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Is exposure to animal feces harmful to child nutrition and health outcomes?

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1. Introduction

- ❑ Livestock accounts for half of all ag-nutrition projects
- ❑ Animal sourced food (ASF) consumption strongly linked to reductions in stunting & micronutrient deficiencies
- ❑ But relationships between livestock ownership & nutrition outcomes are variable
- ❑ One possibility is that livestock ownership has positive and negative impacts on child nutrition and health
- ❑ Under-recognized concern is fecal contamination: children directly or indirectly ingest animal fecal matter
- ❑ Generally neglected by WASH sector: focused on diarrhea
- ❑ But non-pathogenic bacteria may cause stunting via EED



1. Introduction

- ❑ Here I use results from multi-country DHS data and several large IFPRI surveys to inform four questions:
 1. How common is ownership of different types of livestock in developing countries?
 2. How common is it to observe animal feces in household compounds?
 3. How common is it for households to keep livestock in the main house where children eat, sleep, play, etc?
 4. Is exposure to animal feces significantly associated with anthropometric outcomes?
- ❑ Data is all observational; research is exploratory



2. Literature review

- ❑ WASH sector recognizes animal-based pathogens, but few WASH programs focus on livestock
- ❑ Cairncross' (2001) influential review emphasizes human open defecation:

“Whilst animal faeces in food or water is a matter of current concern ... they may be of less relative importance in areas where human faeces are disposed of inadequately...Further study of this issue is required. In the meantime, human faeces...are likely to contain more human pathogens than animal faeces and should therefore be targeted as the first priority, unless we have evidence to the contrary.”



2. Literature review

Recent theories & evidence may prompt a re-think

1. Systematic review: 21 of 27 studies linked animal exposure to diarrhea (Zambrano et al. 2014)
2. Possible that non-pathogenic bacteria can cause environmental enteric disorder (EED) but not diarrhea
3. EED inhibits absorption of nutrients, diverts nutrients to fight infection, and strongly linked with stunting
4. Young children observed to directly ingest chicken feces and/or soil in studies in Peru, Zimbabwe, and Bangladesh
5. Bangladesh studies linked geophagy and keeping chickens indoors to child stunting and EED symptoms



2. Data & methods

Report results from three sources of data:

1. **DHS from 40 countries:** *measures livestock ownership*
 2. **Ethiopian Feed the Future midline:** *measures poultry ownership, keeping poultry in house, anthropometrics*
 3. **Alive and Thrive 2010 baselines and 2014 midlines** from Ethiopia, Bangladesh and Vietnam: *livestock ownership, spot check indicators of animal feces, anthropometrics*
- ❑ Use descriptive statistics to look at prevalence of livestock, animal feces, and practice of keeping poultry in house
 - ❑ Use multivariate regressions to test for associations with HAZ, but also WHZ, diarrhea (24hr), fever, cough (week)



4. Results: 46 countries (rural DHS)

How common is livestock ownership?

	Cattle	Horses	Goats	Sheep	Chickens
MENA (N=2)	21%	20%	22%	24%	31%
Central Africa (N=5)	9%	0%	20%	7%	36%
Tropical W. Africa (N=8)	13%	2%	27%	17%	47%
Latin America (N=3)	19%	18%	21%	4%	53%
ECA (N=6)	54%	17%	11%	27%	58%
South & SE Asia (N=4)	46%	10%	32%	5%	57%
Sahel/Sahara (N=4)	58%	48%	57%	49%	59%
East/Southern Africa (N=10)	33%	9%	30%	9%	59%
Average	31%	14%	28%	18%	52%



4. Results: Ethiopia (FTF)

How common is it to keep livestock indoors?

Livestock type	Livestock ownership (% of households)	Among livestock owners, the percentage who corralled animals in the main house overnight ^a
Poultry	48%	48%
Bulls, oxen	58%	23%
Cows	63%	26%
Calves, heifers	66%	36%
Goats, sheep	52%	31%
Pack animals	42%	18%



4. Results: (A&T spot check data)

How common is it to observe animal feces?

	Bangladesh	Ethiopia	Vietnam
Animal feces in compound (%)	40.61	37.8	41.7
Human feces in compound (%)	4.83	15.8	1.0
No toilet ³ (%)	4.0	16.3	4.9
Use of soap for hand cleaning (%)	43.9	60.5	95.7
Improved drinking water ⁴ (%)	66.7	54.2	86.9
Mother fully clean ¹ (%)	72.7	34.4	69.0
Child fully clean ¹ (%)	62.5	32.7	70.1
House fully clean ²	24.9	15.8	20.1



4. Results: Ethiopia (FTF)

Keeping poultry inside the house & child HAZ?

	Excluding poultry in house	Including poultry in house
Owns poultry (0/1)	0.168**	0.291***
Poultry in house (0/1)		-0.250**
Owns other livestock (0/1)	0.171	0.148
Other livestock in house (0/1)	0.015	0.070
Child age and sex controls?	Yes	Yes
Village fixed effects?	Yes	Yes
Household demographic controls?	Yes	Yes
R-squared	0.149	0.151



4. Results: Ethiopia, BGD, Vietnam (A&T) Animal feces outside the house & child HAZ

	Bangladesh	Ethiopia	Vietnam	Pooled
Animal feces	-0.13*	-0.22*	0.03	-0.11**
Livestock (TLUs)	-0.04	0.07**	-0.02	0.01
Mother fully clean	0.03	-0.06	0.00	-0.00
Child fully clean	0.01	0.11	0.08	0.06
Hygienic toilet	0.13**	-0.41	0.07	0.10*
Hygienic water	0.19*	-0.10	0.13	0.07+
R square (%)	19.41	12.98	17.09	21.42



5. Conclusions

Many implications for research, surveillance, programs....

- ❑ We uncover suggestive evidence that physical exposure to livestock has adverse consequences for child growth
- ❑ More research needed to clarify the mechanisms and identify the scale of the problem
- ❑ Plenty of scope to improve measurement: Hygiene spot checks; parental reports, morbidity symptoms
- ❑ Experimental research needed to identify:
 - 1) Causal effects of livestock exposure on child development
 - 2) Obstacles to more nutrition-sensitive livestock rearing
 - 3) The most effective means of overcoming these obstacles

