

# KENYA: Do Infants Benefit When Older Siblings are Dewormed?

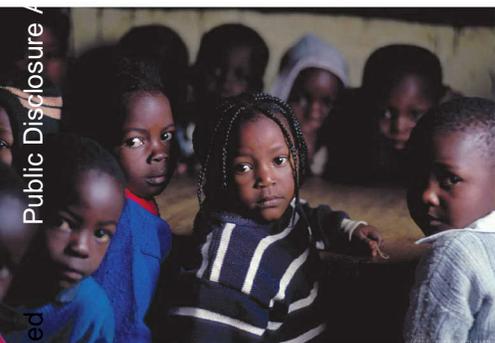
Early childhood is a crucial window of opportunity for improving lives. It's a time when children's brains and bodies rely on good nutrition, health care and stimulation for

proper development. The impacts, as a recent evaluation of an early childhood stimulation program in Jamaica showed (see Evidence to Policy: Can Disadvantaged Kids Ever Catch Up with Better-off Peers?), can be life-

long. The challenge for policymakers and development experts is knowing which programs give children's development the best boost and how to implement them.

The World Bank is committed to helping governments understand whether programs to improve lives are succeeding. Rigorous impact evaluations are often carried out to

provide the evidence of impact. In Kenya, a World Bank researcher went back after a decade to measure the impact of a deworming campaign on young children whose older siblings and neighbors had received the deworming medication. The younger children hadn't received the parasite-killing drugs themselves. These younger siblings, now around 11 and 12 years old, did better on cognitive tests than young children whose older siblings hadn't received the medication at that time. The evaluation indicates that having fewer worms in their communities gave these younger children a boost, most likely because they faced lower risk of infection during a vital period of development. The results are a reminder of the importance of following up on development programs to measure long-term impacts that can show lasting improvements in the lives of millions. **Currently, deworming in Kenya has been scaled up nationwide, giving primary school age children better health and, as this evaluation shows, the chance for cognitive improvement for the youngest family members too.**



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## Context

Intestinal worms are among the most common infections in the world. More than one billion people are infected, mainly children in Asia and Sub-Saharan Africa. The worms live in the human gut and absorb key nutrients, like iron, that would otherwise nourish their human host. While infection is rarely fatal, worms can cause diarrhea, abdominal pain, anemia, general malaise, and weakness.

Two decades ago, researchers Edward Miguel of the University of California, Berkeley, and Michael Kremer of Harvard University, sought to reduce worm infections among children in western Kenya. The problem was particularly acute there—more than 92 percent of children were infected

with at least one parasite, and most infections weren't treated despite the availability of medicines. Between 1998 and 2001, a deworming program was randomly phased in among 75 primary schools in western Kenya. An impact evaluation found that moderate-to-heavy infections were reduced and school attendance went up among children who received the deworming treatment. Importantly, the relatively low-cost program also raised school attendance for children who didn't get the drugs and lived in the same community, indicating that these children were less likely to get infected and suffer the effects that could keep them from school.\* A recent replication study upheld these main results of this paper.\*\*

\* "Worms: Identifying impacts on education and health in the presence of treatment externalities", *Econometrica*, Vol. 72, No. 1 (January, 2004), 159–217, Edward Miguel and Michael Kremer, [http://cega.berkeley.edu/assets/cega\\_research\\_projects/1/Identifying-Impacts-on-Education-and-Health-in-the-Presence-of-Treatment-Externalities.pdf](http://cega.berkeley.edu/assets/cega_research_projects/1/Identifying-Impacts-on-Education-and-Health-in-the-Presence-of-Treatment-Externalities.pdf);

\*\* "Re-analysis of health and educational impacts of a school-based deworming programme in western Kenya: a pure replication," *Int. J. Epidemiology*. First published online July 22, 2015, Alexander M Aiken, Calum Davey, James R Hargreaves, and Richard J Hayes, <http://ije.oxfordjournals.org/content/early/2015/07/21/ije.dyv127.abstract>

Longer term follow-up surveys on children eligible for deworming didn't find evidence of improvements in general intelligence as a result of the intervention, but did detect increased time spent in school and work, and higher earnings among wage workers. Since the window considered most important for child cognitive development had already passed at the time of the intervention, the lack of impact on intelligence isn't surprising. The labor market improvements are attributed to the childhood health improvements changing both child and later adult time allocations.\*

Recently, a World Bank research team decided to take a long-term look at children in the same communities who didn't receive the treatment because they were infants or toddlers at the time. Given the well-known spillover effects on primary school aged children who didn't get treated, the question was whether there was any similar impact on very young children and whether improved health then might have boosted their achievement later on.

## Evaluation

The impact evaluation, carried out in 2009–2010, focused on children who were infants when the deworming started. These children didn't get the deworming treatment themselves during the original deworming study, because the treatment was aimed at primary school children.

The original deworming project's randomized design—treatment was phased in across entire communities over a period of a few years—allowed researchers to avoid problems that hampered earlier studies, which lacked true control groups. In the communities where deworming began in 1998, children born that same year were identified as the treatment group because the deworming program started when they were under the age of one. In the communities where the phased-in deworming didn't start until 2001, children born in 1998 were three years old before they could potentially experience any of the effects from siblings' being dewormed. For the purpose of this evaluation they were classified as “untreated” and used as a control group.

Height, weight, and migration data was collected from more than 20,000 children at all the deworming

project schools in Samia and Bunyala districts of Kenya's Western Province. Cognitive tests were conducted among a subset of slightly more than 2,400 children. The researchers wanted to know if better health in early childhood produced a long-term impact on cognition, given that these children's older siblings and neighbors had received deworming drugs.

The children were tested for “verbal fluency,” in which children name as many items in a category—in this case food and animals—as they can in a minute. Researchers also used the Peabody Picture Vocabulary Test to measure “receptive vocabulary,” in which children point to one of four pictures that best matches a word read aloud to them. To test reasoning, researchers relied on a set of questions from Raven's Progressive Matrices, a series of puzzles that measure nonverbal reasoning and general intelligence. For short-term memory, children were asked to try and repeat a gradually increasing string of numbers back to the interviewer, either forwards or backwards.

## Findings

**A decade later, children who were infants when their siblings were treated for worms showed large gains in cognitive skills.**

Children who were infants when their siblings received the deworming medication scored much better on tests of reasoning than children who were around three years old when deworming was introduced in their communities.

\*Baird, Sarah, Joan Hamory Hicks, Michael Kremer, and Edward Miguel (2015). “Worms at Work: Long-Run Impacts of Child Health Gains.” Unpublished Manuscript.

The cognitive gains were comparable to a half year of schooling. Infants in the communities where deworming took place faced a lower risk of infection during a crucial period when brains and bodies develop. This likely helped their development, giving them a boost that was reflected in tests of their cognitive abilities years later.

**The biggest gain was seen among children who had older siblings in primary schools where the deworming program in the community took place.**

The gains were nearly twice as large for children who had an older sibling in school at the time when compared with children who lived in the community where the deworming was happening but didn't have older siblings who would have received the treatment in school.

Identifying which children had older siblings in school at the time wasn't always easy. Children generally weren't sure of the ages of their older siblings. As a result, the evaluation assumed that a child with three or more older siblings who had gone to primary school had at least one sibling who was part of the deworming program. The larger cognitive gains among children with older siblings in school makes sense because fewer worms among people who live together reduces the chance of infection.

**Infants with older sisters in school appeared to show the biggest cognitive gains.**

The larger impact for children with older sisters could reflect that girls more often than boys are asked to care for younger siblings. This care pattern is common across many cultures, and stands out in Kenya in particular. In western Kenya, where the predominant ethnic group is Luhya, older female siblings are more than twice as likely as male siblings to care for infants.

**However there was no effect on physical development.**

Deworming of children in the community didn't show any impact at the time on physical development and likewise didn't have an impact on those who were infants at the time. The follow-up measured height, height-for-age, and stunting, and didn't find any impact.

**People who had the most physical contact with infants were an important link through which infants and toddlers received the health benefits of deworming.**

The physical contact may have been key to why young children were either more, or less, vulnerable to worms. In other words, the infants could have faced greater risk of infection if the person in physical contact with them had worms, and lower risk if that person was free of worms.



**Deworming produced the biggest cognitive gains among children less than a year old...**

The largest gains from community-wide deworming of primary school children were found among children who were under the age of one when the deworming took place. The impact on children between the ages of one and three years old proved to be no different statistically from the impact of community deworming on much older children. In other words, there were no big gains in cognitive skills, though there may still be school attendance gains and long-term health gains from deworming later in childhood.

**...and it's both cost-effective and a potential revenue booster for governments.**

A variety of studies have calculated that deworming a child costs about \$0.59 a year. If the cognitive gains made by infants exposed to deworming through their older siblings lead to increased earnings then governments stand to gain additionally from increased tax revenue and productivity.

## Conclusion

Children who were infants when deworming was administered to older children in primary school scored higher on cognitive tests a decade later, even though they had not received the deworming drugs at that time. The results are significant, suggesting deworming does have a long-term impact on cognition—contrary to earlier findings—and underscoring the value of long-term follow-up evaluations. In this case, the infants benefited from fewer worms in the community, reducing their risk of infection during a critical period in development.

The biggest gains occurred among infants who had an older sibling in primary school when the deworm-

ing occurred, especially if that sibling was female. The findings reinforce evidence that children's cognitive development is particularly active during early childhood. The results also provide evidence that an inexpensive program like deworming can deliver big, lasting benefits. Together with other recent studies, this evaluation helps paint a complete picture of the long-term benefits of deworming in developing countries. It also points to the usefulness of long term follow-up studies to truly understand a program's impact.

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