Supporting Information

Exposure to animal feces and human health: A systematic review and proposed research priorities

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Supporting Information 1. Search String for Exposure to animal feces and human health: A systematic review and proposed research priorities

We searched in the following databases: PubMed, Web of Science, Cochrane Library, EMBASE, and CAB Direct. We also included a partial search of the Environmental Sciences and Pollution Management (ESPM) database, but due to host database server challenges, 26% of full search results this database could not be downloaded. The database searches took place on October 3, 2016.

We used the following generic search string: [(animals or animal or zoonotic or zoonosis or "domestic animal" or "domestic livestock" or livestock or "animal husbandry" or cattle or cow or bovine or swine or pig or dog or cat or goat or sheep or poultry or chicken or fowl or duck or goose or turkey or mice or rat or murine or rabbit or horse or "guinea pig" or donkey or "water buffalo" or camel or yak or llama or alpaca) AND (feces OR faeces OR fecal OR faecal OR waste OR manure OR dung OR dropping) AND (exposure OR exposures OR contact OR contamination or contaminate or contaminated or presence) AND (human or humans or children or child or adult or patients or infant).

PubMed Search:
((((Animals[Title/Abstract] OR animal[Title/Abstract] OR zoonotic[Title/Abstract] OR zoonosis[Title/Abstract] OR "domestic animal"[Title/Abstract] OR "domestic livestock"[Title/Abstract] OR livestock[Title/Abstract] OR "animal husbandry"[Title/Abstract] OR cattle[Title/Abstract] OR cow[Title/Abstract] OR bovine[Title/Abstract] OR swine[Title/Abstract] OR pig[Title/Abstract] OR dog[Title/Abstract] OR cat[Title/Abstract] OR goat[Title/Abstract] OR sheep[Title/Abstract] OR poultry[Title/Abstract] OR chicken[Title/Abstract] OR fowl[Title/Abstract] OR duck[Title/Abstract] OR goose[Title/Abstract] OR turkey[Title/Abstract] OR mice[Title/Abstract] OR rat[Title/Abstract] OR murine[Title/Abstract] OR rabbit[Title/Abstract] OR horse[Title/Abstract] OR "guinea pig"[Title/Abstract] OR donkey[Title/Abstract] OR "water buffalo"[Title/Abstract] OR camel[Title/Abstract] OR yak[Title/Abstract] OR llama[Title/Abstract] OR alpaca[Title/Abstract])) AND (feces[Title/Abstract] OR faeces[Title/Abstract] OR fecal[Title/Abstract] OR faecal[Title/Abstract] OR waste[Title/Abstract] OR manure[Title/Abstract] OR dung[Title/Abstract] OR dropping[Title/Abstract])) AND (exposure[Title/Abstract] OR exposures[Title/Abstract] OR contact[Title/Abstract] OR contamination[Title/Abstract] OR contaminate[Title/Abstract] OR contaminated[Title/Abstract] OR presence[Title/Abstract])) AND (human[Title/Abstract] OR humans[Title/Abstract] OR children[Title/Abstract] OR child[Title/Abstract] OR adult[Title/Abstract] OR patients[Title/Abstract] OR infant[Title/Abstract])

Web of Science/BIOSIS Search:
TOPIC: (Animals or animal or zoonotic or zoonosis or "domestic animal" or "domestic livestock" or livestock or "animal husbandry" or cattle or cow or bovine or swine or pig or dog or cat or goat or sheep or poultry or chicken or fowl or duck or goose or turkey or mice or rat or murine or rabbit or horse or "guinea pig" or donkey or "water buffalo" or camel or yak or llama or alpaca) *AND* TOPIC: (feces OR faeces OR fecal OR faecal OR waste OR manure OR dung OR dropping) *AND* TOPIC: (exposure OR exposures OR contact OR contamination or contaminate or contaminated or presence)*AND* TOPIC: (human or humans or children or child or adult or patients or infant)

