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Planning schistosomiasis control: investigation of alternative sampling strategies for *Schistosoma mansoni* to target mass drug administration of praziquantel in East Africa

Sturrock HJW et al. *International Health* 2011 3:165-175

Introduction

Control strategies against human schistosomiasis focus on mass drug administration (MDA) and are most cost-effective when targeted to communities with the highest prevalence of infection. For *Schistosoma hamatobium*, geographical targeting of treatment can be effectively and quickly achieved through questionnaire-based studies on the presence of blood in urine. For *Schistosoma mansoni*, parasitological examination of stool samples remains the suggested diagnostic method, but this method is time-consuming and expensive. Lot quality assurance sampling (LQAS), which uses small sample sizes to categorize communities according to prevalence, is one approach to minimizing the time and resources needed to conduct parasitological surveys and has been shown to be more cost-effective than the delivery of blanket MDA without prior surveys. However, LQAS requires that all schools in a given area are surveyed, necessitating significant technical and financial resources. As such, there remains a need to investigate whether *S. mansoni* surveys can be made more efficient by reducing the number of schools to be surveyed. The current study compared two sampling designs for *S. mansoni* surveys, LQAS and a geostatistical survey design (the lattice plus close pairs design, LpCP) to use reduced number of schools to be surveyed, in their performances in correctly classifying schools according to treatment needs and their cost-effectiveness in identifying high prevalence schools.

Methods

The study uses the data collected by Kato-Katz method in Oromia Regional State in Ethiopia during 1990-2009 and in Western and Nyanza provinces in Kenya during 1992-2009. The areas were chosen because of the widespread occurrence of *S. mansoni*, the availability of prevalence data, and the existence of geo-reference databases of all government primary schools. For LQAS, every school in the area needs to be surveyed and a maximum of 15 children examined each school. Using the simulated realisations of data for Western and Nyanza and for Oromia, the authors evaluated this sampling plan classifying schools as ≥10% or <10%. The LpCP design involved undertaking surveys of 50 children from each of a sample of schools selected using a predefined grid and using the collected empirical data to predict prevalence across all schools on the basis of a spatial interpolation technique known as kriging to classify schools as ≥10% or <10%. The survey costs were estimated based on the field experience of the authors in Kenya and Ethiopia, including equipment, salary and transport, consumables, and assumed cost of MDA for six years based on the survey results.

Results

Data from 600 schools were used in the analysis. LQAS correctly classified a higher proportion of intervention schools than an LpCP design, with 88.4% and 89.6% correctly classified in Kenya and Ethiopia, respectively. Within the LpCP design, when smaller grid sizes were used, resulting in larger numbers of schools being selected, a higher proportion of intervention schools were correctly classified. LQAS also correctly classified a higher proportion of infected children within intervention schools than an

LpCP design. In terms of cost-effectiveness, the use of either survey design resulted in lower overall cost than blanket treatment with praziquantel. However, when comparing the two survey designs, survey costs were considerably lower for an LpCP design than for LQAS. Likewise, treatment costs were generally lower when geostatistical designs were used, due to a higher proportion of intervention schools being wrongly classified as not requiring treatment.

Discussion

The results of the study suggest that implementing surveys to guide treatment delivery dramatically reduce program costs and the number of praziquantel treatments required. The results also show that while LQAS correctly classifies a greater proportion of schools according to treatment requirement, the approach is more expensive than a geostatistical approach. Therefore, the decision by control programs about how to best target MDA should be based on a consideration of available resources and desired goals of the control program. It is unlikely that a single targeting approach will be applicable to all areas. A limitation of the study was the fact that the analysis focused on *S. mansoni*. Where *S. haematobium* is common, the WHO recommends using blood in urine questionnaires, implemented through the education system, instead. Other limitations include the fact that the spatial heterogeneity of *S. mansoni* infection may differ in other regions and the fact that special characteristics of infection may vary over time, making the study's results less generalizable.

Editor's Comments

Schistosomiasis is one of the most devastating parasitic diseases in tropical countries, particularly in sub-Saharan Africa. The current control strategy recommended by WHO is morbidity control through preventive chemotherapy annually where prevalence is ≥50% and biennially where prevalence is ≥10% but <50%. It is therefore very important to determine the prevalence before the mass treatment starts in order to determine the treatment strategies. As the current study demonstrated, it is more cost-effective to conduct a targeted MDA after prevalence survey (disease mapping)than a blanket MDA without detailed prevalence survey. As to how many sites should be surveyed, it is always a discussing point and always a balance between the program needs and the resources available. The current schistosomiasis mapping strategy recommended by WHO AFRO provides such a balance. The mapping is based on districts: divide the districts into zone(s) according to ecological situations, select 5 sites (schools) per zone and then select 50 children of 10-14 years each sites. The target population in the same zone should then be treated equally.

Recommended readings:

WHO/AFRO. Operational guide to mapping of schistosomiasis and soil transmitted helminthiasis and evaluation of control programmes. World Health Organization Regional Office for Africa, 2010

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