COUNTDOWN
Calling time on Neglected Tropical Diseases

Nigeria Situational Analysis | Annotated Bibliography

A Scoping Review of Nigerian Neglected Tropical Disease Literature: Annotated Bibliography

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Background

Nigeria has the largest burden of Neglected Tropical Diseases in sub-Saharan Africa, accounting for 25% of the continent's total Neglected Tropical Disease (NTD) burden[1]. In 2012, the World Health Organization (WHO) released a roadmap for implementation aimed at 'accelerating work to overcome the global impact of NTDs'[2]. In line with the roadmap targets, coupled with country commitments following the 2012 London Declaration[3], many endemic countries are striving to control and/or eliminate NTDs by 2020[2,4,5,]. The focus of control and elimination efforts has predominantly been in relation to the Preventative Chemotherapy (PC) NTDs, namely; onchocerciasis, lymphatic filariasis, trachoma, schistosomiasis and soil transmitted helminths (STH)[4,5]. Despite such focus, in many contexts there is a significant implementation gap between impending control and elimination targets and slow progress to date[4]. It has become critical to understand what factors are hindering progression, and what can be done to scale up and speed progress toward these goals.

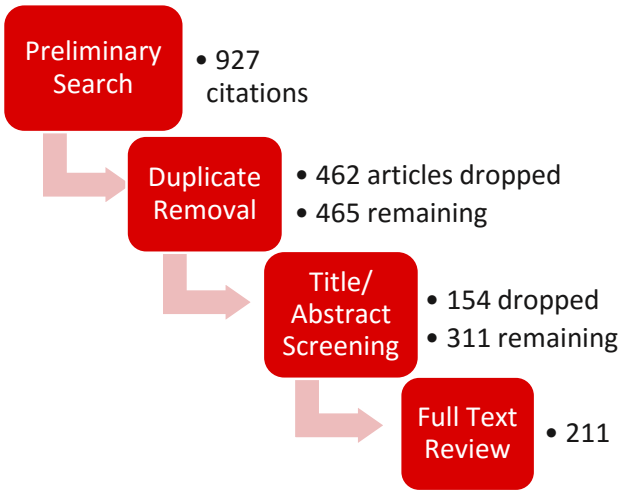
In 2015, the COU**NTD**OWN consortium, funded through the UK Department for International Development (DFID), was established with an overall goal of reducing mortality, morbidity, and poverty associated with NTDs. The consortium is focused in four countries; Ghana, Cameroon, Liberia and Nigeria, and is conducting implementation research to address current NTD programme bottlenecks with a view to accelerate progress toward control and elimination of PC NTDs. This bibliography is one output from the COU**NTD**OWN situational analysis, which sought to document the current strengths and weaknesses of the NTD programme in Nigeria, specifically in Ogun and Kaduna States, with a view to identifying areas for future implementation research. The annotated bibliography presents an overview of the typology of research articles identified and provides some tangible examples of the types of studies conducted to date.

Methodology

To explore the breadth of literature relating to the PC NTDs in Nigeria, we searched for peer-reviewed theoretical and empirical literature through the PubMed and Ovid databases. Detailed search terms are listed below. In Nigeria, co-implementation of different PC NTD control programmes started in 2006. Hence, only studies conducted and published between January 2006 and April 20th 2017 (when the searches took place) were included in this review. Studies were excluded if they did not focus on Nigeria or the full text was not available in English. Following preliminary searches, duplicates were removed. Titles and abstracts were then screened for relevance to the main search criteria - an article focused on one of more of the PC NTDs conducted in Nigeria. Non-relevant articles were removed at this stage and those that appeared relevant included for full text review.

