EFFECTS OF A SCHOOL-BASED EDUCATION PROGRAM FOR SCHISTOSOMIASIS CONTROL

Chizuko Suzuki[1], Tsutomu Mizota[1], Toshiki Awazawa[2], Taro Yamamoto[1], Batsi Makunike[3] and Yasuyuki Rakue[4]

[1]Department of Social and Environmental Medicine, Institute of Tropical Medicine, Nagasaki University, Japan; [2]Infectious Disease Control Project of Zimbabwe by Japan International Cooperation Agency (JICA); [3]Department of Epidemiology and Disease Control, Ministry of Health and Child Welfare, Zimbabwe; [4]Department of Community Health Sciences, School of Public Health and Tropical Medicine, Tulane University Medical Center, New Orleans, USA

Abstract. The role and effect of school-based education for schistosomiasis control needs to be explored further to raise the standard of health in the widely infected areas over the world. This study investigated the effect, particularly the retention or duration of effect, of a school education program for schistosomiasis control. The study was conducted from September 2000 to February 2001 in a district of Mount Darwin, Zimbabwe. Two hundred ninety-nine fifth graders from 8 primary schools were examined for their knowledge, attitude, beliefs and practice regarding schistosomiasis, based on a KABP form, three times in succession. The examinations were a baseline examination, a pre-examination checking for the effect of the program, and a post-examination assessing retention after three-months. Analyses of the examination results indicated a considerable effect of the program in all aspects except for practice. Further detailed analyses on 161 matched pair subjects comparing the difference between the pre- and post-examination results demonstrated how the subjects maintained or rather increased what they had learned, illustrating an amplifying resonance or percussion effect, that is, a group dynamic effect in the school setting. No clear correlation, however, was shown between the education effect and the infection rate of the subject groups. Ways to prevent the deterioration of the practice aspect, and the cause of the negative correlation between the infection rate and education effect need to be closely investigated, while trying out more participatory-type education is an absolute necessity.

INTRODUCTION

The burden caused by schistosomiasis, the so called “hidden killer”, can not be underestimated in highest risk groups: school-age children and adolescent girls in infectious areas of developing countries. The negative effects on school-age children caused by the infections include the detriment of physical, cognitive, and intellectual growth, nutritional deficiencies, and the increased likelihood of having a non-functioning kidney, and cervical or squamous cell bladder carcinoma (WHO Expert Committee, 2002). Furthermore, the potential effect of schistosomiasis as a risk factor for the spread of HIV should not be overlooked (Bichler *et al*, 2001).

Most control programs have adopted an integrated program of diagnosis, treatment and education as promoted by the WHO. The limitations of these control measures have been repeatedly pointed out as exemplified by the following issues: frequent re-infection (N’Goran *et al*, 2001), praziquantel’s ineffectiveness against immature worms, and the unconfirmed safety of increasing doses of praziquantel (Utzinger *et al*, 2000).

In this context, this study re-investigated the efficacy of school-based education in an integrated program for schistosomiasis control, which was conducted as a part of an Infectious

Correspondence: Chizuko Suzuki, Department of Social Medicine, Institute of Tropical Medicine, Nagasaki University, 1-12-4 Sakamoto, Nagasaki City, Japan 852-8523.
Tel: (81) 95-844-0896; 849-7866; Fax: (81) 95-844-0896, 849-7867
E-mail: suzuki@n-junskhin.ac.jp

Disease Control Project of the Ministry of Health and Child Welfare of Zimbabwe supported by the Japan International Cooperation Agency (JICA), taking into account the important role of school education for community health as advocated by Green *et al* (1999).

The specific questions we set up to be answered were as follows: 1) whether children can really learn through a school education program. 2) whether the students can retain what they learned, for how long, and what they retained; 3) if there exists a correlation between education and the infection rate. This paper reports a longitudinal and cross-sectional study.

