

Do schools hold the key to controlling parasitic disease?

The rising rate of school attendance in many African countries is providing an unparalleled opportunity to reach children burdened by parasitic disease.

Gavin Yamey explores how Kenya is seizing its chance

Jimmy Kihara, a 52 year old parasitologist, picks up a clear plastic bottle containing a urine sample given a few minutes ago by a child at the Mkunumbi Primary School on Kenya's northern coast. The urine is stained deep red with blood.

"This child has bilharzia," he says.

Throughout the morning I visited the school, children lined up with great excitement to give samples of urine, stool, and blood. They were being tested not just for schistosomiasis (bilharzia), but for two other parasitic diseases—malaria and intestinal worms—as part of a national prevalence survey.

The national survey is one of the ways in which Kenya is capitalising on its impressive progress towards the second millennium development goal: universal primary school education by 2015. With school attendance on the rise, the country has a tremendous opportunity to reach children infected with parasites. Schools are fast becoming a crucial venue for disease control.

Intolerable burden

Parasite infection is common among school aged children in Kenya. In a recent survey at Mililani primary school in the southern coastal district of Kwale, three in four children were infested with worms and one in six had malaria parasitaemia.

Chimwaga Manga, headmaster of Mililani school, blamed the high rate of schistosomiasis on the nearby lake where children play. "It has stagnant water with snails," he said.

Children also get infected with intestinal worms, or soil transmitted helminths, when they ingest eggs from contaminated soil or when larvae in the soil penetrate their skin. These worms spread easily around the community, explained Mr Manga, because few families have latrines and the soil in the village gets contaminated with

faeces containing worm eggs. Malaria is common because most children at the school aren't sleeping under a mosquito net, he said, so they are prone to being bitten at night by the female mosquitoes that carry the malaria parasite.

These parasitic diseases have profound health effects on school aged children in Africa. Malaria, for example, may be responsible for up to half of all deaths in this age group,¹ while chronic, heavy infection with intestinal worms can cause anaemia and growth retardation.

There is also growing evidence that parasites are impeding educational performance. Intestinal worms have been linked with higher rates of school absenteeism and impaired cognitive function,² while malaria may also have an adverse effect on cognition.³

"In some contexts, for some children, parasitic disease is going to have a big impact on how they learn," says Matthew Jukes, assistant professor of international education at Harvard University. Dr Jukes is based in Kwale and studies the link between parasites and education outcomes. The anaemia caused by parasites, he says, has "permanent effects on the developing brain."

School based disease control

More children than ever before are attending school in Kenya—86% of children are currently enrolled in primary schools, compared with 62% in 1992⁴—giving the government a chance to control the burden of parasitic disease through school based interventions. With support from the joint Kenya Medical Research Institute (KEMRI) and Wellcome Trust research

programme in Nairobi, the government is acting on three fronts. It has launched a long term initiative aimed at achieving malaria-free schools. It has commissioned KEMRI-Wellcome Trust researchers, such as Mr Kihara, to create a national map showing which schools are most heavily affected by parasites. And it has started to distribute deworming drugs free to schoolchildren, beginning with schools along the coast and then moving inland.

The malaria-free schools initiative is part of the government's 2009-18 national plan for malaria control. One intervention being considered for this initiative is the school based distribution of long lasting insecticidal nets, which can reduce

deaths in children by 20% and episodes of malaria by 50%.⁵

"Schoolchildren are the most likely to have malaria parasites in the blood, which causes anaemia, and the least likely to be sleeping under a net," said Simon Brooker, a KEMRI-

Wellcome Trust researcher based in Nairobi, who advises the Kenyan government on school based health interventions.

To boost use of nets among schoolchildren, he suggests a multi-pronged strategy—giving free long lasting insecticidal nets to schoolchildren, encouraging boarding schools to provide nets in dormitories, and supporting net distribution with education about how to reduce malaria risk.⁶

Dr Brooker and his research colleagues have also been investigating the clinical and educational effects of giving children a presumptive course of anti-malarial drugs once a term. In a



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SVEN TORENNIPANOS

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randomised clinical trial in Bondo district, western Kenya, schoolchildren given such presumptive treatment for one year were less likely to have anaemia and asymptomatic parasitaemia, and were more attentive in class, than those given a placebo.³

But children treated with malaria drugs in the Bondo study did not show better overall education outcomes. Dr Jukes, one of the study coauthors, thinks the explanation lies in the quality of the teaching. Although the children given malaria drugs were more attentive, he said, the teaching may not have been effective enough to boost educational performance.

