HELMINTH CONTROL AS AN ENTRY POINT FOR HEALTH-PROMOTING SCHOOLS IN KWAZULU-NATAL

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Objectives. To use a health promotion model to investigate the risk factors (predisposing, enabling and reinforcing) for geohelminth and schistosomiasis infections, in order to develop and implement effective intervention strategies.

Design. Phase 1: Qualitative study using focus group discussions (FGDs) with parents, pupils and teachers; and interviews with health workers.
Phase 2: Quantitative study using a semi-structured questionnaire to investigate whether the determinants identified in phase 1 were generalisable.

Setting. Rural primary schools in Vulamehlo magisterial district, southern KwaZulu-Natal.

Study population. Qualitative study: 9 schools with 179 pupils, 93 parents and 82 teachers; and local clinics (4 fixed, 1 mobile), with 7 professional nurses.
Quantitative study: 2 other schools, with 730 pupils.

Results. Predisposing factors: Respondents were familiar with symptoms, but did not know the cause or mode of transmission of helminth infections. Many respondents perceived food to be the cause of geohelminth infection and swimming in the river to be the cause of schistosomiasis. Although 649 (88.9%) pupils had toilets at home and at school, only 218 (29.9%) were motivated to 'always' use the toilet for faecal disposal (rural communities previously did not have toilets). Six hundred and seventy-eight pupils (92.9%) understood that it was necessary to wash their hands after using the toilet, but many schools lacked water. Personal cleanliness was a problem despite the emphasis on hygiene by health workers and teachers. Few pupils admitted to eating soil, but it was agreed that geophagia affected young children between the ages of 8 months and 6 years.

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Enabling factors (positive/negative): Barriers to health promotion frequently included inadequate toilet facilities at school and home, and river-water contact resulting from a lack of clean water. A dearth of recreational facilities resulted in children swimming and playing in the river. Positive factors were the health-seeking behaviour of the majority of the target group, who identified helminth infections as a health problem and sought treatment. Parents and pupils in the FGDs unanimously supported health education and 655 (89.8%) questionnaire respondents indicated that they wished to learn how to avoid helminth infections.

Conclusions. Although the Government strategy is to provide clean water and adequate sanitation, provision of services does not necessarily ensure usage. A comprehensive approach to health promotion is required and the complementary development of the 'health-promoting school'[1] would support, reinforce and sustain a helminth control programme.

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Globally the World Health Organisation advocates the strategy of health-promoting schools.[1] The relevance of this for South Africa is the synergistic impact appropriate nutritional and educational interventions can have. A recent article in the *SAMJ* emphasised the importance of helminth control.[2] Helminth infections provide a different clinical picture to that of other infectious diseases as they tend to be chronic, with slow onset.[3] The adverse effects of helminth infections on children's nutrition,[4] physical fitness[5] and development[6] have been well documented.

Programmes in many countries are using schools to deliver anthelmintics to school-age children, as they are both most at risk and also the major source of helminth transmission.[7] Repeated treatment maintains worm levels below morbidity levels.[8] In school-based programmes in Ghana, Tanzania, India and Indonesia a simple health package including health education and anthelmintics has been provided through the education sector.[9]

Children most at risk are from disadvantaged communities, and KwaZulu-Natal is one of the poorest of South Africa's provinces, with many children living in households that lack clean water and adequate sanitation.[10] Children of school-going age form a large percentage of the population and the increasing numbers of children attending school in KwaZulu-Natal[11] suggest that targeting schools for health interventions could impact on an important section of the population, resulting in the health and educational benefits[12] envisaged by the World Health Organisation (WHO) Global School Initiative.[13]

This study aimed to investigate the risk factors for helminth infections, the prevalence of which was known from the study conducted previously among rural primary school pupils attending the 11 Vulamehlo schools (C C Jinabhai *et al.* — paper presented at the 16th International Congress of Nutrition, Montreal, Canada, 27 July - 1 August 1997). Helminth infections included *Ascaris lumbricioides* (roundworm) (27.3%), *Trichuris trichiura* (whipworm) (53.9%), *Necator americanus* (hookworm) (3.3%), *Schistosoma haematobium* (24.5%) and *S. mansoni* (1.2%). It is necessary to understand the risk factors and determinants of behaviours that place children at risk in order to develop effective health promotion strategies.