Search Strategy	
Neglected Tropical Diseases OR NTDs	+
Lymphatic Filariasis OR Elephantiasis OR Hydrocele OR Lymphedema OR Wuchereria bancrofti OR Brugia malayi OR Brugia timori	+
Onchocerciasis OR River blindness OR Onchocerca volvulus OR Blackfly OR Simulium*	+
Trach* OR Chlamydia trachomatis OR	+
Soil Transmitted Helminths* OR STH OR Hookworm OR Whipworm OR Roundworm OR Necatoramericanus OR Ancylostomaduodenale OR Ascaris lumbricoides OR Trichuris trichiura OR Ancylostoma ceylanicum OR Geohelminthes OR Intestinal helminthes OR Intestinal helminths	+
Schisto*-+ OR FGS OR UGS OR Bilharzia OR snail fever	

Figure 1: Flow chart of the literature review process



205 articles were included in a full text review. The full text review involved two members of the research team reviewing the articles and developing a list of emergent categories as follows; epidemiological studies, health economics studies, social science studies, veterinary studies, health system strengthening studies and interdisciplinary studies. Following consensus on inductive categories, articles were then reviewed independently and assigned to the relevant category. Reviewers then compared their categorisation and any articles that were categorised differently were independently reviewed and assigned by a third reviewer. Such discrepancies were discussed amongst the review team and consensus reached upon which category that article should be assigned to. Any study relating to prevalence and control of parasites or disease was categorized as an epidemiological study; studies on patient costs or the cost of disease control were categorised as health economics studies; those that involved parasite prevalence in livestock animals were grouped as veterinary studies; and studies relating to behaviour and practice of people in relation to the disease or its control method were categorised as social science studies. Studies addressing any of WHO's six health systems building blocks were categorised as relating to health system strengthening and those that spanned two or more of these categories were grouped as interdisciplinary studies. Table 1 shows the numbers of articles assigned to each category during the review process.

Findings

An overview of each of the article categories is provided below, and two illustrative examples of articles are summarized and presented for each category, with reviewer reflections on article content. These articles were selected because they are representative of articles that were of particular interest to the reviewers and provide evidence that will assist in decision making for NTD programme implementation in Nigeria.

Article Category	Number of Articles
Epidemiology	143
Health Economics	5
Social Science	8
Veterinary Studies	6
Health System Strengthening	9
Interdisciplinary Studies	34
Total	205

Epidemiological Studies

The majority of the articles reviewed in this category focused on epidemiology of infection, particularly prevalence, and were aimed at determining the status and risk factors of the disease in one or more communities or LGAs. Limited studies were conducted on the vector or intermediate host of the parasite that causes the disease. Eighty-five articles in this category were studies conducted in the southern part of Nigeria, in both southwestern (Ogun, Oyo and Osun) and southeastern States (Anambra, Enugu, Imo, Cross River and Edo State). Forty-one studies were conducted in northern Nigeria, in northcentral (Plateau, Nassarawa and Benue) and northwest regions (Kaduna, Kano, Katsina). Very few studies were conducted in northeast regions (Yobe and Borno). Despite integration of disease programmes since 2006, 130 studies focused on a single disease and six studies focused on two of the PC NTDs (typically schistosomiasis and STH). In some cases the study involved one PC NTD and other diseases such as malaria. In terms of different NTDs, schistosomiasis was the most studied (54) while trachoma was least studied (11). All the studies were quantitative in nature.

epidemiological studies

Veterinary Studies

Five articles were identified in this category including studies on prevalence of intestinal helminths in animals belonging to the same genus with human intestinal helminths, and studies where animals were used as an experimental model to test the efficacy of drugs against specific parasites. Five were conducted in the southern part of Nigeria, three in southwest (Oyo and Ogun State), two in the southeast (Enugu State), one in the northern part of Nigeria, and one in the northeast (Borno State). All studies were quantitative.

Veterinary studies

Social Sciences Studies

Studies within this category were conducted to understand the behaviour, perception, and attitude of people living with PC NTDs and their perceptions of intervention programmes to control these diseases. The eight studies reviewed looked at adherence to Community Directed Treatment with ivermectin (CDTi), social benefits of treatment with ivermectin, socio-cultural factors that influence mass drug administration, and Community Drug Distributor (CDD) attrition. Two studies were conducted in Ogun State, southwest Nigeria, one of which was qualitative (focus group discussions and in-depth interviews), while the other had a quantitative cross-sectional design. Two additional studies were conducted in southwestern Nigeria: one in Calabar using both quantitative questionnaires and qualitative focus group discussions, and a qualitative study in Imo State. One study was conducted in Kano, northern Nigeria, and three were multi-country studies.