MATERIALS AND METHODS

Study site

The study was carried out at 8 primary schools in the District of Mt Darwin, the Republic of Zimbabwe. The general prevalence of *Schistosoma haematobium* among 511 fifth graders at the eight primary schools 37.73% according to research reports on screening conducted in November 2000.

Subjects and time of examination

A total of 299 fifth graders (158 females and 141 males, aged 9-17) from the eight schools participated in the baseline examination of this study in September 2000. The number of subjects in the following examinations in November 2000 and February 2001 is shown in Table 1.

Questionnaire design and data analysis

A survey form of KABP: knowledge, attitude, belief and practice, consisting of ten questions relevant to schistosomiasis prevention was developed for this study by the present authors referring to the forms originated by former experts of the project. Using the form, the school children were examined regarding their state of KABP three times: in September 2000 at baseline, in November 2000 immediately after the program to see its effects, and in February. 2001 to examine the duration of effects as post-examination. The administration of the surveys and the data collection were carried out with the assistance of two properly trained local health workers and school teachers of each primary school. SPSS version 11.00 for Windows was used for data analysis.

Table 1
Date of examinations and number of subjects for each examination.

	Date	Subjects no.
Baseline examination	September 2000	299
Program administration	November 2000	230
Post-program examination	February 2001	199

To study the effect of education, the ten questions in the KABP survey form were grouped into two categories: awareness and disease control. The category of awareness was mostly composed of questions on “knowledge” and “awareness”, a total of 5 questions with full-marks of 11 points and the lowest score of -10 points. The disease control category included questions mainly on “beliefs” and “practice” consisting of 4 questions with full-marks of 22 points and the lowest score of -22 point using the method of points deduction for wrong answers. The last tenth question was omitted as it asked subjects their current symptoms. For overall analysis, the total data collected for each examination were used, and the mean scores of each subject group for the questions were calculated.

For the longitudinal study of the duration of knowledge, the data of individual subjects who participated in both the pre- and post- examinations of November 2000 and February 2001, respectively, were used selectively for matched pair analyses. The number of subjects for the narrow investigation analyses was eventually limited to 161, as indicated in Table 2.

On the third research question, a correlation coefficient was calculated by running the Pearson test with two variables: the infection rate and the education effect for each subject group.

RESULTS

The results are summarized in Tables 3, 4 and 5, being derived from the broad analyses, narrow analyses, and correlation coefficient calculation, respectively.

Table 2
The number of subjects who participated in the pre- and post-examinations for each school.

Primary School	Sept 2000 (Baseline)	Nov 2000 (Pre-exam)	Feb 2001 (Post-exam)	Subjects No. who participated in the both
Zambezi P.S.	39	0	0	0
Kamtsenzere P.S.	32	20	16	13
Kapiripiri P.S.	41	22	23	0
Mutasa P.S.	37	32	21	17
Chiswiti P.S.	42	34	30	29
Bandimba P.S.	24	23	18	18
Matope P.S.	41	59	50	47
Mutondwe P.S.	43	40	41	37
Total	299	230	199	161

Table 3
The results of broad analysis in terms of awareness and disease control.

Time after program	No. of subjects examined	Broad analysis results					
		Awareness		Dis control		Total	
		Mean	SD	Mean	SD	Mean	SD
Baseline	299	5.06 (46.0%)	2.64	2.30 (10.5%)	4.31	7.36 (22.3%)	5.57
0 months	230	6.37 (57.7%)	2.94	6.62 (30.1%)	4.22	12.99 (39.4%)	5.72
3 months	199	6.91 (62.9%)	3.36	6.41 (29.1%)	4.09	13.32 (42.2%)	1.64

