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| Institution: The University of Edinburgh | | |
| Unit of Assessment: UoA 5 Biological Sciences | | |
| Title of case study: Reduction in infection and morbidity from neglected tropical disease in Zimbabwe and across Africa | | |
| Period when the underpinning research was undertaken: 2011 - 2020 | | |
| Details of staff conducting the underpinning research from the submitting unit: | | |
| Name(s): | Role(s) (e.g. job title): | Period(s) employed by submitting HEI: |
| Professor Francisca Mutapi | Chair of Global Health Infection and Immunity | 2002 - present |
| Period when the claimed impact occurred: 1 st Aug 2013 - 31 st Dec 2020 | | |
| Is this case study continued from a case study submitted in 2014? Y/N No | | |
| <p>1. Summary of the impact</p> <p>Attribution: Research carried out at The University of Edinburgh led by Professor Mutapi, in close collaboration with The University of Zimbabwe, led to a reduction in schistosomiasis (Bilharzia) and has influenced national control policies.</p> <p>Impact on health and welfare: The treatment program has reached 100% of the target population, and reduced infection and disease level from a national level of 32% to 0% for Schistosomiasis and Soil Transmitted Helminthiasis (STH) in Zimbabwe.</p> <p>Impact on public policy: Professor Mutapi implemented a mapping strategy for Neglected Tropical Diseases (NTDs) in Zimbabwe, which then informed appropriate treatment policies. As a result of the mapping strategy conducted by Mutapi, treatment and resources were focussed on endemic areas. This strategy was subsequently adopted by many other African countries. Preschool aged children are now included in the ongoing 2012 Zimbabwe NTD control policy.</p> <p>Beneficiaries: 5,000,000 Zimbabwean school and preschool aged children at risk of disease by NTDs in Africa; cost savings through safe and integrated Mass Drug Administration (MDA) programmes.</p> <p>Significance and reach: Decrease in infection and disease from Schistosomiasis and STH in Zimbabwe. Mapping of NTDs has been completed in approximately 87% of countries in Africa encompassing an estimated 620,000,000 people at risk of disease by NTDs.</p> | | |
| <p>2. Underpinning research</p> <p>Schistosomiasis (<i>S. haematobium</i> and <i>S. mansoni</i>) and soil transmitted helminthiasis (STH) are among the most widely distributed neglected tropical diseases (NTDs) that affect people living in vulnerable communities with poor and limited access to safe water, sanitary facilities and inadequate health facilities. Approximately 200,000,000 people are affected by schistosomes worldwide, with over 90% of the cases occurring in Africa.</p> <p>Professor Francisca Mutapi, a leading researcher in the field of schistosomiasis and Global Health, has run a collaborative research program in Zimbabwe for the past 20 years. She collaborated with colleagues from the University of Zimbabwe to carry out a nationwide cross-sectional survey to map schistosomiasis and STH in 2010 and 2011, among 13,195 primary school children in 280 primary schools from 68 rural and urban districts in Zimbabwe to represent infection in the country's >5 million children exposed to schistosomiasis [3.1]. The team used the gold standard parasitology diagnostics techniques available at the time to determine schistosome and STH infection prevalence and intensity.</p> <p>Professor Mutapi and her group have shown the detrimental health impact of schistosomiasis in children [3.2] and demonstrated that treatment with praziquantel, the drug of choice, is safe and efficacious not only in treating primary school children, but also preschool children [3.3]. Prior to the work, there was no schistosome control program in Zimbabwe. Following the recommendations of the World Health Assembly (WHA), resolution 54.19 advocated for the control of schistosomiasis morbidity in highly endemic areas, and urged countries to attain a target of regular treatment of "at least 75% and up to 100% of all school-age children at risk</p> | | |

of morbidity by 2010". Zimbabwe needed a national control programme, however, WHO indicated that countries needed to know their baseline infection levels in order to implement the appropriate control strategy.

Overall, the national schistosomiasis prevalence was 22.7% (range 0%–62%) and that of STH was 5.5% (range 0%–45%). Based on the results of this study that confirm nationwide predominance in distribution of schistosomiasis and STH, the team contributed to the development of preventive chemotherapy strategies and implementation in the country [3.4]. In addition to the population impact based on this mapping study, the national control program, which targets individuals, also had a significant positive impact on reducing infection and improving health.

