Intestinal Parasites Infect Over 3 Billion & Cause 3 Million Child Deaths Annually

- Most common intervention is deworming drugs such as Albendazol
- Anti-worm drugs not efficacious against non-worm parasites i.e. amoeba / protozoa
- Other interventions
  - Behavioral changes - wash hands/sanitation
  - Safe water
  - Housing environment

Housing along with food & water are considered basic needs

- Most countries devote substantial resources to
  - Slum upgrading
  - Improving housing quality
    - Existing housing & new housing
    - US spends more on housing than other welfare programs such as TANF (Olsen, 2003).
- Welfare effects
  - Quality of life and mental health
  - Environmental health
    - Air Quality, Parasites & Bacteria

Mexican program PISO FIRME:

- Replace dirt floors with cement
  - Dirt floors are a primary indicator of poverty
  - 13% of Mexican Houses have dirt floors
    - 2.8 million households
- State of Coahuila
  - Northern Mexico
  - IE will inform national scaleup
**Program Characteristics**

- Started in 2000
- Up to 50m sq of antibacterial concrete
  - 7.5cm thick
- Average cost approx. $150 USD (26m sq)
- Government supplies materials and family supplies labor
- Beneficiaries through 2005
  - 34,000 beneficiaries in Coahuila
  - 100% takeup

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**Step 1:**

- And finally in just four hours…

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**Step 2:**
Program Objectives I: Child Health

- Interrupt transmission of parasitic infections
  - Parasites live in fecal matter
  - Dirt floors are hard to clean
  - Hard to see fecal matter on dirt floors
- Expect large effect on young children
  - Play on floors
  - Ingest fecal matter by putting hands in mouth
  - Don’t understand consequences

Implications for child development
(Stephenson et al., 1990 and Gupta et al, 1997)

- Parasites major cause of gastro-intestinal irritation and diarrhea
- Diarrhea reduces calorie absorption & physical growth
- Parasites also consume micronutrients, especially iron, which causes anemia
- Chronic anemia reduces cognitive development

Program Objectives II: Quality of life

- Question is how to measure it
  - unlikely to affect standard measures of welfare e.g. income/consumption
- Happiness and mental health
  - Self-reported satisfaction with life
  - Depression
  - Stress

Outline

- Program
  - Characteristics
  - Objectives
- Analysis
  - Identification strategy
  - Sampling & Measurement
- Results
- Conclusions
Geographical Discontinuity

- State of Coahuila Implemented PISO FIRME, but neighbor Durango did not.
- Similar in levels of trends of socio-economic and health characteristics.
Geographical Discontinuity

- Twin cities of Torreón (Coahuila) and Gómez Palacios and Lerdo (Durango).
  - Separated by a river with many bridges
  - Effectively one city
  - Both have good municipal water & sewage
  - Both use Albendazol to deworm
  - No other local child health/housing programs

Sampling Strategy

- 1500 Treatments from Torreon
  - Received PF btw 2001-2004, min 2 year exposure
  - All beneficiaries on block w/ kids < age 6
- 1500 Controls from Gómez Palacios & Lerdo
  - Matched census blocks (data from 2000 Census)
    - proportion of households with dirt floor,
    - number of children age 0-5 years
    - number of households
    - % of families in poverty
  - Random sample: households with dirt floor in 2000 & kids < age 6

Sample Balance

- 566 treatment census blocks
- 370 matched comparison census blocks
- Balanced based on 22 characteristics from 2000 census
  - Block: # of houses, % dirt floors, % < poverty line, % illiterate head
  - Demographics: HH size, # kids<6, Ave head schooling, Ave # workers
  - Housing: # rooms, % rooms w/dirt floor, % water, % water in house, % gas heater, % washer, % phone, crowding index
Survey Response Rates

- Target sample size of 3,000 households
- Treatments
  - 92.6% response rate
  - 1,390 completed surveys
- Comparisons
  - 92.9% response rate
  - 1,393 surveys

Table 3: Difference of Means for Independent Variables in 2005 Survey

<table>
<thead>
<tr>
<th>Variable</th>
<th>Observations</th>
<th>Mean</th>
<th>Observations</th>
<th>Mean</th>
<th>*</th>
<th>Mean</th>
<th>Mean Difference</th>
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<tbody>
<tr>
<td>Household Demographics</td>
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<tr>
<td>Number of household members</td>
<td>1,362</td>
<td>5.320</td>
<td>1,390</td>
<td>5.374</td>
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<td>0.054</td>
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<tr>
<td>Head of household's age</td>
<td>1,362</td>
<td>37.537</td>
<td>1,390</td>
<td>37.120</td>
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<td>Head of household's years of schooling</td>
<td>1,360</td>
<td>6.128</td>
<td>1,391</td>
<td>6.408</td>
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<td>Spouse's age</td>
<td>1,362</td>
<td>29.645</td>
<td>1,390</td>
<td>28.772</td>
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<td>Spouse's years of schooling</td>
<td>1,207</td>
<td>6.318</td>
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<td>Characteristics of Children Aged 0-5</td>
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<tr>
<td>Age</td>
<td>1,940</td>
<td>2.643</td>
<td>2,112</td>
<td>2.579</td>
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<td>Male (=1)</td>
<td>1,940</td>
<td>0.402</td>
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<td>Mother of at least one child in household present (=1)</td>
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<td>0.964</td>
<td>2,112</td>
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<td>Father of at least one child in household present (=1)</td>
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<td>0.763</td>
<td>2,112</td>
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<td>Housing Characteristics</td>
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<td>Number of rooms</td>
<td>1,362</td>
<td>2.080</td>
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<td>Water connection (=1)</td>
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<td>Water connection inside the house (=1)</td>
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<td>0.511</td>
<td>1,390</td>
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<td>Electricity (=1)</td>
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<td>Share of rooms with cement floors in 2000</td>
<td>1,362</td>
<td>0.330</td>
<td>1,390</td>
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</table>

Results outline

- Sample Balance
- Effect of PISO FIRME on cement floors
- Child Health
- Maternal Happiness
Falsification Tests

- No effects on non-parasite related illness
  - Respiratory, Skin
- No effect on economic status
  - Labor supply, Earnings, Consumption
- Consistent with pathway floor interrupting transmission of parasitic infections
- Rules out other explanations - e.g. improved health care or economic conditions
Outline

- Program
  - Characteristics
  - Objectives
- Analysis
  - Research questions
  - Identification strategy
  - Sampling & Measurement
- Results
- Conclusions

Conclusions

- Piso Frime increased housing quality, improved child & maternal happiness
- Mexican Gov’t scaled up to 3 million houses
- Cement floors as a parasite policy
  - Albendasol works only against worms
  - Nothing similar for protozoa
- Housing quality important for welfare
- Evaluating slum housing policy in South Africa, El Salvador, Mexico, and Uruguay.