Health

Lecture 5/2 - 2/2013

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Identifying impacts of intestinal worms on health in the presence of treatment externalities

- Original paper: Miguel and Kremer (2004), "Worms: Identifying Impacts on Education and Health in the Presence of Treatment Externalities,"
- Policy issue: intestinal helminths (worms) affect 1/4 of the world's population, prevalent among school children in developing countries
- The intervention: offer deworming pills twice per year in schools
- Outcomes: health (worm infections), school attendance, test scores

Intestinal Helminth (Worm) Infections

- 1.3 billion people around the world are infected with at least one type of worms. Most have light infections; a minority have heavy infections: iron-deficiency anemia, protein-energy malnutrition, abdominal pain, and listlessness.
- Not all worms can be treated with single-dose treatments. There can be reinfections, and therefore some treatments need to be taken every 6 months (geohelminth drugs) or annually (schistosomiasis drugs).
- WHO supports mass school-based deworming programs in areas with high helminth infections. This school-based program reduce the cost for parasitological screening.
- Medical treatment could potentially interfere with disease transmission, creating positive externalities.

Intestinal Helminth (Worm) Infections

- Children are most likely to spread worm infections. School children account for 85-90 percent of all heavy schistosomiasis infections in Kenya
- Treatment externalities
  - Worm infections transmitted through bodies of water or through feces
  - This might be worse for 1) children since they tend to have worse hygiene, 2) those who live near lakes or rivers
  - Externalities are likely to operate over larger distances for schistosomiasis than for geohelminths

Primary school deworming project in Busia, Kenya

- The project took place in southern Busia, a poor and densely-settle farming region in western Kenya, the area with the highest helminth infection rates
- Participants: 75 rural primary schools with total student enrollment of over 30,000 pupils, aged 6-18 years old.
- In January 1988, these 75 schools were randomly divided into 3 groups of 25 schools each.
  - Group 1: received free deworming treatment in 1998 and 1999
  - Group 2: received the treatment in 1999
  - Group 3: received the treatment in 2001
- Treatment vs. control (comparison) groups:
  - In 1998: T = group 1; C = group 2,3
  - In 1999: T = group 1,2; C = group 3

Primary school deworming project in Busia, Kenya

- If there are significant differences in health outcomes between treatment and control schools, it will understate overall treatment effects if there are deworming treatment externalities across schools.

	T	C
Having a moderate-to-heavy helminth infection	27%	52%
Prevalences of moderate-to-heavy other infections	lower	higher
Health outcomes after 1st year	better	

- There were likely reinfections during the time between 1998-1999, so differences in worm burden would be greater.
- Pupils prone to worm infections are more likely to be in school in Group 1 than Group 2 due to deworming health gains.

Estimation strategy

- Randomization at school level allows better comparison between T and C in the presence of within-school externalities.
- However, externalities may take place across schools since people living in the same area attended different schools, not the nearest one to their home.
- Use randomization across school to identify the overall program effect and cross-school externalities.
- Use non-experimental methods to decompose the effect on treated school into a direct effect and within-school externality effect.

Econometric specification

- Estimate program impacts in treatment schools and cross-school treatment externalities:

$$Y_{ijt} = a + \beta_1 T_{1it} + \beta_2 T_{2it} + X'_{ijt}\delta + \sum_d (\gamma_d N^T_{dit}) + \sum_d (\phi_d N_{dit}) + u_i + e_{ijt}$$

- Y_{ijt}- inidividual health or education outcome of school i, student j, and t = year 1,2 of the program
- T_{1it}, T_{2it} - indicator variables for school assignment to the 1st and 2nd year of deworming treatment
- X_{ijt}- school and pupil characteristics
- N_{dit}- total number of pupils in primary schools at distance d from school i in year t
- N^T_{dit}- the number of these pupils in schools randomly assigned to deworming treatment
- u_i - school effect

Econometric specification

- Children living or attending school near treatment schools could have lower environmental exposure to helminths
  - less re-infection and lower worm burdens
- N_{dit} captures the effect of local school density
- γ_d coefficients measure the deworming treatment externalities across schools
- $\beta_1 + \sum_d (\gamma_d \bar{N}^T_{dit})$ = average effect of the first year of deworming treatment on overall infection prevalence in treatment schools
- $\beta_2 + \sum_d (\gamma_d \overline{N}^T_{dit})$ = average effect of the second year of deworming
- $\beta_1 and \beta_2$ capture both direct effects of deworming treatment on the treated and externalities on untreated pupils within the treatment schools

Results and health cost effectiveness

- Health
  - Moderate-heavy infection rates cut in half in treatment schools relative to control schools
  - 1000 treatment pupils within 3km lowers infection by 26%
  - 1000 treatment pupils 3-6km away lowers infection by 14%
- Attendance
  - Additional 1000 treatment pupils within 3km results in 4.4% increased attendance
  - No significant effect of treatment pupils 3-6km away

Results and health cost effectiveness

- If we did not account for cross-school health externalities, the "naive" treatment effect result (the difference in average outcomes between treatment and comparison schools) will understate the actual effects of mass deworming.
- When we turn these estimated effects into the project cost analysis, the naive treatment effect estimate that failed to include externalities would underestimate gains among the treatment group. The naive treatment effect estimate also overestimate the cost per DALY, leading to the wrong conclusion that deworming does not meet the cost-effectiveness standards.