

## From morbidity control to transmission control: time to change tactics against helminths on Unguja Island, Zanzibar

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### Introduction

In Zanzibar (Unguja and Pemba), the prevalence and intensity of *Schistosoma haematobium* and soil-transmitted helminth (STH) infections have rapidly decreased over the last 25 years, primarily due to the implementation of the 'preventive chemotherapy (PCT)'-based morbidity control strategy. The population has received repeated large-scale administration of anthelmintic drugs since 1986. It started with praziquantel treatment of *S. haematobium* infected individuals (mainly school-aged children) in Pemba in 1986. It later became a national plan of action for helminth control, and mebendazole was added to the drug package in Pemba in 1992, which was expanded to cover both islands in 1994. After irregular drug administration during 1999-2003, albendazole and praziquantel were distributed to school children during 2004-2006. Five rounds of mass drug administration using ivermectin plus albendazole in the frame of the Global Programme to Eliminate Lymphatic Filariasis (GPELF) were also carried out on both islands from 2001 to 2006. In addition to these, pre-school children have also been targeted since 2005 in the UNICEF-supported programme. Complementary to control efforts, intensive socioeconomic development, improvement to sanitation and better hygiene and health education have been instrumental to the impact on schistosomiasis, STH and other parasitic diseases. The paper focuses on changing patterns of schistosomiasis and STH infections in Unguja, highlighting the importance of socioeconomic development, improvement in sanitation and health education as additional drivers in helminth control. The authors concluded that the tactics against helminthiasis in Zanzibar should now be shifted from morbidity to transmission control, which might ultimately lead to local elimination.

### Materials and Methods

Data were obtained from five cross-sectional surveys carried out between 2006 and 2009 with stool and urine samples from 2858 and 879 individuals, respectively, examined for helminth eggs and larvae. Additionally, several hundred people were interviewed on sanitation and hygienic behaviour. Data on Unguja's economic growth and improvements in access to clean water and household latrines in the recent past were derived from the extant literature. In order to determine the association between the helminth infections and access to sanitation and hygiene behaviour; univariable and multivariable logistic regression was used for estimating odds ratios (ORs), including 95% confidence intervals (CIs).

### Results

#### Prevalence of STH and *S. haematobium*

All data was pooled and only the first stool/urine sample examined per individual was used in the age-groups which included over 20 individuals. In individuals aged  $\leq 5$ , 6-18 and  $\geq 19$  years, detected prevalence of *Ascaris lumbricoides* was 9.5%, 12.8% and 10.4%, hookworm 2.8%, 11.2% and 8.2%, *Trichuris trichiura* 20.3%, 43.5% and 13.9%, and *Strongyloides stercoralis* 12.0%, 6.3% and 5.2% respectively. *S. haematobium* was detected in 36.8% of urine samples in children/adolescents aged 6-18 years and 4.6% of adults. A smaller subset of individuals (n=319) were assessed for multiple species parasite infections and 24.5% were infected with two or more helminth species concurrently.

Further analysis also showed a considerable difference in prevalence at village and district level. Hookworm infections were found in all districts with the highest prevalence in District West (11.4%) and lowest in District South (1.9%). *T. trichiura* infections were predominant in all districts of Unguja (range: 15.3-45.3%), with the exception of District West (9.6%). *A. lumbricoides* was moderately prevalent in North A (16.5%) and Central (12.6%) districts, in contrast however no infections were detected in participants from the urban district. The prevalence of *S.stercoralis* infections was found to be uniformly distributed across all districts in Unguja (range: 4.5-9.5%) and *S.haematobium* infections were most frequently detected in schoolchildren from Kinyasini in District North A (67.7%). Furthermore, light infections of hookworm, *T.trichuris* and *A.lumbricoides* were detected in 99.3%, 93.9% and 74.5% respectively, of all participants within the analysis.

#### **Changes to helminth infections between 2006 and 2009**

In a multivariable analysis, adjusting for sex, age and village, a statistically significant decrease of *A.lumbricoides* (OR: 0.58;  $p<0.001$ ) and significant increase in *T.trichiura* infections (OR: 1.33;  $p=0.001$ ) was detected. No such trends were seen for hookworm, *S.stercoralis* (OR:1.04;  $p=0.958$ ) and *S.haematobium* infections (OR: 0.85;  $p=0.640$ )

#### **Sanitation and hygiene as risk factors for STH infections**

The study showed a negative association between age and *T.trichiura* and *S.haematobium* infections; however an increased risk to hookworm infection was detected in relation to age. A correlation between sex and infection with hookworm or *S.stercoralis* indicated that males were more likely to be infected than females. Using univariable regression analysis, individuals who had a toilet at home and washed their hands before eating were found to be statistically significantly less likely to be infected with *A.lumbricoides* and *T.trichiura*, however no such statistically significant relationship could be associated with hookworm or *S.stercoralis*. In addition, no statistically significant relationship could be detected between washing hands after defecation and infection of any of STHs investigated. However, when adjusting the individual risk factors for sex, age and village in multivariate regression analyses, having a toilet at home and washing hands before eating showed no significant protective efficacy against *A. lumbricoides* and *T. trichiura*.

#### **Discussion**

The data show significant reductions in schistosomiasis and STH infections on Unguja Island over the past 20-25 years, highlighting the importance and success of helminth control programmes emphasising PCT. However, there are still pockets of high prevalence helminth infections and considerable regional heterogeneities in the prevalence of each helminth species investigated. *T. trichiura* infection is one exception with the continued high prevalence in face of ongoing deworming activities, and this may be explained by the low efficacy of the two widely used anthelmintic drugs (i.e. albendazole and mebendazole) against this species when administered as single oral dose. Overall the study found that PCT was only partially attributable to the success of the control programme, with social and economic development playing an important role in driving the control of not only schistosomiasis and STH, but also other tropical parasitic diseases, such as malaria. Hotspots of helminth infections are most likely to be caused by environmental, host or socioeconomic risk factors. Since infection intensities with STH and *S. haematobium* on Unguja have dropped to a low level across the island, and no further significant reduction in helminth infections has been seen since 2006, even with slight increase of *T. trichiura* infections, the authors conclude that helminth control on the island should be shifted from morbidity control to transmission control with the ultimate goal of local elimination by filling the gaps in adequate health education, hygiene behaviour and appropriate sanitation.

#### **Editor's Comments**

Helminth infections are a major burden imposed on poor populations in the developing world, however

utilising low-cost yet effective public health interventions could relieve the burden and vastly improve the quality of life. Through over 25 years of large scale PCT, Zanzibar has seen significant reduction of urinary schistosomiasis and STH infections, particularly, intensity of infections. However, the helminth control in Zanzibar has reached a bottleneck as no further significant reduction in helminth infections has been seen since 2006 with ongoing PCT for morbidity control. There is a need and opportunity in Zanzibar for a shift of control strategy to transmission control. By such a shift, further improvements in behaviour change communications and water supply and sanitation should be enhanced by well structured and repeated awareness campaigns to accompany the ongoing PCT activities. With expanding integrated NTD control efforts in sub-Saharan Africa, more countries will reach such a stage that the control strategy needs to be shifted to accommodate the changing situation. There is a need of global guidelines for a streamlined and progressive transition in control strategies.

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