Review Article

Urinary schistosomiasis in Ebonyi State, Nigeria from 2006 to 2017

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ABSTRACT

Urinary schistosomiasis, caused by Schistosoma haematobium is very common in Nigeria, with Ebonyi State implicated to have the highest prevalence in the southeastern part of the country. The aim of this review was to estimate the status of urinary schistosomiasis in the State with regards to the elimination goals of World Health Organization (WHO). A comprehensive search of published articles on urinary schistosomiasis in Ebonyi State, Nigeria from 2006 to 2017 was conducted using Google Scholar, PubMed and African Journals Online (AJOL) databases. Out of 26 retrieved articles, 15 met the inclusion criteria. The MetaXL software was used to compute the pooled prevalence of urinary schistosomiasis using the random effect model and results are presented as forest plot. Based on meta-analysis output, the pooled prevalence of urinary schistosomiasis was 26.02% [95% Confidence Interval (CI) = 17.91–35.04%]. The pooled prevalence was higher before 2014, the year when treatment with praziquantel (PZQ) was started. Of the senatorial zones, Ebonyi North had the highest pooled prevalence of 34.57% (95% CI = 10.50–61.32%). In addition, the prevalence of the disease was higher when all the age groups were sampled (31.33%; 95% CI = 12.75–51.98%) than when only schoolchildren were used as sampling population (25.23%; 95% CI = 15.66–35.93%). The pooled prevalence revealed that despite the mass drug distribution (MDA) of PZQ in the State, there is continued transmission of urinary schistosomiasis. Hence, if the WHO elimination goal of the disease has to be met, focused control and elimination programmes along with intense complementary public-health interventions are necessary.

Key words Control; Ebonyi state; Nigeria; prevalence; Schistosoma haematobium; urinary schistosomiasis

INTRODUCTION

Schistosomiasis is a neglected tropical disease (NTD) and the most important water-borne disease1. It ranks second only to malaria as the most common parasitic disease. It is the most deadly NTD, infecting an estimated 140 million people each year, with over 90% of cases occurring in sub-Saharan Africa2. The disease primarily affects the rural poor and some disadvantaged urban populations3. Three main species of schistosomes infect human beings, Schistosoma haematobium, S. mansoni, and S. japonicum4. Schistosoma haematobium occurs in Africa and the Middle-East, whereas S. mansoni is present in the Americas and Africa. Schistosoma japonicum is localized to Asia, primarily the Philippines and China. Three more locally distributed species also cause human disease: S. mekongi, in the Mekong River basin, and S. guineensis and S. intercalatum in west and central Africa, respectively. Each species has a specific range of suitable snail hosts; hence their distribution is defined by the habitat range of their host snails. Schistosoma mansoni and S. haematobium need certain species of aquatic freshwater Biomphalaria and Bulinus snails, respectively. Schistosoma japonicum uses amphibious fresh water Oncomelania spp snails as its intermediate host4–5.

Nigeria has the greatest number of schistosomiasis cases worldwide6; and in the southeastern part of the country where urinary schistosomiasis is prevalent; Ebonyi State is reported to have the highest prevalence7. Urinary schistosomiasis is characterized by haematuria, dysuria, bladder wall pathology, hydronephrosis (swelling of a kidney due to a build-up of urine), and it can also lead to squamous cell carcinoma. In adults, the infection can cause genital ulcers and other lesions resulting in poor reproductive health, with sexual dysfunction and infertility8. These pathological alterations caused by S. haematobium occur mostly in school-age children, adolescent and young adults7.

As a result of this, the World Health Assembly (WHA) between 2001 and 2006 endorsed preventive chemotherapy by distributing Praziquantel (PZQ) tablets to primary target groups, like school-age children7. Adults in areas
of moderate and high prevalence, and those at risk due to their occupation were also included as target groups. The aim was to control the disease morbidity by 2010. However, in Nigeria, a country estimated to account for 24.5% of the global population requiring preventive chemotherapy,9 the range of PZQ distribution coverage was only 4%.

In 2012 and 2013, the WHA endorsed yet another resolution with the vision of, a world free of schistosomiasis. Some goals of the resolution were control of morbidity by 2020; and elimination of schistosomiasis as a public health problem by 2025. The WHA aimed to achieve these goals by 100% geographic coverage and 75% national coverage of PZQ distribution in endemic countries. In order to achieve this, challenges such as rate of implementation in endemic countries and the availability/access to PZQ, which is donated in very low quantity, have to be surmounted. Report of the ENVISION project funded by the US Agency for International Development (USAID) in Nigeria showed that inaccessibility of PZQ tablets due to delay in donations led to the low distribution coverage in some states in the country, including the Ebonyi State. Therefore, this study aimed to estimate the current prevalence of urinary schistosomiasis in Ebonyi State as the WHA target year is nearing up.

Literature search strategy

A systematic literature search of articles on the prevalence of urinary schistosomiasis in Ebonyi State, Nigeria published between 2006 and 2017 was conducted using Google scholar, PubMed and African Journal Online (AJOL) databases. The search started in July 2016 and was completed in August 2017. The combinations of key words used for the search were ‘prevalence’, ‘urinary schistosomiasis or Schistosoma haematobium infection’, ‘Ebonyi State’ and ‘Nigeria’.

Studies were screened and selected (as per the PRISMA guidelines) if those were published between 2006 and 2017 and included details of the study area in Ebonyi State, study population and prevalence of the infection as determined by microscopy. The studies showed that there are three senatorial zones in Ebonyi State: Ebonyi North comprising Abakaliki, Ebonyi, Ishielu, Ohaukwu and Izzi Local Government Areas (LGAs); Ebonyi Central: Ikwo, Ezza North and Ezza South LGAs; and Ebonyi South: Afikpo North, Afikpo South, Ivo, Ohaozara and Onicha LGAs.

Data extraction and statistical analysis

Articles were screened for duplicates and relevance. From the relevant studies; author, year of publication, study area/senatorial zone, study population and reported prevalence were extracted and subjected to meta-analysis using MetaXL software. Heterogeneity across studies was evaluated using Crohmnate Q test and F statistics. The random effect model was used to estimate the pooled prevalence at 95% CIs. To deal with the problems of confidence limits and erratic variance when population is small or big, a double arc sine transformation was used. Publication bias was measured using Doi plot and Luis Furuya-Kanamori asymmetry index (LFK index).

Characteristics of included studies

The literature search retrieved 26 published articles. After screening, 15 studies were found eligible and included in the final analysis as per the PRISMA guidelines (Fig. 1). The study characteristics are summarized in Table 1.

Prevalence of urinary schistosomiasis in Ebonyi State

The overall prevalence of urinary schistosomiasis from the studies selected ranged from 5 to 79%, with a pooled prevalence of 26.02% (95% CI = 17.91–35.04%) (Fig. 2). High heterogeneity was observed across studies (Crohmnate’s Q, p = 0; I² = 99.07%; 95% CI = 98.89–99.23%) and as such subgroup analysis was performed (Table 2). In the subgroup analysis, for the year of publication, pooled prevalence was highest in 2008 (61.51%; 95% CI = 20.33–97.27%) and least in 2012 (14.86%; 95% CI = 4.59–27.65%). Further subgroup analysis of the State senatorial zones revealed that Ebonyi North had a pooled prevalence of 34.57% (95% CI = 10.50–61.32%). This was followed by Ebonyi Central (33.81%; 95% CI= 21.99–46.46%) and Ebonyi South (12.45%; 95% CI= 6.39–19.99%). Prevalence of urinary schistosomiasis was higher for studies with all the age groups (31.33%; 95% CI = 12.75–51.98%) compared to when only school-
age children were sampled (25.23%; 95% CI = 15.66–35.93%).

Publication bias

The Doi plot demonstrated clear symmetry, indicating that most publications will report the State as a moderate-risk State for urinary schistosomiasis. The LFK index of 0.95 concurred with the Doi plot interpretation of symmetry (Fig. 3).

With few years to the WHA’s target of morbidity control and elimination of schistosomiasis as a public health problem, the pooled prevalence estimate of the infection still places the Ebonyi State as a moderate-risk State. According to the WHO, control of morbidity in moderate-risk areas demands preventive chemotherapy of school-age children and special risk groups9. Therefore, the retention of the State as a moderate-risk State at a time when there should have been substantial morbidity control is indicative of late implementation of mass PZQ distribution, and low drug coverage since distribution started. According to School and Health24, in the coun-

