SCHOOL ENROLMENT IN ZANZIBAR LINKED TO CHILDREN'S AGE AND HELMINTH INFECTIONS

Antonio Montresor*, Mahdi Ramsan§, Hababu M.Chwaya°, Haji Ameir°, Ali Foum° Marco Albonico§, Theresa W. Gyorkos# and Lorenzo Savioli*

* Communicable Diseases Prevention and Control
World Health Organization
Geneva, Switzerland

§ Ivo de Carneri Foundation
Milan, Italy

° Ministry of Health
Zanzibar, United Republic of Tanzania

#McGill University
Department of Epidemiology and Biostatistics
Montreal, Canada

Corresponding Author: Dr Antonio Montresor
WHO Communicable Disease
Avenue Appia 20
CH-1211 Geneva 27
Switzerland
Fax +41 22 791 2621
e-mail <montresora@who.int>

The field study was conducted in Zanzibar, United Republic of Tanzania

Abstract

School health programmes have been identified as a cost-effective strategy to reduce morbidity due to soil-transmitted helminths in the school-age population, but the low rate of school enrolment in developing countries is a major factor limiting their success.

Objective The present study was conducted to identify reasons for non-enrolment and to evaluate differences in the occurrence of helminth infection between enrolled and non-enrolled children in Zanzibar, United Republic of Tanzania.

Method A questionnaire was submitted to 520 households to obtain information about enrolment and other socio-economic indicators. In addition, one school-age child was randomly selected in each household and investigated for soil-transmitted helminth infection.

Results Overall, 71% of school-age children were enrolled. Enrolment increased with age. Only 41% of children under 9 years of age were enrolled compared to 91% in children older than 12 years. Enrolment is delayed because of an insufficient number of schools. Among non-enrolled school-age children, the proportion of heavy intensity infections was twice that of enrolled school-age children.

Conclusions. Most of the non-enrolled school-age children live together with enrolled siblings in the same household thereby representing an important opportunity for effective outreach activities. The effectiveness of the school-based helminth control programme in reducing the intensity of infection was confirmed. The significant gains achieved by enrolled school-age children in this study must be similarly viewed as an attainable goal for the important numbers of non-enrolled school-age children in endemic areas. Decision-makers must ensure that outreach activities are included in helminth control programmes targeted to school-age children.

Key Words

school health programme – enrolment – helminth infection – school-age children --

Zanzibar-Tanzania

Introduction

School health programmes have been identified as a cost-effective strategy to control morbidity due to soil-transmitted helminths (*Ascaris lumbricoides, Trichuris trichiura* and hookworms) in the school-age group (Bundy *et al* 1992; WORLD BANK 1993; Evans & Guyatt 1995). One of the important limitations of this strategy is the fact that, in developing countries, this approach excludes a large component of the identified risk group: non-enrolled school-age children (Gyorkos *et al* 1996; Hussein *et al* 1996). Differences in enrolment and absenteeism among children of different gender or social groups are also identified as a possible cause of inequity and reduced impact of the school-based intervention (Nokes & Bundy 1993). Most of the studies evaluating school attendance and school coverage are based on school data rather than community data (Partnership for Child Development 1998), consequently, there is a lack of information on non-enrolled school-age children.

In Zanzibar, a school-based National Helminth Control Programme was initiated in 1994 where all enrolled schoolchildren were treated with mebendazole 500 mg every four months (Renganathan *et al* 1995). Between January 1994 and August 1998, a total of 13 rounds of drug administration have been completed. The control programme is continuing to provide anthelminthic treatment to school-age children. The coverage of enrolled schoolchildren is generally over 90% but non-enrolled school-age children are not yet being adequately reached by the programme. The present household study is part of an operational research project aimed at identifying possible methods of reaching non-enrolled school-age children within the school-based Helminth Control Programme in Zanzibar.

Materials and Methods

The survey was conducted during the months of July and August 1998 in Zanzibar, United Republic of Tanzania, a country where the Primary Net Enrolment Ratio is estimated to be 48% (UNICEF 1998). A questionnaire was designed to obtain information about the number of school-age children, their sex and enrolment status, reasons for possible non-enrolment and to assess selected socio-economic indicators in each household (Table 1). Ten "shehias", the administrative units in which the district is divided, were randomly selected out of a total of 27 in the North A District of Unguja Island. In each shehia, an average of 52 (range 43-61) households having at least one child of school age (7 to 14 years) were selected using the cluster sampling method described by Bennett *et al* (1991). A total of 520 households were investigated.