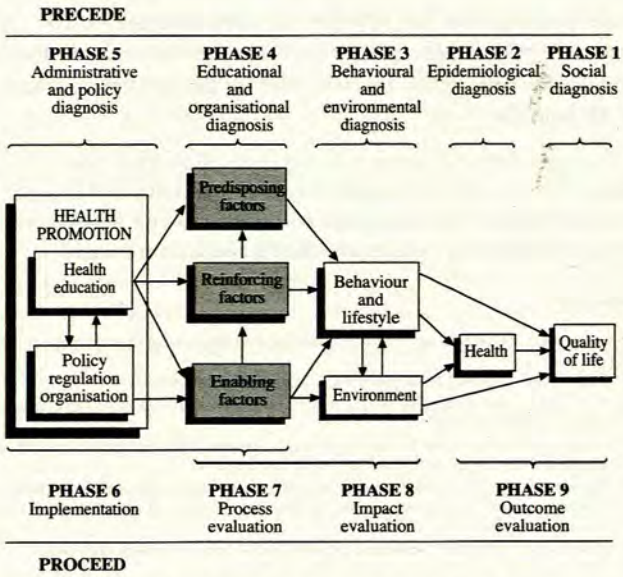

Fig. 1. Green and Kreuter's Health Promotion Model.

CONCEPTUAL FRAMEWORK

Green and Kreuter's Health Promotion Model (Fig. 1)[14] was used to identify the predisposing, reinforcing and enabling factors that impact on geohelminth and schistosomiasis infections; if modified, these factors could result in reduced morbidity.

Predisposing factors provide a rationale for the behaviour and facilitate or hinder motivation for change. They include knowledge, perceptions, values and self-confidence.

Enabling factors may be vehicles or barriers and include all the factors in the environment that impact on behaviour change.

Reinforcing factors include positive or negative feedback as well as social and physical benefits.

METHOD (TABLE I)

Qualitative study

Focus group discussions (FGDs) were used to provide in-depth information; they also permitted wide-ranging discussions and

Table I. Study design, schools and participants

Methodology	Number of schools (N = 11)	Subjects	Total number of subjects
Qualitative FGDs	4 lower primary	Grade 1 (6 - 7 yrs)	179
		Grade 3 (8 - 10 yrs)	(18 focus groups;
	5 combined primary (CP)	Grade 5 (11 - 12 yrs)	average 10
		Grade 7 (13 - 14 yrs)	participants)
		Parents/caregivers (of above pupils)	93 (9 focus groups with 4 - 23 participants; average 10)
		Teachers/principals	82 (9 focus groups)
Individual interviews	5 clinics (nearest schools)	Clinic nurses	7
Quantitative	2 CP schools	Pupils	730 (545 + 185)

raised probing questions on pertinent issues. The schools were homogeneous with regard to physical facilities, language, culture and gender mix. Two FGDs were held at each of the 9 primary schools randomly chosen from the Vulamehlo magisterial district, with pupils (N = 179) randomly selected from two different grades. Grade 1 pupils were 6 - 7 years of age, Grade 3 pupils 8 - 10 years old, Grade 5 pupils 11 - 12 years old and Grade 7 pupils 13 - 14 years old. All the children in all the schools were first-language Zulu speakers, as were their parents (N = 93), teachers (N = 82) and nurses (N = 7) at the nearest clinics. At each school there were separate FGDs for parents and teachers, and nurses were interviewed at the clinics. Informed consent was obtained from participants and parents of participating pupils. One school was randomly chosen to be used as a pilot study. The average discussion group consisted of 10 persons.

The FGDs were conducted in 1996 by four trained Zulu-speaking moderators, mature women with rural backgrounds. Each school was visited on a separate day, allowing each interviewer to transcribe and translate the taped interview as soon as possible after completion. The tape recordings and transcriptions were subsequently checked for accuracy. The FGDs with teachers were conducted in English (with their consent).

