Intestinal helminths—including hookworm, roundworm, whipworm, and schistosomiasis—infect more than one in four people worldwide. Researchers evaluated the short-run impacts of a mass school-based deworming program in western Kenya, and found that deworming substantially improved health and school participation of treated children, as well as of untreated children in treatment schools and children in neighboring schools. Approximately 10 years after treatment, researchers found that the program increased women’s educational attainment and men’s labor supply, with accompanying shifts in occupation choice. Researchers are currently collecting data to examine the intergenerational effects of the deworming treatment, measuring impacts on both the health and cognitive development of beneficiaries’ children.

Policy Issue
Intestinal helminths—including hookworm, roundworm, whipworm, and schistosomiasis—infect more than one in four people worldwide and are particularly prevalent among school-aged children in less-developed countries. While light worm infections are often asymptomatic, more intense infections can lead to lethargy, anemia, and growth stunting, and may weaken the immune system. There is a growing body of evidence that suggests that school-based deworming can generate immediate improvements in child appetite, growth, and overall health, and subsequent improvements in school attendance. However, in order to understand what level of public investment is worthwhile to support such public health measures, it is necessary to assess the long-run impacts of such programs, including both the effects on beneficiaries’ well-being as adults and the intergenerational effects on their children.

Evaluation Context
This study is a follow-up to the Primary School Deworming Program (PSDP) launched by Investing in Children and their Societies (ICS) in Busia district in 1998. Busia district is a poor and densely-settled farming region in western Kenya adjacent to Lake Victoria. Environmental research indicated that in 1998, over 90 percent of individuals in this area were infected with helminths, and that over
one-third of these individuals had moderate to heavy infections (which would suggest higher morbidity). Helminth infections can be transmitted several ways, including contact with contaminated lake water (schistosomiasis) or contact with or ingestion of fecal matter (geohelminths). This can occur, for example, if children do not have access to a latrine and instead defecate in the fields near their home or school–where they also play.

**Details of the Intervention**

In early 1998, 75 schools were randomly divided into three groups of 25 schools each. All groups were phased into treatment over four years, and received treatment until the program ended in 2002. The first group began treatment in 1998, the second group began treatment in 1999, and the third group began treatment in 2001. Treatment entailed mass drug administration to students enrolled in the school (every six months for the geohelminths, and annually for schools with schistosomiasis infections above a cutoff). The evaluation design ensured that all children received deworming treatment by year three, but children in treatment schools received two to three more years of deworming than the comparison group.

A [2004 evaluation](#) by J-PAL affiliates Edward Miguel and Michael Kremer examined the 1-2 year impacts of PSDP, and found that the deworming treatment led to large gains in school attendance and health outcomes. Children in treatment schools who did not receive deworming pills, as well as children living within three kilometers of treatment schools, also had lower worm infection rates and higher school participation.

In the long-term analysis, researchers examined health, education, and labor market outcomes a decade after treatment, at which point most subjects were 19 to 26 years old. The Kenyan Life Panel Survey (KLPS-2) was collected during 2007-2009, and tracked a representative sample of approximately 7,500 respondents who were enrolled in grades 2-7 in the PSDP schools at baseline in 1998. Of the individuals in the original study sample who were still alive at this time, the follow-up survey achieved an effective tracking rate of 84 percent.

Between 2018 and 2021, researchers will gather data to examine the intergenerational effects of the deworming treatment on beneficiaries' children. In particular, data collection will focus on approximately 7,200 randomly selected biological children ages three to nine of the 1998 PSDP study participants in order to assess the effects of parental deworming on children’s health and cognitive development.

**Results and Policy Lessons**

One decade after receiving the deworming treatment, education and labor market outcomes improved among individuals who received the deworming pills as children. Evidence from this study suggests that health interventions among school-aged children, delivered too late in life to affect cognition or height, can have long-run impacts on labor outcomes by affecting the amount of time people spend in school or work.
Impacts on health: There were no long-term effects on physical growth or body mass index. However, there is some evidence of improved self-reported health and reduced miscarriage. Respondents in the treatment group were 4.0 percentage points more likely to report that their health was “very good” relative to the comparison group mean of 67.3 percent. Deworming reduced miscarriage rates among women in the treatment group by 2.8 percentage points (from a base of 3.9 percent).

Impacts on education: A long-term follow up found that deworming also improved school performance and future earnings. Deworming led to large academic gains for girls, increasing the rate at which girls passed the secondary school entrance exam by 9.6 percentage points over the comparison group mean of 41 percent. This increase of roughly 25 percent halved the existing gender gap in exam performance.

Impacts on labor supply and occupation: Deworming increased time men spent working by 17 percent, or 3.5 hours per week. Men and women spent 45 percent more hours in non-agricultural self-employment, and the deworming treatment led to a shift in occupation choice: beneficiaries were three times more likely to work in manufacturing and less likely to work in casual labor.

Impact on living standards: Deworming led to more consumed meals per day, as well as increased earnings. Among male and female wage earners, earnings increased by more than 20 percent. The estimated differences in earnings was larger than those of hours, suggesting that the deworming treatment led men to shift into jobs that required more work hours and that offered better pay.

Returns to society: The returns to mass school-based deworming in terms of measured earnings gains versus the costs of treatment are high; researchers estimate a conservative internal rate of return to deworming at 32 percent per year. This estimate suggests that the program generated benefits to society that were larger than the cost of the program, and therefore likely exceeds conventional hurdles for public health investment.

Results on the intergenerational effects of the deworming program on beneficiaries’ children are forthcoming.

Sources