% = scores out of 100 for each category

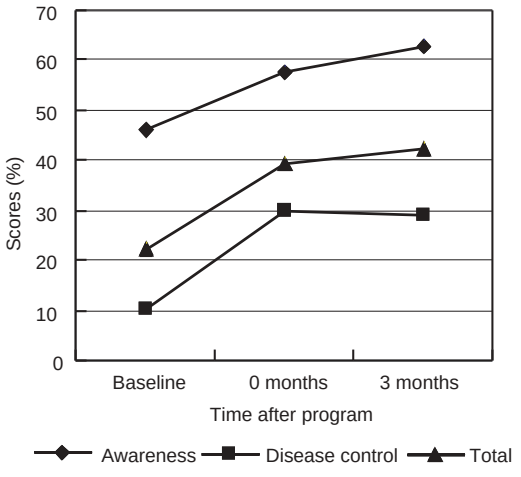

Fig 1–Broad analysis results of the program effect and its duration in terms of awareness and disease control.

Effects by broad analysis

Table 3 summarizes the program effects on the subjects' awareness and control of the disease, by comparing the mean scores of the baseline examination and the examination immediately after the program administration. The duration effects three months after the program were also examined in the same way and the overall effect was confirmed with the total scores. The effect on disease control was observed to be slightly deteriorated, as illustrated by the graph in Fig 1.

Effects by narrow analyses

Analysis of the 161 matched pairs of pre- and post-KABP examination scores indicated the following three effects (Table 4): 1) 79 subjects (66.5%) maintained or increased their total scores while 54 (33.5%) failed; 2) the mean score

Table 4
The results of narrow analysis in terms of knowledge, attitudes, beliefs, practice, and totals for all the aspects.

Time	Matched pair analysis results (n=161)									
	Knowledge		Attitudes		Beliefs		Practices (urination)		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
0 mos (Pre-)	7.94 (36.1%)	4.41	4.07 (67.8%)	1.86	2.96 (74.0%)	1.29	0.24 (6.0%)	1.89	15.20 (42.2%)	5.92
3 mos (Post-)	9.14 (41.5%)	5.25	4.62 (77.0%)	1.63	3.34 (83.5%)	1.16	0.12 (3.0%)	2.00	17.23 (47.9%)	6.49
	+15.1% (p=0.014)		+13.5% (p=0.001)		+13.1% (p=0.001)		-50.0% (p=0.537)		+13.3% (p=0.001)	

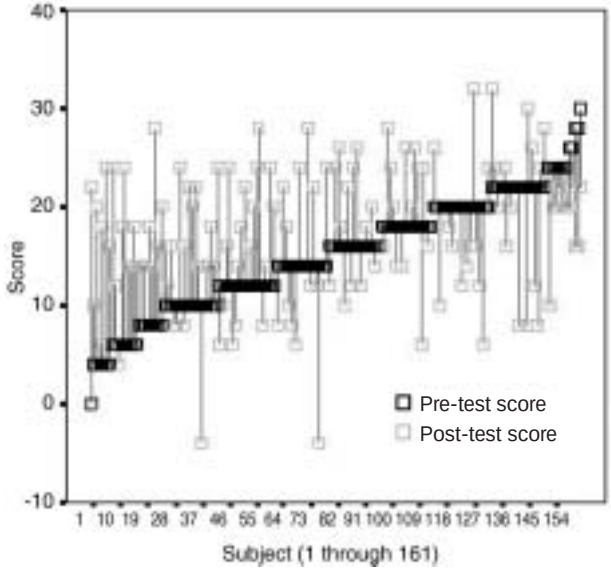

Fig 2–Comparison of the difference in the scores between the pre- and post- examinations for each subject arranged in the order of the lower score on the pre-examination.

of the subject group increased (pre=15.20, post=17.23) by 13.3% (p=0.001) in all genres; and 3) the question item only in the practice aspect, concerning where to urinate, showed a lower mean score (-50.0%) but this was not of significance (p=0.537).

For the individual subjects, the difference in the total score between the pre- and post-examinations was displayed by plotting both scores on one axis for each subject in order of the lower score on the pre-examination, as seen in Fig 2. The graph shows that the subjects whose pre-examination scores were lower tended to gain higher scores on the post-examination than pre-examination, catching up to the subjects who had already achieved high scores on the pre-examination. The correlation coefficient between the pre-examination score and the difference or increase/decrease in the post-examination score was calculated to get the result: r= -0.574, p<0.01, proving a significant negative correlation, as illustrated by Fig 3.

