INTRODUCTION

The burden caused by schistosomiasis, the so-called "hidden killer," cannot be underestimated in the 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
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.

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

### Table 4
Matched pair analysis results (n=161)

<table>
<thead>
<tr>
<th>Time</th>
<th>Knowledge</th>
<th>Attitudes</th>
<th>Beliefs</th>
<th>Practices (urination)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>(Pre-)</td>
<td>(Post-)</td>
<td>(Pre-)</td>
<td>(Post-)</td>
<td></td>
</tr>
<tr>
<td>0 mos</td>
<td>7.94</td>
<td>4.41</td>
<td>4.07</td>
<td>1.86</td>
<td>2.96</td>
</tr>
<tr>
<td>(Pre-)</td>
<td>(36.1%)</td>
<td>(36.1%)</td>
<td>(67.8%)</td>
<td>(74.0%)</td>
<td>(6.0%)</td>
</tr>
<tr>
<td>3 mos</td>
<td>9.14</td>
<td>5.25</td>
<td>4.62</td>
<td>1.63</td>
<td>3.34</td>
</tr>
<tr>
<td>(Post-)</td>
<td>(41.5%)</td>
<td>(77.0%)</td>
<td>(83.5%)</td>
<td>(3.0%)</td>
<td>(47.9%)</td>
</tr>
<tr>
<td>+15.1%</td>
<td>+13.5%</td>
<td>+13.1%</td>
<td>-50.0%</td>
<td>+13.3%</td>
<td></td>
</tr>
<tr>
<td>(p=0.014)</td>
<td>(p=0.001)</td>
<td>(p=0.001)</td>
<td>(p=0.537)</td>
<td>(p=0.001)</td>
<td></td>
</tr>
</tbody>
</table>

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-
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 schistosomiasis 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
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 involved. Awareness/knowledge is necessary but not sufficient for eradication in a restricted environment.

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REFERENCES