**Table 1. Summary of studies on the prevalence of urinary schistosomiasis in Ebonyi State, Nigeria**

| Study reference | Study area (LGA) | Senatorial zone | Study population | Sample size | No. of cases |
|-----------------|------------------|-----------------|------------------|-------------|--------------|
| Anosike et al12  | Ezza North       | Ebonyi Central  | All groups       | 2104        | 466          |
| Uneke et al15    | Ohaukwu          | Ebonyi North    | School children  | 376         | 180          |
| Uneke et al13    | Onicha           | Ebonyi South    | School children  | 500         | 55           |
| Uneke and Egede14| Ezza North       | Ebonyi Central  | School children  | 403         | 320          |
| Uwaezueko et al15| Ikwo             | Ebonyi Central  | School children  | 838         | 350          |
| Oyibo et al11    | Ikwo             | Ebonyi Central  | School children  | 576         | 169          |
| Nworie et al16   | Afikpo North     | Ebonyi South    | School children  | 500         | 49           |
| Elom17           | Ikwo             | Ebonyi Central  | School children  | 359         | 77           |
| Ivoke et al18    | Ohoazara         | Ebonyi South    | School children  | 894         | 137          |
| Nwosu et al19    | Afikpo North     | Ebonyi South    | School children  | 1010        | 50           |
| Ozowara et al20  | Ezza North       | Ebonyi Central  | School children  | 812         | 375          |
| Nwosu et al21    | Ezza North       | Ebonyi Central  | School children  | 325         | 57           |
| Onwe et al22     | Ebonyi           | Ebonyi North    | School children  | 525         | 119          |
| Nworie23         | Ezza North       | Ebonyi Central  | All groups       | 1800        | 342          |
| Elom et al24     | Onicha           | Ebonyi South    | School children  | 400         | 108          |

**Table 2. Pooled prevalence of urinary schistosomiasis according to subgroups**

| Subgroups | No. of studies analyzed | Prevalence (%) | 95% CI  
|-----------|-------------------------|----------------|--------|
| Year of publication |                          |                |        |
| 2006      | 3                        | 25.37          | 9.56–43.54 |
| 2007      | –                       | –              | –      |
| 2008      | 2                        | 61.51          | 20.33–97.27 |
| 2009      | –                       | –              | –      |
| 2010      | –                       | –              | –      |
| 2011      | 1                        | 29.17          | 25.69–33.12 |
| 2012      | 2                        | 14.86          | 4.59–27.65 |
| 2013      | –                       | –              | –      |
| 2014      | 1                        | 15.02          | 13.03–17.76 |
| 2015      | 3                        | 20.12          | 0–53.23 |
| 2016      | 1                        | 22.45          | 19.18–26.35 |
| 2017      | 2                        | 22.43          | 15.05–30.31 |
| Senatorial zones |                          |                |        |
| Ebonyi North | 2                        | 34.57          | 10.50–61.32 |
| Ebonyi Central | 8                        | 33.81          | 21.99–46.46 |
| Ebonyi South  | 5                        | 12.45          | 6.39–19.99 |
| Study population |                          |                |        |
| All age groups | 2                        | 31.33          | 12.75–51.98 |
| School children | 13                       | 25.23          | 15.66–35.93 |

**Fig. 2:** Forest plot of the pooled prevalence of urinary schistosomiasis in Ebonyi State, Nigeria.

**Fig. 3:** Doi plot generated using the prevalence of urinary schistosomiasis at different locations in Ebonyi state.
try’s master plan for NTDs, Ebonyi State was not listed among States that got donations of PZQ from 2009–2011. In Ebonyi State, distribution of PZQ started in 2014 after the schistosomiasis mapping (carried out in 2013); but the ENVISION project overview on NTDs revealed that some LGAs in Ebonyi State had zero percent coverage of PZQ distribution in 2015 due to delayed PZQ supply.

The subgroup analysis of the year of publication is necessary to analyze the progress made in the adoption of the resolutions of WHA. The prevalence of S. haematobium between 2006 and 2012 (as seen in the 95% CI) showed that there was no progress made in the control of the infection in the State during this period. Thereafter, in 2014 when distribution started the prevalence decreased and increased again in 2015 due to delayed PZQ supply as reported by USAID. However, in 2016 when mass drug distribution resumed, the prevalence dropped again and remained within the moderate-risk range in 2017.

Despite the ongoing PZQ MDA in the State, higher prevalence estimate of the infection in Ebonyi North and Ebonyi Central senatorial zones may imply that communities in these senatorial zones still depend on ponds, lakes, streams and rivers as water source, exposing them to the parasitic agent. Our finding showed that higher prevalence is recorded when the disease sampling involved all age groups. This implies that communities in the State are occupationally exposed to the infection because of the swampy nature of rice farms and dependence on ponds, lakes, streams and rivers as source of water.

CONCLUSION

The prevalence estimates obtained in this study showed that there is no significant reduction in the prevalence of S. haematobium infection despite the acclaimed MDA of PZQ, indicating continued transmission of urinary schistosomiasis in the Ebonyi State. Hence, there is need to boost availability of PZQ and its distribution in the State. The distribution of this drug of choice should not be limited to school-age children, rather it should be readily accessible to all the age groups in different communities that make up the State. If the WHO elimination goal of the disease has to be met, the focused control and elimination programmes are very necessary in the state. Implementation of complementary public-health interventions such as health education for behavioural change, provision of safe water and sanitation, environmental management and snail control is also necessary.

Conflict of interest

The authors declare that there is no conflict of interest related to this study.

Ethical statement: Not applicable

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