Understanding Deworming Impacts on Education

Michael Kremer (Harvard University), Edward Miguel (University of California, Berkeley)

July 27, 2015

Below we discuss the recent re-analysis of our *Econometrica* paper and the broader evidence on the impact of deworming.

1) Comments on the 2004 *Econometrica* Paper

While we are very much in favor of re-analysis, replication, and transparency, Davey et al. make a series of non-standard analytical decisions and present results in a misleading way. This is discussed in our response to the authors here (response to their 3IE report) and here (*International Journal of Epidemiology*), and in writing by independent scholars Chris Blattman (Columbia University), Alexander Berger (GiveWell), and Berk Ozler (World Bank).

The re-analysis authors conduct two analyses. One is a pure replication of the analysis in the paper (Aiken et al., 2015), largely documenting errors we had already identified in replication materials made publicly available in 2007,[1] and finds results mostly in line with the original paper. In particular, the main findings of the 2004 study were:

1) Deworming reduces worm infections in both treated children, and untreated children living nearby (through reduced disease transmission).
2) Deworming improves school attendance for treated and nearby untreated children.

Both of these main findings are affirmed in the "pure replication" work of Aiken et al., although this is partly hidden by how the authors present and discuss their results. In fact, their online-only appendix tables show the raw results, and these results confirm substantial reductions in worm infections and increases in school attendance due to deworming, for both treated and nearby untreated individuals. Figure 1 in our *IJE* response piece shows graphically how similar the original and updated results are. The only difference in key findings between the original paper and the re-analysis is that impacts on untreated individuals do not reach distances quite as far as originally believed (i.e., worm infections are reduced among schoolchildren living within 3 km of treated individuals, but not much beyond that, although the original paper estimated benefits out to a distance of 6 km due to a coding error).

The second re-analysis piece (Davey et al., 2015) makes a series of analytical errors, many of which run counter to their own pre-analysis plan. The following are three examples:

---

[1] There were two important errors in our original analysis.

1) First, in some calculations of statistical significance, we divided rounded numbers, rather than rounding after dividing. That usually led to very minor differences, but in one case (anemia) it led to a substantial difference in a p-value, although not in the coefficient estimate itself.
2) Second, when estimating epidemiological spillovers, rather than looking at all the schools within 6 kilometers, we mistakenly looked at only the 12 closest schools within 6 kilometers. This affected our estimate of epidemiological spillovers beyond three kilometers, but it did not affect estimates of epidemiological spillovers within three kilometers, because in no case were there more than 12 schools within three (or even four) kilometers. Correcting this thus has no impact on our estimate of within-school epidemiological spillovers or on our estimate of cross-school spillovers within three kilometers, and indeed Aiken et al. find similar results on these measures, as shown in Figure 1 of our response.

1) The original study covered two years and as the authors' own power calculations make clear, using both years of data is necessary for adequate statistical power. Davey et al. arbitrarily divide the data into two separate one-year experiments, dramatically reducing statistical power and making it unlikely that estimates will be statistical significant.
2) Rather than weight every individual child equally (or every school attendance check equally), Davey et al. weight each school equally, such that a child in large population school has much less weight in the analysis than a child in a small population school. This is a non-standard statistical approach with no natural interpretation or justification.
3) They misdefine the deworming treatment measure to include periods before treatment even began (and before it was even supposed to have begun). Defining people as treated before anyone received a pill or worm prevention lecture makes no sense, and simply adds unnecessary "noise" to the treatment variable.

These are all non-standard and highly questionable analytical choices, and we show in our *IJE* response piece that it is only when Davey et al. simultaneously make at least two of these analytical errors—in weighting observations, defining treatment, and failing to pool the data—that deworming impact estimates on school attendance are not statistically significant.

2) The Broader Evidence on the Impact of Deworming

Even though some of the press coverage made the claim that the case for deworming rests on just one study, there are in fact multiple studies documenting the educational and economic impact of deworming. This *World Bank Economic Review* paper reviews the literature, which includes:

- Owen Ozier's recent study shows that preschool-age Kenyan children who lived in communities where a deworming program was conducted, and thus were exposed to epidemiological spillovers, showed cognitive improvements ten years later.
- A separate RCT finds that Ugandan children randomly exposed to more years of deworming have higher test scores in literacy and numeracy 7 to 8 years later.
- Our "Worms at Work" study finds that 10 years after deworming, Kenyan women who were dewormed for more years as girls were 25% more likely to have attended secondary school, and men who were dewormed for more years as boys worked 17% more hours and had better labor market outcomes, including higher earnings.
- Hoyt Bleakley's study in the *Quarterly Journal of Economics* finds that deworming in the U.S. in the early 1900's lead to increased school enrollment and attendance for children, and improved literacy and income for adults who were treated as children. (This is a carefully executed difference-in-difference design, rather than an RCT.)

The Cochrane Review on deworming does not include any of these papers, because the first three compare children who received more years of deworming rather than less, instead of the "pure" comparison of children who received no deworming at all versus children who received some deworming. It excludes the historical paper on the U.S. South because it is not an RCT, which is understandable under the rules of the Review, but since the Bleakley paper uses a credible research design, it deserves weight in any review of whether deworming is an appropriate policy.

The Cochrane Review's recommendation is at odds with most other groups in the policy discussion on deworming. Multiple organizations have carefully reviewed all the evidence on deworming, and concluded that mass drug administration is highly cost-effective. These include the World Health Organization, the Disease Control Priorities Project, the Copenhagen Consensus, GiveWell, and the Jameel Poverty Action Lab at MIT.