Correlation between the infection rate and the education effect

The calculation of the correlation coefficient for the two variables, prevalence and education effect, for the six subject schools revealed no significant relation between the infection rate and education effect, being proved by r=0.320 (p=0.536) as its correlation coefficient (Table 5).

DISCUSSION

The role of education in a schistosomiasis control program is now emphasized from the viewpoint of cost-effectiveness (Partnership for Child Development, 1999) particularly for a case in which selective treatment or “passive chemotherapy” is recommended or applied instead of mass treatment (Guo *et al*, 2005). Education is not always effective depending on other factors involved in the complicated infection route. For example, even an intense and long-lasting health education program for schistosomiasis control was reported to have been insufficient to pro-

vide adequate knowledge in a rural traditional community in Senegal (Sow *et al*, 2003). Therefore the role of school-based education needs to be investigated, in addition to following WHO guidance (Saathoff *et al*, 2004).

Our study showed the positive effects of a school-based education program specifically focusing on the retention or duration of effect. It is important to note the amplifying resonance or repercussion effect of education within the school setting. In other words, a "peer/group-learning effect" or "group dynamics effect" was seen among the schoolchildren.

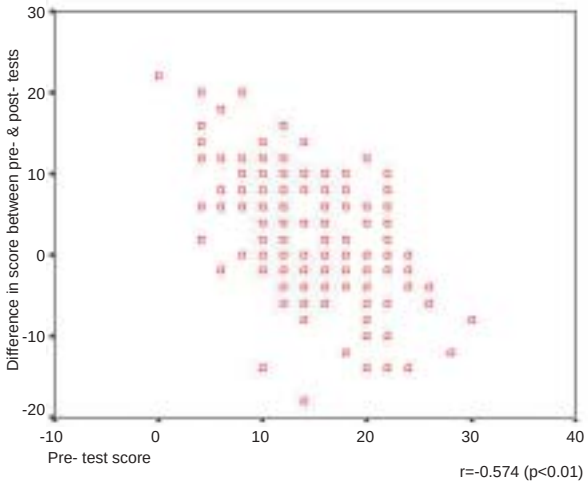

Fig 3–Correlation coefficient between differencs in pre- and post- examination scores, and pre- examination scores from the pre- examination score.

The present study, however, also reveals the difficulty of translating knowledge into action, in regard to practicing safer behaviors. The retention period or intervals for repeating the education needs to be further evaluated, in order to find the most optimal method of forming desirable habits for scistosomiasis prevention. To meet this problem, various approaches which involve activities have been practiced integrating schoolchildren's commitment in observation, interviews with families, newspaper/magazine editing, or organization of exhibits/fairs/contests, into provision of the children with sufficient knowledge (Massara and Schall, 2004). This suggests the necessity to adopt a more integrative and participatory method of education in heavily infected areas. Simple methods, such as diary writing, singing songs, and dances appropriate to the children's ages and interests may be promising for generating some behavioral changes. Along these lines, there has been an attempt to introduce wider and more varied aspects, especially the concept of information generation and management, into community-based health initiatives (Solomon, 2005), which could improve the primary health care system in the present day world.

The last result of our study showing no clear correlation between the infection rate and the education effect seems to explain another delicate issue to be tackled, though our data were limited due to a lack of individually matched pair data. The discrepancy between awareness and

Table 5
Correlation between the infection rate and the education effect.