3. References to the research

[3.1] Midzi, N, Mduluza, T, Chimbari, MJ, Tshuma, C, Charimari, L, Mhlanga, G, Manangazira, P, Munyati, SM, Phiri, I, Mutambu, SL, Midzi, SS, Ncube, A, Muranzi, LP, Rusakaniko, S & Mutapi, F. 2014, 'Distribution of Schistosomiasis and Soil Transmitted Helminthiasis in Zimbabwe: Towards a National Plan of Action for Control and Elimination'; 2014; PLoS Neglected Tropical Diseases, vol 8, no. 8, e3014.

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[3.3] Mutapi, Francisca ; Rujeni, Nadine ; Bourke, Claire ; Mitchell, Kate ; Appleby, Laura ; Nausch, Norman ; Midzi, Nicholas ; Mduluza, Takafira. Schistosoma haematobium Treatment in 1-5 Year Old Children. 2011; Safety and Efficacy of the Antihelminthic Drug Praziquantel. PLoS Negl Trop Dis, Vol. 5, No. 5, 05.

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[3.5] Mutapi, F. Getting a GRiPP on everyday schistosomiasis: experience from Zimbabwe. Parasitology. 2017; 144, 1624–1632. 2016. <https://doi.org/10.1017/S0031182016001724>

[3.6] Lim RM, Woolhouse MEJ, Mduluza T, Chase-Topping M, Osakunor DNM, Chitsulo L, Mutapi F. Investigating a strategy for quantifying schistosome infection levels in preschool-aged children using prevalence data from school-aged children. PLoS Negl Trop Dis. 2020 Oct 1;14(10):e0008650. <https://doi.org/10.1371/journal.pntd.0008650>

4. Details of the impact

Background and pathway to impact

The World Health Organisation has a roadmap (2020 Roadmap for Neglected Tropical Disease) for member states to eliminate schistosomiasis as a public health problem by 2030. Based on the results of Professor Mutapi's research that confirmed nationwide predominance in distribution of schistosomiasis and a lesser extent of STH, preventive chemotherapy strategies were determined and recommended for the elimination of these two specific NTDs in Zimbabwe.

"On a national scale, Professor Mutapi has been involved in the genesis, planning and implementation of Zimbabwe's helminth control programme started in 2012."

[5.1]

In September 2012, the Zimbabwe Ministry of Health formulated a national NTD control policy, 5-year action plan and implemented school-based mass drug administration, including schistosomiasis treatment, targeting primary and secondary school children across the country based on this mapping exercise. Five of the six annual mass drug administrations (MDAs) occurred within the REF2021 impact period [5.1].

Crucially, Zimbabwe's control programme recommended **treating all children annually irrespective of the regional prevalence of infection**. This is in contrast to the WHO preventive chemotherapy guidelines that recommend the frequency of treatment based on community/regional infection level, *i.e.* high risk communities should be treated annually, whereas those at lower risk should be treated every two years or twice within a child's school career.

"This work provided the evidence base leading to the WHO recommendations, thus correcting a significant and long-standing health inequity, and making ~50 million pre-school African children eligible for schistosomiasis treatment." [5.1].

Impact on health and welfare

Disease: The treatment program has not only reached 100% of the target population, but has reduced infection and disease level in school children from a national level of 32% to 0% [5.1]. Annual MDAs were carried out in Zimbabwe from September 2012. Five of the six annual MDAs occurred within the REF2021 impact period (10/2013, 01/2015, 11/2015, 11/2016, 11/2017). For the six years of annual MDA, monitoring and evaluation of the treatments were conducted [3.4]. After six rounds of annual MDA, Zimbabwe surpassed the WHO

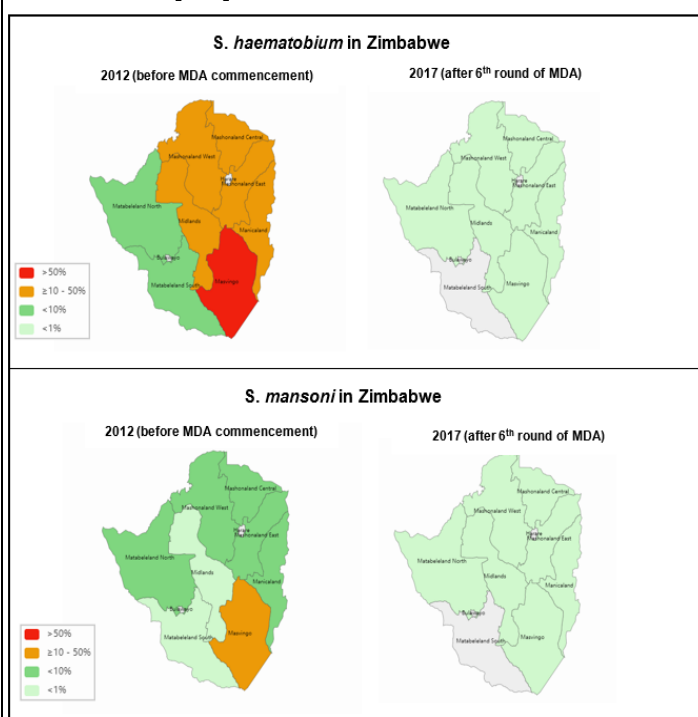


Figure 1 Changes in prevalence at national level from MDA 1 to MDA 6.

