ABDUL LATIF JAMEEL
Poverty Action Lab

TRANSLATING RESEARCH INTO ACTION

Case 4: Deworming in Kenya

Addressing threats to experimental integrity

This case study is based on Edward Miguel and Michael Kremer, "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities," *Econometrica* 72(1): 159-217, 2004

J-PAL thanks the authors for allowing us to use their paper

Massachusetts Institute of Technology

Key Vocabulary

1. Phase-in Design: a study design in which groups are individually phased into treatment over a period of time; groups which are scheduled to receive treatment later act as the comparison groups in earlier rounds.
2. Equivalence: groups are identical on all baseline characteristics, both observable and unobservable. Ensured by randomization.
3. Attrition: the process of individuals joining in or dropping out of either the treatment or comparison group over the course of the study.
4. Attrition Bias: statistical bias which occurs when individuals systematically join in or drop out of either the treatment or the comparison group for reasons related to the treatment.
5. Partial Compliance: individuals do not comply with their assignment (to treatment or comparison). Also termed "diffusion" or "contamination."
6. Intention to Treat: the measured impact of a program that includes all data from participants in the groups to which they were randomized, regardless of whether they actually received the treatment. Intention-to-treat analysis prevents bias caused by the loss of participants, which may disrupt the baseline equivalence established by randomization and which may reflect non-adherence to the protocol.
7. Treatment on the Treated: the measured impact of a program that includes only the data for participants who actually received the treatment.
8. Externality: an indirect cost or benefit incurred by individuals who did not directly receive the treatment. Also termed "spillover."

Between 1998 and 2001, the NGO International Child Support Africa implemented a school-based mass deworming program in 75 primary schools in western Kenya. The program treated the 30,000 pupils enrolled at these schools for worms—hookworm, roundworm, whipworm, and schistosomiasis. Schools were phased-in randomly.

Randomization ensures that the treatment and comparison groups are comparable at the beginning, but it cannot ensure that they remain comparable until the end of the program. Nor can it ensure that people comply with the treatment they were assigned. Life also goes on after the randomization: other events besides the program happen between initial randomization and the end-line. These events can reintroduce selection bias; they diminish the validity of the impact estimates and are threats to the integrity of the experiment.

How can common threats to experimental integrity be managed?

Worms—a common problem with a cheap solution

Worm infections account for over 40 percent of the global tropical disease burden. Infections are common in areas with poor sanitation. More than 2 billion people are affected. Children, still learning good sanitary habits, are particularly vulnerable: 400 million school-age children are chronically infected with intestinal worms.

Worms affect more than the health of children. Symptoms include listlessness, diarrhea, abdominal pain, and anemia. Beyond their effects on health and nutrition, heavy worm infections can impair children's physical and mental development and reduce their attendance and performance in school.

Poor sanitation and personal hygiene habits facilitate transmission. Infected people excrete worm eggs in their feces and urine. In areas with poor sanitation, the eggs contaminate the soil or water. Other people are infected when they ingest contaminated food or soil (hookworm, whipworm, and roundworm), or when hatched worm larvae penetrate their skin upon contact with contaminated soil (hookworm) or fresh water (schistosome). School-age children are more likely to spread worms because they have riskier hygiene practices (more likely to swim in contaminated water, more likely to not use the latrine, less likely to wash hands before eating). So treating a child not only reduces her own worm load; it may also reduce disease transmission—and so benefit the community at large.

Treatment kills worms in the body, but does not prevent re-infection. Oral medication that can kill 99 percent of worms in the body is available: albendazole or mebendazole for treating hookworm, roundworm, and whipworm infections; and praziquantel for treating schistosomiasis. These drugs are cheap and safe. A dose of albendazole or mebendazole costs less than 3 US cents while one dose of praziquantel costs less than 20 US cents. The drugs have very few and minor side effects.

Worms colonize the intestines and the urinary tract, but they do not reproduce in the body; their numbers build up only through repeated contact with contaminated soil or water. The WHO recommends presumptive school-based mass deworming in areas with high prevalence. Schools with hookworm, whipworm, and roundworm prevalence over 50 percent should be mass treated with albendazole every 6 months, and schools with schistosomiasis prevalence over 30 percent should be mass treated with praziquantel once a year.

Primary School Deworming Program

International Child Support Africa (ICS) implemented the Primary School Deworming Program (PSDP) in the Busia District in western Kenya, a densely-settled region with high worm prevalence. Treatment followed WHO guidelines. The medicine was administered by public health nurses from the Ministry of Health in the presence of health officers from ICS.

The PSDP was expected to affect health, nutrition, and education. To measure impact, ICS collected data on a series of outcomes: prevalence of worm infection, worm loads (severity of worm infection); self-reported illness; and school participation rates and test scores.

Evaluation design — the experiment as planned

Because of administrative and financial constraints the PSDP could not be implemented in all schools immediately. Instead, the 75 schools were randomly divided into 3 groups of 25 schools and phased-in over 3 years. Group 1 schools were treated starting in both 1998 and 1999, Group 2 schools in 1999, and Group 3 starting in 2001. Group 1 schools were the treatment group in 1998, while schools Group 2 and Group 3 were the comparison. In 1999 Group 1 and Group 2 schools were the treatment and Group 3 schools the comparison.

Figure 1: The planned experiment: the PSDP treatment timeline showing experimental groups in 1998 and 1999

	1998	1999	2001
Group 1	**Treatment**	**Treatment**	**Treatment**
Group 2	Comparison	**Treatment**	**Treatment**
Group 3	Comparison	Comparison	**Treatment**

Threats to integrity of the planned experiment

Managing attrition—when the groups do not remain equivalent

Attrition is when people join or drop out of the sample—both treatment and comparison groups—over the course of the experiment. One common example in clinical trials is when people die; so common indeed that attrition is sometimes called experimental mortality.

Managing partial compliance—when the treatment does not actually get treated or the comparison gets treated

Some people assigned to the treatment may in the end not actually get treated. In an after-school tutoring program, for example, some children assigned to receive tutoring may simply not show up for tutoring. And the others assigned to the comparison may obtain access to the treatment, either from the program or from another provider. Or comparison group children may get extra help from the teachers or acquire program materials and methods from their classmates. In any of these scenarios, people are not complying with their assignment in the planned experiment. This is called "partial compliance" or "diffusion" or, less benignly, "contamination." In contrast to carefully-controlled lab experiments, diffusion is ubiquitous in social programs. After all, life goes on, people will be people, and you have no control over what they decide to do over the course of the experiment. All you can do is plan your experiment and offer them treatments. How, then, can you deal with the complications that arise from partial compliance?

Managing spillovers—when the comparison, itself untreated, benefits from the treatment being treated

People assigned to the control group may benefit indirectly from those receiving treatment. For example, a program that distributes insecticide-treated nets may reduce malaria transmission in the community, indirectly benefiting those who themselves do not sleep under a net. Such effects are called externalities or spillovers.