Social sciences studies

Health Economics Studies

Studies reviewed in this category were on the cost implications of NTDs from the patient and health system perspective. Economic literature was limited; only five studies were identified. Three studies used cost analysis methods, two of which were conducted in north central Nigeria (Plateau and Nassarawa State) and one which was completed in southwestern Nigeria (Oyo State). One study was conducted in Enugu using questionnaire administration and one was a multi-country study focused on the cost of estimating prevalence using an incremental cost ratio. Interesting studies in this category include those conducted to determine the cost-effectiveness of a diagnostic method and strategies used in programme implementation of a single disease. All the studies were quantitative.

Health economics studies

Health System Studies

Nine articles were identified in this category; two focused on capacity building of the NTD programme health workforce, and seven focused on service delivery—specifically, improving strategies for the implementation of Mass Administration of Medicines (MAM). Out of the nine articles, five were conducted in the central north of Nigeria (Pleateu, Nassarawa and Taraba); one study used data from all the States; one article was a review that focused on four countries including Nigeria, and two others were also multi-county studies which included three other African countries. Of these multi-country studies, one was an experimental study designed to evaluate the process, effectiveness and efficiency of an intervention strategy while the other was a viewpoint on MAM programmes. All the studies were solely quantitative in nature.

Health systems studies

Interdisciplinary Studies

Studies in this category were those that spanned various disciplines to answer specific research questions. Twenty-two articles utilised both epidemiological and social science approaches to gather information on disease prevalence as well as knowledge attitudes, and practice (KAP) about a specific disease in a specific locality. Out of these, 17 studies employed quantitative methods only, while four studies used mixed methods. Ten studies used mathematical modelling or/and Geographical Information System (GIS) to provide information on disease prevalence and distribution. Two studies focused on the impact of soil transmitted helminths on the nutritional status of infected persons using qualitative methods. One study used qualitative methods to evaluate policy briefs and the policy dialogue process for the control of poverty related disease. In terms of study area, 18 of the studies were conducted in the southern part of Nigeria; 7 in the southeast (Enugu, Ebonyi and Imo States) and 11 in the southwest (Ogun, Osun and Ondo States). Eight studies were conducted in the north; 3 in the northwest (Kano and Katsina State), 4 in north central (Benue, Taraba, Pleateu and Nassarawa) and 1 in northeast (Borno).

Interdisciplinary studies

Study Summaries

Epidemiological Studies

Ramyil, A., Wade, P., Ogoshi, C., Goyol, M., Adenuga, O., Dami, N. and Mpyet, C. (2015). Prevalence of Trachoma in Jigawa State, North-western Nigeria. *Ophthalmic Epidemiology*, 22(3), pp.184-189.

Authors from The University of Jos conducted an ophthalmology survey to determine the magnitude of trachoma and the prevalent forms of the disease in Jigawa State in north-western Nigeria. The purpose was to provide baseline data for the establishment of a trachoma control program in Jigawa State. They observed that trachoma is a major public health problem in Jigawa State, with the prevalence of follicular trachoma in children aged ≤ 9 years at 20.5% and prevalence of trichiasis in adults aged ≥15 years was 5%. Prevalence was higher in adult females than adult males. They highlighted the need to determine the district-level prevalence of trachoma to know which aspects of the WHO SAFE strategy (surgery, antibiotics, facial cleanliness and environmental improvements) should be emphasized in each district. The authors used a population based cross-sectional, 2-stage cluster random sampling technique to produce reliable and useful data to guide programme implementation, and for monitoring, evaluation, and measuring the impact of the trachoma control programme in Jigawa State.

King, J., Eigege, A., Richards, F., Jip, N., Umaru, J., Deming, M., Miri, E., McFarland, D. and Emerson, P. (2009). Integrating NTD Mapping Protocols: Can Surveys for Trachoma and Urinary Schistosomiasis Be Done Simultaneously?. *American Journal of Tropical Medicine and Hygiene*, 81(5), pp.793-798.