recommended 75% coverage to over 90% coverage and decreased national prevalence of schistosomiasis (infection and disease) from 32% to <1% in school children [5.1]. The treatment coverage increased each year peaking at 90% in 2016, well above the 75% coverage for schoolchildren set by the WHO for the "2020 Roadmap" for schistosomiasis [5.2]. Annual assessment in sentinel sites throughout the country showed that schistosome infection and disease level decreased significantly after each round of treatment from the pre-treatment levels in the same year. Most notably, both urogenital schistosomiasis infection and morbidity prevalence reduced from 32% at baseline in 2012 to 0% in 2017, and infection intensity reduced and 28.75 eggs/10ml urine to 0 in the same time period. Intestinal schistosomiasis prevalence and intensity reduced from 4.6% and 0.28 eggs/25mg of stool to 0% and 0 eggs respectively [3.4], [all the treatment coverage data are publicly available on the ESPEN database 5.3, 5.4 & 5.5]. Thus, the control programme significantly reduced schistosome infection and morbidity in the school children, illustrated in Figure 1 [3.4], moving the national schistosome prevalence in school-aged children from moderate to low by WHO classification.

In 2018, Zimbabwe spent USD15,392,840.14, on drugs to treat NTDs (intestinal worms, schistosomiasis, lymphatic filariasis and trachoma) as part of the MDA programmes [5.6, pg14], placing Zimbabwe in the top 8 African countries based on the value of treatments. In 2018, 95,300,000 people received preventative chemotherapy for schistosomiasis, 76,200,000 million were school-aged children and the remaining 19,100,000 were adults [5.7 i-iii].

Due to the success of the MDAs, the need for an integrated strategy for eliminating schistosomiasis in Zimbabwe involving treatment, sanitation and education was highlighted in The End Fund, "Breaking the Cycle of neglect" review.

"To develop robust elimination strategies it is vital for Zimbabwe to gain a better understanding of the distribution of these diseases in adults and preschool-age children." [5.8]

"There is also an urgent need to improve education on NTDs within the primary school curriculum on hygiene and sanitation practices." [5.8]

Daily life: To capture impact at the individual child level as well as overall impact in schools, a community impact evaluation [5.9] was carried out in late October 2019. Perception of the MDA programmes for helminth control by the affected populations influences compliance and future designs of the programmes. Public perception of Zimbabwe's National Helminth Control Program (2012-2017) was determined with a specific focus on schistosomiasis in the school children treated with praziquantel, school teachers and village health workers (VHW).

The study enrolled 409 children from Grades 6 and 7 who had the full benefit of the 6 years of MDA from 2012 to 2017. 36 schoolteachers and 22 VHW serving the schools were also recruited. The evaluation focused on the perceived impact on health, school attendance and performance and Knowledge Attitudes and Practice (KAP). Overall, 84% of the children responded that their awareness of schistosomiasis (transmission, disease, treatment and infection avoidance) had improved because of participating in the MDAs. Of the 151 children self-diagnosed with schistosomiasis, 74% reported that their health had improved following treatment with praziquantel. This included resolution of haematuria, painful urination, sore stomach, tiredness and falling asleep during class lessons. The children and teachers reported improvements in both pupil school attendance and performance at school as well as an increase in health seeking behaviour for schistosomiasis treatment in-between MDAs.

The majority of VHW (96%) reported improvement in handwashing behaviour, schistosomiasis awareness (96%) and treatment uptake (91%) within the community. However, only 59% and 50% of the VHW reported improvement in toilet use and clean water use respectively, within their communities.

This study indicated that the community perceived that the MDA programme had improved the health of children, their school attendance, school performance and awareness of schistosomiasis. The VHW also perceived that the MDA program had improved the community KAP. Perception of helminth MDA programs by the affected populations influences compliance and therefore, affects the success of the programme. This evaluation determined the perception of Zimbabwe's National Helminth Control Program with a specific focus on schistosomiasis in the school children treated with praziquantel, schoolteachers and village health workers (VHWs) [5.9].

