Effect of water, sanitation, and hygiene interventions on detection of enteropathogens and host-specific fecal markers in the environment: an individual-participant data meta-analysis

Andrew Mertens, Benjamin F. Arnold, Jade Benjamin-Chung, Alexandria Boehm, Joe Brown, Drew Capone, Thomas Clasen, Erica Fuhrmeister, Jessica Grembi, David Holcomb, Jackie Knee, Laura Kwong, Audrie Lin, Stephen P. Luby, Rassul Nala, Kara Nelson, Sammy Njenga, Clair Null, Amy J. Pickering, Mahbubur Rahman, Heather Reese, Lauren Steinbaum, Jill Stewart, Ruwan Thilakaratne, Oliver Cumming, John M. Colford Jr., Ayse Ercumen

# Supplementary Tables

## Table S1. Systematic review search terms

Search terms were combined with “OR” within columns and with “AND” across columns.

| **Study design** | **WASH** | **Environmental markers** | **Child health** |
| --- | --- | --- | --- |
| matched, trial, RCT, experiment, intervention, randomized, randomised, quasi-randomized, quasi-randomised, quasi-experimental, pseudo-randomized, pseudo-randomised, non-randomized controlled trials | Water, Sanitation, Hygiene, Handwashing, WSH, Sanitation, Water Supply, Sanitary Drainage, Toilet Facilities, Drinking Water, Hand Hygiene, Water Purification, Waste Water, disinfection | molecular source tracking, microbial source tracking, microbial transmission, diarrheal pathogen, diarrheal pathogens, diarrhoeal pathogen, diarrhoeal pathogens, fecal-oral, faecal-oral, entericpathogen, entericpathogens, ruminant, avian, Feces, Faeces, Fecal, Faecal, Fecally, Faecally | Entericinfection, Soil-transmitted helminth, Protozoan, Seroconversion, Fecal microbiology, Faecal microbiology, Fecal biomarker, Faecal biomarker, Intestinal Diseases, Parasitic, Seroconversion, Enteritis, Helminthiasis, Helminthiases, Intestinal infection, Viral infection, Bacterial infection, Parasite infection, Parasitic infection, Helminth infection, Fecal sampling, Faecal sampling, Stool sampling, Stool collection, Diarrhea, Dysentery, Child growth faltering, Growth faltering, Child development, Length-for-age, Height-for-age, Weight-for-age, Head circumference, Waist circumference, Stunting, Stunted, Wasting, Wasted, Linear growth, Anthropometric measurement, Malnutrition, Undernourished, Undernutrition, Underweight, Growth Disorders, Childnutrition disorder, Wasting syndrome, Thinness, Growth velocity |

## Table S2. Pubmed search string

[MH] are mesh headers and [TW] are text words.

|  |
| --- |
| ((matched [tw]) OR (trial [tw]) OR (RCT [tw]) OR (experiment [tw]) OR (intervention [tw]) OR (randomized [tw]) OR (randomised [tw]) OR (quasi-randomized [tw]) OR (quasi-randomised [tw]) OR (quasi-experimental [tw]) OR (pseudo-randomized [tw]) OR (pseudo-randomised [tw]) OR (“non-randomized controlled trials as topic” [mh])) AND ((Water [tw]) OR (Sanitation [tw]) OR (Hygiene [tw]) OR (Handwashing [tw]) OR (WSH [tw]) OR (“Sanitation” [mh]) OR (“Water Supply” [mh]) OR (“Drainage, Sanitary” [mh]) OR (Sanitary Drainage [tw]) OR (“Toilet Facilities” [mh]) OR (“Drinking Water” [mh]) OR (“Hand Hygiene” [mh]) OR (“Water Purification” [mh]) OR (“Waste Water” [mh]) OR (disinfect\* [tw])) AND ((molecular source tracking [tw]) OR (microbial source tracking [tw]) OR (microbial transmission [tw]) OR (diarrheal pathogen [tw]) OR (diarrheal pathogens [tw]) OR (diarrhoeal pathogen [tw]) OR (diarrhoeal pathogens [tw]) OR (fecal-oral [tw]) OR (faecal-oral [tw]) OR (enteric pathogen [tw]) OR (enteric pathogens [tw]) OR (ruminant\* [tw]) OR (avian\* [tw]) OR (“Feces” [mh]) OR (Feces [tw]) OR (Faeces [tw]) OR (Fecal [tw]) OR (Faecal [tw]) OR (Fecally [tw]) OR (Faecally [tw])) AND (((Enteric infection\* [tw]) OR (Soil-transmitted helminth\* [tw]) OR (Protozoan\* [tw]) OR (Seroconversion [tw]) OR (Fecal microbio\* [tw]) OR (Faecal microbio\* [tw]) OR (Fecal biomarker\* [tw]) OR (Faecal biomarker\* [tw]) OR (“Intestinal Diseases, Parasitic/epidemiology” [mh]) OR (“Seroconversion” [mh]) OR (Seroconversion [tw]) OR (“Enteritis/epidemiology” [mh]) OR (“Helminthiasis/complications” [mh]) OR (Helminthiasis [tw]) OR (Helminthiases)OR (“Helminthiasis/epidemiology” [mh]) OR (“Helminthiasis/prevention and control” [mh]) OR (Intestinal infection\* [tw]) OR (Viral infection\* [tw]) OR (Bacterial infection\* [tw]) OR (Parasite infection\* [tw]) OR (Parasitic infection\* [tw]) OR (Helminth infection\* [tw]) OR (Fecal sampling [tw]) OR (Faecal sampling [tw]) OR (Bacterial infection\* [tw]) OR (Parasite infection\* [tw]) OR (Parasitic infection\* [tw]) OR (Helminth infection\* [tw]) OR (Fecal sampling [tw]) OR (Faecal sampling [tw]) OR (Stool sampling [tw]) OR (Stool collection [tw])) OR ((Diarrh\* [tw]) OR (Dysentery [tw]) OR (“Diarrhea/epidemiology” [mh]) OR (“Diarrhea/etiology” [mh]) OR (“Diarrhea/prevention and control” [mh]) OR (“Diarrhea, Infantile” [mh]) OR (“Dysentery” [mh])) OR (Child growth faltering [tw]) OR (Growth faltering [tw])OR (Child development [tw]) OR (Length-for-age [tw]) OR (Height-for-age [tw]) OR (Weight-for-age [tw]) OR (Head circumference [tw]) OR (Waist circumference [tw]) OR (Stunt\* [tw]) OR (Wasting [tw]) OR (Wasted [tw]) OR (Linear growth [tw]) OR (Anthropometric measurement\* [tw]) OR (Maln\* [tw]) OR (Undernourish\* [tw]) OR (Undernutrition [tw]) OR (Underweight [tw]) OR (“Growth Disorders” [mh]) OR (Growth Disorders [tw]) OR (“Child nutrition disorders” [mh]) OR (Child nutrition disorder\* [tw]) OR (“Malnutrition” [mh]) OR (“Wasting Syndrome” [mh]) OR (Wasting syndrome [tw]) OR (“Thinness” [mh]) OR (Thinness [tw]) OR (Growth velocity [tw])) |