In each household, one school-age child was randomly selected from all eligible children. From this child, a faecal sample was collected and analysed for the presence of ova of soil-transmitted helminths using the Kato-Katz method (WHO 1991). Only one child was selected in each household in order to avoid mis-classification which could have resulted if several samples were obtained from the same household. A child was defined as not enrolled if s/he was between the ages of 7 and 14 and had not been enrolled in school over the past year.

The following parasitological indicators were calculated for each parasite: prevalence of infection, geometric mean eggs per gram (epg), prevalence of moderate intensity infections, prevalence of heavy intensity infections. Intensities were classified according to the WHO thresholds (WHO 1998).

Data entry and statistical analyses were performed using EpiInfo 4.1. Chi-square tests were used to evaluate the correlation between enrolment status and qualitatively measured variables collected by questionnaire. ANOVA was used to evaluate the correlation between enrolment status and quantitative variables. At the end of the data collection, all the children in all of the ten sheihas, whether they participated in the study or not, were treated with mebendazole 500 mg.

The study received approval from the Ethical Committee of the Ministry of Health of Zanzibar and from the World Health Organization.

Results

Questionnaire

In the 520 households, 1056 school-age children were identified (Table 1). The sex distribution was roughly equal (boys 50.2%; girls 49.8%). The average number of school-age children per study household was 1.9, without significant differences among different shehias (range 1.8 – 2.3). A total of 750 children were enrolled in school (71%) and 306 were not enrolled. There was wide variation in the proportion non-enrolled (19-84%) among the different shehias.

The child's enrolment status was not correlated with any socio-economic variable measured, such as parents' employment status, education of the mother, marital status or quality of the house. The only strong correlation observed was between age and enrolment: in children under 9 years of age the proportion non-enrolled was as high as 59% compared to a non-enrolment proportion of less than 9% in children over 12 years of age. School enrolment appears to be delayed between two to three years with attainment of more than 80% enrolment only after the age of 9 (Figure 1). Although length of time spent in school was not directly ascertained for each child, these data nonetheless provide indirect evidence that the period of school enrolment is shorter than the expected 8 years, with boys after 13 years of age beginning to drop out of school.

In 236 households (43%) at least one non-enrolled school-age child was present, and in 154 cases (65% of households with non-enrolled children) at least one older enrolled brother or sister was living in the house. The answers to the open-ended question regarding the reason for non-enrolment were: in 128 households (53.8%), the absence of available places in the village school was included among reasons for non-enrollment, in 57 households (24.2 %) the parents decided not to enrol the child for various other reasons including health reasons and the long distance to be covered by a young child. In 52 cases (22 %), no reason was given for the non-enrolment.

Parasitology

A stool sample was provided by 517 of the 520 households investigated. The sex distribution of the school-age children providing the samples was roughly equal (boys 47.6%; girls 52.4%) and 64.7% were enrolled in school. Table 2 presents the parasitological results in enrolled and non-enrolled children. The prevalences and geometric mean epg for *A. lumbricoides, T. trichiura* and hookworm infections and the prevalences of moderate and heavy intensity infections for each of the three parasites, are statistically significantly different between the enrolled and non-enrolled children. Non-enrolled children had more than twice the intensity of all three parasite infections, reflecting also in higher geometric mean egg counts, on average. Moreover, among enrolled children, more than 50% of the moderate and heavy intensity infections were found to occur in children between the ages of 7 and 10 years of age. These children have been in school for only a small number of years and would have benefited from only a limited number of drug distributions in the school compared to older children.

Discussion

The major limitation to school enrolment of Zanzibar children is the insufficient number of school facilities. This is reported by parents and confirmed by the pattern of delayed enrolment and by the fact that enrolled and non-enrolled children are living in the same house. Families are willing to send children to school, but they can obtain a place in the first grade only when the children are 8 or 9 years old.

Gender differences in school enrolment were not observed in our sample and girls in primary schools did not tend to drop out of schools as they got older as claimed in other countries (Ahlberg 1996). This study confirms the finding that neither better income or socio-economic status nor education of the mothers seem to be associated with higher enrolment (Partnership for Child Development 1999), and that primary schools can be used to reach a significant proportion of school-age children even in low-income countries (Partnership for Child Development 1998). The shorter total school enrolment time of Zanzibari schoolchildren confirms that repetition of anthelminthic treatment during the school year may be advisable to better profit from the "window of opportunity" provided by the schools.

