I Get Height With a Little Help From My Friends

Herd Protection From Sanitation in Rural Ecuador

James Fuller, PhD, MSPH
University of Michigan
Herd Thinking

• Interventions can protect non-recipients
Herd Thinking

• Interventions can protect non-recipients
  – Vaccines (herd immunity)
  – Insecticide Treated Bednets
  – Deworming drugs
  – Antibiotics
  – Gametocyte vaccines
Herd Thinking

• Risk reduction

• Risk elimination (threshold)
Herd Thinking

What happens when we ignore herd protection?
Herd Thinking

What happens when we ignore herd protection?

1. Underestimate

Herd immunity conferred by killed oral cholera vaccines in Bangladesh: a reanalysis

Mohammad Ali, Michael Emch, Lorenz von Seidlein, Mohammad Yunus, David A Sack, Malla Rao, Jan Holmgren, John D Clemens

Background Decisions about the use of killed oral cholera vaccines, which confer moderate levels of direct protection to vaccinees, can depend on whether the vaccines also provide indirect (herd) protection when high levels of vaccine coverage are attained. We reanalysed data from a field trial in Bangladesh to ascertain whether there is evidence of indirect protection from killed oral cholera vaccines.
Herd Thinking

What happens when we ignore herd protection?

1. Underestimate

2. Overestimate?
Herd Thinking

• Sanitation
  – Prevent contamination of shared spaces
  – There is some evidence, but lacking quality
Herd Thinking

• Is higher neighborhood sanitation coverage associated with better child growth?

• Is this association linear across levels of coverage?
Study Population

- 24 rural villages in northern Ecuador
- Predominantly Afro-Ecuadorian
4 Study Visits

• Observed All Children < 5
  – Height-for-age z score

• Observed All Households
  – Sanitation facility
  – Household Assets
  – Educational Attainment
  – GPS Coordinates
Sanitation Coverage

- Calculated for each household
- 500 meter radius
- Proportion improved
Limitations

• No information on compliance

• Not randomized
  – Breastfeeding?
  – Food security, diet?

• Longitudinal, but not an intervention
Descriptive Statistics

- 2,225 observations (1,314 children)
- 18% stunted (HAZ < -2)
- 75% improved sanitation
- Sanitation Coverage
# Prevalence Ratios for Stunting

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*Adjusted for child’s age, sex, and household SES*
Prevalence Ratios for Stunting

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26% reduction in stunting!

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## Prevalence Ratios for Stunting

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<td><strong>68% reduction!!</strong></td>
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**Adjusted for child’s age, sex, household SES, and neighborhood SES

73% reduction!!!
Growth Curves*

*Mixed effects linear regression, age is restricted cubic spline, adjusted for household wealth, household education, neighborhood wealth
Threshold?

*Mixed effects Poisson regression, adjusted for age, sex, household wealth, household education, neighborhood wealth wealth
Conclusion

• Neighborhood coverage more important than household access

• Effect concentrated:
  – Among girls
  – After 1st birthday (weaning)

• Threshold?
Thank you!

• Co-authors
  – Joe Eisenberg (UofM)
  – Eduardo Villamor (UofM)
  – William Cevallos (USFQ)
  – James Trostle (Trinity)

• EcoDESS project team
  – Denys Tenorio
  – Mariuxi Caicedo

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  – NIAID (R01-AI050038)
  – ASPPH/CDC (Co-Ag U36OE000002)
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