## Table S3. PRISMA Checklist

(See separate attachment)

## Table S4. Risk of bias based on modified Newcastle-Ottawa scale

Stars are given for low risk of bias in each category, up to a total of nine stars. Scoring details are in the footnotes.

| **Reference** | **Selection bias** | **Response bias** | **Follow-up bias** | **Misclassification bias** | **Outcome assessment** | **Outcome measurement** | **Bias in analysis** | **Total** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Is there evidence of selection bias, which refers to systematic differences between baseline characteristics of the groups that are compared?a | Is there evidence of response bias?b | Is there evidence of bias due to missing follow-up data?c | Is there risk of households not receiving the intervention being misclassified as having received it, or vice versa?d | Is there evidence of bias arising from how the outcome was assessed?e | Is there evidence of ascertainment bias?f | Is there evidence that analysis was not appropriately adjusted for clustering and/or confounding, if appropriate?g | Total number of stars (x/9 possible stars). |
| Clasen T, et al. Effectiveness of a rural sanitation programme on diarrhoea, soil-transmitted helminth infection, and child malnutrition in Odisha, India: a cluster-randomised trial. Lancet Glob Health. 2014. | \* | \* no, laboratory assessed and blinded | possible (86% of possible weeks are reported weeks) | \* household-level interventions | \*\* | \* | \*\* adjusted for clustering | 8 |
| Luby, S.P. et al.. Effects of water quality, sanitation, handwashing, and nutritional interventions on diarrhoea and child growth in rural Bangladesh: a cluster randomised controlled trial. The Lancet Global Health 2018 | \* | \* no, laboratory assessed and blinded | \* 94% complete FU | \* household-level interventions | \*\* | \* | \*\* | 9 |
| Null, C. et al., Effects of water quality, sanitation, handwashing, and nutritional interventions on diarrhoea and child growth in rural Kenya: a cluster-randomised controlled trial. The Lancet Global Health 2018 | \* | \* no, laboratory assessed and blinded | \* <1% loss to FU | \* household-level interventions | \*\* | \* | \*\* | 9 |
| Reese, H. et al. Assessing longer-term effectiveness of a combined household-level piped water and sanitation intervention on child diarrhoea, acute respiratory infection, soil-transmitted helminth infection and nutritional status: a matched cohort study in rural Odisha, India. International journal of epidemiology 2019 | selection bias is possible, as the study is not randomized and there are some baseline differences between intervention and control group | \* no, laboratory assessed and blinded | substantial loss to FU | \* household-level interventions | \*\* | \* | \*\* | 7 |
| Knee, J. et al. Effects of an urban sanitation intervention on childhood enteric infection and diarrhea in Maputo, Mozambique: A controlled before-and-after trial. eLife 2011 | selection bias is possible, as the study is not randomized, but intervention and control groups were mostly balanced at baseline. Control households were more likely to have covered floors and higher quality walls and intervention groups had more people per household. | \* no, laboratory assessed and blinded | substantial loss to FU | \* household-level interventions | \*\* | \* | \*\* | 7 |

a RCTs receive 1 star, unless evidence of selection bias (e.g. randomisation procedures not followed). Meaningful differences between groups at baseline in RCTs receive 0 stars. Rates of declining to participate >10% receive 0 stars. Non- or quasi-randomised studies receive 0 stars.

b If intervention recipient was not blinded to intervention status, 0 stars.

c <10% receives 1 star, greater than or equal to 10% receives 0 stars.

d Interventions delivered at the household/individual level receive 1 star. Interventions delivered at the community level that missed a substantial, i.e. greater than or equal to 10%, proportion of the target population receive 0 stars, including when there is insufficient information to verify whether this is the case. Interventions with substantial risk of contamination (control households receiving intervention) receive 0 stars.

e Parent / person recall (=0 stars). Fieldworker assessed (=1 star). Physician/microbiologically assessed (=2 stars)

f If outcome measurement staff were not blinded to intervention status, 0 stars.

g Scoring is based on losing stars (max. 2). Individual RCTs with baseline balance on covariates are unlikely to require adjustment (=2 stars). Cluster-RCTs and non-randomised trials may require adjustment for clustering (-1 star if not done). RCTs or cRCTs may require adjustment for covariates, with justification (-1 star if not done). Non-randomised studies require adjustment for covariates (-1 star if not done), but also adequate justification for covariate selection (-1 star if not included), and there can be too few or too many covariates.

## Table S5. Prevalence of pathogens by sample type tested in each study

| **Study** | **Sample** | **Target** | **Percent positive (n/N)** | **PR (95% CI)** |
| --- | --- | --- | --- | --- |
| Odagiri 2016 | Source water | V. cholerae | 31.7% (19/60) | 0.73 (0.34, 1.57) |
| - | - | Adenovirus | 8.3% (5/60) | 0.25 (0.03, 2.19) |
| - | - | Rotavirus | 23.3% (14/60) | 0.75 (0.29, 1.93) |
| Boehm 2016 | Stored water | Rotavirus | 0.6% (3/493) | - |
| - | Child hand rinse | Rotavirus | 6.1% (30/493) | - |
| - | House soil | Rotavirus | 1.4% (7/496) | 2.52 (0.51, 12.42) |
| Reese 2017 | Source water | Shigella | 10.7% (161/1499) | 0.73 (0.46, 1.15) |
| - | - | V. cholerae | 13% (36/276) | 0.93 (0.46, 1.85) |
| - | Stored water | Shigella | 10.1% (190/1874) | 1.08 (0.77, 1.51) |
| - | - | V. cholerae | 23.7% (100/422) | 1.03 (0.66, 1.6) |
| Steinbaum 2019 | House soil | Ascaris | 13% (273/2107) | 0.88 (0.68, 1.13) |
| - | - | Trichuris | 6.9% (146/2107) | 0.86 (0.6, 1.23) |
| Fuhrmeister 2020 | Stored water | Pathogenic E. coli | 38.6% (286/741) | 1 (0.84, 1.19) |
| - | Child hand rinse | Pathogenic E. coli | 34% (127/373) | - |
| - | - | Giardia | 4.8% (15/311) | - |
| - | - | Norovirus | 4.2% (14/337) | - |
| - | Mother's hand rinse | Pathogenic E. coli | 24% (177/737) | - |
| - | - | Giardia | 2.3% (14/602) | - |
| - | - | Norovirus | 3.1% (21/684) | - |
| - | House soil | Pathogenic E. coli | 61.3% (453/739) | 0.94 (0.84, 1.06) |
| Capone 2021 | Latrine soil | C. difficile | 14.8% (13/88) | 0.9 (0.32, 2.48) |
| - | - | Campylobacter | 6.8% (6/88) | 2.09 (0.4, 11.05) |
| - | - | Pathogenic E. coli | 56.8% (50/88) | 0.89 (0.56, 1.42) |
| - | - | Salmonella | 6.8% (6/88) | 0.52 (0.1, 2.76) |
| - | - | Shigella | 21.6% (19/88) | 0.28 (0.1, 0.78) |
| - | - | V. cholerae | 0% (0/88) | - |
| - | - | Yersinia | 4.5% (4/88) | - |
| - | - | Ascaris | 60.2% (53/88) | 0.65 (0.41, 1.02) |
| - | - | Trichuris | 17% (15/88) | 0.92 (0.36, 2.33) |
| - | - | Cryptosporidium | 8% (7/88) | 0.78 (0.18, 3.36) |
| - | - | Entamoeba histolytica | 1.1% (1/88) | - |
| - | - | Giardia | 31.8% (28/88) | 0.47 (0.21, 1.07) |
| - | - | Adenovirus | 20.5% (18/88) | 0.21 (0.06, 0.68) |
| - | - | Astrovirus | 29.5% (26/88) | 1.27 (0.67, 2.43) |
| - | - | Norovirus | 2.3% (2/88) | - |
| - | - | Rotavirus | 4.5% (4/88) | - |
| - | - | Sapovirus | 0% (0/88) | - |
| Capone 2022 in prep | Flies | Campylobacter | 1.2% (1/86) | - |
| - | - | Pathogenic E. coli | 30.2% (26/86) | - |
| - | - | Shigella | 2.3% (2/86) | - |
| - | - | V. cholerae | 2.3% (2/86) | - |
| - | - | Ascaris | 0% (0/86) | - |
| - | - | Trichuris | 3.5% (3/86) | - |
| - | - | Giardia | 4.7% (4/86) | - |
| - | - | Adenovirus | 4.7% (4/86) | - |
| - | - | Astrovirus | 0% (0/86) | - |
| - | - | Norovirus | 2.3% (2/86) | - |
| - | - | Pan enterovirus | 0% (0/86) | - |
| - | - | Rotavirus | 1.2% (1/86) | - |
| - | - | Sapovirus | 0% (0/86) | - |
| Kwong 2021 | House soil | Ascaris | 62.1% (886/1426) | 0.97 (0.87, 1.08) |
| - | - | Trichuris | 56% (798/1426) | 1.03 (0.91, 1.15) |

