Twenty Year Economic Impacts of Deworming in Kenya

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Motivation

Do child health investments increase adult living standards?
• This question is of great interest to researchers, and of major policy importance for governments and aid donors, but solid answers remain elusive in low-income countries (Martorell et al 2010, Almond et al. 2017).

• Why? Many methodological challenges:
  >> Non-random child health investments (i.e., sick children may have other disadvantages, such as poverty)
  >> Few longitudinal (panel) datasets tracking children into adulthood
  >> Measurement of living standards in low-income regions.
Focus on the problem of worm infections in rural Kenya

• 1 in 5 people globally remain infected with intestinal worms, with major disease burden (due to anemia, growth stunting, lethargy), especially among children in Africa and Asia (Pullan et al 2014).

• Intestinal worms may have other adverse consequences for the immune system (Kirwan et al 2010), gut microbiome (dysbiosis).

• Prevalent worms in Kenya: hookworm, roundworm, whipworm, and schistosomiasis

>> Transmission through frequent reinfection with fecal matter (contact or ingestion); worms have a limited lifespan.
WHO recommends mass school-based deworming treatment in endemic areas (typically >20% prevalence)

- Screening is expensive, but drugs are inexpensive and safe

- Existing survey finds benefits for infected children, but is under-powered to detect population impacts (Taylor-Robinson et al 2015)

- Recent meta-analysis incorporating more studies and focusing on settings with >20% prevalence finds positive population impacts on child weight (and height); mass treatment 23x more cost effective than school feeding (Croke et al 2019)

>> Limited evidence re: long-run impacts on living standards
This Project


• 75 primary schools (30,000 children aged 6-18), with deworming treatment phased in over three years in 25 schools at a time.
• Rural district with 90 percent worm infection rates at baseline. Treatment with albendazole (twice per year) and praziquantel costs <0.50 USD per child.
Previous Findings

Mass deworming led to schooling gains and community health benefits, at low cost (Miguel and Kremer 2004).

• Rates of serious worm infections fell by half, from 52% to 25%. There were also gains in self-reported health, height.

• Increased school participation in the first two years of the project, with absenteeism falling by one quarter, or 6 percentage points.

>> Re-infection fell among other community members, including untreated children in treatment schools and those living within 4 km.
Assessing long-run impacts


• A representative sample of 7,530 of the baseline deworming sample (in grades 2-7) were tracked over time to assess long-run impacts on income, living standards, other life outcomes.

• Unusual element: KLPS individuals “tracked” as they move throughout Kenya and East Africa (and surveyed by phone if abroad). Regularly contact via cell phones.

• Two phase tracking approach, with “intensive” follow-up for subset

>> An effective tracking rate of 85% (among those still alive), a high rate for a young adult population over the course of 20 years.
Residential location of KLPS-4 respondents

- Uganda (4.8%)
- Busia (46.6%)
- Nairobi (21.2%)
- Mombasa (7.1%)
Estimate 10 to 20 year impacts utilizing KLPS rounds 2, 3 and 4

• Are there persistent labor market and livings standards gains?

• Noteworthy aspects of KLPS-4:
1. 20 year longitudinal data in African populations are extremely rare
2. Respondent tracking high (85% among those alive), balanced across arms
3. Detailed measurement of subsistence agriculture productivity
4. Inclusion of a full Consumption Expenditure Module for all KLPS-4 respondents
5. Registration of a pre-analysis plan for KLPS-4 (AEARCTR-0001191)
Deworming as an Investment

Does child deworming pay in economic terms?

- **Costs**: deworming pills and delivery cost per child is low in school-based mass treatment (<0.50 USD), subsidy $S$, for +2.4 years of treatment.

- Plus additional teacher salaries to maintain class sizes at pre-program level due to increased enrollment, cost per unit increase in schooling (Baird et al 2016).

- **Benefits** are the higher earnings in the treatment group, $\lambda_1$.

- Government revenue benefit: Kenya collects share 16% of income in taxes, $\tau$.

>> Compute future earnings gains, NPV of future government revenue, and social internal rate of return over a working life (of 40 years).
Timeline of deworming project costs and benefits, from 1998 (t=0) to t+50 years.
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Social IRR of 10% with an annual earnings gain of US$8.68, or +0.7%.
20 Year Economic Impacts

Treatment increases earnings and consumption by +6 to 14%

- Pooling data from KLPS 2, 3, 4: 10 to 20 year follow-up.
- Hourly earnings up +18% (p<0.10)
- Somewhat larger productivity and living standards gains for males than females
  >> Individuals shift their labor effort into non-agricultural activities (p<0.01).

- Migration to urban areas increases substantially (p<0.05)
  >> Over a third of urban migrants live in the capital Nairobi
NPV of deworming (per child): US$245.

Social IRR of deworming (per annum): 38.4%.
Discussion

Childhood health investments in Kenya led to improved adult labor market earnings and living standards 10 to 20 years later

- Implications: health investments for school-age children (above age 0-5) can still have meaningful impacts on adult life outcomes.

>> Context: Busia district is a high worm infection setting, and the baseline period (1998) had particularly high worm prevalence due to flooding

- Tracking of the Kenya Life Panel Survey (KLPS) sample continues
- New activity: data collection on children (aged 3-9) of the original KLPS participants. Do child health investments reduce the intergenerational transmission of poverty?