The Ministry of Education of Zanzibar is aware of the shortage of school facilities and important efforts are being made to increase their numbers. Unfortunately, the population's growth is one of the highest in Africa, making these efforts insufficient for to meet current demands. The fact that 65% of non-enrolled children have an enrolled sibling can be considered a critical feature which can be used to enhance coverage of school-based interventions by using a child-to-child communications approach. Such a method was used successfully in Guinea in 1995 (Montresor *et al* 1997). The major consequences of this approach are that enrolled children can serve to communicate information on school health activities (eg. upcoming treatment days at the school) to their younger school-age siblings. In addition, the fact that the household is in contact with the school through one of the children also provides the opportunity for health education messages to be passed along to the parents. This may promote increased sensitisation of positive family health initiatives such as improved hygiene and better sanitation which was observed to be a major problem in half of the households.

While some misclassification, in terms of classifying individuals as light, moderate or heavily infected, is expected to occur from single specimen Kato- Katz examinations, this field technique is considered adequate to classify groups of individuals (as has for example been shown by Stoltzfus (1996) in correlating the amount of blood loss with the intensity of hookworm infection). The parasitological results show a significant difference between enrolled and non-enrolled school-age children, as has previously been noted in other studies (Gyorkos *et al* 1996). The enrolled children are healthier (less moderate and heavy intensity infections) despite the fact that the peaks of prevalence and intensity of infection, for all the three parasites and particularly for hookworms, usually increase in this age interval (Renganathan *et al* 1995). This situation may be attributable to on-going school health interventions which distribute mebendazole 500 mg quarterly to all the schoolchildren in Zanzibar. This result is considered particularly significant, considering that the last mebendazole distribution was conducted four months prior to our study (with sufficient time for there to be significant re-infection). These results, confirming the success of the helminth control programme targeted to both enrolled and non-enrolled school-age children, should be encouraging for the Ministry of Health. It will now be important to monitor the continuing effectiveness of this programme. Researchers and others involved in implementing helminth control programmes in school-age populations should ensure that effective and culturally appropriate outreach activities are included, if possible, from the very start of the programme.

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Table 1

Demographic characteristics of the households of enrolled and non-enrolled school-age children, Zanzibar, 1998

Table 2

Prevalence and intensity of soil-transmitted helminth infections in enrolled and non-enrolled school-age children, Zanzibar, 1998

Figure 1

Evolution in the enrolment of school-age children, according to age and sex, Zanzibar, 1998

Table 1

Variable	Cumulative Results	Enrolled n = 750	Non-enrolled n = 306
Age (mean)	9.5 (δ=5.658)	10.8* (δ=4.765)	8.4 * (δ=3.857)
Sex (% boys)	50.2	50.1	50.3
Marital status of the mother (% married)	73.6	74.0	76.0
Housing and sanitation:			
The family owns its house	87.9 %	88.8 %	92.0 %
Wall cement	28.1 %	30.2 %	23.6 %
mud/stick	66.9 %	64.4 %	72.0 %
other	5.0 %	5.4 %	4.4 %
Roof corrugated iron	33.7 %	35.3 %	29.9 %
Traditional	63.9 %	61.8 %	69.0 %
other	2.4 %	2.9 %	1.1 %
Water availability: tap	92.0 %	91.0 %	94.3 %
Well	8.0 %	9.0 %	5.6 %
Presence of latrine	51.8 %	55.8 %	42.5 %
Employment of the household members:			
Subsistence Farmer	52.6 %	52.5 %	52.9 %
Fisherman	14.4 %	13.5 %	16.5 %
Civil servant	14.4 %	15.8 %	11.1 %
Business person	8.8 %	8.5 %	9.6 %
Shopkeeper (owner)	0.9 %	1.0 %	0.8 %
Shopkeeper (employee)	1.3 %	1.3 %	1.1 %
Unemployed	8.1 %	8.3 %	7.3 %
Education (years of formal education):			
Mother	2.5 (δ=17.12)	2.6 (δ=17.81)	2.4 (δ=15.54)
Father	3.9 (δ=21.90)	4.1 (δ=22.53)	3.4 (δ=20.18)
Mean number of children per household	4.4 (δ= 4.05)	4.4 (δ= 4.26)	4.3 (δ= 3.50)
Main reason for non-enrolment:			
No place available in the school			53.8 %
Parents decide not to enrol			24.2 %
No answer			22 %