## Table S6. Prevalence of microbial source tracking markers by sample type tested in each study

| **Study** | **Sample** | **Target** | **Percent positive (n/N)** | **PR (95% CI)** |
| --- | --- | --- | --- | --- |
| Odagiri 2016 | Source water | Animal (BacCow) | 91.7% (55/60) | 1.04 (0.89, 1.21) |
| - | - | Human (BacHum) | 71.7% (43/60) | 1.05 (0.76, 1.45) |
| Boehm 2016 | Stored water | Avian (GFD) | 9.3% (46/493) | 0.71 (0.37, 1.36) |
| - | - | Ruminant (BacR) | 21.9% (108/493) | 0.62 (0.43, 0.9) |
| - | - | Human (HumM2) | 0% (0/493) | - |
| - | Child hand rinse | Avian (GFD) | 16.2% (80/493) | - |
| - | - | Ruminant (BacR) | 54.2% (267/493) | - |
| - | - | Human (HumM2) | 2.4% (12/493) | - |
| - | House soil | Avian (GFD) | 33.3% (165/496) | 0.98 (0.76, 1.27) |
| - | - | Ruminant (BacR) | 66.7% (331/496) | 0.98 (0.85, 1.12) |
| - | - | Human (HumM2) | 8.9% (44/496) | 0.94 (0.5, 1.75) |
| Fuhrmeister 2020 | Stored water | Animal (BacCow) | 68.5% (482/704) | 0.97 (0.87, 1.08) |
| - | - | Human (HumM2) | 2.6% (17/651) | 0.44 (0.16, 1.23) |
| - | Child hand rinse | Animal (BacCow) | 97.5% (356/365) | - |
| - | - | Human (HumM2) | 21.9% (74/338) | - |
| - | Mother's hand rinse | Animal (BacCow) | 96.7% (702/726) | - |
| - | - | Human (HumM2) | 18.1% (118/651) | - |
| - | House soil | Animal (BacCow) | 90.6% (572/631) | 0.99 (0.94, 1.04) |
| - | - | Human (HumM2) | 20.1% (127/631) | 1.24 (0.91, 1.7) |
| Holcomb 2021 | Source water | Avian (GFD) | 0% (0/41) | - |
| - | - | Human (HF183) | 2.4% (1/41) | - |
| - | - | Human (M. smithii) | 0% (0/41) | - |
| - | Stored water | Avian (GFD) | 1.1% (1/94) | - |
| - | - | Human (HF183) | 14.9% (14/94) | 1.72 (0.57, 5.18) |
| - | - | Human (M. smithii) | 0% (0/94) | - |
| - | Latrine soil | Avian (GFD) | 3.3% (2/60) | - |
| - | - | Human (HF183) | 50% (30/60) | 0.88 (0.51, 1.52) |
| - | - | Human (M. smithii) | 45% (27/60) | 0.74 (0.36, 1.55) |
| - | House soil | Avian (GFD) | 3.6% (3/83) | - |
| - | - | Human (HF183) | 42.2% (35/83) | 0.81 (0.49, 1.34) |
| - | - | Human (M. smithii) | 24.1% (20/83) | 1.3 (0.62, 2.73) |
| Capone 2022 in prep | Flies | Animal (BacCow) | 12.8% (11/86) | - |
| - | - | Dog (BacCan) | 30.2% (26/86) | - |
| - | - | Human (BacHum) | 72.1% (62/86) | - |

## Table S7.

Unadjusted and adjusted results by study, sample type, and aggregated variables for pathogen targets (any pathogen, any bacteria, any viruses, any protozoa, any STH).