NTD Mapping in Zimbabwe and elsewhere: Due to the success of the Zimbabwe National NTD programme, other countries in Africa have adopted the mapping strategy [3.3] and subsequent implementation of control programmes for schistosomiasis, STH and other NTDs [5.1].

"We conducted a national survey to map the current distribution of schistosomiasis and for the first time, to map the distribution of STH in Zimbabwe" [3.3].

Mapping of NTDs is now complete in 41 (87%) countries in the African region [5.7, pg 5]. In the REF impact period (2014 & 2015), 22 African countries including Mauritania, Liberia, Chad, Niger, Nigeria, Benin, Namibia, Madagascar & DR Congo were mapped for NTDs by the WHO-AFRO mapping project.

"A total of 75 million school aged children (SAC) were treated in 2017, representing an unprecedented coverage of 69.4% from 29 countries that reported data in a timely manner." [5.10, pg 5].

Mapping was ongoing in Ethiopia and Angola and was soon to start in South Africa, South Sudan and Algeria. The AFRO Mapping project, a joint effort of WHO's African Regional Office and NTD Support Centre, is nearing completion of Phase I: the district-wide assessments for preventative chemotherapy against NTDs (lymphatic filariasis, onchocerciasis, soil-transmitted helminthiasis, schistosomiasis and trachoma). Building on countries' earlier mapping efforts, 85% of districts in the AFRO region now are fully mapped for these diseases. This impact covers over 87% of countries in Africa and an estimated 620 Million people at risk of disease by NTDs in Africa. The mapping of NTDs across Africa has allowed countries to work towards effective regional elimination programmes and improve accuracy of the

incidence of NTDs. There will be cost savings through safe and integrated mass drug administration, and through ending of unnecessary treatments.

More recently, Professor Mutapi's group extended the findings of the mapping exercise to develop a strategy for mapping schistosome infection in preschool children, a current knowledge gap identified by the WHO. The strategy developed by Professor Mutapi and her group uses data from the surveys in school age children such as that highlighted here for an inexpensive approach applicable in poor resource settings obviating the need for surveying young children [3.6].

Impact on public policy:

As a direct result of the Mutapi group's research [3.2], preschool aged children are included in the 2012 Zimbabwe NTD control policy. Zimbabwe implemented this policy throughout the REF period, and consequently these children have been treated annually in local clinics out with the MDAs [3.5] [5.1].

"Professor Mutapi and her team showed that pre-school children are exposed, infected and suffer from schistosome morbidity. She also showed that treatment with praziquantel was safe and efficacious in this age group. This work provided the evidence base leading to the WHO recommendations, thus correcting a significant and long-standing health inequity, and making ~50 million pre-school African children eligible for schistosomiasis treatment." Director Epidemiology and Disease Control, Ministry for Health and Child Welfare, Zimbabwe [5.1]

5. Sources to corroborate the impact

[5.1] Testimonial, Director Epidemiology and Disease Control, Ministry for Health and Child Welfare, Zimbabwe.

[5.2] Ending the Neglect to Attain the Sustainable Development Goals: A road map for neglected tropical diseases 2021–2030 https://www.who.int/neglected_diseases/Ending-the-neglect-to-attain-the-SDGs--NTD-Roadmap.pdf

[5.3] The ESPEN Portal enables health ministries and stakeholders to share, and exchange subnational programme data, in support of the NTD control and elimination goals. This site has Schistosomiasis and STH (and other) mapping information – mapping surveys, endemicity maps, MDA/PC coverage, MDA/PC rounds
<http://espen.afro.who.int/countries/zimbabwe>

[5.4] EPSEN web portal showing MDA coverage. <https://espen.afro.who.int/program-stages/mdapc-coverage>

[5.5] ESPEN_2019-Annual-Report- This Year's Report At A Glance –pg 8
https://espen.afro.who.int/system/files/content/resources/ESPEN_2019-Annual-Report_En_HD_2020-07_21.pdf

[5.6] ENDFUND: Zimbabwe's MDA programme expenditure for the control of NTDs. 2018-annual report-PDF <https://end.org/cms/assets/uploads/2019/05/2018-Annual-Report-Final.pdf>

[5.7] i) Weekly epidemiology record–Schisto & STH number of people treated in 2016-PDF <https://apps.who.int/iris/bitstream/handle/10665/259593/WER9249.pdf?sequence=1>

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iii) Weekly epidemiology record–Schisto & STH number of people treated in 2018-PDF <https://extranet.who.int/iris/restricted/bitstream/handle/10665/330108/WER9450-eng-fre.pdf?ua=1>

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