1981 to 2004)

To effectively map the disease, a shapefile of Map of Nigeria showing 36 states and FCT (courtesy of divagis.org) was loaded into the ArcMap 10.1 environment. The map was projected to Universal Transverse Mercator (UTM, WGS 84). The prevalence data for the respective states were entered into attribute table of ArcMap. Using symbology tab in the Layer Properties, the prevalence data were displayed with circular graduated symbols. The Statistical Package for Social Science (SPSS) Windows Version 20.0 was used for data analysis.

3.0 Results

3.1 Trends in schistosomiasis prevalence in Nigeria

Table 4.1 shows the trends in prevalence from 1981 to 2004. In 1981, 41, 662 cases of schistosomiasis were reported. The number of reported cases of schistosomiasis decreased markedly by 56.4 per cent from 41, 662 in 1981 to 18, 146 in 1990 and then dropped drastically by 33.32 percent between 1991 and 2004 to 4, 282 cases in 2004, which perhaps represents the lowest reported number of cases of urinary schistosomiasis in Nigeria.

Table 4.1: Reported cases of urinary schistosomiasis in Nigeria (1981-2004)

S/n	Years	No. of urinary schistosomiasis
1.	1981	41,662
2.	1982	40,028
3.	1983	41,889
4.	1984	36,710
5.	1985	31,788
6.	1986	26975
7.	1987	31,146
8.	1988	32,977
9.	1989	13,146
10.	1990	18,146
11.	1991	13,204
12.	1992	17,066
13.	1993	11,957
14.	1994	17,100
15.	1995	17,381
16.	1996	9,685
17.	1997	10,494
18.	1998	19,497
19.	1999	15,134
20.	2000	14,251
21.	2001	11,311
22.	2002	13,657
23.	2003	7,657
24.	2004	4,282
Total		499143

Source: National Bureau of Statistics, 2013.

Fig. 4.1 also revealed that the highest reported case of schistosomiasis was in 1983 (41,889 cases), while the lowest was recorded in 2004 (4, 282 cases), which is 89.8 per cent decrease in the reported cases of schistosomiasis from 1983 – 2004. The phenomenal increase in the number of reported cases of urinary schistosomiasis in the early 80's (1981 - 1983) could be a consequence of the proliferation of irrigation projects of the 1970's especially in the northern part of the country. In recent decades, cautionary warnings have accompanied many irrigation and dam projects on the likely impact of increased schistosomiasis transmission. In some cases, these predictions came true, including the Kainji Lake project in Nigeria around 1970. However, after 1983, the number of reported cases of urinary schistosomiasis declined steadily with the lowest prevalence recorded in 2004 (4, 282 cases). As could be seen, the figure however shows a downward trend (from 4 – 24) for the period under review. This sharp decline in active infection may be attributed to the provision of basic infrastructure such as pipe-borne water etc., which reduce peoples' contact with the vector environment.