| **Study** | **Target** | **Sample** | **Positive, Intervention** | **Negative, Intervention** | **Positive, Control** | **Negative, Control** | **Total observations** | **Unadjusted Prevalence Ratio** | **Unadjusted p-value** | **Adjusted Prevalence Ratio** | **Adjusted p-value** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Capone 2022 | Any pathogen | Any sample | 7 | 13 | 20 | 17 | 57 | PR=0.65 (95% CI: 0.33, 1.28) | 0.21 | PR=0.5 (95% CI: 0.21, 1.19) | 0.12 |
| Capone 2021 | Any pathogen | Any sample | 37 | 6 | 43 | 2 | 88 | PR=0.9 (95% CI: 0.78, 1.03) | 0.13 | PR=0.9 (95% CI: 0.78, 1.03) | 0.13 |
| Fuhrmeister 2020 | Any pathogen | Any sample | 314 | 136 | 348 | 123 | 921 | PR=0.94 (95% CI: 0.87, 1.02) | 0.17 | PR=0.94 (95% CI: 0.87, 1.02) | 0.13 |
| Steinbaum 2019 | Any pathogen | Any sample | 206 | 979 | 173 | 707 | 2,065 | PR=0.88 (95% CI: 0.7, 1.11) | 0.29 | PR=0.87 (95% CI: 0.7, 1.09) | 0.24 |
| Reese 2017 | Any pathogen | Any sample | 185 | 792 | 238 | 825 | 2,040 | PR=0.85 (95% CI: 0.66, 1.08) | 0.18 | PR=0.86 (95% CI: 0.68, 1.09) | 0.21 |
| Boehm 2016 | Any pathogen | Any sample | 19 | 229 | 15 | 234 | 497 | PR=1.27 (95% CI: 0.6, 2.68) | 0.53 | PR=1.28 (95% CI: 0.62, 2.66) | 0.5 |
| Odagiri 2016 | Any pathogen | Any sample | 12 | 18 | 15 | 15 | 60 | PR=0.8 (95% CI: 0.45, 1.42) | 0.45 |  |  |
| Reese 2017 | Any pathogen | Source water | 68 | 588 | 122 | 747 | 1,525 | PR=0.74 (95% CI: 0.49, 1.12) | 0.15 | PR=0.74 (95% CI: 0.5, 1.12) | 0.16 |
| Odagiri 2016 | Any pathogen | Source water | 12 | 18 | 15 | 15 | 60 | PR=0.8 (95% CI: 0.45, 1.42) | 0.45 |  |  |
| Fuhrmeister 2020 | Any pathogen | Stored water | 138 | 218 | 148 | 237 | 741 | PR=1.01 (95% CI: 0.85, 1.2) | 0.93 | PR=1 (95% CI: 0.84, 1.19) | 0.97 |
| Reese 2017 | Any pathogen | Stored water | 134 | 786 | 147 | 860 | 1,927 | PR=1 (95% CI: 0.75, 1.32) | 0.99 | PR=1.01 (95% CI: 0.77, 1.34) | 0.94 |
| Boehm 2016 | Any pathogen | Stored water | 2 | 243 | 1 | 245 | 491 | Not estimated |  | Not estimated |  |
| Kwong 2021 | Any pathogen | House soil | 363 | 125 | 687 | 221 | 1,396 | PR=0.98 (95% CI: 0.91, 1.06) | 0.67 | PR=0.98 (95% CI: 0.91, 1.06) | 0.68 |
| Fuhrmeister 2020 | Any pathogen | House soil | 217 | 144 | 236 | 142 | 739 | PR=0.96 (95% CI: 0.86, 1.08) | 0.53 | PR=0.94 (95% CI: 0.84, 1.06) | 0.31 |
| Steinbaum 2019 | Any pathogen | House soil | 209 | 1,000 | 173 | 725 | 2,107 | PR=0.9 (95% CI: 0.72, 1.13) | 0.35 | PR=0.89 (95% CI: 0.71, 1.11) | 0.31 |
| Boehm 2016 | Any pathogen | House soil | 5 | 242 | 2 | 247 | 496 | PR=2.52 (95% CI: 0.51, 12.42) | 0.26 | PR=2.52 (95% CI: 0.51, 12.42) | 0.26 |
| Capone 2021 | Any pathogen | Latrine soil | 37 | 6 | 43 | 2 | 88 | PR=0.9 (95% CI: 0.78, 1.03) | 0.13 | PR=0.9 (95% CI: 0.78, 1.03) | 0.13 |
| Capone 2022 | Any pathogen |  | 8 | 23 | 25 | 30 | 86 | PR=0.57 (95% CI: 0.28, 1.15) | 0.12 | PR=0.37 (95% CI: 0.16, 0.85) | 0.02 |
| Fuhrmeister 2020 | Any pathogen |  | 75 | 113 | 72 | 116 | 376 | PR=1.04 (95% CI: 0.8, 1.35) | 0.76 | PR=1.05 (95% CI: 0.81, 1.37) | 0.69 |
| Fuhrmeister 2020 | Any pathogen |  | 96 | 266 | 110 | 267 | 739 | PR=0.91 (95% CI: 0.72, 1.15) | 0.43 | PR=0.92 (95% CI: 0.72, 1.16) | 0.47 |
| Boehm 2016 | Any pathogen |  | 16 | 231 | 14 | 232 | 493 | PR=1.14 (95% CI: 0.52, 2.48) | 0.75 | PR=1.13 (95% CI: 0.52, 2.44) | 0.76 |
| Capone 2022 | Any bacteria | Any sample | 7 | 13 | 17 | 20 | 57 | PR=0.76 (95% CI: 0.38, 1.54) | 0.45 | PR=0.6 (95% CI: 0.24, 1.46) | 0.26 |
| Capone 2021 | Any bacteria | Any sample | 28 | 15 | 35 | 10 | 88 | PR=0.84 (95% CI: 0.64, 1.1) | 0.2 | PR=0.85 (95% CI: 0.65, 1.11) | 0.24 |
| Fuhrmeister 2020 | Any bacteria | Any sample | 306 | 144 | 340 | 131 | 921 | PR=0.94 (95% CI: 0.86, 1.03) | 0.18 | PR=0.94 (95% CI: 0.86, 1.02) | 0.14 |
| Reese 2017 | Any bacteria | Any sample | 185 | 792 | 238 | 825 | 2,040 | PR=0.85 (95% CI: 0.66, 1.08) | 0.18 | PR=0.86 (95% CI: 0.68, 1.09) | 0.21 |
| Odagiri 2016 | Any bacteria | Any sample | 8 | 22 | 11 | 19 | 60 | PR=0.73 (95% CI: 0.34, 1.57) | 0.42 |  |  |
| Reese 2017 | Any bacteria | Source water | 68 | 588 | 122 | 747 | 1,525 | PR=0.74 (95% CI: 0.49, 1.12) | 0.15 | PR=0.74 (95% CI: 0.5, 1.12) | 0.16 |
| Odagiri 2016 | Any bacteria | Source water | 8 | 22 | 11 | 19 | 60 | PR=0.73 (95% CI: 0.34, 1.57) | 0.42 |  |  |
| Fuhrmeister 2020 | Any bacteria | Stored water | 138 | 218 | 148 | 237 | 741 | PR=1.01 (95% CI: 0.85, 1.2) | 0.93 | PR=1 (95% CI: 0.84, 1.19) | 0.97 |