Quantitative study

A semi-structured questionnaire was completed 4 months after the FGDs were held. All the pupils in Grades 3 - 7 attending 2 of the 11 Vulamehlo primary schools that had been randomly chosen, completed the questionnaire. A pilot study had indicated that pupils in Grades 1 and 2 would not be able to participate effectively. There were 342 (46.8%) male pupils and 372 (51.0%) female pupils, while 16 (2.2%) did not indicate their sex. Ages ranged from 7 to 24 years, with the majority (444, 60.8%) aged 10 - 13 years. The questionnaires were anonymous and pupils completed the questionnaire in the classroom guided by one of five trained Zulu-speaking fieldworkers.

DATA ANALYSIS

The information collected from each of the focus groups was coded and analysed using open coding.[15] Recurring ideas were identified and patterns of belief were analysed. Data were then triangulated to compare the views of parents, pupils, teachers and health workers.[16] Data from the questionnaires were coded, then entered and checked using Epi-Info 6 statistical package.

RESULTS

Predisposing factors

The perceived symptoms resulting from geohelminth infection were well known. The most common complaint and the most severe was stomach-ache; this was reported by pupils in all the discussion groups and was highlighted in the questionnaire by 335 (45.9%) pupils, although other symptoms such as appetite problems (126, 17.2%), feeling sick (80, 11%), being weak/tired (14, 1.9%) and grinding of teeth (9, 1.2%) were also mentioned. The majority of parents also identified stomach-ache as a problem, but noticed that their children had a range of the above symptoms. Blood in the urine was mentioned by the majority of parents and pupils in the FGDs, and 149 (20.4%) pupils listed this as a symptom of schistosomiasis when answering the questionnaire. Parents and teachers also noticed the frequency and difficulty of urination, and this was mentioned by 90 (12.3%) pupils. However, neither parents and pupils nor teachers knew what caused the infections.

Sanitation

Teachers explained that when starting school many children had to be taught to use the toilet and that there were insufficient toilets for the number of pupils. Although 649 (88.9%) pupils indicated that there was a pit latrine at home, 68 (9.3%) indicated that they had no toilet. Only 218 (29.9%) pupils with toilets 'always' made use of them, 222 (30.4%) used a toilet 'often' and 155 (21.2%) used a toilet 'sometimes' for

faecal disposal. In answering a similar question about toilet use for urination, 179 (25.8%) 'always' used a toilet, 185 (26.7%) used it 'often', and 265 (38.2%) 'sometimes' used one. Sixty-eight respondents (9.4%) did not answer this question.

In the FGDs, however, parents mentioned that the toilet at home was commonly used by all the household members except the very young, and that neither gender nor age were factors that discriminated against toilet use. Health workers said that they emphasised the need for toilets and the importance of keeping the toilet clean, but felt that the cost of adequate sanitation mitigated against this being achieved. Lack of toilets in rural areas resulted in faecal environmental pollution, as toilets were not always available on the way to school and away from home.

Washing of hands

Most pupils understood that it was necessary to wash their hands after going to the toilet in order to prevent the spread of germs. This was confirmed by 678 (92.9%) pupils who answered the questionnaire. However pupils who did not wash their hands included all age groups from 8 to 16 years of age. During discussions older pupils suggested that a basin of water be placed in close proximity to the toilet, and that younger children be reminded of the need to wash their hands. Parents and teachers communicated health messages to pupils about hand washing, and these were reinforced by health workers. The problem, however, was the lack of water at many of the schools.

Effects of dust

The problem of dust as a possible vector for soil-transmitted helminth eggs was highlighted by health workers. Teachers also considered dust a health problem, although they did not link it to helminth infection.

Preparation of food/cleanliness

Clinic nurses emphasised the importance of hygiene and encouraged patients to store food hygienically, to cover food and to wash perishable food before use. Teachers indicated that cleanliness among pupils was a problem in that children did not bathe daily, and their clothes were not washed regularly. They explained that poverty in the area was endemic, that parents lacked resources and that children were not provided with a nutritious diet.

Eating of soil/sand (geophagia)

Most of the pupils in the FGDs said that they did not eat sand and some insisted that they had never eaten sand. Several groups of pupils explained that other children who ate sand did so because 'it is tasty'. Parents and teachers agreed that young children did eat sand. The suggested age range for children at risk of ingesting soil-transmitted helminth eggs ranged from 8 months to 6 years.

Recognition of the problem of helminth infections

All the parent groups recognised that both geohelminths and schistosomiasis cause health problems. Parents indicated that it was mainly children who were affected by schistosomiasis, more commonly boys. Pupils agreed that geohelminths were prevalent and a problem, but a quarter of the groups had participants who said that schistosomiasis was not a problem in their areas. A group of teachers mentioned that a child could die because of too many worms, and many teachers said that stomach-ache was a common complaint among pupils. Pupils distinguished between having worms and having 'too many' worms, which could be dangerous as they could come out the mouth/nose.

However, perceptions also included such comments as 'worms are natural in a person', 'we're born with some of them', 'worms are created to be in humans', 'part of life' and 'worms indicate when you are hungry'.

Perceived causes of geohelminth and schistosomiasis infections

Most pupils, parents and teachers perceived food to be the cause of geohelminth infection. Milk or sour milk was considered to be the cause by either pupils or parents at each of the schools. Other perceived causes included raw fruit and vegetables, or food not properly cooked, e.g. 'half-cooked mealie meal'. Eating too much food or food that was not clean were other suggestions from different groups of pupils, and these were confirmed by pupils answering the questionnaire.

The majority of parents agreed that they did not know the real cause of worm infections, with many parents expressing a lack of confidence in their ability to handle the problem and requesting assistance.

While answers varied as to the perceived cause of worms, most pupils, parents and teachers associated 'red' urine with swimming in the river. Other suggestions included drinking dirty water and 'bile'.

Enabling factors

Enabling factors, as defined in the model,[14] may facilitate or obstruct health promotion. Those that increase the possibility of helminth infections are barriers to health promotion and included the often inadequate toilet facilities at schools and homes, river-water contact due to lack of clean water, and a dearth of recreational facilities resulting in children swimming and playing in the river, as confirmed by 443 pupils answering the questionnaire (60.7%). Parents explained that most children were told not to swim in the river, but that admonitions were ineffective. Over the weekends 224 (65.5%) of the boys (30.7% of the total sample) looked after cattle and swam in the river while the cattle grazed.

The source of the water that had to be collected, and the use of rivers for the washing of clothes, were other determinants

affecting pupils' water-contact behaviours, with 641 (87.8%) pupils using the river to wash their clothes. Neither their homes nor any of the rural schools had reticulated water; depending on the area and location of home or school, water was collected by pupils from rivers and streams (311, 42.6%), springs (246, 33.7%), taps (70, 9.6%), rainwater tanks (53, 7.3%) and boreholes (43, 5.9%). Seven respondents (0.9%) did not reply.

A positive enabling factor was the health-seeking behaviour of the majority of the target group, with these individuals indicating that they purchased anthelmintics and/or sought help from clinics, doctors and hospitals. A total of 478 parents and pupils (65.5% of questionnaire respondents) supported the use of medicines to get rid of geohelminths, but in the opinion of 359 pupils (49.2%) there was less certainty as to the effectiveness of treatment for schistosomiasis.

There was unanimous support from parents and pupils in the FGDs for health education, with 655 (89.8%) questionnaire respondents indicating that they wished to learn how to avoid helminth infections.

DISCUSSION — STRATEGIES FOR HELMINTH CONTROL

Comprehensive helminth control strategies need to address a range of predisposing and enabling factors, as detailed above. The provision of clean water and sanitation are basic requisites which the government is planning to address through the Reconstruction and Development Programme (RDP). Improved sanitation with hygienic latrines for every household may encourage household members to 'always' use the toilet. Provision of services, however, does not always ensure their use.[17]

Health education is an important component, as there is inadequate knowledge among rural communities regarding the risk factors for geohelminth infections and schistosomiasis. Without the requisite knowledge people cannot take the necessary steps to alter their risk behaviours, but information alone is insufficient to promote the required behaviour changes.[18] The complexity of behaviour change emphasises the need for health education to address the perceptions and influence the attitudes of the target group. However 'the effectiveness of health education is dependent on the quality of the planning process'.[18]

In the Seychelles health education is one of the components of the National Intestinal Parasite Control Programme (L Chow — paper presented at the WHO Seychelles Workshop, 23 - 24 October 1995). Health education is delivered at schools and health centres as well as through the mass media; in this way the 'population is made conscious of health risks and is motivated to take responsibility' for controlling such risks (L Chow).

Historically (in KwaZulu-Natal) there has been concern that the disposal of faeces could be a target for witchcraft.[19] One of the principals maintained that this perception is still a constraint with regard to community acceptance of toilets. Community involvement is therefore important so that such fears can be discussed.

Schools are an accessible conduit for this type of strategy, and a parasite control programme is to be implemented in KwaZulu-Natal schools over the next 3 years. The aim is to use targeted treatment to reduce the levels of helminth infection in children so that morbidity is decreased. This should coincide with the current sanitation programme in communities and schools funded by Government, and will be combined with a health education strategy aimed at teachers, pupils and parents.

The success of helminth control programmes depends on behaviour changes that reduce the possibility of infection. An appropriate strategy to assist in addressing the determinants of the risk factors would be to link parasite control with the development of health-promoting schools. With the focus on helminth control, pupils should be encouraged to change their behaviour and avoid risk-taking behaviours. The 'health-promoting school' would strive to improve health through interventions such as health education, health services and environmental changes conducive to health.[2]

REINFORCING FACTORS

Social pressures existed among pupils who swam and played together in the river. There was also acceptance of the status quo, namely with regard to the lack of sanitation and resulting environmental contamination. Health education would seek to address these topics, to provide information and explanations, and to initiate the social pressures and self-efficacy skills that would support the behavioural changes required for the control of helminth infections. This could be addressed through the development of health-promoting schools (Table II).

CONCLUSION

This study indicated that the results of the FGDs were generalisable, as confirmed by pupils' responses to the questionnaire. The predisposing and enabling risk factors have been identified and a health education programme is being developed. This study suggested that the determinants of the predisposing and enabling risk factors for helminth infections may be a public health problem and require a variety of interventions. Health education at schools would enhance pupils' knowledge (and possibly that of some parents), but behaviour change will require more than the introduction of sanitation and water projects. Improved hygiene with regard to toilet use and handwashing (using soap and clean water) would have a positive impact on diarrhoeal diseases as well as helminth infections.

Table II. Helminth control using health promotion in schools

Description of risk factor	Risk factor	Link with health-promoting schools	Possible result
Predisposing	Sanitation	Improved school sanitation Emphasis on importance of sanitation	Recognition of importance of sanitation to health
		Social pressure to always use toilets	Decrease in diarrhoeal diseases/helminth control
	Washing of hands	Focus on hand-washing at school	Regular practical implementation at school /home
		Provision of soap and water Social pressure supported by teachers/peers	Decrease in diarrhoeal diseases/helminth control
	Dust	Prevent by growing grass/cement the area	Improved school environment
	Preparation of food	Clean/nutritious food sold by vendors Washing of fruit/vegetables	Better nutrition Decreased infections
	Eating of soil	Pupils wash foods that have fallen on ground	Reduced transmission of helminth infections
Enabling	Targeted anthelmintic chemotherapy Healthy school environment Adequate, clean, toilets Clean water Health education Community involvement Avoid entering river	Reduction in intensity of helminth infections Improved school environment Changes in pupil behaviour resulting from health education, feelings of self-empowerment and peer pressure to avoid risk behaviours	Reduction in morbidity, transmission of infections
Reinforcing	Information and social pressure by peers/ teachers/parents to avoid risk behaviours	Health-promoting schools to promote health education, self-help training, peer pressure to promote healthy behaviours	Knowledge to be supported by other determinants, e.g. self-empowerment and positive social pressures

