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Elimination of schistosomiasis haematobia as a public health problem in five governorates in Upper Egypt

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ABSTRACT

The prevalence and intensity of *Schistosoma haematobium* infection was determined among schoolchildren living in five governorates in Upper Egypt. Between November 2016 and March 2017, urine samples were collected from 30,083 schoolchildren (6–16 years of age) from the governorates of Assiut (n = 7496; 6 districts), Bani Sweif (n = 4493; 7 districts), Fayoum (n = 4597; 6 districts), Menia (n = 7500; 9 districts) and Sohag (n = 5997; 11 districts). All samples were processed using urine filtration to detect and quantify *S. haematobium* eggs. The overall prevalence was 1.3% (95% Confidence Interval (CI) = 1.1%, 1.4%), but the prevalence varied considerably across districts in the studied governorates (from 0%, Fayoum to 13.4%, Sohag). The prevalence of heavy-intensity infections (≥50 egg/10 ml) varied from 0.05% (95% CI = 0.01-0.1) in Sohag to 0.3% (95% CI = 0.1-0.4) in Menia. No subject with heavy intensity of infection was detected in Fayoum and Bani Sweif governorates. Of the 39 studied districts 97.4% had prevalence of heavy intensity infection of < 1%, indicating elimination of schistosomiasis haematobia as a public health problem in these districts. Of those studied 72.0% were male. Males were 2.9 times as likely to be infected (1.5% [95% CI: 1.4–1.7]) as females (0.5% [95% CI: 0.3-0.7]); $\chi 2 = 51.2$, $p < 0.0001$. Heavy intensity of infection was detected only in males. The prevalence of *S. haematobium* infection increased steadily with age, and the age group > 15 years was 7 times as likely to be infected as the younger age group (6- < 9; 0.8%); $\chi 2 = 44.9$, $p < 0.0001$. The national schistosomiasis control programme (NSCP) adopted a new elimination strategy by readjusting thresholds for MDA using praziquantel and targeting all transmission areas. The NSCP, after this major achievement of elimination of schistosomiasis haematobia as a public health problem, is now moving to interruption of its transmission.

1. Introduction

Schistosomiasis is one of the major neglected tropical diseases worldwide, ranked second only in parasitic diseases to malaria in terms of its socioeconomic and public health importance in tropical and subtropical areas. By 2016, it was estimated that at least 209 million people require preventive treatment (World Health Organization, 2018). The disease mostly affects poor and rural communities, particularly agricultural and fishing populations. The disease is caused by an infection with the blood fluke *Schistosoma* spp. and is transmitted to humans through transcutaneous penetration by its larval stages following human direct contact with infested water (Steinmann et al., 2006). Two forms are endemic in Egypt: intestinal schistosomiasis caused by *Schistosoma mansoni*, and urinary schistosomiasis caused by *S. haematobium*; the latter prevails south of Cairo along the Nile Valley (El Khoby et al., 2000).

The National Schistosomiasis Control Program (NSCP), established by Egypt's Ministry of Health and Population (MoHP) in 1977, has been

Abbreviations: CIs, confidence intervals; MDA, mass drug administration; MoHP, Ministry of Health and Population; NSCP, National Schistosomiasis Control Programme; WHO, World Health Organization

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successful in significantly decreasing the overall disease prevalence, which declined from about 40% in 1967 to ≤ 3% in 2012, due to application of different control measures. In addition, the intensity of infection, measured by egg count, has decreased considerably. However, there were still "hot spot" transmission foci with prevalence rates of about 10% in 2006. The number of "hot spots" was 136 in 2010 and decreased to 88 in 2013, of which 83 were in Lower Egypt (Nile delta governorates) and 5 in Upper Egypt (Barakat, 2013). Such achievements have encouraged the NSCP to consider moving its target objective from disease control to elimination, i.e. reducing incidence of infection to zero. The NSCP objective is in accordance with the World Health Assembly Resolution WHA65.21 (2012) calling for "Elimination of Schistosomiasis". To achieve this goal, the NSCP has recently decided to apply mass drug administration (MDA) of praziquantel to children and adults in areas where the prevalence of any form of the disease is ≥2%, and other treatment schemes where prevalence is below that. Therefore, accurate assessment of infection prevalence rates is a key factor for successful implementation of MDA.

Recently the NSCP has updated the distribution map of *S. mansoni* in five Nile Delta governorates, using a commercially available diagnostic cassette format kit (Urine-CCA). The prevalence rates of *S. mansoni* infection based on the Urine-CCA detecting the circulating cathodic antigen (CCA) were significantly higher than those calculated based on a single Kato-Katz thick smear (Haggag et al., 2017). Consequently, the MoHP adopted a new treatment strategy by readjusting thresholds for mass treatment to maintain control pressure of intestinal schistosomiasis in all transmission areas (Haggag et al., 2017).