Authors from the Carter Center Nigeria and their collaborating institution in the US, conducted a study to assess whether disease programme integration can reduce fixed costs for single disease mapping and benefit more people. Their aim was to assess the feasibility of integrating NTD mapping protocols for schistosomiasis and trachoma to determine if integrating methodologies would yield similar findings to single disease mapping, and result in similar programmatic decision making. They conducted two separate integrated surveys in eight districts of central Nigeria using the standard mapping protocol for schistosomiasis (school-based survey) and that of trachoma (district-based survey) adopted by the Plateau and Nasarawa State Ministries of Health from the WHO. This was used to determine the prevalence of schistosomiasis and trachoma in 8 local government areas in Nassarawa and Plateau State. The authors observed that the integrated survey using the schistosomiasis school-based methodology identified 142 communities that required interventions for the control of trachoma, and 67 communities that required treatment with praziquantel (PZQ) to control schistosomiasis. Using the recommended trachoma district-based survey methodology, no district-wide trachoma interventions were required and three districts needed further investigation to ascertain intervention needs, because the rounded point estimate prevalence for trachomatous inflammation follicular was between 5% and 10%. Praziquantel treatment to school children would be targeted only to communities in Keffi if community-based treatment thresholds were applied to district-level estimates of haematuria. They observed that basing schistosomiasis interventions solely on the integrated trachoma district based surveys would result in missing 57 communities qualified for praziquantel treatment and treating of 14 communities in Keffi that did not warrant treatment. Findings from this study suggest that integrated mapping of NTD is feasible and cost effective; however, an integrated mapping protocol needs to be developed to include disease specific indicators for informed programmatic decision-making.

Veterinary Studies

Nwosu, C., Madu, P. and Richards, W. (2007). Prevalence and seasonal changes in the population of gastrointestinal nematodes of small ruminants in the semi-arid zone of north-eastern Nigeria. *Veterinary Parasitology*, 144(1-2), pp.118-124.

Authors from the University of Maiduguri conducted a survey to determine the prevalence and seasonal abundance of the eggs and adult stages of nematode parasites of sheep and goats in the semi-arid zone of north-eastern Nigeria. The authors did a parasitological examination of faecal samples of 102 sheep and 147 goats. Findings show that 44 (43.1%) and 82 (55.8%) samples of the sheep and goats respectively contained at least one nematode egg type. Three nematode egg types were recovered, with strongyle egg type (22.5% in sheep and 35.4% in goats) being the most prevalent followed by *Trichuris* (5.9% in sheep and 4.1% in goats) and *Strongyloides* (4.9% in sheep and 4.1% in goats). Authors observed that in both sheep and goats, counts of strongyle egg type increased with the rains and reached peak levels during the peak of the rainy season (September).

Authors also identified seven genera of adult nematodes within this study including: s*trongyloides, Trichostrongylus, Haemonchus, Trichuris, Cooperia, Oesophagophagostonum* and *Bunostomum*. The authors concluded that *Haemonchus*, *Trichostrongylus* and *Strongyloides* species may be the major contributors to small ruminant helminthiasis in the study area. The three helminths species found in this study belong to the same genus with that found in humans. Consequently, there is need to investigate their potential as a zoonotic parasite as this has implications for their epidemiology and control.

Sowemimo, O. (2008). The prevalence and intensity of gastrointestinal parasites of dogs in Ile-Ife, Nigeria. *Journal of Helminthology*, 83(01), p.27.

The authors from the University of Ife conducted a study to determine the prevalence and intensity of gastrointestinal parasites in dogs. A total of 269 faecal samples were collected from dogs (*Canis familiaris*) in Ile-Ife and examined. Findings show that seven helminth species were identified, including; *Toxocara canis* (33.8%), *Ancylostoma* sp. (34.6%), *Toxascaris leonina* (3.3%), *Trichuris vulpis* (3.7%), *Dipylidiumcaninum* (4.1%) , *Uncinaria stenocephala* (0.7%) and *Taenia* sp. (1.1%). The authors observed that prevalence of intestinal parasites was significantly higher ($P < 0.05$) in dogs of age 0–6 months than in older age groups. The prevalence of helminth parasites was significantly higher ($P < 0.05$) in free-ranging than in kennelled dogs. The authors concluded that the overall prevalence of intestinal parasites may continue to rise due to lack of functional veterinary clinics for dog care in Ile-Ife. They recommend the need to establish a veterinary facility in Ile-Ife. Some of the parasites identified in this study are zoonotic in nature, hence the establishment of a veterinary clinic for animal care and control of NTD parasites of veterinary origin is highly important.