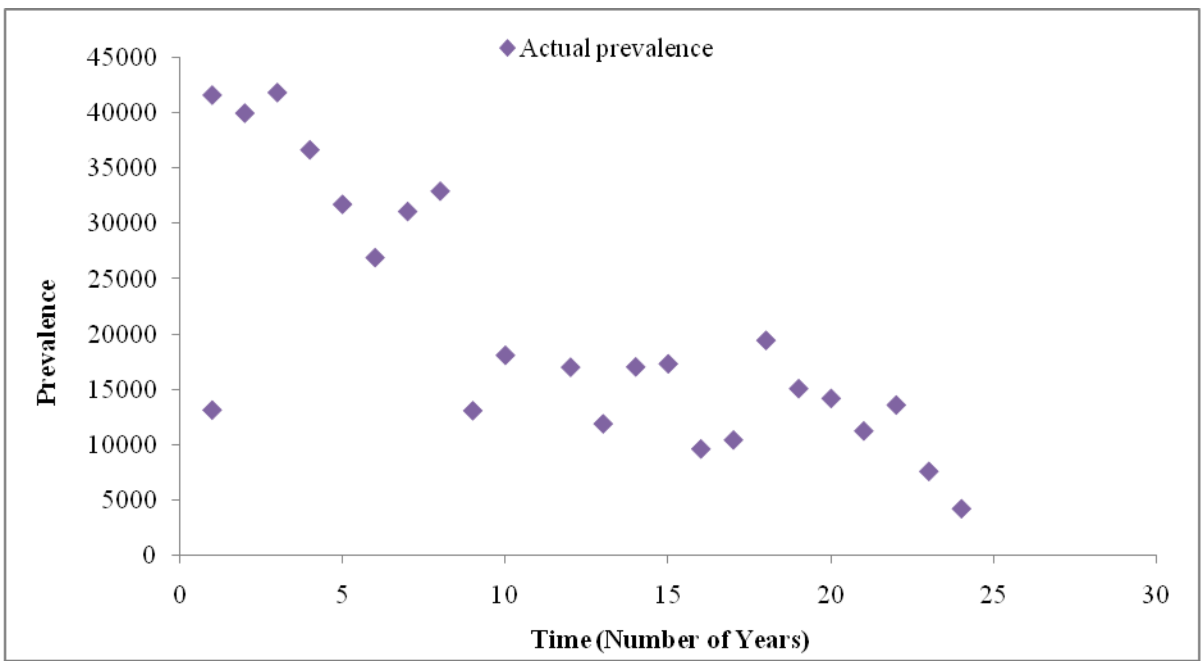

Fig 4.1: Trend in reporetd cases of urinary schistosomiasis (1981 – 2004)

The regression result in Table 4.2 shows that the time factor significantly explains the number of reported cases of urinary schistosomiasis. This is so given the fact that the $R^2 = 0.628$ is significant at 5 percent level (R^2= 0. 628, $p<0.05$). The regression coefficient also shows that over the past 23 years, there was a marked decline in the prevalence of urinary schistosomiasis (Fig. 4.1). This is confirmed by the regression coefficient in Table 4.2 which has a negative sign (-0.792). This result implies that urinary schistosomiasis is fast declining. This sharp drop in schistosomiasis prevalence could be attributed to concerted efforts from government and other sponsoring agencies in the provision of safe water, mass treatment of affected populations as well as increased health education. This corroborates the assertion by the WHO (2000) that once people's basic needs are met, especially the provision of potable water, sanitation improvements together with health and hygiene promotion, it results in improvements in their health.

Table 4.2: Summary of linear regression result

Variables	**Coefficients**		
	B	**B**	**t-value**
Year	-0.027	-0.792	6.090*
Test results			
F- value	37.092*		
R	0.792		
R^2	0.628		
Constant	4.577		72.793*
DF	1/22		

*Significant at 5% significance level
Source: SPSS Window Output Version 20.0

The reported cases of urinary schistosomiasis across the six (6) geopolitical zones are shown in Fig 4. 2. It shows that the northeastern region had the highest prevaence of urinary schistosomiasis, followed by the northwestern and north-central regions. The geopolitical zones with the lowest reported cases of schistosomiasis were southeast and south-south. Fig. 4.2 indicates that the geopolitical zones in the northern part of the country (northeastern, northwestern and north-central) are the worst hit. A plausible explanation for the high prevalence of urinary schistosomiasis among geopolitical zones in northern Nigeria is the dependence on irrigation and dam water for agriculture and other purposes. Irrigation and dam projects favour the breeding of schistosomiasis snail vectors and increased man-vector contact. This confirms the findings of Adebayo (2003) who explored the effects of prevalence of urinary schistosomiasis among irrigation farmers in northern Nigeria and noted that within the irrigation system, the adverse public health effect is the outbreak of diseases. The study reported the widespread human infection with urinary schistosomiasis and river blindness along Kainji and Jebba Basins following the construction of dams.

The picture portrayed in Fig 4. 2 invariably implied that the northern region was the most affected, while the southern part of the country had the lowest prevalence of urinary schistosomiasis. Low prevalence of urinary schistosomiasis in southern Nigeria could be attributed to rapid urbanization and access to safe water supply. Across the geopolitical zones, years with the highest reported cases of schistosomiasis revealed that in 1983, 25854 cases of urinary schistosomiasis were reported in the northeast. In 1982, there were 11496 reported cases in the north-central; 10301 cases in the northwest in 1988; in 1990, 773 and 764 cases were reported in south-south and southwest respectively, while only 230 cases of schistosomiasis were reported in the southeast in 1994. For the 16 years prevalence (1982 – 1997), the northeastern zone recorded a mean value of 24, 596, northwestern zone recorded 8, 225, north-central had 5, 290 cases, south-southern zone had 372 cases, southwestern zone recorded 849 cases, while southeastern part reported 274 cases. The national epidemiological situation of urinary schistosomiasis indicates that the disease is a public health problem. Ejezi *et al*. (1989) studied the problem of schistosomiasis in Nigeria and reported that the establishment of several irrigation projects all over the country has stabilized the infection in northern Nigeria while in the south intensed urbanisation, access to potable water and mass treatment have combined to lessen the prevalence rates.