Difficulty in accessing water resulted in the river serving as a source of household water for 43% of questionnaire respondents, with 88% washing clothes at the river and 60% playing in the river (as did 31% of pupils herding cattle). This study suggests that preventing water contact is likely to prove extremely difficult. The potential cost of reticulated water, and the lack of boreholes or problem of boreholes drying out in the winter months, would result in the river still being used for clothes washing. Furthermore, there are few alternative recreational activities for children in rural areas. In one study in Kenya children were provided with a swimming pool (N Muhoho and Y Aoki — paper presented at the 18th African Health Sciences Congress, Cape Town, 14 - 17 April 1997) which solved this problem, but the considerable financial resources required makes this impractical. In Kenya selective mass treatment using urinalysis reagent strips has proved effective in reducing morbidity and intensity of infection over a 5-year period (W Ndiritu *et al.* — paper presented at the 18th African Health Sciences Congress). An effective parasite-control programme must include the targeted treatment of pupils, improved sanitation, health education and perhaps molluscicide. Such a programme may be facilitated and reinforced by linking it to the development of the health-promoting schools.

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References

1. World Health Organisation. *Strengthening Interventions to Reduce Helminth Infections As an Entry Point for the Development of Health Promoting Schools.* Geneva: WHO, 1997.
2. Fincham JE, Evans AC, Woodrof CW, Seager JR, Benade AJS, Appleton DD. Feed the children, not the parasites — an essential part of primary health care in South Africa. *S Afr Med J* 1996; **86:** 647-649.
3. Hall A, Chan M. Intestinal worms; strategies to control disease. *Africa Health* 1994; **17**(1): 23-26.

4. Stephenson LS, Holland C. *The Impact of Helminth Infections on Human Nutrition.* London: Taylor & Francis, 1987.
5. Stephenson LS, Latham MC, Kinoti SN, Kurz KM, Brigham H. Improvements in physical fitness in Kenyan schoolboys infected with hookworm, *Trichuris trichiura* and *Ascaris lumbricoides*, following a single dose of albendazole. *Trans R Soc Trop Med Hyg* 1990; **84:** 277-282.
6. Connolly KJ, Kvalsvig JD. Infection, nutrition and cognitive performance in children. *Parasitology* 1993; **107:** S187-200.
7. Partnership for Child Development. This wormy world: fifty years on. The challenge of controlling common helminthiases of humans today. *Parasitology Today* 1997; **13:** (11, Nov) (insert).
8. Savioli L, Bundy D, Tomkins A. Intestinal parasitic infections; a soluble public health problem. *Trans R Soc Trop Med Hyg* 1992; **86:** 353-354.
9. Partnership for Child Development. Better health, nutrition and education for the school aged child. *Trans R Soc Trop Med Hyg* 1997; **91:** 1-2.
10. Hirschowitz R, Orkin M. *A National Household Survey of Health Inequalities in South Africa.* (CASE survey for Henry J Kaiser Family Foundation). Henry J Kaiser Family Foundation, 1995: viii.
11. Taylor M, Morar NS, Memela D, Nzimakwe D, Bruce-Brand J. *Evaluation of School Health Services in KwaZulu-Natal.* Department of Community Health, University of Natal, August 1996.
12. Leslie J, Jamison DT. Health and nutrition consequences in education planning. 1. Educational consequences of health problems among school-age children. *Food and Nutrition Bulletin* 1990; **12**(3): 191-203.
13. World Health Organisation. *Promoting Health Through Schools.* Geneva: The World Health Organisation's Global School Health Initiative, 1996.
14. Green LW, Kreuter MW. *Health Promotion Planning. An Educational and Environmental Approach.* Mountain View, Calif.: Mayfield Publishing Company, 1991: 14-89.
15. Strauss AL. *Qualitative Analysis for Social Scientists.* Cambridge: Cambridge University Press, 1987: 55-81.
16. Jick TD. Mixing qualitative and quantitative methods: triangulation in action. *Administrative Science Quarterly* 1979; **24:** 602-611.
17. Woolhouse M. Schistosomiasis: the Zimbabwe experience. *New Scientist* 1 October 1987: 60-65.
18. Kok G. Health education theories and research for AIDS prevention. *Hygie* 1991; **X:** 32-37.
19. Bryant AT. *The Zulu People.* 2nd ed. Pietermaritzburg: Shuter & Shooter, 1967: 236.

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