| Reese 2017 | Any bacteria | Stored water | 134 | 786 | 147 | 860 | 1,927 | PR=1 (95% CI: 0.75, 1.32) | 0.99 | PR=1.01 (95% CI: 0.77, 1.34) | 0.94 |
| Fuhrmeister 2020 | Any bacteria | House soil | 217 | 144 | 236 | 142 | 739 | PR=0.96 (95% CI: 0.86, 1.08) | 0.53 | PR=0.94 (95% CI: 0.84, 1.06) | 0.31 |
| Capone 2021 | Any bacteria | Latrine soil | 28 | 15 | 35 | 10 | 88 | PR=0.84 (95% CI: 0.64, 1.1) | 0.2 | PR=0.85 (95% CI: 0.65, 1.11) | 0.24 |
| Capone 2022 | Any bacteria |  | 8 | 23 | 21 | 34 | 86 | PR=0.68 (95% CI: 0.32, 1.41) | 0.3 | PR=0.62 (95% CI: 0.28, 1.38) | 0.24 |
| Fuhrmeister 2020 | Any bacteria |  | 64 | 122 | 63 | 124 | 373 | PR=1.02 (95% CI: 0.78, 1.35) | 0.88 | PR=1.02 (95% CI: 0.78, 1.35) | 0.88 |
| Fuhrmeister 2020 | Any bacteria |  | 81 | 281 | 96 | 279 | 737 | PR=0.87 (95% CI: 0.68, 1.13) | 0.3 | PR=0.85 (95% CI: 0.67, 1.09) | 0.2 |
| Capone 2022 | Any virus | Any sample | 0 | 20 | 4 | 33 | 57 | Not estimated |  | Not estimated |  |
| Capone 2021 | Any virus | Any sample | 16 | 27 | 22 | 23 | 88 | PR=0.76 (95% CI: 0.46, 1.25) | 0.28 | PR=0.63 (95% CI: 0.35, 1.14) | 0.13 |
| Fuhrmeister 2020 | Any virus | Any sample | 17 | 330 | 14 | 338 | 699 | PR=1.23 (95% CI: 0.63, 2.4) | 0.54 | PR=1.22 (95% CI: 0.63, 2.34) | 0.56 |
| Boehm 2016 | Any virus | Any sample | 19 | 229 | 15 | 234 | 497 | PR=1.27 (95% CI: 0.6, 2.68) | 0.53 | PR=1.28 (95% CI: 0.62, 2.66) | 0.5 |
| Odagiri 2016 | Any virus | Any sample | 7 | 23 | 10 | 20 | 60 | PR=0.7 (95% CI: 0.3, 1.62) | 0.4 |  |  |
| Odagiri 2016 | Any virus | Source water | 7 | 23 | 10 | 20 | 60 | PR=0.7 (95% CI: 0.3, 1.62) | 0.4 |  |  |
| Boehm 2016 | Any virus | Stored water | 2 | 243 | 1 | 245 | 491 | Not estimated |  | Not estimated |  |
| Boehm 2016 | Any virus | House soil | 5 | 242 | 2 | 247 | 496 | PR=2.52 (95% CI: 0.51, 12.42) | 0.26 | PR=2.52 (95% CI: 0.51, 12.42) | 0.26 |
| Capone 2021 | Any virus | Latrine soil | 16 | 27 | 22 | 23 | 88 | PR=0.76 (95% CI: 0.46, 1.25) | 0.28 | PR=0.63 (95% CI: 0.35, 1.14) | 0.13 |
| Capone 2022 | Any virus |  | 0 | 31 | 5 | 50 | 86 | PR=0 (95% CI: 0, 0) | 0 | PR=0 (95% CI: 0, 0) | 0 |
| Fuhrmeister 2020 | Any virus |  | 7 | 162 | 7 | 161 | 337 | PR=0.99 (95% CI: 0.37, 2.69) | 0.99 | PR=0.99 (95% CI: 0.37, 2.69) | 0.99 |
| Fuhrmeister 2020 | Any virus |  | 11 | 331 | 10 | 332 | 684 | PR=1.1 (95% CI: 0.47, 2.57) | 0.83 | PR=1.06 (95% CI: 0.45, 2.46) | 0.9 |
| Boehm 2016 | Any virus |  | 16 | 231 | 14 | 232 | 493 | PR=1.14 (95% CI: 0.52, 2.48) | 0.75 | PR=1.13 (95% CI: 0.52, 2.44) | 0.76 |
| Capone 2022 | Any protozoa | Any sample | 0 | 20 | 3 | 34 | 57 | Not estimated |  | Not estimated |  |
| Capone 2021 | Any protozoa | Any sample | 15 | 28 | 19 | 26 | 88 | PR=0.83 (95% CI: 0.48, 1.42) | 0.49 | PR=0.83 (95% CI: 0.48, 1.42) | 0.49 |
| Fuhrmeister 2020 | Any protozoa | Any sample | 12 | 293 | 16 | 291 | 612 | PR=0.75 (95% CI: 0.35, 1.65) | 0.48 | PR=0.77 (95% CI: 0.35, 1.67) | 0.5 |
| Capone 2021 | Any protozoa | Latrine soil | 15 | 28 | 19 | 26 | 88 | PR=0.83 (95% CI: 0.48, 1.42) | 0.49 | PR=0.83 (95% CI: 0.48, 1.42) | 0.49 |
| Capone 2022 | Any protozoa |  | 0 | 31 | 4 | 51 | 86 | Not estimated |  | Not estimated |  |
| Fuhrmeister 2020 | Any protozoa |  | 7 | 147 | 8 | 149 | 311 | PR=0.89 (95% CI: 0.33, 2.38) | 0.82 | PR=0.89 (95% CI: 0.33, 2.38) | 0.82 |
| Fuhrmeister 2020 | Any protozoa |  | 5 | 296 | 9 | 292 | 602 | PR=0.56 (95% CI: 0.14, 2.13) | 0.39 | PR=0.56 (95% CI: 0.14, 2.13) | 0.39 |
| Capone 2022 | Any STH | Any sample | 0 | 20 | 3 | 34 | 57 | Not estimated |  | Not estimated |  |
| Capone 2021 | Any STH | Any sample | 20 | 23 | 34 | 11 | 88 | PR=0.62 (95% CI: 0.43, 0.89) | 0.01 | PR=0.69 (95% CI: 0.45, 1.07) | 0.1 |
| Steinbaum 2019 | Any STH | Any sample | 206 | 979 | 173 | 707 | 2,065 | PR=0.88 (95% CI: 0.7, 1.11) | 0.29 | PR=0.87 (95% CI: 0.7, 1.09) | 0.24 |
| Kwong 2021 | Any STH | House soil | 363 | 125 | 687 | 221 | 1,396 | PR=0.98 (95% CI: 0.91, 1.06) | 0.67 | PR=0.98 (95% CI: 0.91, 1.06) | 0.68 |
| Steinbaum 2019 | Any STH | House soil | 209 | 1,000 | 173 | 725 | 2,107 | PR=0.9 (95% CI: 0.72, 1.13) | 0.35 | PR=0.89 (95% CI: 0.71, 1.11) | 0.31 |
| Capone 2021 | Any STH | Latrine soil | 20 | 23 | 34 | 11 | 88 | PR=0.62 (95% CI: 0.43, 0.89) | 0.01 | PR=0.69 (95% CI: 0.45, 1.07) | 0.1 |
| Capone 2022 | Any STH |  | 0 | 31 | 3 | 52 | 86 | Not estimated |  | Not estimated |  |