School	Prevalence (Nov 2000)	Pre- examination (Nov 2000)	Post- examination (Feb 2001)	Education effect[a]
Kamtzenzere P.S.	60.6%	13.1	14.2	1.1
Mutasa P.S.	35.9%	15.1	20.1	5.1
Chiswiti P.S.	25.0%	13.7	15.0	1.4
Bandimba P.S.	62.1%	13.2	18.3	5.1
Matope P.S.	11.3%	14.4	16.6	2.2
Mutondwe P.S.	29.3%	19.2	19.0	-0.3
Total	37.7%	15.2	17.2	2.0

[a]Education effect was the difference of mean scores between pre- and post- examinations for each school group.

infection rate was pointed out in a study in southern Ghana by Wagatsuma *et al* (2003), suggesting the necessary and sufficient condition for complete eradication, for which several factors are involed. Awareness/knowledge is necessary but not sufficient for eradication in a restricted environment.

ACKNOWLEDGEMENTS

We acknowledge the field efforts of Mr Nzuma, Ms V Nyamudoka, Mr E Govere and other health officers in Mt Darwin District. We are also sincerely grateful to all the schoolchildren and teachers for their participation in this study. This study comprises part of a PhD dissertation submitted by the first author to the Graduate School of Medicine, Nagasaki University, Japan. The author would like to express gratitude to Dr K Moji and Dr R Tsuyuoka for their advice.

REFERENCES

Bichler KH, Feil G, Zumbragel A, Eipper E, Dyballa S. Schistosomiasis: a critical review. *Curr Opin Urol* 2001; 11: 97-101.

Green LW, Kreuter MW. Health promotion planning: An educational and ecological approach. 3rd ed. Mountain View, California: Mayfield Publishing, 1999.

Guo JG, Chun-Li C, Guang-Han H, *et al.* The role of 'passive chemotherapy' plus health education for schistosomiasis control in China during maintenance and consolidation phase. *Acta Trop* 2005 [Epub ahead of print].

Massara CL, Schall VT. A pedagogical approach of schistosomiasis: An experience in health education in Minas Gerais, Brazil. *Mem Inst Oswaldo Cruz* 2004; 99 (5 suppl 1): 113-9. Epub 2004 Oct 13.

N'Goran EK, Utzinger J, N'guessan AN, *et al.* Reinfection with *Schistosoma haematobium* following school-based chemotherapy with praziquantel in four highly endemic villages in Cote d'Ivoire. *Trop Med Int Health* 2001; 6: 817-25.

Partnership for Child Development. The cost of large-scale school health programmes which deliver anthelmintics to children in Ghana and Tanzania. *Acta Trop* 1999; 73: 183-204.

Saathoff E, Olsen A, Magnussen P, Kvalsvig JD, Becler W, Appleton CC. Patterns of *Schistosoma haematobium* infection, impact of praziquantel treatment and re-infection after treatment in a cohort of schoolchildren from rural KwaZulu-Natal/South Africa. *BMC Infect Dis* 2004; 4: 40. [Published online 2004 October 7. doi: 10.1186/1471-2334-4-40].

Solomon NM. Health information generation and utilization for informed decision-making in equitable health service management: The case of Kenya Partnership for Health program. *Int J Equity Health* 2005; 4: 8 [Published online 2005 June 24. doi: 10.1186/1475-9276-4-8].

Sow S, de Vlas SJ, Mbaye A, Polman K, Gryseels B. Low awareness of intestinal schistosomiasis in northern Senegal after 7 years of health education as part of intense control and research activities. *Trop Med Int Health* 2003; 8: 744-9.

Utzinger J, N'Goran EK, N'Dri A, Lengeler C, Xiao S, Tanner M. Oral artemether for prevention of *Schistosoma mansoni* infection: Randomized controlled trial. *Lancet* 2000; 355: 1320-5.

Wagatsuma Y, Aryeetey ME, Nkrumah FK, Sack DA, Kojima S. Highly symptom-aware children were heavily infected with urinary schistosomiasis in southern Ghana. *Cent Afr J Med* 2003; 49: 16-19.

WHO Expert Committee. Prevention and control of Schistosomiasis and soil transmitted helminthiasis. *World Health Organ Tech Rept Ser* 2002; 912: i-vi, 1-57.