Social Science Studies

Okeibunor, J., Amuyunzu-Nyamongo, M., Onyeneho, N., Tchounkeu, Y., Manianga, C., Kabali, A. and Leak, S. (2011). Where would I be without ivermectin? Capturing the benefits of community-directed treatment with ivermectin in Africa. *Tropical Medicine & International Health*, 16(5), pp.608-621.

Researchers at the University of Nsukka and their collaborating institutions conducted a cross-sectional study to document peoples' perceptions of the benefits of taking ivermectin as an important predictor of sustained compliance with long-term ivermectin treatment, and to identify the socio-demographic correlates of perceived benefits of ivermectin treatment.

The authors used mixed-methods to obtain information from individuals, families, and communities living in onchocerciasis meso- and hyper-endemic areas. This multi-country study also includes data from Cameroon, Democratic Republic of Congo, and Uganda. Findings include: 84.7% of respondents agreed that ivermectin treatment has many benefits which include social benefits (improved ability to work, peer acceptance and improved school attendance), individual benefits (self-respect /esteem, election to political office and improved relationships in the home) and health benefits (improved skin texture and less ill health). The authors identified important demographic factors influencing perception of the benefits of taking ivermectin. These include marital status ($P = 0.012$), age ($P = 0.029$) and length of stay in onchocerciasis-endemic communities ($P < 0.001$). These findings illustrate the importance of capturing beneficiaries' perceptions towards CDTi to produce effective health education materials and to increase the sustainability of ivermectin distribution. The authors concluded that a programmatic focus on the benefits of CDTi could provide the basis for motivating communities to comply with long-term treatment strategies. This study identified a means of developing health educational messages that can be used for community mobilization and sensitization.

Emukah, E., Enyinnaya, U., Olaniran, N., Akpan, E., Hopkins, D., Miri, E., Amazigo, U., Okoronkwo, C., Stanley, A., Rakers, L., Richards, F. and Katabarwa, M. (2008). Factors affecting the attrition of community-directed distributors of ivermectin, in an onchocerciasis-control programme in the Imo and Abia states of south–eastern Nigeria. *Annals of Tropical Medicine & Parasitology*, 102(1), pp.45-51.

Researchers at the Carter Center and Federal Ministry of Health Nigeria conducted a study to identify the factors that affect attrition of CDDs in the onchocerciasis control programme in two south-eastern states in Nigeria. The study was carried out through in-depth interviews with 101 CDDs from 12 communities. Participants included both serving CDDs and those who had withdrawn from being CDDs. Their findings show that CDDs who had ceased participating in the annual rounds of ivermectin distribution blamed lack of incentives (65.9%), the demands of other employment (14.6%), the long distances involved in the house-to-house distribution (12.2%), or marital duties as their reasons for quitting work as a CDDs. However, all CDDs (serving and non-serving) highlighted a lack of supervision and a lack of monetary incentive as a factor that significantly increased CDD attrition. They also observed that CDD retention was significantly enhanced when the distributors were selected by their community members, involved in educating their community members, and/or involved in other health programmes. This study shows that the problem of lack of incentives for CDDs has been ongoing for some time and can be a challenge to the sustainability of the CDTi programme if not addressed.

Health Economics Studies

Fatiregun, A., Osungbade, K. and Olumide, A. (2009). Cost-effectiveness of screening methods for urinary schistosomiasis in a school-based control programme in Ibadan, Nigeria. *Health Policy*, 89(1), pp.72-77.

The authors from the Department of Epidemiology, University of Ibadan, conducted a comparative cost-effectiveness analysis of the screening methods used for urinary schistosomiasis in a school-based screening and treatment programme in Ibadan. Findings were explored from a programme management perspective. The screening methods included terminal haematuria, unqualified haematuria, dysuria, visual urine examination, and chemical reagent strip technique. They observed that unqualified haematuria was found to be the most cost-effective method, costing N 51.06/US $2.16 to diagnose a schistosomiasis case correctly. They also found that despite the relatively high input costs (N 22.12/US $0.94) of chemical reagent strip technique compared to visual urine examination (N 6.44/US $0.27 per student), it was found to be more cost-effective (costing N 304.56 /US $12.91) than visual examination of urine, costing N 317.58/US $13.46 per correct case diagnosed. They concluded that from the view point of a programme manager working in the studied area, interviewing participants about evidence of blood in their urine is the most efficient means of screening for urinary schistosomiasis in school-based control programmes in their own environmental setting. Findings from this study show that cost effectiveness of screening methods can vary from one locality to another and is based on the level of endemicity and other environmental factors that influence the screening cost. This study was conducted in highly endemic settings and the findings may not apply in other epidemiological settings where prevalence is low or the disease is highly focalised.

Gutman, J., Richards, F., Eigege, A., Umaru, J., Alphonsus, K. and Miri, E. (2009). The presumptive treatment of all school-aged children is the least costly strategy for schistosomiasis control in Plateau and Nasarawa states, Nigeria. *Annals of Tropical Medicine & Parasitology*, 103(6), pp.501-511.

Researchers from Emory University School of Medicine used the method of Gutman *et al* (2008) to model the costs of four strategies for schistosomiasis control in Plateau and Nassarawa State with a view of identifying the most cost-effective control strategy. They used a typical Local Government Area in central Nigeria and costs were projected over 5 years for all four models. These four models include: screening for *Schistosoma heamatobium* only before treatment; screening for both *Schistosoma heamatobium* and *Schistosoma mansoni* before treatment; treatment of all school-aged children without screening; and treatment of the entire population without screening. They observed that first-year 'assessment' costs were particularly high for the models that included screening. The total 5-year costs to cover a population of 30,000, were estimated at US $18,673 for the model with screening for *Schistosoma heamatobium* only; a total of US $36,816 for the model with screening for both *Schistosoma heamatobium* and *Schistosoma mansoni*; US $15,510 for the treatment of all school-aged children; and US $68,610 for the treatment of the entire population. Authors identified that the presumptive treatment of school-aged children appeared to be the cheapest approach but that it would exclude community-wide treatment of highly endemic communities. Consequently, they emphasize the need for further studies to ascertain the implication of only treating part of the population. At the time of the study, the goal of the NTD programme was to control schistosomiasis. However, in line with the recommendations of the authors, and with a move towards elimination, there may be a need to replicate such studies to determine the cost effectiveness of the alternative treatment strategies in order to meet the goal of eliminating schistosomiasis in Nigeria by 2020.

Health Systems Studies

Richards, F., Eigege, A., Miri, E.S, Jinadu, MY., and Hopkins, R (2006). Integration of mass drug administration programmes in Nigeria: the challenge of schistosomiasis. *Bulletin of the World Health Organisation*. 84: 673-676

Authors from the Carter Center in Nigeria and the US conducted a study to assess the possibility of integrating treatment activities for onchocerciasis, lymphatic filariasis, and schistosomiasis in areas where they are co-endemic. Three stages of integrated MDA implementation were discussed: mapping the distribution of the three diseases at district level; tailoring district training and logistics based on the results of the mapping exercises; and implementing community based annual health education and mass treatment where appropriate. The authors were able to identify the "know–do" gaps in the MAM guidelines for each disease that prevented the successful integration of these programmes. They reported that current guidelines allowed onchocerciasis and lymphatic filariasis activities to be integrated but schistosomiasis activities could not be effectively integrated because of more restrictive guidelines. The authors recommended amendments to guidelines for schistosomiasis control to make it easier to integrate with other MAM programmes. This would facilitate mapping and an increase in the number of treatments. This study provides evidence supporting the need to develop an integrated NTD protocol that will allow for easy integration of NTD control, particularly for PC NTDs which have similar at-risk groups.