## Table S8.

Unadjusted and adjusted results by study, sample type, and aggregated variables for MST targets (any MST, any general MST, any human MST, any animal MST).

| **Study** | **Target** | **Sample** | **Positive, Intervention** | **Negative, Intervention** | **Positive, Control** | **Negative, Control** | **Total observations** | **Unadjusted Prevalence Ratio** | **Unadjusted p-value** | **Adjusted Prevalence Ratio** | **Adjusted p-value** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Capone 2022 | Any MST Marker | Any sample | 20 | 0 | 32 | 5 | 57 | PR=1.16 (95% CI: 1.02, 1.32) | 0.03 | PR=1.16 (95% CI: 1.02, 1.32) | 0.03 |
| Holcomb 2021 | Any MST Marker | Any sample | 41 | 28 | 44 | 17 | 130 | PR=0.82 (95% CI: 0.62, 1.09) | 0.18 | PR=0.86 (95% CI: 0.65, 1.13) | 0.27 |
| Fuhrmeister 2020 | Any MST Marker | Any sample | 421 | 26 | 438 | 29 | 914 | PR=1 (95% CI: 0.97, 1.04) | 0.8 | PR=1.01 (95% CI: 0.97, 1.04) | 0.7 |
| Boehm 2016 | Any MST Marker | Any sample | 220 | 28 | 222 | 27 | 497 | PR=0.99 (95% CI: 0.93, 1.06) | 0.88 | PR=0.99 (95% CI: 0.93, 1.06) | 0.76 |
| Odagiri 2016 | Any MST Marker | Any sample | 30 | 0 | 28 | 2 | 60 | Not estimated |  |  |  |
| Holcomb 2021 | Any MST Marker | Source water | 1 | 21 | 0 | 19 | 41 | Not estimated |  | Not estimated |  |
| Odagiri 2016 | Any MST Marker | Source water | 30 | 0 | 28 | 2 | 60 | Not estimated |  |  |  |
| Holcomb 2021 | Any MST Marker | Stored water | 9 | 39 | 6 | 40 | 94 | PR=1.44 (95% CI: 0.51, 4.08) | 0.5 | PR=1.44 (95% CI: 0.51, 4.08) | 0.5 |
| Fuhrmeister 2020 | Any MST Marker | Stored water | 230 | 119 | 256 | 119 | 724 | PR=0.97 (95% CI: 0.87, 1.07) | 0.52 | PR=0.97 (95% CI: 0.88, 1.08) | 0.63 |
| Boehm 2016 | Any MST Marker | Stored water | 57 | 188 | 82 | 164 | 491 | PR=0.7 (95% CI: 0.51, 0.96) | 0.03 | PR=0.69 (95% CI: 0.5, 0.95) | 0.02 |
| Holcomb 2021 | Any MST Marker | House soil | 21 | 18 | 26 | 18 | 83 | PR=0.91 (95% CI: 0.6, 1.38) | 0.66 | PR=0.89 (95% CI: 0.62, 1.28) | 0.54 |
| Fuhrmeister 2020 | Any MST Marker | House soil | 283 | 38 | 297 | 36 | 654 | PR=0.99 (95% CI: 0.93, 1.05) | 0.7 | PR=0.99 (95% CI: 0.93, 1.05) | 0.66 |
| Boehm 2016 | Any MST Marker | House soil | 180 | 67 | 187 | 62 | 496 | PR=0.97 (95% CI: 0.87, 1.08) | 0.59 | PR=0.97 (95% CI: 0.87, 1.08) | 0.58 |
| Holcomb 2021 | Any MST Marker | Latrine soil | 21 | 9 | 22 | 8 | 60 | PR=0.95 (95% CI: 0.69, 1.32) | 0.78 | PR=0.95 (95% CI: 0.69, 1.32) | 0.78 |
| Capone 2022 | Any MST Marker |  | 27 | 4 | 42 | 13 | 86 | PR=1.14 (95% CI: 0.93, 1.39) | 0.2 | PR=1.14 (95% CI: 0.93, 1.39) | 0.2 |
| Fuhrmeister 2020 | Any MST Marker |  | 174 | 11 | 182 | 1 | 368 | PR=0.95 (95% CI: 0.91, 0.98) | 0.01 | PR=0.95 (95% CI: 0.91, 0.98) | 0.01 |
| Fuhrmeister 2020 | Any MST Marker |  | 346 | 14 | 359 | 9 | 728 | PR=0.99 (95% CI: 0.96, 1.01) | 0.26 | PR=0.99 (95% CI: 0.96, 1.01) | 0.29 |
| Boehm 2016 | Any MST Marker |  | 145 | 102 | 148 | 98 | 493 | PR=0.98 (95% CI: 0.82, 1.16) | 0.78 | PR=0.97 (95% CI: 0.82, 1.15) | 0.74 |
| Capone 2022 | Any human MST Marker | Any sample | 17 | 3 | 30 | 7 | 57 | PR=1.05 (95% CI: 0.82, 1.34) | 0.71 | PR=1.05 (95% CI: 0.82, 1.34) | 0.71 |
| Holcomb 2021 | Any human MST Marker | Any sample | 41 | 28 | 43 | 18 | 130 | PR=0.84 (95% CI: 0.63, 1.12) | 0.24 | PR=0.89 (95% CI: 0.67, 1.18) | 0.41 |
| Fuhrmeister 2020 | Any human MST Marker | Any sample | 124 | 313 | 133 | 330 | 900 | PR=0.99 (95% CI: 0.8, 1.22) | 0.91 | PR=1.01 (95% CI: 0.82, 1.25) | 0.92 |
| Boehm 2016 | Any human MST Marker | Any sample | 26 | 222 | 26 | 223 | 497 | PR=1 (95% CI: 0.57, 1.75) | 0.99 | PR=1 (95% CI: 0.57, 1.76) | 0.99 |
| Odagiri 2016 | Any human MST Marker | Any sample | 22 | 8 | 21 | 9 | 60 | PR=1.05 (95% CI: 0.76, 1.45) | 0.78 |  |  |
| Holcomb 2021 | Any human MST Marker | Source water | 1 | 21 | 0 | 19 | 41 | Not estimated |  | Not estimated |  |
| Odagiri 2016 | Any human MST Marker | Source water | 22 | 8 | 21 | 9 | 60 | PR=1.05 (95% CI: 0.76, 1.45) | 0.78 |  |  |
| Holcomb 2021 | Any human MST Marker | Stored water | 9 | 39 | 5 | 41 | 94 | PR=1.72 (95% CI: 0.57, 5.18) | 0.33 | PR=1.72 (95% CI: 0.57, 5.18) | 0.33 |