To test this hypothesis, a new trial will begin this year in Kwale to see whether education outcomes can be improved by combining the malaria treatment with an intensive three day training programme for teachers.

Galvanising effects of deworming

The deworming component of Kenya's school based health programme got a glitzy launch at last year's World Economic Forum in Davos by the Kenyan prime minister, Raila Odinga. Using funds from the World Bank, Kenya's Ministry of Education has committed 70m Kenyan shillings (around £600 000; €660 000; \$910 000) to delivering school based deworming drugs.

Kenya's plans for national deworming build on the success of a small pilot project to map and treat worms among 43 000 schoolchildren in the rice growing region of Mwea, Central Kenya.⁷ Charles Mwandawiro, deputy head of KEMRI, said that the "Mwea model" was a powerful demonstration to the government of the benefits of deworming in schools.

"If you deworm, it helps galvanise the community," he said. "It's dramatic—the next day, the child passes worms."

Vuga Primary School is one of the coastal schools in Kwale district that has received free deworming treatment through the national programme. "This programme is very helpful, especially in this area, which has a low income," said the head teacher, Saidi Shee. The parents are too poor to pay for the deworming drugs themselves.

Parents say they notice a difference in their children after the deworming. "When they have worms, they are inactive," said Matthew Mulli, who has five children at schools in Kwale. "They become active after worm treatment."

Recent systematic reviews have shown that deworming drugs can significantly increase weight and reduce anaemia.^{8,9} But the question of whether deworming also has educational benefits has become one of the most highly contentious public health debates of recent times.

Proponents of deworming as a tool to improve education outcomes point to a study that showed that school based deworming was associated with a 25% reduction in school absenteeism.¹⁰ However, this study was excluded from the Cochrane systematic review of deworming children because of the reviewers' concerns about possible confounding.⁸ The review found no evidence of an effect on school performance.

Paul Garner, coordinating editor of the Cochrane Infectious Diseases Group, one of the authors of the Cochrane review, said that deworming "has the potential to do good." But at the end of the day, he said, "the evidence is somewhat limited."

It is important to get the design of deworming trials right, he said, because of the risk of confounding: "Children with worms are more likely

to be absent from school for other reasons—because they're poor or don't have latrines."

The contentious debate surrounding the benefits of deworming may be answered, said Professor Garner, by the upcoming results of the Deworming and Enhanced Vitamin A (DEVTA) trial in India, the world's largest ever randomised trial, involving one million rural children.¹¹

Deworming advocates don't see the need to wait for the results of the trial before scaling up the delivery of deworming drugs. Karen Levy of Deworm the World, a non-governmental organisation that is helping the Kenyan government to take the Mwea model nationwide, believes that the impact of deworming on absenteeism justifies the intervention.

"In Kenya, if we treat 3 million children, and reduce absenteeism by 25%, the aggregate number of school days attended goes up enormously," she said. "There's no question in my mind that that's a good thing."

Compared with other educational strategies, said Levy, such as distributing school uniforms or giving incentives to teachers, deworming is by far the cheapest. "It's about 25 cents a kid," she said. Most of the cost is in training the drug distributors and doing the distribution. The medicines themselves are just pennies."

The scale and ambition of Kenya's school based programme to map and control worms and malaria is unprecedented. Despite the ongoing debate surrounding the long term value of deworming,^{8,10,12} some health and education experts believe it could have a profound long term effect on Kenyan society. "For me, the story is mainly about the potential for these health interventions to have an impact," said Dr Jukes. "And they're incredibly cheap."

Dr Kihara, who had schistosomiasis and intestinal worms as a child growing up in the village of Taveta below Mount Kilimanjaro, believes the school health programme will "change the children and the community."

"The children will be healthier," he said. "They'll learn better. It will transform society."

Gavin Yamey lead, Evidence to Policy Initiative (E2Pi), Global Health Group, University of California San Francisco, USA
YameyG@globalhealth.ucsf.edu

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References are in the version on bmj.com

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