Akogun, O. and Badaki, J. (2011). Management of adenolymphangitis and lymphoedema due to lymphatic filariasis in resource-limited North-eastern Nigeria. *Acta Tropica*, 120, pp.S69-S75.

Researchers from Elephantiasis Project, Common Heritage Foundation, Yola, conducted a study to identify a culturally acceptable and effective strategy for the management of lymphoedema and adenolymphangitis (ADL) in three endemic Local Government Areas in Taraba State. They compared three approaches: community-based care, patient care, and health facility care. A total of 325 lymphoedema and ADL patients were recruited for the study, which found that the community care approach was more culturally acceptable and effective for the management of lymphoedema and ADL than other approaches. In this arm, compliance with hygiene practices increased from 29.4% to 62.6% and ADL episodes declined from 43.1% to 4.4% within 12 months compared to negligible effects in the other arms. In the patient and health care arms, compliance and accessibility to supplies was severely affected by poor coordination and delays in resource collection. It was noted that participants left the health facility care on average after their second visit. This study provides evidence to support the need for community awareness and engagement in effective delivery of NTD interventions, to promote community ownership and sustainability of the intervention programme.

Interdisciplinary Studies

Ekpo, U., Alabi, O., Oluwole, A. and Sam-Wobo, S. (2011). Schistosoma haematobium infections in preschool children from two rural communities in Ijebu East, south-western Nigeria. *Journal of Helminthology*, 86(03), pp.323-328.

Authors from the Federal University of Agriculture, Abeokuta, used quantitative (parasitological examination) and qualitative methods (focus group discussions and in-depth interviews) to understand the epidemiology of *Schistosoma* infections among pre-school children in two rural communities in Ijebu East, Ogun State. They observed that while some older school children (4-6 years) were exposed to schistosome-contaminated water when they went to the river to play or bathe, younger children were exposed to infection by their parent/caregiver who took them to the river to bathe the child and/or themselves. The authors recommended health education programmes be targeted at parents and caregivers of pre-school aged children to sensitize them on disease transmission. The use of qualitative data collection methods in this study allowed for an in-depth understanding of how the pre-school children are exposed to S*chistosoma* infection in this community. The information from the qualitative data could guide the development of integrated and alternative strategies to complement preventive chemotherapy approaches.

Okorie, P., Ademowo, G., Saka, Y., Davies, E., Okoronkwo, C., Bockarie, M., Molyneux, D. and Kelly-Hope, L. (2013). Lymphatic Filariasis in Nigeria; Micro-stratification Overlap Mapping (MOM) as a Prerequisite for Cost-Effective Resource Utilization in Control and Surveillance. *PLoS Neglected Tropical Diseases*, 7(9), p.e2416.

Authors from the University of Ibadan and Federal ministry of Health Nigeria developed a database for Lymphatic Filariasis (LF) distribution in Nigeria using prevalence data on LF obtained from the literature and Federal Ministry of Health data. They employed GIS software to incorporate overlay maps of LF prevalence with predicted prevalence of *Loa loa*. This was done for areas were there is ongoing onchocerciasis community-directed treatment with ivermectin and areas where distribution of long-lasting insecticidal mosquito nets (LLIN) for malaria has been completed. The authors observed that LF endemic areas geographically coincided with CDTi priority areas, however, LLIN coverage was generally low (50%) in areas where LF prevalence was high or co-endemic with *Loa loa*. The authors concluded that the extensive database and series of maps produced in this study provide an important overview of the LF programme and will assist in maximising existing interventions while ensuring efficient use of resources as the programme scales up. The use of GIS technology in epidemiology and control of disease is a recent trend in Nigeria. Several other authors in Nigeria have also used it to delineate distribution of other NTDs like schistosomiasis and soil transmitted helminths. It is a very useful tool for disease programme managers for the purpose of easy identification of areas that needs intervention and maximization of scarce resources.

* A full list of citations is available at **http://countdown.lstmed.ac.uk/**

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COUNTDOWN (grant ID PO 6407) is a multi-disciplinary research consortium dedicated to investigating cost-effective, scaled-up and sustainable solutions to control and eliminate the seven most common NTDs by 2020.

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