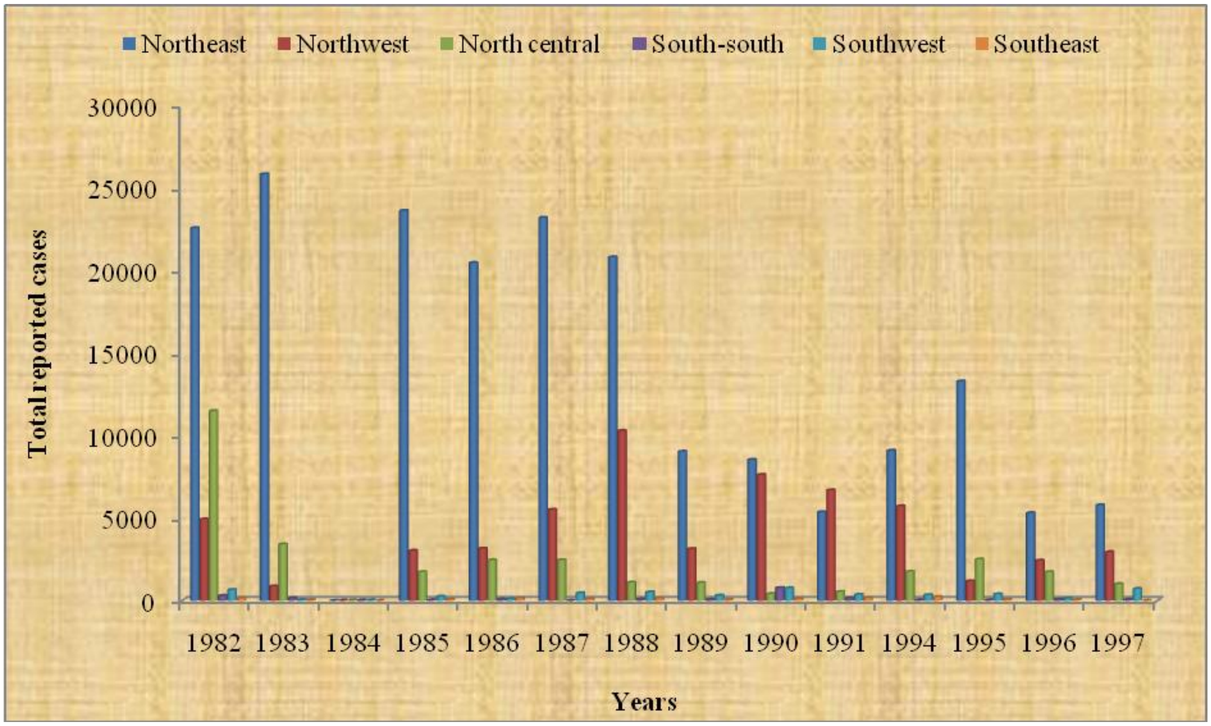

Fig 4. 2: Trend in reported cases of schistosomiasis across Geopolitical zones

The reported cases of schistosomiasis across states in Nigeria are contained in Fig 4. 3. It shows that the highest prevalence of schistosomiasis was reported in the Taraba and Adamawa states, followed closely by Borno, Taraba and Plateau states. Low schistosomiasis cases were reported in states found in the southern part of the country. However, among the states, Ondo, Ogun and Oyo states, all in the southwestern part, had higher prevalence of schistosomiasis. States in the northeast and northwest had the highest prevalence of schistosomiasis, followed by states in the north-central and then those in the southwestern and south-southern zones. States in the southeast had the lowest prevalence of schistosomiasis. This indicates that urinary schistosomiasis is highly prevalent among states in the northern part of Nigeria. Arinola (2005) explored the immunological status of urinary schistosomiasis in Nigeria and reported that urinary schistosomiasis is known to have existed from time immemorial and might have been brought to the country by the migrating Fulani people when they travelled westwards from the Nile Basin. In the southern part of Nigeria, particularly, the Niger Delta Region, apart from the fact that the numerous ponds, creeks and swamps may have favoured the breeding of the vector, Anosike *et al*., (2006) opined that the spread of the disease may have occurred during the Civil war when infected Nigerian soldiers migrated southwards and had contact with the freshwaters.

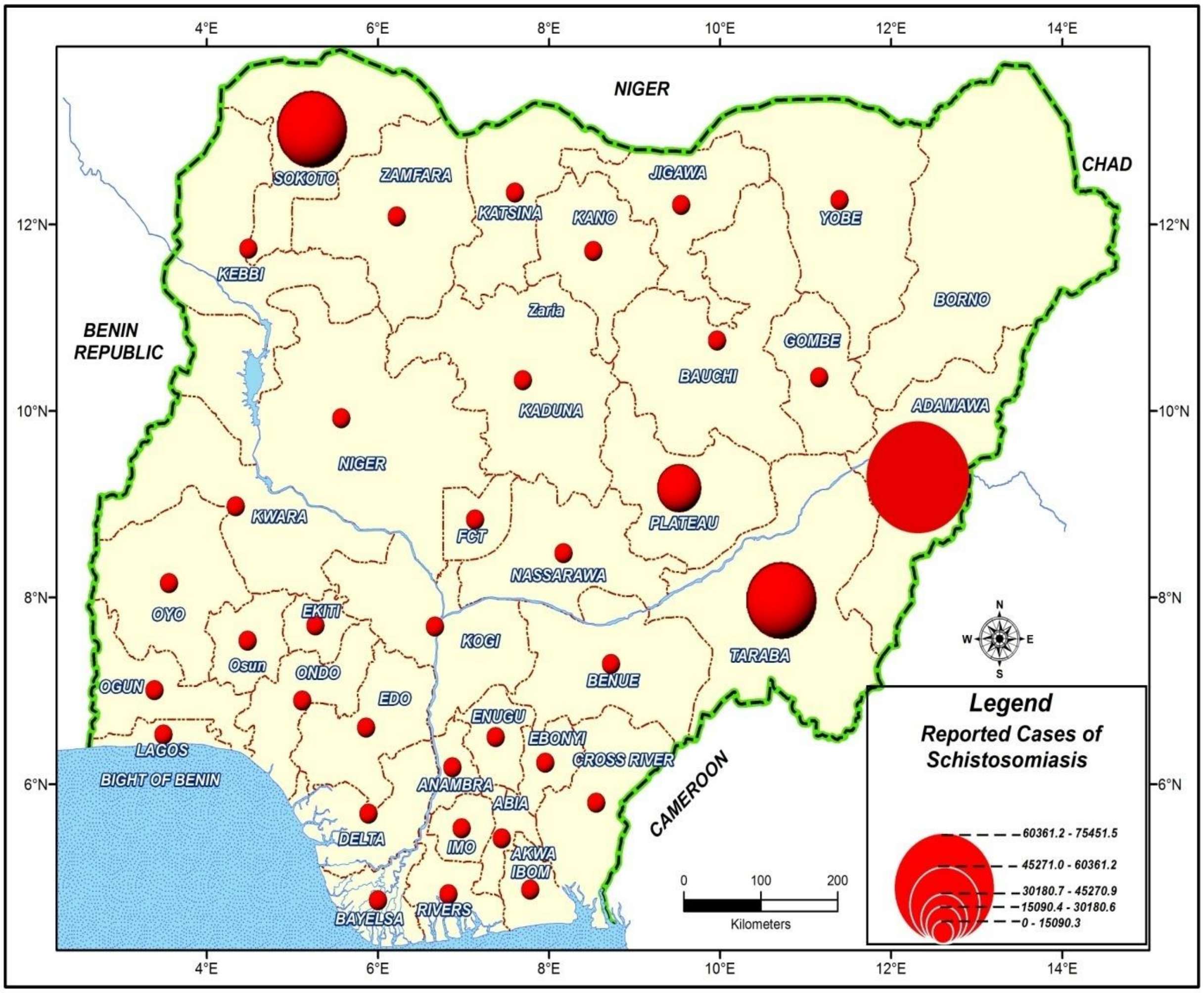

Fig. 4.3 Spatial distribution of urinary schistosomiasis in NIgeria

4.0 Conclusion

The study examined the spatial and temporal changes in the prevalence of urinary schistosomiasis. The study clearly showed that urinary schistosomiasis is a disease of public health concern in Nigeria. A total of 499,143 cases were reported, but the number decreased by 56.4 percent from 1981 to 1990 and by 33.32 percent between 1991 and 2004. The time factor was important and significant in explaining the prevalence of urinary schistosomiasis. The study observed that states in the northern region are highly infected than states in the southern part of the country. Over the past 23 years, Nigeria experienced a marked decline in the reported cases of urinary schistosomiasis. However, focal areas of the disease still persist in some parts of the country that requires immediate attention.

The past 24-year decline in schistosomiasis prevalence is a good indicator of the future and goes to buttress the fact that the Linear (trend) regression model can be used to forecast for future time periods in order to effectively control urinary schistosomiasis in Nigeria. The sharp decline in the reported cases of urinary schistosomiasis means that schistosomiasis is a winnable battle if concerted efforts are made to seriously tackle the disease. To effectively control the disease, mass drug administration and treatment of all infected persons should be organized alongside with socioeconomic improvement of endemic communities. The control strategy of de-worming and mass treatment of school-aged children should focus more in the Northern part of the country. Due to the relatively non-existent case registry data of urinary schistosomiasis for some specific time periods, further studies can be conducted in future to cover the periods for which the data was not available at the time of this survey for effective monitoring of the disease.

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