δ=variance * $p<0.001$

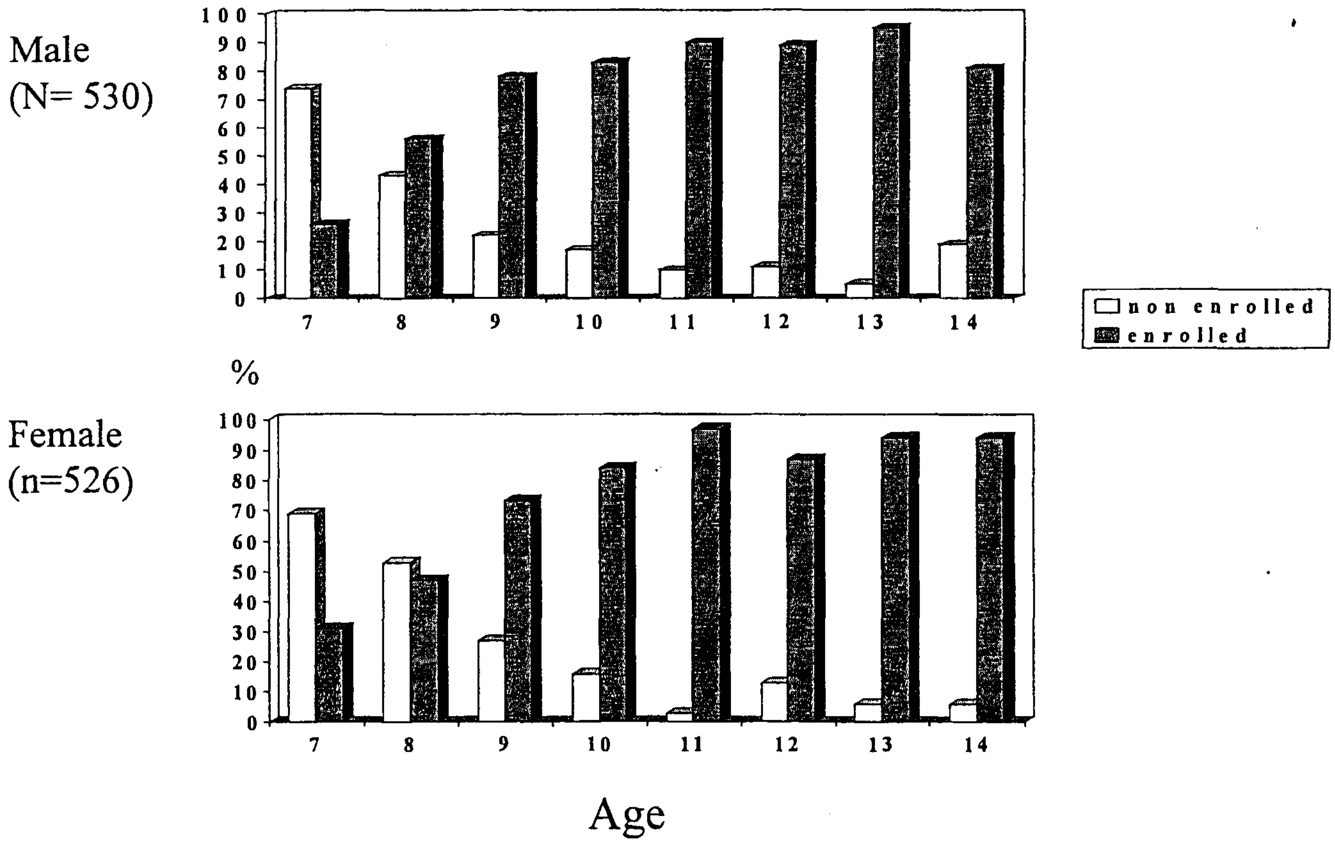
Table 2

	Threshold for intensity of infection (epg)		Enrolled School-age children (n=335)			Non-enrolled School-age children (n=182)		
	Moderate intensity	Heavy intensity	Prevalence of infection	Prevalence of moderate/ heavy int. infections	epg geometric mean	Prevalence of infection	Prevalence of moderate/ heavy int. infections	epg geometric mean
A. lumbricoides	*5,000-49,999*	*≥50,000*	23.0%**	3.0%**	3**	59.6%	27.4%	115
T. trichiura	*1,000-9,999*	*≥10,000*	72.7%**	12.7%**	64**	92.0%	25.9%	294
Hookworms	2,000-3,999	*≥ 4,000*	78.2%	5.3% *	89	73.3%	10.7 %	74
Cumulative percentage of heavy intensity infections			3.1%			6.1%		
Mean age years (SD)			10.3 ** (2.18)			8.0 (1.57)		
Sex (% male)			47.8 %			47.3 %		

** p<0.001 if compared with the correspondent value for non-enrolled children

* p=0.01 if compared with the correspondent value for non-enrolled children

Figure 1


Male
(N= 530)
100
90
80
70
60
50
40
30
20
10
0
7
8
9
10
11
12
13
14
non enrolled
enrolled
%
Female
(n=526)
100
90
80
70
60
50
40
30
20
10
0
7
8
9
10
11
12
13
14
Age