Cochrane Library Search:
'(Animals or animal or zoonotic or zoonosis or "domestic animal" or "domestic livestock" or livestock or "animal husbandry" or cattle or cow or bovine or swine or pig or dog or cat or goat or sheep or poultry or chicken or fowl or duck or goose or turkey or mice or rat or murine or rabbit or horse or "guinea pig" or donkey or "water buffalo" or camel or yak or llama or alpaca) in Title, Abstract, Keywords and (feces OR faeces OR fecal OR faecal OR waste OR manure OR dung OR dropping) in Title, Abstract, Keywords and (exposure OR exposures OR contact OR contamination or contaminate or contaminated or presence) in Title, Abstract, Keywords and (human or humans or children or child or adult or patients or infant) in Title, Abstract, Keywords

EMBASE Search:
animals:ab,ti OR animal:ab,ti OR zoonotic:ab,ti OR zoonosis:ab,ti OR 'domestic animal':ab,ti OR 'domestic livestock':ab,ti OR livestock:ab,ti OR 'animal husbandry':ab,ti OR cattle:ab,ti OR cow:ab,ti OR bovine:ab,ti OR swine:ab,ti OR pig:ab,ti OR dog:ab,ti ORcat:ab,ti OR goat:ab,ti OR sheep:ab,ti OR poultry:ab,ti OR chicken:ab,ti OR fowl:ab,ti OR duck:ab,ti OR goose:ab,ti OR turkey:ab,ti OR mice:ab,ti OR rat:ab,ti OR murine:ab,ti OR rabbit:ab,ti OR horse:ab,ti OR 'guinea pig':ab,ti OR donkey:ab,ti OR 'water buffalo':ab,ti OR camel:ab,ti OR yak:ab,ti OR llama:ab,ti OR alpaca:ab,ti AND (feces:ab,ti OR faeces:ab,ti OR fecal:ab,ti OR faecal:ab,ti OR waste:ab,ti OR manure:ab,ti OR dung:ab,ti OR dropping:ab,ti) AND (exposure:ab,ti OR exposures:ab,ti OR contact:ab,ti ORcontamination:ab,ti OR contaminate:ab,ti OR contaminated:ab,ti OR presence:ab,ti) AND (human:ab,ti OR humans:ab,ti OR children:ab,ti OR child:ab,ti OR adult:ab,ti OR patients:ab,ti OR infant:ab,ti)

CAB Direct Search:
ab:((Animals or animal or zoonotic or zoonosis or "domestic animal" or "domestic livestock" or livestock or "animal husbandry" or cattle or cow or bovine or swine or pig or dog or cat or goat or sheep or poultry or chicken or fowl or duck or goose or turkey or mice or rat or murine or rabbit or horse or "guinea pig" or donkey or "water buffalo" or camel or yak or llama or alpaca)) AND ab:((feces OR faeces OR fecal OR faecal OR waste OR manure OR dung OR dropping)) AND ab:((exposure OR exposures OR contact OR contamination or contaminate or contaminated or presence)) AND ab:((human or humans or children or child or adult or patients or infant))

ESPM Search:
ab((Animals OR animal OR zoonotic OR zoonosis OR "domestic animal" OR "domestic livestock" OR livestock OR "animal husbandry" OR cattle OR cow OR bovine OR swine OR pig OR dog OR cat OR goat OR sheep OR poultry OR chicken OR fowl OR duck OR goose OR turkey OR mice OR rat OR murine OR rabbit OR horse OR "guinean pig" OR donkey OR "water buffalo" OR camel OR yak OR llama OR alpaca)) AND ab((feces OR faeces OR fecal OR faecal OR waste OR manure OR dung OR dropping)) AND ab((exposure OR exposures OR contact OR contamination OR contaminate OR contaminated OR presence)) AND ab((human OR humans OR children OR child OR adult OR patients OR infant))
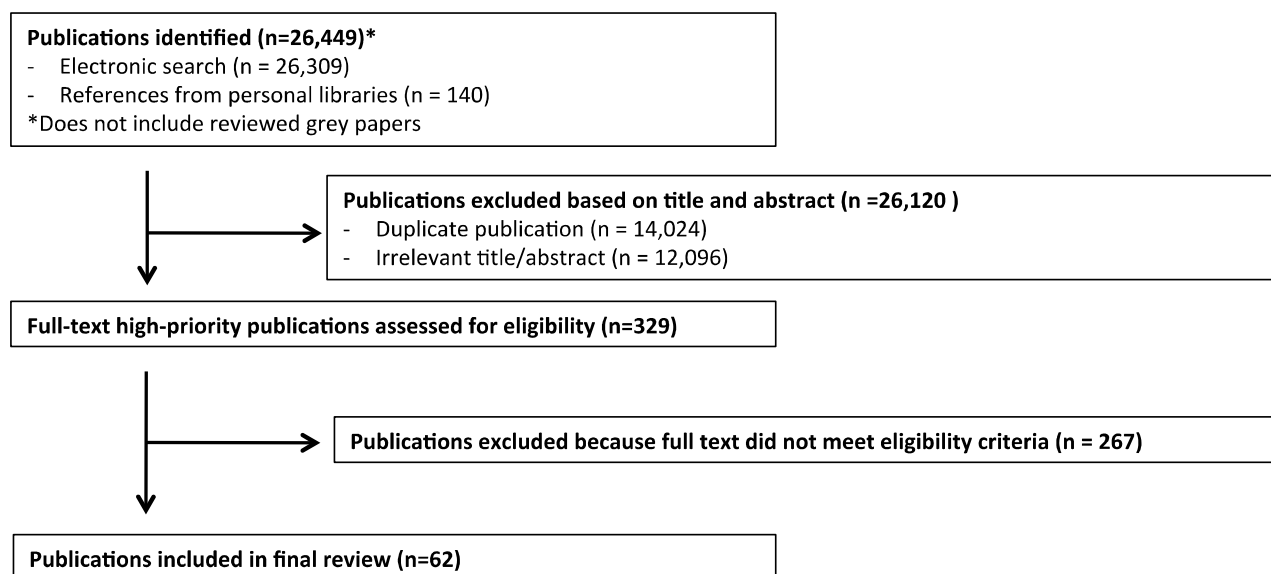
Publications identified (n=26,449)*
- Electronic search (n = 26,309)
- References from personal libraries (n = 140)
*Does not include reviewed grey papers

Publications excluded based on title and abstract (n =26,120)
- Duplicate publication (n = 14,024)
- Irrelevant title/abstract (n = 12,096)

Full-text high-priority publications assessed for eligibility (n=329)

Publications excluded because full text did not meet eligibility criteria (n = 267)

Publications included in final review (n=62)

Figure S1. Global PRISMA Chart - Adapted from Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., The PRISMA Group. Preferred Reporting Items for Systematic Reviews and MetaAnalyses: The PRISMA Statement. *PLoS Medicine.* **2009**, 6, e1000097. Copyright 2009, The PRISMA Group.

TableS1. Data Extraction Forms

Key Findings	
Pathogen & Health Outcomes Possible health outcomes: diarrhea, enteric infection, STH, trachoma, nutritional growth outcomes, microbial source tracking, behaviors/risk-factors	
Population	
Animal	
Country	
Study Design & Sample Size	
Research Objective	
Findings	
Methods	

Table S2. PRISMA Checklist[1]

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Title: a systematic review
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Abstract
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Introduction
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Introduction
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Methods
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Methods
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Methods
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplemental Material 1, p2-3
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Methods
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Methods
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Methods
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Not assessed
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	Not assessed
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	Not assessed
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Not assessed

Section/topic	#	Checklist item	Reported on page #
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Not assessed
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Results, Table S1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Table 3
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Not assessed
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Not assessed
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Not assessed
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Not assessed
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Not assessed
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Discussion
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Discussion
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Discussion
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Title Page

Adapted from Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., The PRISMA Group. Preferred Reporting Items for Systematic Reviews and MetaAnalyses: The PRISMA Statement. *PLoS Medicine.* **2009**, 6, e1000097. Copyright 2009, The PRISMA Group.

Table S3. Characteristics of studies (*n*=62) included in review of potential health impacts from exposure to animals, animal feces, and associated pathogens

Authors	Location & Geographic Classification	Study Population	Data sources	Animals	Pathogens	Health Outcomes	Exposures to Animal Feces[a]	Study Design & Sample Size
a Mpalang et al. 2014	Democratic Republic of Congo; urban	Goat meat	Goat feces, goat meat	Goats	**Bacteria:** *Campylobacter coli, Campylobacter jejuni*	None	**Contamination of food (CF)**	cross-sectional; goat meat samples (n=402), goat fecal samples (n=242)
Acosta-Jamett et al. 2014	Chile; rural	Dog-owning adults	Human blood, dog feces, survey	Dogs	**Helminths:** *Echinococcus granulosus*	Helminth seropositivity	**Presence of/contact with animals (PCA); contamination of environment (CE):** permitting dogs to defecate in orchards, not collecting dog feces	cross-sectional; humans (n=403), dogs (n=93)
Adjei et al. 2004	Ghana; urban	Children <5 years	Human stool, observation, survey	Cats, dogs, goats, poultry, sheep	**Bacteria:** *Salmonella* spp., *Shigella* spp. **Helminths:** Hookworm *(Ancylostoma* spp.), *Ascaris lumbricoides, Schistosoma mansoni, Strongyloides* spp., and *Trichuris trichiura* **Protozoa:** *Cryptosporidium* spp., *Giardia lamblia, Entamoeba* spp.	Diarrhea, pathogens found in stool	**PCA:** animals inside	case-control; diarrheic children (n=227), controls (n=77)
Alyousefi et al. 2011	Yemen; urban	All individuals	Human stool, survey	Not specified	**Helminths:** *A. lumbricoides, Enterobius vermicularis, Hymenolepis nana, S. mansoni* **Protozoa:** *Cryptosporidium* spp., *Giardia duodenalis, Entamoeba histolytica/dispar*	Pathogens found in stool	**PCA:** animals inside	cross-sectional; humans (n=503)
Anuar et al. 2012	Malaysia; rural and suburban	Individuals >2 years	Human stool, survey	Not specified	**Protozoa:** *Entamoeba* spp.	Pathogens found in stool	**PCA**	cross-sectional; humans (n=500)
Anuar et al. 2014	Malaysia; rural	Individuals >2 years	Human stool, survey	Cats, dogs	**Protozoa:** *G. duodenalis*	Pathogens found in stool	**PCA**	cross-sectional; humans (n=611)

Authors	Location & Geographic Classification	Study Population	Data sources	Animals	Pathogens	Health Outcomes	Exposures to Animal Feces[a]	Study Design & Sample Size
Bern et al. 2005	Peru; peri-urban	HIV-positive individuals	Human stool, human blood, survey	Pigs, poultry, rabbits, sheep	**Microsporidia:** *Enterocytozoon bieneusi* **Protozoa:** *Cryptosporidium* spp., *Isospora belli, Cyclospora cayetanensis*	Diarrhea, pathogens found in stool	**Contact with animal feces (CAF)**	cross-sectional and nested cohort; humans (n=2652)
Black et al. 1989	Peru; peri-urban	Children <11 months	Human stool, animal rectal samples, food samples, swabs of fomites	Cats, dogs, poultry	**Bacteria:** *Aeromonas hydrophila, Campylobacter* spp., Enterotoxigenic *Escherichia coli* (ETEC), Enteropathogenic *E. coli* (EPEC), *Shigella* spp., *Salmonella* spp., *Vibrio cholerae* **Protozoa:** *Giardia* spp. **Viruses:** Rotavirus	Diarrhea, pathogens found in stool	**CE: c**ontamination of water; **PCA**	longitudinal; children (n=153), food samples (n=1882), fomites (n=287), animal rectal samples (n=62)
Boehm et al. 2016	Bangladesh; rural	All individuals	Human stool, animal feces, drinking water/ soil samples, child hand rinses, survey	Cattle, goats, poultry	**Viruses:** Rotavirus	None	**PCA**	nested randomized controlled trial; compounds (n=497)
Bublitz et al. 2014	Madagascar; rural	All individuals	Human stool, animal feces, survey	Cattle, pigs, synanthropic rodents	**Bacteria:** ETEC, *Salmonella enterica, Shigella dysenteriae, Shigella flexneri, V. cholerae, Yersinia enterocolitica, Yersinia pseudotuberculosis*	Pathogens found in stool	**PCA**	cross-sectional; humans (n=163), cattle (n=58), pigs (n=18), rodents (n=65)
Bukenya and Nwokolo 1991	Papua New Guinea; peri-urban	Children <5 years	Survey	Pigs	None	Diarrhea	**PCA; presence of animal feces in environment (PAF)**	cohort; children (n=479)
Cassenote et al. 2014	Brazil; urban	Children 1-12 years	Human stool, human blood, survey	Not specified	**Helminths:** *Toxocara* spp.	Helminth seropositivity	**CAF:** geophagy, lack of handwashing	cross-sectional; children (n=252)
Chiodo et al. 2006	Argentina; rural	Health center patients	Human blood, dog feces, soil samples, survey	Dogs	**Helminths:** *Toxocara canis*	Helminth seropositivity	**PCA**	cross-sectional; humans (n=100), dogs (n=81)

Authors	Location & Geographic Classification	Study Population	Data sources	Animals	Pathogens	Health Outcomes	Exposures to Animal Feces[a]	Study Design & Sample Size
Collinet-Adler et al. 2011	India; rural and urban	All individuals	Human stool, fly samples, survey	Not specified	**Bacteria:** *E. coli, Shigella* spp., *Vibrio* spp**, Protozoa:** *Cryptosporidium* spp., *Giardia* spp. **Viruses:** Rotavirus	Diarrhea	**PCA:** animals inside	open cohort; humans (n=1274)
Cumberland et al. 2005	Ethiopia, rural	Children 3-9 years	Observations, survey	Cattle	**Bacteria:** *Chlamydia trachomatis*	Trachoma	**PCA:** cows residing in or near home**; PAF**	cross-sectional; children (n=1960)
Daniels et al. 2015	India; rural	All individuals	Human stool, animal feces, water samples	Buffaloes, cats, cattle, dogs, goats, poultry, sheep	**Protozoa:** *Cryptosporidium* spp., *Giardia* spp.	Diarrhea, pathogens found in stool	**CE**	cross-sectional; humans (n=85), animals (n=111)
Daniels et al. 2016	India; rural	All individuals	Meteorological data, census data, survey	Buffaloes, cats, cattle, dogs, goats, poultry, sheep	**Protozoa:** *Cryptosporidium* spp., *Giardia* spp.	None	**CE**	conceptual model; community ponds (n=94), deep tube wells (n=107), shallow tube wells (n=96)
Dwivedi et al. 2007	India; urban	HIV-positive individuals	Human stool, human blood, survey	Not specified	**Helminths:** *A. duodenale, A. lumbricoides, Strongyloides stercoralis* **Microsporidia:** Not specified **Protozoa:** *C. parvum, G. lamblia, I. belli, C. cayetanensis, E. coli*	Diarrhea	**PCA**	case-control; diarrheic individuals (n=75), controls (n=25)
El-Tras et al. 2015	Egypt; rural	Children 7-15 years	Human stool, poultry feces, observations, survey	Poultry	**Bacteria:** *C. coli, C. jejuni*	Pathogens found in stool	**PCA:** residing in a household with *Campylobacter* spp.-infected backyard poultry	cross-sectional; children (n=106), poultry (n=379)
Fernando et al. 2007	Sri Lanka; urban	Children 5-12 years	Human blood, survey	Dogs	**Helminths:** *Toxocara* spp.	Helminth seropositivity	**PCA; CE:** playgrounds contaminated by dogs	cross-sectional; children (n=196)

Authors	Location & Geographic Classification	Study Population	Data sources	Animals	Pathogens	Health Outcomes	Exposures to Animal Feces[a]	Study Design & Sample Size
George et al. 2015	Bangladesh; rural	Children ≤30 months	Human stool, child health physicals, survey	Cattle, goats, poultry	None	Child growth, environmental enteric dysfunction (EED)	**PCA:** animals inside	cross-sectional; children (n=216)
Grados et al. 1988	Peru; peri-urban	Children <3 years	Human and animal rectal swabs, survey	Cats, dogs, poultry	**Bacteria:** *Campylobacter* spp.	Diarrhea	**PCA:** residing in a household with *Campylobacter* spp.-infected backyard poultry	case-control; diarrheic children (n=104), controls (n=104)
Hall et al. 2012	Bangladesh; rural	All individuals	Survey	Cattle	None	None	**PCA; PAF**	quasi-experimental; households (n=300), villagers (n=1500)
Harris et al. 2016	Bangladesh; urban	All individuals	Human stool, animal feces, child hand rinses, floor samples, survey	Cattle, goats, poultry	Microbial source tracking (MST) assays to detect a composite of *Bacteriodales*	None	**CE**	cross-sectional; households (n=59)
Harvey et al. 2003	Peru; peri-urban	All individuals	Observations, survey	Cattle, goats, poultry, sheep	None	Behavior	**PCA:** animal containment practices	cross-sectional; families for corralling practices (n=62), participants for perceptions of poultry (n=50), participants in semi-structured interviews (n=15)
Headey and Hirvonen 2016	Ethiopia; rural	Children <5 years	Survey	Cattle, goats, poultry, sheep	None	Child growth	**PCA:** poultry inside	cross-sectional; children (n=3494)
Headey et al. 2016	Bangladesh, Ethiopia, and Vietnam; rural	Children <5 years	Observations, survey	Buffaloes, cattle, goats, poultry, sheep	None	Diarrhea, child growth	**PCA; PAF**	cross-sectional; mother and child dyads [Bangladesh (n=2214), Ethiopia (n=1750), and Vietnam (n=2104)]
Hetherington et al. 2017	sub-Saharan Africa; rural	Children <5 years	Survey	Cattle, goats, pigs, poultry, sheep	None	Child growth	**PCA**	secondary data analysis; children (n=1543)

Authors	Location & Geographic Classification	Study Population	Data sources	Animals	Pathogens	Health Outcomes	Exposures to Animal Feces[a]	Study Design & Sample Size
Hussain et al. 2013	Bangladesh; rural	All individuals	Observations, survey	Not specified	None	None	**CAF:** use of cow dung; **PAF; PCA**	quasi-experimental; households at baseline (n=104); households at follow-up (n=75)
Kaur et al. 2017	sub-Saharan Africa; rural	Children <5 years	Survey	Cattle, goats, pigs, poultry, sheep	None	Diarrhea, mortality, child growth	**PCA**	cross-sectional; children (n=215996)
Labrique et al. 2013	Bangladesh; rural	All individuals >1 year	Human blood, survey	Cattle, goats, poultry, synanthropic rodents	**Viruses:** Hepatitis E virus (HEV)	Pathogens found in stool	**CAF**: cow dung use for house repairs and cooking fuel	case-control; HEV cases (n=46), controls (n=134)
Leung et al. 2013	Bangladesh; urban	All individuals	Human stool, survey	Goats, poultry	**Bacteria:** Non-typhoidal *Salmonella* (NTS)	Pathogens found in stool	**PCA**	case-control; cases with NTS isolated in stool (n=468), controls (n=762)
Li et al. 2015	China; rural	Patients with pulmonary tuberculosis	Human stool, human blood, survey	Not specified	**Helminths:** *A. lumbricoides, Clonorchis sinensis,* hookworm, *T. trichiura* **Protozoa:** *Blastocystis hominis, Entamoeba* spp., *Trichomonas hominis*	Pathogens found in stool	**PCA:** raised pets or poultry/livestock	cross-sectional; humans (n=389)
Lupindu et al. 2014	Tanzania; urban and peri-urban	All individuals	Human stool, soil and water samples, survey	Cattle	**Bacteria:** pathogenic *E. coli*	Pathogens found in stool	**CAF:** cattle manure management, contact with cattle feces in soil in fields and households	cross-sectional; humans (n=200), cattle (n=446)
Marquis et al. 1990	Peru; peri-urban	Children <5 years	Observations	Poultry	**Bacteria:** *C. jejuni*	None	**CAF:** toddler feces-to-hand and feces-to-mouth episodes; **PCA:** poultry inside	cross-sectional; children (n=21)
Moore et al. 2016	Cambodia; urban	Children <16 years	Human stool, survey	Poultry	**Protozoa:** *Cryptosporidium* spp., *G. duodenalis*	Pathogens found in stool	**PCA:** poultry inside	cross-sectional; children (n=498)
Mosites et al. 2016	Kenya; rural	Children <5 years	Survey	Cattle, goats, poultry, sheep	None	Child growth	**PCA; Other:** livestock disease episodes	prospective cohort; children (n=925)

Authors	Location & Geographic Classification	Study Population	Data sources	Animals	Pathogens	Health Outcomes	Exposures to Animal Feces[a]	Study Design & Sample Size
Mpyet et al. 2012	Nigeria; rural	All individuals >1 year	Observations, survey	Not specified	**Bacteria:** *C. trachomatis*	Trachoma	**PCA**	cross-sectional; humans (n=4491)
Ngure et al. 2013	Zimbabwe; rural	Caregivers and children <18 months	Observations, swabs of samples of potential fecal-oral vectors	Poultry	**Bacteria:** *E. coli*	None	**CAF:** floors contaminated with chicken feces or made of dirt/cow dung; **PCA:** poultry inside	cross-sectional; caregiver and child pairs (n=23)
Nigusie et al. 2015	Ethiopia; rural	Children 1-9 years	Observations, survey	Cattle	**Bacteria:** *C. trachomatis*	Trachoma	**PCA:** cattle in sleeping quarters, cattle ownership	cross-sectional; children (n=618)
Nyariki et a. 2009	Kenya; rural	All individuals	Survey	Cattle, goats, sheep	None	Behavior	**PCA:** herding, milking, and meat production practices	cross-sectional; households (n=100)
Oberhelman et. al 2006	Peru; peri-urban	All individuals	Human stool, animal feces, hand rinse, soil/food/water samples, survey	Poultry	**Bacteria:** *Campylobacter* spp.	Diarrhea, pathogens found in stool	**PCA:** animals inside; **PAF**	longitudinal; households (n=62); samples from chickens, humans, and environment (n=3574)
Odagiri et al. 2016	India; rural	Rural households	Water samples, mother and child hand rinses	Buffaloes, cattle, goats, sheep	**Bacteria:** *E. coli, V. cholerae* **Protozoa:** *Cryptosporidium* spp., *Giardia* spp. **Viruses:** Adenovirus, rotavirus	Diarrhea	**CE:** ponds and drinking water sources	cross-sectional; households (n=354)
Ordiz et al. 2016	Malawi; rural	Children 12-61 months	Human urine and stool, survey	Not specified	None	EED	**PCA:** animals in sleeping quarters	cross-sectional; children (n=798)
Osbjer et al. 2015	Cambodia; rural	All individuals	Survey	Buffaloes, cattle, pigs, poultry	None	Behavior	**PCA:** animals in sleeping and food preparation areas	cross-sectional; households (n=300)
Randremanana et al. 2016	Madagascar; rural	Children <5 years	Human stool, child health physicals, survey	Cattle, poultry	**Bacteria:** *Campylobacter* spp., EPEC, *Shigella* spp. **Viruses:** Adenovirus, astrovirus, rotavirus	Diarrhea, child growth	**PCA**	case-control; diarrheic children (n=199), controls (n=199)

Authors	Location & Geographic Classification	Study Population	Data sources	Animals	Pathogens	Health Outcomes	Exposures to Animal Feces[a]	Study Design & Sample Size
Reichert et al. 2016	Brazil; urban	All individuals	Observations, survey	Cats, dogs	**Helminths:** Hookworm	Hookworm-related cutaneous larva migrans (HrCLM)	**PAF**	cross-sectional; humans (n=806)
Schmidt et al. 2015	India; rural	Children <5 years	Survey	Cattle	None	Diarrhea, child growth	**PCA; CAF:** use of cow dung as fuel	cohort; children (n=2739)
Schriewer et al. 2015	India; rural	Households with children <5 years	Water samples, mother and child hand rinses	Not specified	None	None	**CE**	cross-sectional; households (n=137)
Sprenger et al. 2014	Brazil; urban	N/A	Soil samples	Cats, dogs	**Helminths**: Hookworm (*Ancylostoma* spp.), Strongyloidea superfamily, *Toxocara* spp., *Trichuris* spp.	None	**CE**	cross-sectional; soil samples (n=345)
Subrata et al. 2015	Bali; urban	Mothers	Cat feces, survey	Cats	**Protozoa:** *Toxoplasma gondii*	Helminth seropositivity	**PAF**: exposure to *T. gondii*-infected cat feces from pets and stray cats	case-control; *T. gondii*-positive case mothers (n=40), controls (n=40)
Sultana et al. 2012	Bangladesh; rural	All individuals	Observations, survey	Poultry	None	Behavior	**PCA:** poultry-raising practices	qualitative; households in interviews (n=40), households in observations (n=16)
Suwannarong and Chapman 2015	Thailand; rural and urban	Adults	Survey	Synanthropic rodents	None	Behavior	**PCA:** contact with rodents in and around the home and when working with crops	cross-sectional; humans (n=201)
Torondel et al. 2015	India, rural	Households	Toy rinses	Poultry, other livestock	**Bacteria:** *E. coli*	None	**PCA:** animals inside	cross-sectional; assays (n=60), households (n=326)
Tun et al. 2015	Malaysia; urban	Stray cats and dogs	Cat and dog feces, soil samples	Cats, dogs	**Helminths:** *Ascaris* spp., hookworm, *Spirometra* spp., *Toxocara* spp., *Trichuris* spp.	None	**CE**	cross-sectional; cat fecal samples (n=152), dog fecal samples (n=227)

Authors	Location & Geographic Classification	Study Population	Data sources	Animals	Pathogens	Health Outcomes	Exposures to Animal Feces[a]	Study Design & Sample Size
Uga et al. 2009	Vietnam; suburban	Market vegetables	Vegetable rinses	Not specified	**Helminths:** *Ascaridia galli, Ascaris* spp., *Tenia* spp., *Toxocara* spp., *Trichuris* spp.	None	**CAF:** animal feces used as fertilizer; **CF**	cross-sectional; vegetables (n=317)
Vasco et al. 2016	Ecuador; semi-rural	Children <6 years	Human stool, animal fecal samples	Cats, cattle, dogs, guinea pigs, horses, pigs, poultry, rabbits, sheep	**Bacteria:** Atypical enteropathogenic *Escherichia coli* (aEPEC), *Campylobacter* spp., *Salmonella* spp., Shiga toxin-producing *E. coli* (STEC), *Yersinia* spp. **Protozoa:** *C. parvum, G. lamblia*	Pathogens found in stool	**PCA**	cross-sectional; children (n=64)
Vujcic et al. 2014	Bangladesh; rural	Primary caregivers of children ≤ 3 years	Toy rinses, survey	Not specified	None	None	**CE**	cross-sectional; households (n=100)
Wanyiri et al. 2014	Kenya; urban	HIV-positive individuals	Human stool, human blood, survey	Not specified	**Bacteria:** ETEC, *Klebsiella* spp., *Salmonella* spp. **Helminths:** *A. duodenale, A. lumbricoides, S. mansoni* **Protozoa:** *C. cayetanensis, E. histolytica, G. lamblia, I. belli*	Diarrhea	**PCA**	cross-sectional; humans (n=167)
Wolking et al. 2016	Tanzania; rural	All individuals	Calf feces, survey	Cattle	**Protozoa:** *Cryptosporidium* spp., *Giardia* spp.	Diarrhea	**CAF:** handling manure; **Other:** Exposure to diarrheic calves	cross-sectional; households (n=159), calves (n=312)
Wumba et al. 2012	Democratic Republic of the Congo; urban	HIV-positive individuals	Human stool, survey	Dogs, goats, pigs, poultry	**Helminths:** *A. lumbricoides, T. trichiura* **Protozoa:** *E. histolytica, G. lamblia*	Diarrhea	**PCA**	cross-sectional; humans (n=242)
Zambrano et al. 2014	Global; rural and urban	All individuals	Systematic review and meta-analysis	Cattle, goats, pigs, poultry, sheep	**Bacteria:** *Campylobacter* spp., enterohemorrhagic *Escherichia coli* (EHEC) **Protozoa:** *Cryptosporidium* spp., *Giardia* spp.	Diarrhea, pathogens found in stool	**PCA**	systematic review and meta-analysis; studies in qualitative synthesis (n=29), studies in systematic review (n=23), studies in meta-analysis (n=7)

a. Codes for Exposure to Animal Feces: **CAF:** contact with animal feces; **CE:** contamination of environment; **CF:** contamination of food; **PCA:** presence of/contact with animals; and **PAF:** presence of animal feces in environment

References

1. Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., The PRISMA Group. Preferred Reporting Items for Systematic Reviews and MetaAnalyses: The PRISMA Statement. *PLoS Medicine.* **2009**, 6, e1000097.