Prevalence rates of *S. haematobium* currently available with the NSCP are based on a single urine sedimentation, a qualitative method which does not provide insights on intensity of infection. Previous studies in African countries have shown that urine filtration using polycarbonate filters is accurate, sensitive, reproducible, and extremely rapid (Degarege et al., 2015; Kosinski et al., 2018). The aim of the present study was to assess the prevalence and intensity of *S. haematobium* infection in five endemic governorates in Upper Egypt using the urine filtration method, as a necessary step for refining the preventive chemotherapy strategy towards interruption of transmission of urinary schistosomiasis. The study relied on schoolchildren (6–15 years of age) as they represent the age group of highest prevalence and intensity of infection (El Khoby et al., 2000) and often provide convenient study populations. When appropriately studied they can provide data of the overall prevalence of schistosomiasis (Mott and Cline, 1980).

2. Materials and methods

2.1. Ethics statement

The present work was conducted as a standard and regular part of the MoHP's plan of public health fieldwork in anticipation of a policy shift from morbidity control to elimination of schistosomiasis (WHO, 2013). The Ethics Review Committee of the Faculty of Medicine, Ain Shams University, reviewed and approved the study protocol. The work included only non-invasive collections of urine specimens and their examination to obtain population data needed for programmatic decisions. Thus, individual consent was not obtained, but rather consent was obtained at the school and community administrative levels for this public health programme.

2.2. Study population

The present work was carried out in five Upper Egypt governorates (i.e. Assiut, Bani Sweif, Fayoum, Menia and Sohag; Fig. 1), from November 2016 to March 2017. A convenience sampling methodology was employed to maximize the probability of identifying endemic settings. In each governorate a number of schools (5–20, based on the population in rural areas) within a study district were sampled, with

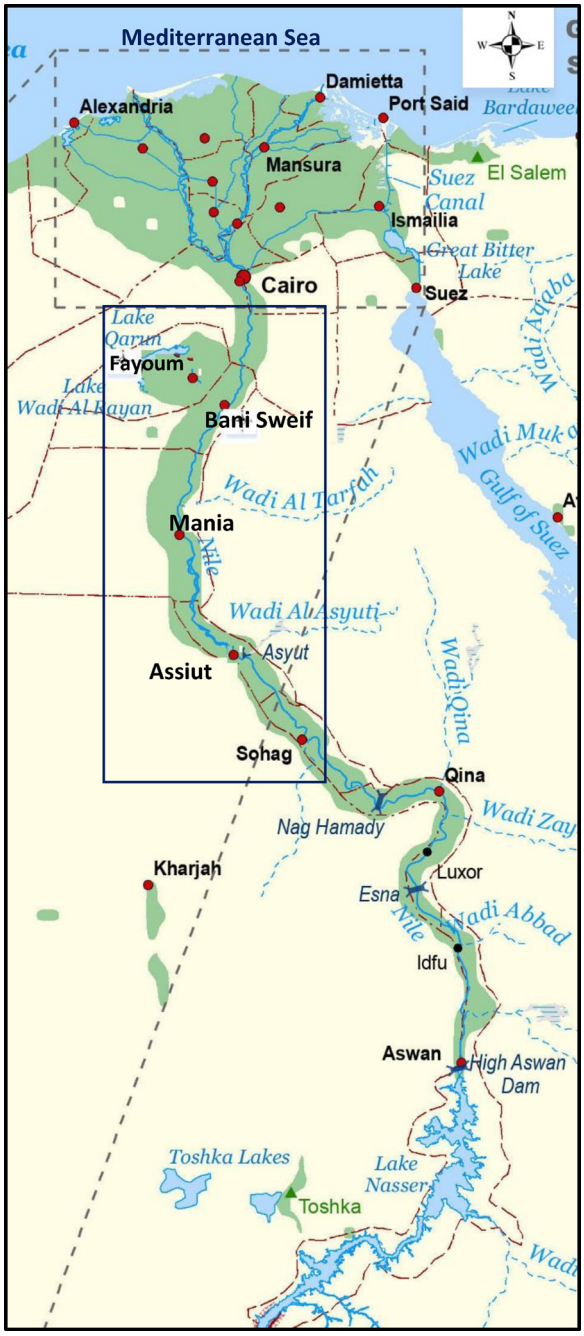

Fig. 1. Map of Egypt showing the study governorates (inside rectangle).

100 children selected per school. In selecting schools for the survey, the location of irrigation canals and drainage sites was of major consideration (WHO, 2011). Names of participating children were not recorded; they were anonymously coded according to their number in the classroom list. The annual schistosomiasis treatment intervention with praziquantel, prior to this work, was implemented during the 2014–2015 scholastic year, and the last school assessment, using urine sedimentation, carried out during the 2015–2016 scholastic year.

2.3. Parasitological examination

Infection status was determined by urine filtration and subsequent microscopy for identification of S. haematobium eggs. Urine was collected in urine specimen collection containers (100 ml capacity) between 10:00 and 14:00 h from selected children. Urine samples were