| Fuhrmeister 2020 | Any human MST Marker | Stored water | 5 | 310 | 12 | 324 | 651 | PR=0.44 (95% CI: 0.16, 1.23) | 0.12 | PR=0.44 (95% CI: 0.16, 1.23) | 0.12 |
| Boehm 2016 | Any human MST Marker | Stored water | 0 | 245 | 0 | 246 | 491 | Not estimated |  | Not estimated |  |
| Holcomb 2021 | Any human MST Marker | House soil | 20 | 19 | 26 | 18 | 83 | PR=0.87 (95% CI: 0.57, 1.32) | 0.5 | PR=0.86 (95% CI: 0.6, 1.24) | 0.42 |
| Fuhrmeister 2020 | Any human MST Marker | House soil | 68 | 243 | 59 | 261 | 631 | PR=1.19 (95% CI: 0.87, 1.61) | 0.28 | PR=1.24 (95% CI: 0.91, 1.7) | 0.18 |
| Boehm 2016 | Any human MST Marker | House soil | 21 | 226 | 23 | 226 | 496 | PR=0.92 (95% CI: 0.5, 1.71) | 0.79 | PR=0.94 (95% CI: 0.5, 1.75) | 0.84 |
| Holcomb 2021 | Any human MST Marker | Latrine soil | 21 | 9 | 22 | 8 | 60 | PR=0.95 (95% CI: 0.69, 1.32) | 0.78 | PR=0.95 (95% CI: 0.69, 1.32) | 0.78 |
| Capone 2022 | Any human MST Marker |  | 24 | 7 | 38 | 17 | 86 | PR=1.12 (95% CI: 0.83, 1.51) | 0.46 | PR=1.02 (95% CI: 0.75, 1.41) | 0.88 |
| Fuhrmeister 2020 | Any human MST Marker |  | 30 | 142 | 44 | 122 | 338 | PR=0.66 (95% CI: 0.44, 0.99) | 0.04 | PR=0.72 (95% CI: 0.48, 1.07) | 0.11 |
| Fuhrmeister 2020 | Any human MST Marker |  | 58 | 268 | 60 | 265 | 651 | PR=0.96 (95% CI: 0.68, 1.37) | 0.84 | PR=0.96 (95% CI: 0.68, 1.35) | 0.82 |
| Boehm 2016 | Any human MST Marker |  | 7 | 240 | 5 | 241 | 493 | PR=1.39 (95% CI: 0.46, 4.2) | 0.56 | PR=1.39 (95% CI: 0.46, 4.2) | 0.56 |
| Capone 2022 | Any animal MST Marker | Any sample | 12 | 8 | 17 | 20 | 57 | PR=1.31 (95% CI: 0.78, 2.17) | 0.3 | PR=1.2 (95% CI: 0.72, 1.99) | 0.48 |
| Holcomb 2021 | Any animal MST Marker | Any sample | 3 | 66 | 2 | 59 | 130 | PR=1.33 (95% CI: 0.18, 9.59) | 0.78 | PR=1.33 (95% CI: 0.18, 9.59) | 0.78 |
| Fuhrmeister 2020 | Any animal MST Marker | Any sample | 419 | 26 | 437 | 28 | 910 | PR=1 (95% CI: 0.97, 1.04) | 0.91 | PR=1 (95% CI: 0.97, 1.04) | 0.8 |
| Boehm 2016 | Any animal MST Marker | Any sample | 219 | 29 | 221 | 28 | 497 | PR=0.99 (95% CI: 0.93, 1.06) | 0.88 | PR=0.99 (95% CI: 0.93, 1.06) | 0.74 |
| Odagiri 2016 | Any animal MST Marker | Any sample | 28 | 2 | 27 | 3 | 60 | PR=1.04 (95% CI: 0.89, 1.21) | 0.65 |  |  |
| Holcomb 2021 | Any animal MST Marker | Source water | 0 | 22 | 0 | 19 | 41 | Not estimated |  | Not estimated |  |
| Odagiri 2016 | Any animal MST Marker | Source water | 28 | 2 | 27 | 3 | 60 | PR=1.04 (95% CI: 0.89, 1.21) | 0.65 |  |  |
| Holcomb 2021 | Any animal MST Marker | Stored water | 0 | 48 | 1 | 45 | 94 | Not estimated |  | Not estimated |  |
| Fuhrmeister 2020 | Any animal MST Marker | Stored water | 229 | 113 | 253 | 109 | 704 | PR=0.96 (95% CI: 0.86, 1.07) | 0.43 | PR=0.97 (95% CI: 0.87, 1.08) | 0.57 |
| Boehm 2016 | Any animal MST Marker | Stored water | 57 | 188 | 82 | 164 | 491 | PR=0.7 (95% CI: 0.51, 0.96) | 0.03 | PR=0.69 (95% CI: 0.5, 0.95) | 0.02 |
| Holcomb 2021 | Any animal MST Marker | House soil | 2 | 37 | 1 | 43 | 83 | Not estimated |  | Not estimated |  |
| Fuhrmeister 2020 | Any animal MST Marker | House soil | 281 | 30 | 291 | 29 | 631 | PR=0.99 (95% CI: 0.94, 1.05) | 0.82 | PR=0.99 (95% CI: 0.94, 1.04) | 0.72 |
| Boehm 2016 | Any animal MST Marker | House soil | 178 | 69 | 186 | 63 | 496 | PR=0.96 (95% CI: 0.86, 1.08) | 0.53 | PR=0.96 (95% CI: 0.86, 1.08) | 0.51 |
| Holcomb 2021 | Any animal MST Marker | Latrine soil | 2 | 28 | 0 | 30 | 60 | Not estimated |  | Not estimated |  |
| Capone 2022 | Any animal MST Marker |  | 12 | 19 | 18 | 37 | 86 | PR=1.18 (95% CI: 0.7, 2) | 0.53 | PR=1.33 (95% CI: 0.62, 2.86) | 0.47 |
| Fuhrmeister 2020 | Any animal MST Marker |  | 174 | 8 | 182 | 1 | 365 | PR=0.96 (95% CI: 0.93, 1) | 0.03 | PR=0.96 (95% CI: 0.93, 1) | 0.03 |
| Fuhrmeister 2020 | Any animal MST Marker |  | 344 | 15 | 358 | 9 | 726 | PR=0.98 (95% CI: 0.96, 1.01) | 0.17 | PR=0.98 (95% CI: 0.96, 1.01) | 0.19 |
| Boehm 2016 | Any animal MST Marker |  | 144 | 103 | 147 | 99 | 493 | PR=0.98 (95% CI: 0.82, 1.16) | 0.78 | PR=0.97 (95% CI: 0.82, 1.15) | 0.7 |

## Table S9.

Baseline covariates by study. Note that Odigari et al. 2016 is not included as data shared from this study were from village water sources and did not have associated covariates from individual households; therefore all estimates for this study are unadjusted.

| **.** | **Boehm 2016** | **Reese 2017** | **Steinbaum 2019** | **Fuhrmeister 2020** | **Holcomb 2021** | **Capone 2021** | **Capone 2022 in prep.** | **Kwong 2021** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Household wealth |  |  |  |  |  |  |  |  |
| Low | 125 (25.2%) | 28 (11.6%) | 861 (40.9%) | 153 (25.6%) | 45 (27.6%) | 22 (25.0%) | 14 (24.6%) | 355 (25.4%) |
| Medium-low | 124 (24.9%) | 51 (21.1%) | 439 (20.8%) | 145 (24.3%) | 46 (28.2%) | 23 (26.1%) | 18 (31.6%) | 343 (24.6%) |
| Medium-high | 125 (25.2%) | 39 (16.1%) | 402 (19.1%) | 147 (24.6%) | 35 (21.5%) | 22 (25.0%) | 12 (21.1%) | 351 (25.1%) |
| High | 123 (24.7%) | 65 (26.9%) | 403 (19.1%) | 152 (25.5%) | 37 (22.7%) | 21 (23.9%) | 13 (22.8%) | 347 (24.9%) |
| Missing | 0 (0%) | 59 (24.4%) | 2 (0.1%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Number of people in the household |  |  |  |  |  |  |  |  |
| <5 | 271 (54.5%) | 17 (7.0%) | 612 (29.0%) | 335 (56.1%) | 38 (23.3%) | 0 (0%) | 0 (0%) | 783 (56.1%) |
| 5-8 | 199 (40.0%) | 171 (70.7%) | 1149 (54.5%) | 224 (37.5%) | 44 (27.0%) | 7 (8.0%) | 3 (5.3%) | 528 (37.8%) |
| >8 | 27 (5.4%) | 54 (22.3%) | 245 (11.6%) | 38 (6.4%) | 81 (49.7%) | 81 (92.0%) | 54 (94.7%) | 85 (6.1%) |
| Missing | 0 (0%) | 0 (0%) | 101 (4.8%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Number of rooms in the household |  |  |  |  |  |  |  |  |
| 1-2 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 98 (60.1%) | 61 (69.3%) | 41 (71.9%) | 0 (0%) |
| >3 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 65 (39.9%) | 27 (30.7%) | 16 (28.1%) | 0 (0%) |
| Missing | 497 (100%) | 242 (100%) | 2107 (100%) | 597 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 1396 (100%) |
| Improved roof |  |  |  |  |  |  |  |  |
| 0 | 8 (1.6%) | 0 (0%) | 693 (32.9%) | 8 (1.3%) | 0 (0%) | 0 (0%) | 0 (0%) | 23 (1.6%) |
| 1 | 489 (98.4%) | 0 (0%) | 1414 (67.1%) | 589 (98.7%) | 0 (0%) | 0 (0%) | 0 (0%) | 1373 (98.4%) |
| Missing | 0 (0%) | 242 (100%) | 0 (0%) | 0 (0%) | 163 (100%) | 88 (100%) | 57 (100%) | 0 (0%) |
| Father in agriculture |  |  |  |  |  |  |  |  |
| 0 | 332 (66.8%) | 126 (52.1%) | 0 (0%) | 419 (70.2%) | 0 (0%) | 0 (0%) | 0 (0%) | 952 (68.2%) |
| 1 | 165 (33.2%) | 89 (36.8%) | 0 (0%) | 178 (29.8%) | 0 (0%) | 0 (0%) | 0 (0%) | 444 (31.8%) |
| Missing | 0 (0%) | 27 (11.2%) | 2107 (100%) | 0 (0%) | 163 (100%) | 88 (100%) | 57 (100%) | 0 (0%) |
| Land owned |  |  |  |  |  |  |  |  |
| 0 | 0 (0%) | 97 (40.1%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| 1 | 0 (0%) | 117 (48.3%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Missing | 497 (100%) | 28 (11.6%) | 2107 (100%) | 597 (100%) | 163 (100%) | 88 (100%) | 57 (100%) | 1396 (100%) |
| Acres of land owned |  |  |  |  |  |  |  |  |
| Mean (SD) | 0.110 (0.128) | NA (NA) | NA (NA) | 0.150 (0.206) | NA (NA) | NA (NA) | NA (NA) | 0.142 (0.212) |
| Median [Min, Max] | 0.0700 [0.0100, 1.23] | NA [NA, NA] | NA [NA, NA] | 0.0800 [0.0100, 2.10] | NA [NA, NA] | NA [NA, NA] | NA [NA, NA] | 0.0800 [0.0100, 3.15] |
| Missing | 13 (2.6%) | 242 (100%) | 2107 (100%) | 21 (3.5%) | 163 (100%) | 88 (100%) | 57 (100%) | 62 (4.4%) |
| Maternal education |  |  |  |  |  |  |  |  |
| No education | 85 (17.1%) | 0 (0%) | 0 (0%) | 86 (14.4%) | 6 (3.7%) | 0 (0%) | 0 (0%) | 207 (14.8%) |
| Incomplete Primary | 0 (0%) | 83 (34.3%) | 1095 (52.0%) | 0 (0%) | 38 (23.3%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Primary | 180 (36.2%) | 30 (12.4%) | 511 (24.3%) | 183 (30.7%) | 14 (8.6%) | 0 (0%) | 0 (0%) | 449 (32.2%) |
| Secondary | 232 (46.7%) | 70 (28.9%) | 499 (23.7%) | 328 (54.9%) | 41 (25.2%) | 0 (0%) | 0 (0%) | 740 (53.0%) |
| More than secondary | 0 (0%) | 11 (4.5%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Missing | 0 (0%) | 48 (19.8%) | 2 (0.1%) | 0 (0%) | 64 (39.3%) | 88 (100%) | 57 (100%) | 0 (0%) |
| Maternal age |  |  |  |  |  |  |  |  |
| Mean (SD) | 23.7 (5.18) | NA (NA) | 26.4 (6.32) | 23.7 (5.08) | NA (NA) | NA (NA) | NA (NA) | 24.0 (5.03) |
| Median [Min, Max] | 23.0 [15.0, 42.0] | NA [NA, NA] | 25.5 [14.9, 47.9] | 23.0 [15.0, 41.0] | NA [NA, NA] | NA [NA, NA] | NA [NA, NA] | 24.0 [15.0, 43.0] |
| Missing | 0 (0%) | 242 (100%) | 11 (0.5%) | 0 (0%) | 163 (100%) | 88 (100%) | 57 (100%) | 2 (0.1%) |
| Animal ownership |  |  |  |  |  |  |  |  |
| Mean (SD) | 0.956 (0.206) | 0.423 (0.495) | 0.899 (0.302) | 0.955 (0.208) | 0.896 (0.307) | 0.966 (0.183) | 0.982 (0.132) | 0.968 (0.177) |
| Median [Min, Max] | 1.00 [0, 1.00] | 0 [0, 1.00] | 1.00 [0, 1.00] | 1.00 [0, 1.00] | 1.00 [0, 1.00] | 1.00 [0, 1.00] | 1.00 [0, 1.00] | 1.00 [0, 1.00] |
| Missing | 1 (0.2%) | 29 (12.0%) | 0 (0%) | 1 (0.2%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (0.1%) |
| Improved wall |  |  |  |  |  |  |  |  |
| 0 | 78 (15.7%) | 0 (0%) | 2019 (95.8%) | 197 (33.0%) | 41 (25.2%) | 16 (18.2%) | 10 (17.5%) | 369 (26.4%) |
| 1 | 419 (84.3%) | 0 (0%) | 88 (4.2%) | 400 (67.0%) | 122 (74.8%) | 72 (81.8%) | 47 (82.5%) | 1027 (73.6%) |
| Missing | 0 (0%) | 242 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Improved floor |  |  |  |  |  |  |  |  |
| 0 | 461 (92.8%) | 0 (0%) | 1999 (94.9%) | 524 (87.8%) | 4 (2.5%) | 1 (1.1%) | 1 (1.8%) | 1253 (89.8%) |
| 1 | 36 (7.2%) | 0 (0%) | 108 (5.1%) | 73 (12.2%) | 159 (97.5%) | 87 (98.9%) | 56 (98.2%) | 143 (10.2%) |
| Missing | 0 (0%) | 242 (100%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Electricity |  |  |  |  |  |  |  |  |
| 0 | 234 (47.1%) | 34 (14.0%) | 1958 (92.9%) | 246 (41.2%) | 3 (1.8%) | 4 (4.5%) | 2 (3.5%) | 584 (41.8%) |
| 1 | 263 (52.9%) | 202 (83.5%) | 147 (7.0%) | 351 (58.8%) | 160 (98.2%) | 84 (95.5%) | 55 (96.5%) | 812 (58.2%) |
| Missing | 0 (0%) | 6 (2.5%) | 2 (0.1%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |