

**Supplementary Information for
WASH Benefits Kenya Respiratory Infections Analysis**

TABLE OF CONTENTS

| | |
|--|----|
| CONSORT Abstract Checklist..... | 1 |
| CONSORT Checklist | 2 |
| Table S1: Baseline characteristics of participating households and households lost to follow-up | 5 |
| Table S2: Indicators of intervention adoption one year after intervention delivery | 6 |
| Table S3: Indicators of intervention adoption two years after intervention delivery | 7 |
| Table S4: Unadjusted effects of interventions on prevalence of respiratory outcomes, interventions vs. control..... | 8 |
| Table S5: Adjusted effects of interventions on prevalence of respiratory outcomes, interventions vs. control, years one and two combined..... | 9 |
| Table S6: Effects of interventions on prevalence of respiratory outcomes, combined (intervention) vs. single (reference) intervention arms, years one and two combined | 10 |
| Table S7: Unadjusted effects of interventions on prevalence of respiratory outcomes, combined (intervention) vs. single (reference) intervention arms, year one only..... | 11 |
| Table S8: Respiratory outcome prevalence ratios by index child status, interventions vs. control | 12 |
| Table S9: Respiratory outcome prevalence differences by index child status, interventions vs. control | 13 |
| Table S10: Respiratory outcome prevalence differences by child sex, interventions vs. control | 14 |
| Table S11: Respiratory outcome prevalence differences by malaria seasonality, interventions vs. control..... | 15 |
| Table S12: Prevalence of breastfeeding indicators | 16 |
| Table S13: Prevalence of breastfeeding indicators, stratified by child sex..... | 16 |
| Table S14: Unadjusted effects of interventions on prevalence of reported runny nose, intervention vs. control..... | 17 |
| Table S15: Reported runny nose prevalence ratios and differences by malaria seasonality interventions vs. control | 17 |
| Figure S1: Acute respiratory illness by calendar month..... | 18 |

CONSORT Abstract Checklist

| Item | Standard Description | Description for Cluster Trials | Reported in Line: |
|--------------------|---|--|---|
| Title | Identification of the study as randomised | Identification of the study as cluster-randomised | 2 |
| Trial design | Description of the trial design (e.g. parallel, cluster, non-inferiority) | Definition of cluster and description of how the design features apply to the clusters | 31 |
| Methods | | | |
| Participants | Eligibility criteria for participants and the settings where the data were collected | Eligibility criteria for clusters | 32 |
| Interventions | Interventions intended for each group | Whether interventions pertain to the cluster level, the individual participant level or both | 33-37 |
| Objective | Specific objective or hypothesis | | 30-31 |
| Outcome | Clearly defined primary outcome for this report | Whether outcome measures pertain to the cluster level, the individual participant level or both | 38-39 |
| Randomization | How participants were allocated to interventions | | 33-34 |
| Blinding (masking) | Whether or not participants, care givers, and those assessing the outcomes were blinded to group assignment | | 39 |
| Results | | | |
| Numbers randomized | Number of participants randomized to each group | Number of clusters randomized to each group | 40 |
| Recruitment | Trial status | | Not applicable – publication indicates this is final report |
| Numbers analysed | Number of participants analysed in each group | For each group, number of clusters included in each analysis | 41 |
| Outcome | For the primary outcome, a result for each group and the estimated effect size and its precision | Results at the individual or cluster level as applicable and a coefficient of intracluster correlation (ICC or k) for each primary outcome | 42 |
| Harms | Important adverse events or side effects | | Not applicable |
| Conclusions | General interpretation of the results | | 42-45 |
| Trial registration | Registration number and name of trial register | | 45 |
| Funding | Source of funding | | 45 |

CONSORT Checklist

| Section/Topic | Item No | Standard Checklist item | Extension for cluster designs | Extension for multi-arm trials | Reported in Section: |
|----------------------------------|---------|--|--|--|--|
| Title and abstract | | | | | |
| | 1a | Identification as a randomised trial in the title | Identification as a cluster randomised trial in the title | Identification as a multi-arm randomised trial in the title or an indication of the number of treatment groups that the participants were randomly assigned to | Title |
| | 1b | Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts) ^{i, ii} | See table 2 | Specification of the number of treatment groups; details of any groups added or dropped | Abstract |
| Introduction | | | | | |
| Background and objectives | 2a | Scientific background and explanation of rationale | Rationale for using a cluster design | Rationale for using a multi-arm design | Introduction |
| | 2b | Specific objectives or hypotheses | Whether objectives pertain to the cluster level, the individual participant level or both | Specification of the research question referring to all of the treatment groups Clear statement of all hypotheses to be tested and the primary comparisons involved | Introduction, last paragraph |
| Methods | | | | | |
| Trial design | 3a | Description of trial design (such as parallel, factorial) including allocation ratio | Definition of cluster and description of how the design features apply to the clusters | Specification of the number of treatment groups | Materials and Methods (Study design) |
| | 3b | Important changes to methods after trial commencement (such as eligibility criteria), with reasons | | Details of any treatment groups added or dropped (if relevant), with reasons, and/or changes to the allocation ratio | Not applicable |
| Participants | 4a | Eligibility criteria for participants | Eligibility criteria for clusters | | Materials and Methods (Study design) |
| | 4b | Settings and locations where the data were collected | | | Materials and Methods (Study design) |
| Interventions | 5 | The interventions for each group with sufficient details to allow replication, including how and when they were actually administered | Whether interventions pertain to the cluster level, the individual participant level or both | | Materials and Methods (Procedures) |
| Outcomes | 6a | Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed | Whether outcome measures pertain to the cluster level, the individual participant level or both | | Materials and Methods (Outcomes) |
| | 6b | Any changes to trial outcomes after the trial commenced, with reasons | | | Not applicable |
| Sample size | 7a | How sample size was determined | Method of calculation, number of clusters(s) (and whether equal or unequal cluster sizes are assumed), cluster size, a coefficient of intracluster correlation (ICC or k), and an indication of its uncertainty | Planned sample size with details of how it was determined for each primary comparison | Materials and Methods (Statistical analysis) |
| | 7b | When applicable, explanation of any interim analyses and stopping guidelines | | | Not applicable |
| Randomisation: | | | | | |
| Sequence generation | 8a | Method used to generate the random allocation sequence | | | Materials and Methods (Study design) |
| | 8b | Type of randomisation; details of any restriction (such as blocking and block size) | Details of stratification or matching if used | | Materials and Methods (Study design) |

| | | | | | |
|---|-----|---|--|---|--|
| Allocation concealment mechanism | 9 | Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned | Specification that allocation was based on clusters rather than individuals and whether allocation concealment (if any) was at the cluster level, the individual participant level or both | | Materials and Methods (Study design) |
| Implementation | 10 | Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions | Replace by 10a, 10b and 10c | | |
| | 10a | | Who generated the random allocation sequence, who enrolled clusters, and who assigned clusters to interventions | | Materials and Methods (Study design) |
| | 10b | | Mechanism by which individual participants were included in clusters for the purposes of the trial (such as complete enumeration, random sampling) | | Materials and Methods (Study design) |
| | 10c | | From whom consent was sought (representatives of the cluster, or individual cluster members, or both), and whether consent was sought before or after randomisation | | Materials and Methods (Study design) |
| Blinding | 11a | If done, who was blinded after assignment to interventions (for example, participants, care providers, those assessing outcomes) and how | | | Materials and Methods (Study design) |
| | 11b | If relevant, description of the similarity of interventions | | | Not applicable |
| Statistical methods | 12a | Statistical methods used to compare groups for primary and secondary outcomes | How clustering was taken into account | Explicitly state if no adjustments for multiplicity were applied; if adjustments were applied, state the method used | Materials and Methods (Statistical analysis, second paragraph) |
| | 12b | Methods for additional analyses, such as subgroup analyses and adjusted analyses | | | Materials and Methods (Statistical analysis) |
| Results | | | | | |
| Participant flow (a diagram is strongly recommended) | 13a | For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome | For each group, the numbers of clusters that were randomly assigned, received intended treatment, and were analysed for the primary outcome | | Results; Figure 1 |
| | 13b | For each group, losses and exclusions after randomisation, together with reasons | For each group, losses and exclusions for both clusters and individual cluster members | | Results; Figure 1 |
| Recruitment | 14a | Dates defining the periods of recruitment and follow-up | | If periods of recruitment and follow-up are different across treatment groups (eg, groups were added or dropped), the periods of recruitment and follow-up, reason(s) for the differences, and any statistical implications should be described | Results, first paragraph |
| | 14b | Why the trial ended or was stopped | | | Not applicable |
| Baseline data | 15 | A table showing baseline demographic and clinical characteristics for each group | Baseline characteristics for the individual and cluster levels as applicable for each group | | Results; Table 1 |

| | | | | | |
|--------------------------------|-----|---|---|--|--|
| Numbers analysed | 16 | For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups | For each group, number of clusters included in each analysis | | Results; Figure 1 |
| Outcomes and estimation | 17a | For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval) | Results at the individual or cluster level as applicable and a coefficient of intracluster correlation (ICC or k) for each primary outcome | Results for each prespecified comparison of treatment groups | Results; Figure 2; Figure 3; Table 2 |
| | 17b | For binary outcomes, presentation of both absolute and relative effect sizes is recommended | | | Results; Figure 2; Figure 3; Table 2; Table S3 |
| Ancillary analyses | 18 | Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory | | | Results; Table 3; Table 4; Table S4; Table S5; Table S6; Table S7; Table S11; Table S12; Table S13; Table S14; Table S15 |
| Harms | 19 | All important harms or unintended effects in each group (for specific guidance see CONSORT for harms ⁱⁱⁱ) | | | Not applicable |
| Discussion | | | | | |
| Limitations | 20 | Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses | | | Discussion, second to last paragraph |
| Generalisability | 21 | Generalisability (external validity, applicability) of the trial findings | Generalisability to clusters and/or individual participants (as relevant) | | Discussion, last paragraph |
| Interpretation | 22 | Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence | | | Discussion |
| Other information | | | | | |
| Registration | 23 | Registration number and name of trial registry | | | Materials and Methods (Study design) |
| Protocol | 24 | Where the full trial protocol can be accessed, if available | | | Reference 21 Methods (Study design, first paragraph) |
| Funding | 25 | Sources of funding and other support (such as supply of drugs), role of funders | | | Financial support |

ⁱ Hopewell S, Clarke M, Moher D, Wager E, Middleton P, Altman DG, et al. CONSORT for reporting randomised trials in journal and conference abstracts. *Lancet* 2008, 371:281-283

ⁱⁱ Hopewell S, Clarke M, Moher D, Wager E, Middleton P, Altman DG at al (2008) CONSORT for reporting randomized controlled trials in journal and conference abstracts: explanation and elaboration. *PLoS Med* 5(1): e20

ⁱⁱⁱ Ioannidis JP, Evans SJ, Gotzsche PC, O'Neill RT, Altman DG, Schulz K, Moher D. Better reporting of harms in randomized trials: an extension of the CONSORT statement. *Ann Intern Med* 2004; 141(10):781-788.

Table S1: Baseline characteristics of participating households and households lost to follow-up

| No. of households: | Households in Analysis | Households Lost to Follow-Up |
|---|------------------------|------------------------------|
| | (N=7057) | (N=1189) |
| | n (%) / mean (SD) | n (%) / mean (SD) |
| Maternal | | |
| Age (years) | 26 (6) | 25 (7) |
| Completed primary school | 3345 (47%) | 568 (48%) |
| Paternal | | |
| Completed primary school | 4060 (62%) | 611 (59%) |
| Works in agriculture | 2909 (43%) | 408 (38%) |
| Household | | |
| Number of persons | 5 (2) | 5 (3) |
| Has electricity | 499 (7%) | 63 (5%) |
| Has a cement floor | 401 (6%) | 73 (6%) |
| Drinking water | | |
| Has protected primary drinking water source* | 5248 (75%) | 883 (75%) |
| Stored water observed at home | 5760 (82%) | 919 (78%) |
| Reported treating currently stored water | 728 (13%) | 113 (12%) |
| Sanitation | | |
| Daily defecating in the open | | |
| Children: 3-<8 years | 587 (13%) | 100 (15%) |
| Children: 0-<3 years | 3006 (78%) | 410 (76%) |
| Latrine | | |
| Owned by compound | 5831 (83%) | 951 (80%) |
| Household has access to a latrine with slab or ventilation pipe | 1116 (17%) | 199 (18%) |
| Visible stool on slab or floor | 3160 (49%) | 529 (49%) |
| Has a potty | 157 (2%) | 33 (3%) |
| Human feces observed in the compound | 604 (9%) | 93 (8%) |
| Handwashing | | |
| Handwashing station has water and soap | 413 (6%) | 65 (5%) |
| Nutrition | | |
| Moderate-to-severe household hunger [†] | 736 (10%) | 172 (15%) |

Percentages were calculated from smaller denominators than those shown at the top of the table for all variables because of missing values.

* Protected water sources include borewells, protected springs, protected dug wells, rainwater collection, and piped water into the home or yard/plot

[†] Assessed by Household Hunger Scale

Table S2: Indicators of intervention adoption one year after intervention delivery

| No. of households: | Control (N=1015) | Water Treatment (N=468) | Sanitation (N=464) | Handwashing (N=483) | Water + Sanitation + Handwashing (N=522) | Nutrition (N=446) | Nutrition + Water + Sanitation + Handwashing (N=485) |
|---|---------------------|----------------------------|-----------------------|------------------------|---|----------------------|--|
| | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) |
| Intervention Promotion | | | | | | | |
| Visited by a promoter in the past month | 655 (69%) | 334 (76%) | 328 (75%) | 329 (71%) | 378 (75%) | 341 (80%) | 384 (82%) |
| Water Storage | | | | | | | |
| Had stored drinking water available in household | 899 (90%) | 402 (86%) | 401 (88%) | 439 (91%) | 424 (82%) | 415 (94%) | 381 (79%) |
| Obtained stored water from protected water source* | 671 (80%) | 283 (76%) | 297 (82%) | 314 (76%) | 300 (75%) | 313 (81%) | 276 (78%) |
| Water Treatment | | | | | | | |
| Reported treating currently stored water | 92 (10%) | 213 (53%) | 48 (12%) | 49 (11%) | 251 (59%) | 36 (9%) | 208 (55%) |
| Used Vestergaard LifeStraw® family filter | 19 (2%) | 3 (1%) | 6 (1%) | 5 (1%) | 1 (0%) | 5 (1%) | 1 (0%) |
| Boiled water | 12 (1%) | 2 (0%) | 4 (1%) | 4 (1%) | 0 (0%) | 3 (1%) | 1 (0%) |
| Treated with chlorine | 5 (6%) | 206 (51%) | 29 (7%) | 35 (8%) | 250 (59%) | 22 (5%) | 205 (54%) |
| Detectable total chlorine in stored drinking water | 24 (3%) | 155 (40%) | 23 (6%) | 19 (5%) | 187 (44%) | 9 (2%) | 157 (43%) |
| Sanitation | | | | | | | |
| Household has access to a latrine with slab or ventilation pipe | 170 (18%) | 73 (16%) | 402 (90%) | 64 (14%) | 458 (89%) | 63 (15%) | 417 (89%) |
| Has a potty | 22 (2%) | 7 (2%) | 446 (97%) | 21 (4%) | 507 (98%) | 5 (1%) | 461 (96%) |
| Child feces safely disposed† | 331 (37%) | 153 (37%) | 313 (77%) | 153 (36%) | 320 (70%) | 154 (40%) | 285 (67%) |
| Handwashing | | | | | | | |
| Handwashing station has water and soap | 120 (12%) | 53 (11%) | 49 (11%) | 372 (77%) | 407 (78%) | 61 (14%) | 377 (78%) |
| Nutrition | | | | | | | |
| LNS sachets consumed (% of expected) | - | - | - | - | - | 4984/5264 (95%) | 5279/5530 (95%) |

Percentages were calculated from smaller denominators than those shown at the top of the table for all variables because of missing values.

* Protected water sources include borewells, protected springs, protected dug wells, rainwater collection, and piped water into the home or yard/plot

† Safe child faeces disposal was defined as the index child's last defecation in a latrine, or diaper or potty and rinsed into a latrine or buried

Table S3: Indicators of intervention adoption two years after intervention delivery

| No. of households: | Control (N=1506) | Water Treatment (N=691) | Sanitation (N=713) | Handwashing (N=684) | Water + Sanitation + Handwashing (N=676) | Nutrition (N=652) | Nutrition + Water + Sanitation + Handwashing (N=734) |
|---|---------------------|----------------------------|-----------------------|------------------------|---|----------------------|--|
| | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) | n (%) |
| Intervention Promotion | | | | | | | |
| Visited by a promoter in the past month | 493 (34%) | 252 (37%) | 275 (40%) | 229 (34%) | 241 (37%) | 252 (40%) | 257 (37%) |
| Water Storage | | | | | | | |
| Had stored drinking water available in household | 1406 (94%) | 631 (92%) | 639 (91%) | 640 (94%) | 597 (89%) | 613 (95%) | 647 (89%) |
| Obtained stored water from protected water source* | 1196 (85%) | 498 (79%) | 554 (87%) | 551 (86%) | 480 (80%) | 497 (81%) | 525 (81%) |
| Water Treatment | | | | | | | |
| Reported treating currently stored water | 217 (15%) | 226 (36%) | 93 (15%) | 81 (13%) | 196 (33%) | 74 (12%) | 202 (31%) |
| Used Vestergaard LifeStraw® family filter | 28 (2%) | 8 (1%) | 12 (2%) | 4 (1%) | 0 (0%) | 3 (0%) | 6 (1%) |
| Boiled water | 22 (2%) | 4 (1%) | 8 (1%) | 11 (2%) | 8 (1%) | 9 (1%) | 6 (1%) |
| Treated with chlorine | 121 (9%) | 208 (33%) | 53 (8%) | 47 (7%) | 184 (31%) | 47 (8%) | 190 (29%) |
| Detectable total chlorine in stored drinking water | 48 (3%) | 150 (24%) | 19 (3%) | 18 (3%) | 120 (20%) | 17 (3%) | 127 (20%) |
| Sanitation | | | | | | | |
| Household has access to a latrine with slab or ventilation pipe | 287 (20%) | 126 (19%) | 530 (78%) | 120 (19%) | 530 (82%) | 98 (16%) | 558 (80%) |
| Has a potty | 76 (5%) | 30 (4%) | 607 (86%) | 34 (5%) | 566 (85%) | 31 (5%) | 609 (84%) |
| Child feces safely disposed† | 149 (11%) | 52 (8%) | 239 (37%) | 62 (10%) | 204 (34%) | 49 (8%) | 217 (33%) |
| Handwashing | | | | | | | |
| Handwashing station has water and soap | 131 (9%) | 51 (7%) | 58 (8%) | 159 (23%) | 132 (20%) | 76 (12%) | 154 (21%) |
| Nutrition | | | | | | | |
| LNS sachets consumed (% of expected) | - | - | - | - | - | 3566/3122 (114%) | 4046/3486 (116%) |

Percentages were calculated from smaller denominators than those shown at the top of the table for all variables because of missing values.

* Protected water sources include borewells, protected springs, protected dug wells, rainwater collection, and piped water into the home or yard/plot

† Safe child faeces disposal was defined as the index child's last defecation in a latrine, or diaper or potty and rinsed into a latrine or buried

Table S4: Unadjusted effects of interventions on prevalence of respiratory outcomes, interventions vs. control

| Outcome, Arm | Years One and Two Combined | | | | Year One Only | | | |
|--|----------------------------|-------|------------------------------|---------|---------------|-------|------------------------------|---------|
| | N | Prev. | Prev. Difference (95% CI) | P-value | N | Prev. | Prev. Difference (95% CI) | P-value |
| Acute respiratory infection (ARI)* | | | | | | | | |
| Control | 4769 | 46.0% | | | 2347 | 48.1% | | |
| Water | 1545 | 48.2% | 0.02 (-0.02 - 0.05) | 0.397 | 764 | 50.0% | 0.01 (-0.04 - 0.06) | 0.704 |
| Sanitation | 1546 | 43.9% | -0.02 (-0.05 - 0.02) | 0.285 | 755 | 45.6% | -0.02 (-0.06 - 0.02) | 0.402 |
| Handwashing | 1496 | 43.8% | -0.02 (-0.05 - 0.02) | 0.345 | 738 | 47.6% | 0.01 (-0.04 - 0.05) | 0.769 |
| Nutrition | 1472 | 42.6% | -0.04 (-0.08 - 0.00) | 0.050 | 735 | 41.8% | -0.06 (-0.12 - -0.01) | 0.024 |
| WSH | 1563 | 44.9% | -0.01 (-0.04 - 0.02) | 0.470 | 788 | 47.2% | -0.01 (-0.05 - 0.04) | 0.671 |
| WSHN | 1657 | 45.1% | -0.01 (-0.05 - 0.02) | 0.360 | 833 | 46.5% | -0.02 (-0.07 - 0.02) | 0.275 |
| Panting, wheezing or difficulty breathing | | | | | | | | |
| Control | 4765 | 13.3% | | | 2344 | 11.5% | | |
| Water | 1544 | 14.0% | 0.00 (-0.02 - 0.03) | 0.788 | 764 | 12.8% | 0.01 (-0.02 - 0.05) | 0.526 |
| Sanitation | 1545 | 11.0% | -0.02 (-0.04 - 0.00) | 0.074 | 754 | 10.5% | -0.01 (-0.04 - 0.02) | 0.591 |
| Handwashing | 1496 | 13.0% | 0.00 (-0.02 - 0.02) | 0.785 | 738 | 13.1% | 0.01 (-0.02 - 0.05) | 0.389 |
| Nutrition | 1470 | 12.1% | -0.01 (-0.04 - 0.01) | 0.400 | 734 | 10.4% | -0.01 (-0.04 - 0.02) | 0.598 |
| WSH | 1563 | 13.2% | 0.00 (-0.02 - 0.02) | 0.976 | 788 | 13.5% | 0.02 (-0.02 - 0.06) | 0.378 |
| WSHN | 1657 | 12.7% | -0.01 (-0.03 - 0.02) | 0.541 | 833 | 10.3% | -0.01 (-0.04 - 0.02) | 0.462 |
| Fever and ARI | | | | | | | | |
| Control | 4764 | 24.7% | | | 2345 | 26.1% | | |
| Water | 1544 | 27.0% | 0.02 (-0.01 - 0.05) | 0.134 | 763 | 27.3% | 0.01 (-0.03 - 0.05) | 0.625 |
| Sanitation | 1546 | 24.3% | 0.00 (-0.03 - 0.02) | 0.716 | 755 | 24.9% | -0.02 (-0.05 - 0.02) | 0.416 |
| Handwashing | 1496 | 23.7% | -0.01 (-0.04 - 0.02) | 0.505 | 738 | 25.9% | 0.00 (-0.04 - 0.03) | 0.937 |
| Nutrition | 1470 | 22.2% | -0.03 (-0.06 - 0.00) | 0.043 | 734 | 21.8% | -0.05 (-0.09 - 0.00) | 0.033 |
| WSH | 1563 | 24.4% | -0.01 (-0.03 - 0.02) | 0.675 | 788 | 25.5% | -0.01 (-0.04 - 0.02) | 0.589 |
| WSHN | 1656 | 25.1% | 0.00 (-0.03 - 0.02) | 0.776 | 832 | 25.0% | -0.02 (-0.05 - 0.02) | 0.365 |
| Visibly runny nose | | | | | | | | |
| Control | 4422 | 6.7% | | | 2035 | 6.9% | | |
| Water | 1407 | 6.7% | 0.00 (-0.01 - 0.02) | 0.749 | 647 | 7.3% | 0.01 (-0.02 - 0.04) | 0.576 |
| Sanitation | 1416 | 6.2% | 0.00 (-0.02 - 0.02) | 0.952 | 632 | 4.3% | -0.03 (-0.05 - 0.00) | 0.050 |
| Handwashing | 1397 | 6.7% | 0.00 (-0.02 - 0.01) | 0.535 | 650 | 7.8% | 0.01 (-0.02 - 0.04) | 0.654 |
| Nutrition | 1346 | 7.0% | 0.01 (-0.01 - 0.02) | 0.522 | 618 | 7.6% | 0.01 (-0.02 - 0.04) | 0.468 |
| WSH | 1421 | 6.5% | 0.00 (-0.01 - 0.02) | 0.698 | 662 | 6.8% | 0.00 (-0.03 - 0.03) | 0.889 |
| WSHN | 1500 | 5.9% | -0.01 (-0.03 - 0.01) | 0.418 | 687 | 4.8% | -0.02 (-0.05 - 0.00) | 0.052 |

*An ARI was defined as caregiver-reported cough or difficulty breathing, including panting and wheezing, within the past seven days prior to the interview

Table S5: Adjusted effects of interventions on prevalence of respiratory outcomes, interventions vs. control, years one and two combined

| Outcome, Arm | N | Prev. | Prev. Ratio (95% CI) | P-value | Prev. Difference (95% CI) | P-value |
|--|----------|--------------|---------------------------------|----------------|--------------------------------------|----------------|
| Acute respiratory infection (ARI)* | | | | | | |
| Control | 4769 | 46.0% | | | | |
| Water | 1545 | 48.2% | 1.01 (0.94 - 1.09) | 0.736 | 0.01 (-0.03 - 0.04) | 0.727 |
| Sanitation | 1546 | 43.9% | 0.97 (0.90 - 1.05) | 0.512 | -0.01 (-0.05 - 0.02) | 0.514 |
| Handwashing | 1496 | 43.8% | 0.95 (0.89 - 1.03) | 0.210 | -0.02 (-0.05 - 0.01) | 0.233 |
| Nutrition | 1472 | 42.6% | 0.92 (0.85 - 1.00) | 0.060 | -0.03 (-0.07 - 0.00) | 0.058 |
| WSH | 1563 | 44.9% | 0.96 (0.90 - 1.03) | 0.216 | -0.02 (-0.05 - 0.01) | 0.209 |
| WSHN | 1657 | 45.1% | 1.00 (0.93 - 1.07) | 0.911 | 0.00 (-0.03 - 0.03) | 0.890 |
| Panting, wheezing or difficulty breathing | | | | | | |
| Control | 4765 | 13.3% | | | | |
| Water | 1544 | 14.0% | 0.99 (0.84 - 1.17) | 0.928 | 0.00 (-0.03 - 0.02) | 0.847 |
| Sanitation | 1545 | 11.0% | 0.93 (0.79 - 1.09) | 0.371 | -0.01 (-0.03 - 0.01) | 0.294 |
| Handwashing | 1496 | 13.0% | 0.97 (0.86 - 1.10) | 0.680 | 0.00 (-0.02 - 0.01) | 0.726 |
| Nutrition | 1470 | 12.1% | 0.93 (0.79 - 1.10) | 0.403 | -0.01 (-0.03 - 0.01) | 0.313 |
| WSH | 1563 | 13.2% | 0.96 (0.82 - 1.11) | 0.563 | 0.00 (-0.02 - 0.01) | 0.603 |
| WSHN | 1657 | 12.7% | 1.02 (0.87 - 1.20) | 0.800 | 0.00 (-0.02 - 0.02) | 0.878 |
| Fever and ARI | | | | | | |
| Control | 4764 | 24.7% | | | | |
| Water | 1544 | 27.0% | 1.06 (0.95 - 1.18) | 0.328 | 0.01 (-0.02 - 0.04) | 0.329 |
| Sanitation | 1546 | 24.3% | 1.00 (0.89 - 1.12) | 0.997 | 0.00 (-0.03 - 0.03) | 0.914 |
| Handwashing | 1496 | 23.7% | 0.94 (0.82 - 1.06) | 0.285 | -0.02 (-0.04 - 0.01) | 0.277 |
| Nutrition | 1470 | 22.2% | 0.88 (0.77 - 1.00) | 0.048 | -0.03 (-0.06 - 0.00) | 0.052 |
| WSH | 1563 | 24.4% | 0.98 (0.89 - 1.08) | 0.676 | 0.00 (-0.03 - 0.02) | 0.759 |
| WSHN | 1656 | 25.1% | 1.01 (0.92 - 1.11) | 0.844 | 0.00 (-0.02 - 0.03) | 0.820 |
| Visibly runny nose | | | | | | |
| Control | 4422 | 6.7% | | | | |
| Water | 1407 | 6.7% | 0.96 (0.72 - 1.28) | 0.770 | 0.00 (-0.02 - 0.02) | 0.949 |
| Sanitation | 1416 | 6.2% | 0.96 (0.72 - 1.29) | 0.783 | 0.00 (-0.02 - 0.02) | 0.965 |
| Handwashing | 1397 | 6.7% | 0.83 (0.64 - 1.09) | 0.176 | -0.01 (-0.03 - 0.01) | 0.170 |
| Nutrition | 1346 | 7.0% | 1.07 (0.82 - 1.41) | 0.609 | 0.01 (-0.01 - 0.02) | 0.577 |
| WSH | 1421 | 6.5% | 1.19 (0.91 - 1.56) | 0.211 | 0.01 (-0.01 - 0.03) | 0.338 |
| WSHN | 1500 | 5.9% | 0.90 (0.64 - 1.27) | 0.551 | -0.0 (-0.03 - 0.01) | 0.570 |

*An ARI was defined as caregiver-reported cough or difficulty breathing, including panting and wheezing, within the past seven days prior to the interview

Table S6: Effects of interventions on prevalence of respiratory outcomes, combined (intervention) vs. single (reference) intervention arms, years one and two combined

| Outcome, Arm | Unadjusted | | | | Adjusted | | | |
|--|-------------------------|-------------|------------------------------|-------------|-------------------------|-------------|------------------------------|-------------|
| | Prev. Ratio (95% CI) | P- value | Prev. Difference (95% CI) | P- value | Prev. Ratio (95% CI) | P- value | Prev. Difference (95% CI) | P- value |
| Acute respiratory infection (ARI)* | | | | | | | | |
| WSH vs. Water | 0.94 (0.86 - 1.03) | 0.217 | -0.03 (-0.07 - 0.02) | 0.218 | 0.94 (0.86 - 1.03) | 0.185 | -0.03 (-0.07 - 0.01) | 0.164 |
| WSH vs. Sanitation | 1.04 (0.94 - 1.15) | 0.461 | 0.02 (-0.03 - 0.06) | 0.461 | 1.01 (0.92 - 1.11) | 0.823 | 0.00 (-0.04 - 0.04) | 0.880 |
| WSH vs. Handwashing | 1.03 (0.94 - 1.13) | 0.496 | 0.01 (-0.03 - 0.05) | 0.495 | 1.04 (0.95 - 1.14) | 0.369 | 0.02 (-0.02 - 0.06) | 0.384 |
| WSHN vs. WSH | 1.01 (0.92 - 1.11) | 0.834 | 0.00 (-0.04 - 0.05) | 0.834 | 1.08 (0.99 - 1.18) | 0.090 | 0.03 (-0.01 - 0.07) | 0.115 |
| WSHN vs. Nutrition | 1.07 (0.98 - 1.16) | 0.133 | 0.03 (-0.01 - 0.07) | 0.130 | 1.10 (1.02 - 1.19) | 0.015 | 0.04 (0.01 - 0.08) | 0.021 |
| Panting, wheezing or difficulty breathing | | | | | | | | |
| WSH vs. Water | 0.98 (0.79 - 1.20) | 0.827 | 0.00 (-0.03 - 0.02) | 0.828 | 0.95 (0.76 - 1.17) | 0.620 | -0.01 (-0.04 - 0.02) | 0.567 |
| WSH vs. Sanitation | 1.24 (1.00 - 1.55) | 0.054 | 0.03 (0.00 - 0.05) | 0.052 | 1.24 (0.99 - 1.55) | 0.061 | 0.02 (0.00 - 0.04) | 0.108 |
| WSH vs. Handwashing | 1.07 (0.85 - 1.35) | 0.557 | 0.01 (-0.02 - 0.04) | 0.557 | 1.04 (0.84 - 1.29) | 0.724 | 0.00 (-0.02 - 0.03) | 0.721 |
| WSHN vs. WSH | 0.97 (0.78 - 1.20) | 0.773 | 0.00 (-0.03 - 0.02) | 0.772 | 1.02 (0.82 - 1.27) | 0.843 | 0.01 (-0.02 - 0.03) | 0.608 |
| WSHN vs. Nutrition | 0.97 (0.77 - 1.22) | 0.796 | 0.00 (-0.03 - 0.03) | 0.796 | 1.10 (0.90 - 1.33) | 0.360 | 0.01 (-0.02 - 0.03) | 0.618 |
| Fever and ARI | | | | | | | | |
| WSH vs. Water | 0.93 (0.81 - 1.06) | 0.280 | -0.02 (-0.05 - 0.02) | 0.283 | 0.94 (0.83 - 1.07) | 0.336 | -0.02 (-0.05 - 0.02) | 0.302 |
| WSH vs. Sanitation | 1.04 (0.90 - 1.21) | 0.585 | 0.01 (-0.03 - 0.05) | 0.585 | 0.99 (0.87 - 1.13) | 0.905 | 0.00 (-0.03 - 0.03) | 0.996 |
| WSH vs. Handwashing | 1.07 (0.92 - 1.25) | 0.351 | 0.02 (-0.02 - 0.05) | 0.348 | 1.12 (0.97 - 1.30) | 0.134 | 0.02 (-0.01 - 0.06) | 0.186 |
| WSHN vs. WSH | 1.01 (0.88 - 1.16) | 0.841 | 0.00 (-0.03 - 0.04) | 0.841 | 1.06 (0.93 - 1.20) | 0.400 | 0.01 (-0.02 - 0.04) | 0.404 |
| WSHN vs. Nutrition | 1.15 (1.00 - 1.33) | 0.046 | 0.03 (0.00 - 0.07) | 0.044 | 1.20 (1.04 - 1.39) | 0.012 | 0.04 (0.01 - 0.08) | 0.014 |
| Visibly runny nose | | | | | | | | |
| WSH vs. Water | 0.98 (0.70 - 1.36) | 0.901 | 0.00 (-0.02 - 0.02) | 0.901 | 1.19 (0.85 - 1.66) | 0.324 | 0.01 (-0.01 - 0.04) | 0.334 |
| WSH vs. Sanitation | 1.20 (0.84 - 1.71) | 0.318 | 0.01 (-0.01 - 0.03) | 0.314 | 1.40 (0.93 - 2.13) | 0.110 | 0.01 (-0.01 - 0.04) | 0.200 |
| WSH vs. Handwashing | 1.11 (0.81 - 1.53) | 0.504 | 0.01 (-0.01 - 0.03) | 0.502 | 1.36 (0.97 - 1.90) | 0.073 | 0.02 (0.00 - 0.04) | 0.119 |
| WSHN vs. WSH | 0.80 (0.54 - 1.20) | 0.282 | -0.01 (-0.04 - 0.01) | 0.269 | 0.83 (0.55 - 1.24) | 0.361 | -0.02 (-0.04 - 0.01) | 0.235 |
| WSHN vs. Nutrition | 0.82 (0.56 - 1.19) | 0.291 | -0.01 (-0.04 - 0.01) | 0.275 | 0.78 (0.49 - 1.25) | 0.305 | -0.01 (-0.04 - 0.01) | 0.302 |

*An ARI was defined as caregiver-reported cough or difficulty breathing, including panting and wheezing, within the past seven days prior to the interview

Table S7: Unadjusted effects of interventions on prevalence of respiratory outcomes, combined (intervention) vs. single (reference) intervention arms, year one only

| Outcome, Arm | Prev. Ratio (95% CI) | P-value | Prev. Difference (95% CI) | P-value |
|--|---------------------------------|----------------|--------------------------------------|----------------|
| Acute respiratory infection (ARI)* | | | | |
| WSH vs. Water | 0.98 (0.87 - 1.11) | 0.751 | -0.01 (-0.07 - 0.05) | 0.751 |
| WSH vs. Sanitation | 1.07 (0.94 - 1.21) | 0.317 | 0.03 (-0.03 - 0.09) | 0.318 |
| WSH vs. Handwashing | 1.00 (0.88 - 1.13) | 0.943 | 0.00 (-0.06 - 0.06) | 0.943 |
| WSHN vs. WSH | 0.98 (0.86 - 1.12) | 0.788 | -0.01 (-0.07 - 0.05) | 0.788 |
| WSHN vs. Nutrition | 1.13 (0.99 - 1.28) | 0.061 | 0.05 (0.00 - 0.11) | 0.058 |
| Panting, wheezing or difficulty breathing | | | | |
| WSH vs. Water | 1.08 (0.75 - 1.55) | 0.685 | 0.01 (-0.04 - 0.06) | 0.685 |
| WSH vs. Sanitation | 1.33 (0.92 - 1.93) | 0.124 | 0.03 (-0.01 - 0.08) | 0.119 |
| WSH vs. Handwashing | 1.09 (0.78 - 1.53) | 0.622 | 0.01 (-0.03 - 0.06) | 0.625 |
| WSHN vs. WSH | 0.77 (0.56 - 1.05) | 0.100 | -0.03 (-0.07 - 0.01) | 0.106 |
| WSHN vs. Nutrition | 0.87 (0.62 - 1.22) | 0.426 | -0.01 (-0.05 - 0.02) | 0.424 |
| Fever and ARI | | | | |
| WSH vs. Water | 0.96 (0.80 - 1.16) | 0.702 | -0.01 (-0.06 - 0.04) | 0.702 |
| WSH vs. Sanitation | 1.11 (0.81 - 1.35) | 0.325 | 0.02 (-0.02 - 0.07) | 0.323 |
| WSH vs. Handwashing | 1.01 (0.84 - 1.20) | 0.956 | 0.00 (-0.04 - 0.05) | 0.956 |
| WSHN vs. WSH | 0.96 (0.80 - 1.16) | 0.683 | -0.01 (-0.06 - 0.04) | 0.683 |
| WSHN vs. Nutrition | 1.17 (0.94 - 1.46) | 0.166 | 0.04 (-0.01 - 0.09) | 0.163 |
| Visibly runny nose | | | | |
| WSH vs. Water | 0.98 (0.62 - 1.57) | 0.944 | 0.00 (-0.04 - 0.03) | 0.944 |
| WSH vs. Sanitation | 1.77 (0.97 - 3.22) | 0.064 | 0.03 (0.00 - 0.06) | 0.06 |
| WSH vs. Handwashing | 0.94 (0.58 - 1.52) | 0.803 | 0.00 (-0.04 - 0.03) | 0.803 |
| WSHN vs. WSH | 0.62 (0.38 - 1.02) | 0.060 | -0.03 (-0.06 - 0.00) | 0.071 |
| WSHN vs. Nutrition | 0.59 (0.36 - 0.96) | 0.033 | -0.03 (-0.06 - 0.00) | 0.042 |

*An ARI was defined as caregiver-reported cough or difficulty breathing, including panting and wheezing, within the past seven days prior to the interview

Table S8: Respiratory outcome prevalence ratios by index child status, interventions vs. control

| Subgroup | Index Children | | | Non-index Children | | | Interaction P-value |
|--|----------------|-------|-------------------------|--------------------|-------|-------------------------|------------------------|
| | N | Prev. | Prev. Ratio (95% CI) | N | Prev. | Prev. Ratio (95% CI) | |
| Acute respiratory infection (ARI)* | | | | | | | |
| Control | 4331 | 46.5% | | 438 | 41.1% | | |
| Water | 1395 | 48.7% | 1.03 (0.96 - 1.11) | 150 | 44.0% | 1.04 (0.81 - 1.33) | 0.965 |
| Sanitation | 1383 | 44.9% | 0.97 (0.90 - 1.05) | 163 | 35.6% | 0.84 (0.66 - 1.07) | 0.212 |
| Handwashing | 1357 | 44.6% | 0.97 (0.90 - 1.05) | 139 | 36.0% | 0.87 (0.67 - 1.14) | 0.408 |
| Nutrition | 1329 | 43.1% | 0.92 (0.84 - 1.01) | 143 | 37.8% | 0.87 (0.66 - 1.14) | 0.689 |
| WSH | 1415 | 45.3% | 0.97 (0.90 - 1.05) | 148 | 41.2% | 0.96 (0.77 - 1.19) | 0.875 |
| WSHN | 1473 | 45.8% | 0.97 (0.91 - 1.05) | 184 | 39.7% | 0.94 (0.76 - 1.15) | 0.709 |
| Panting, wheezing or difficulty breathing | | | | | | | |
| Control | 4327 | 13.6% | | 438 | 10.5% | | |
| Water | 1394 | 14.8% | 1.07 (0.90 - 1.28) | 150 | 6.0% | 0.47 (0.23 - 0.97) | 0.031 |
| Sanitation | 1382 | 10.9% | 0.83 (0.69 - 1.00) | 163 | 11.7% | 1.12 (0.64 - 1.95) | 0.292 |
| Handwashing | 1357 | 13.3% | 0.98 (0.84 - 1.14) | 139 | 10.1% | 0.99 (0.54 - 1.83) | 0.952 |
| Nutrition | 1327 | 12.4% | 0.92 (0.75 - 1.13) | 143 | 9.8% | 0.90 (0.50 - 1.60) | 0.930 |
| WSH | 1415 | 13.6% | 1.02 (0.85 - 1.23) | 148 | 9.5% | 0.77 (0.45 - 1.31) | 0.327 |
| WSHN | 1473 | 12.6% | 0.92 (0.76 - 1.11) | 184 | 13.6% | 1.22 (0.81 - 1.85) | 0.155 |
| Fever and ARI | | | | | | | |
| Control | 4326 | 25.6% | | 438 | 16.4% | | |
| Water | 1394 | 27.8% | 1.07 (0.96 - 1.20) | 150 | 20.0% | 1.26 (0.81 - 1.96) | 0.511 |
| Sanitation | 1383 | 25.2% | 0.99 (0.89 - 1.11) | 163 | 16.0% | 0.91 (0.56 - 1.48) | 0.723 |
| Handwashing | 1357 | 24.6% | 0.97 (0.86 - 1.09) | 139 | 14.4% | 0.87 (0.52 - 1.45) | 0.682 |
| Nutrition | 1327 | 23.1% | 0.89 (0.78 - 1.01) | 143 | 14.0% | 0.76 (0.45 - 1.28) | 0.551 |
| WSH | 1415 | 25.1% | 0.97 (0.88 - 1.08) | 148 | 17.6% | 1.05 (0.66 - 1.66) | 0.761 |
| WSHN | 1472 | 25.7% | 0.98 (0.88 - 1.09) | 184 | 20.1% | 1.17 (0.79 - 1.73) | 0.397 |
| Visibly runny nose | | | | | | | |
| Control | 4300 | 6.8% | | 122 | 4.1% | | |
| Water | 1375 | 6.8% | 1.05 (0.81 - 1.36) | 32 | 0.0% | NA | NA |
| Sanitation | 1378 | 6.4% | 1.01 (0.77 - 1.32) | 38 | 0.0% | NA | NA |
| Handwashing | 1358 | 6.8% | 0.93 (0.74 - 1.18) | 39 | 2.6% | 0.68 (0.07 - 6.23) | 0.780 |
| Nutrition | 1315 | 7.1% | 1.09 (0.85 - 1.40) | 31 | 0.0% | NA | NA |
| WSH | 1387 | 6.6% | 1.04 (0.79 - 1.35) | 34 | 5.9% | 2.73 (0.46 - 16.3) | 0.300 |
| WSHN | 1452 | 6.1% | 0.90 (0.66 - 1.22) | 48 | 0.0% | NA | NA |

*An ARI was defined as caregiver-reported cough or difficulty breathing, including panting and wheezing, within the past seven days prior to the interview

Table S9: Respiratory outcome prevalence differences by index child status, interventions vs. control

| Subgroup | Index Children | | | Non-index Children | | | Interaction P-value |
|--|----------------|-------|---------------------------|--------------------|-------|---------------------------|---------------------|
| | N | Prev. | Prev. Difference (95% CI) | N | Prev. | Prev. Difference (95% CI) | |
| Acute respiratory infection (ARI)* | | | | | | | |
| Control | 4331 | 46.5% | | 438 | 41.1% | | |
| Water | 1395 | 48.7% | 0.02 (-0.02 - 0.05) | 150 | 44.0% | 0.01 (-0.09 - 0.12) | 0.991 |
| Sanitation | 1383 | 44.9% | -0.01 (-0.5 - 0.02) | 163 | 35.6% | -0.07 (-0.16 - 0.02) | 0.203 |
| Handwashing | 1357 | 44.6% | -0.01 (-0.05 - 0.02) | 139 | 36.0% | -0.05 (-0.15 - 0.05) | 0.417 |
| Nutrition | 1329 | 43.1% | -0.04 (-0.08 - 0.00) | 143 | 37.8% | -0.06 (-0.16 - 0.05) | 0.733 |
| WSH | 1415 | 45.3% | -0.01 (-0.05 - 0.02) | 148 | 41.2% | -0.02 (-0.11 - 0.07) | 0.897 |
| WSHN | 1473 | 45.8% | -0.01 (-0.05 - 0.02) | 184 | 39.7% | -0.03 (-0.11 - 0.05) | 0.706 |
| Panting, wheezing or difficulty breathing | | | | | | | |
| Control | 4327 | 13.6% | | 438 | 10.5% | | |
| Water | 1394 | 14.8% | 0.01 (-0.02 - 0.04) | 150 | 6.0% | -0.06 (-0.11 - -0.01) | 0.009 |
| Sanitation | 1382 | 10.9% | -0.02 (-0.04 - 0.00) | 163 | 11.7% | 0.01 (-0.05 - 0.08) | 0.276 |
| Handwashing | 1357 | 13.3% | 0.00 (-0.02 - 0.02) | 139 | 10.1% | 0.00 (-0.06 - 0.06) | 0.909 |
| Nutrition | 1327 | 12.4% | -0.01 (-0.04 - 0.02) | 143 | 9.8% | -0.01 (-0.07 - 0.05) | 0.980 |
| WSH | 1415 | 13.6% | 0.00 (-0.02 - 0.03) | 148 | 9.5% | -0.02 (-0.07 - 0.02) | 0.328 |
| WSHN | 1473 | 12.6% | -0.01 (-0.03 - 0.01) | 184 | 13.6% | 0.02 (-0.03 - 0.08) | 0.163 |
| Fever and ARI | | | | | | | |
| Control | 4326 | 25.6% | | 438 | 16.4% | | |
| Water | 1394 | 27.8% | 0.02 (-0.01 - 0.05) | 150 | 20.0% | 0.04 (-0.04 - 0.12) | 0.276 |
| Sanitation | 1383 | 25.2% | 0.0 (-0.03 - 0.03) | 163 | 16.0% | -0.02 (-0.09 - 0.06) | 0.639 |
| Handwashing | 1357 | 24.6% | -0.01 (-0.04 - 0.02) | 139 | 14.4% | -0.02 (-0.09 - 0.05) | 0.756 |
| Nutrition | 1327 | 23.1% | -0.03 (-0.06 - 0.00) | 143 | 14.0% | -0.05 (-0.12 - 0.03) | 0.702 |
| WSH | 1415 | 25.1% | -0.01 (-0.03 - 0.02) | 148 | 17.6% | 0.01 (-0.07 - 0.08) | 0.759 |
| WSHN | 1472 | 25.7% | -0.01 (-0.03 - 0.02) | 184 | 20.1% | 0.03 (-0.05 - 0.10) | 0.421 |
| Visibly runny nose | | | | | | | |
| Control | 4300 | 6.8% | | 122 | 4.1% | | |
| Water | 1375 | 6.8% | 0.0 (-0.01 - 0.02) | 32 | 0.0% | NA | NA |
| Sanitation | 1378 | 6.4% | 0.00 (-0.02 - 0.02) | 38 | 0.0% | NA | NA |
| Handwashing | 1358 | 6.8% | 0.00 (-0.02 - 0.01) | 39 | 2.6% | -0.01 (-0.07 - 0.06) | 0.897 |
| Nutrition | 1315 | 7.1% | 0.01 (-0.01 - 0.02) | 31 | 0.0% | NA | NA |
| WSH | 1387 | 6.6% | 0.00 (-0.02 - 0.02) | 34 | 5.9% | 0.05 (-0.05 - 0.14) | 0.378 |
| WSHN | 1452 | 6.1% | -0.01 (-0.03 - 0.01) | 48 | 0.0% | NA | NA |

*An ARI was defined as caregiver-reported cough or difficulty breathing, including panting and wheezing, within the past seven days prior to the interview

Table S10: Respiratory outcome prevalence differences by child sex, interventions vs. control

| Subgroup | Male | | | Female | | | Interaction P-value |
|--|------|-------|---------------------------|--------|-------|---------------------------|---------------------|
| | N | Prev. | Prev. Difference (95% CI) | N | Prev. | Prev. Difference (95% CI) | |
| Acute respiratory infection (ARI)* | | | | | | | |
| Control | 2254 | 44.8% | | 2487 | 47.4% | | |
| Water | 724 | 51.0% | 0.05 (0.00 - 0.10) | 812 | 46.1% | -0.02 (-0.06 - 0.03) | 0.033 |
| Sanitation | 751 | 42.7% | -0.02 (-0.07 - 0.03) | 783 | 45.5% | -0.02 (-0.07 - 0.03) | 0.907 |
| Handwashing | 736 | 45.2% | 0.00 (-0.04 - 0.05) | 755 | 42.4% | -0.04 (-0.08 - 0.01) | 0.180 |
| Nutrition | 760 | 43.4% | -0.03 (-0.08 - 0.02) | 705 | 42.1% | -0.05 (-0.10 - 0.01) | 0.641 |
| WSH | 742 | 46.1% | 0.01 (-0.03 - 0.06) | 812 | 44.3% | -0.04 (-0.07 - 0.00) | 0.078 |
| WSHN | 799 | 43.2% | -0.03 (-0.08 - 0.02) | 847 | 47.3% | 0.00 (-0.04 - 0.04) | 0.318 |
| Panting, wheezing or difficulty breathing | | | | | | | |
| Control | 2252 | 13.8% | | 2485 | 13.0% | | |
| Water | 724 | 15.5% | 0.01 (-0.03 - 0.04) | 811 | 12.8% | 0.00 (-0.03 - 0.03) | 0.800 |
| Sanitation | 750 | 10.7% | -0.03 (-0.06 - 0.00) | 783 | 11.5% | -0.01 (-0.04 - 0.01) | 0.329 |
| Handwashing | 736 | 13.0% | -0.01 (-0.04 - 0.03) | 755 | 13.0% | 0.00 (-0.03 - 0.02) | 0.850 |
| Nutrition | 760 | 10.4% | -0.04 (-0.07 - -0.01) | 703 | 14.1% | 0.02 (-0.02 - 0.06) | 0.022 |
| WSH | 742 | 14.4% | 0.01 (-0.02 - 0.04) | 812 | 12.2% | -0.01 (-0.04 - 0.02) | 0.394 |
| WSHN | 799 | 12.4% | -0.02 (-0.05 - 0.01) | 847 | 13.1% | 0.00 (-0.03 - 0.04) | 0.290 |
| Fever and ARI | | | | | | | |
| Control | 2252 | 24.2% | | 2484 | 25.5% | | |
| Water | 724 | 28.0% | 0.04 (0.00 - 0.08) | 811 | 26.3% | 0.01 (-0.03 - 0.04) | 0.261 |
| Sanitation | 751 | 23.3% | -0.01 (-0.05 - 0.03) | 783 | 25.5% | 0.00 (-0.04 - 0.03) | 0.794 |
| Handwashing | 736 | 25.8% | 0.01 (-0.03 - 0.06) | 755 | 21.7% | -0.03 (-0.07 - 0.00) | 0.093 |
| Nutrition | 760 | 21.6% | -0.04 (-0.08 - 0.00) | 703 | 23.0% | -0.02 (-0.07 - 0.02) | 0.646 |
| WSH | 742 | 24.9% | 0.01 (-0.03 - 0.05) | 812 | 24.1% | -0.02 (-0.05 - 0.01) | 0.160 |
| WSHN | 799 | 25.5% | 0.01 (-0.03 - 0.04) | 846 | 24.9% | -0.01 (-0.04 - 0.02) | 0.485 |
| Visibly runny nose | | | | | | | |
| Control | 2110 | 6.7% | | 2312 | 6.7% | | |
| Water | 663 | 5.4% | -0.01 (-0.04 - 0.01) | 744 | 7.8% | 0.02 (0.00 - 0.04) | 0.025 |
| Sanitation | 685 | 6.4% | 0.00 (-0.02 - 0.03) | 731 | 6.0% | 0.00 (-0.03 - 0.02) | 0.632 |
| Handwashing | 679 | 6.2% | -0.01 (-0.03 - 0.01) | 718 | 7.1% | 0.00 (-0.03 - 0.02) | 0.752 |
| Nutrition | 712 | 7.0% | 0.01 (-0.01 - 0.03) | 634 | 6.9% | 0.00 (-0.02 - 0.02) | 0.633 |
| WSH | 672 | 5.2% | -0.01 (-0.03 - 0.01) | 748 | 7.8% | 0.02 (-0.01 - 0.04) | 0.028 |
| WSHN | 719 | 5.3% | -0.01 (-0.04 - 0.01) | 781 | 6.4% | 0.00 (-0.03 - 0.02) | 0.349 |

*An ARI was defined as caregiver-reported cough or difficulty breathing, including panting and wheezing, within the past seven days prior to the interview

Table S11: Respiratory outcome prevalence differences by malaria seasonality, interventions vs. control

| Subgroup | Malaria Season | | | Not Malaria Season | | | Interaction P-value |
|--|----------------|-------|---------------------------|--------------------|-------|---------------------------|---------------------|
| | N | Prev. | Prev. Difference (95% CI) | N | Prev. | Prev. Difference (95% CI) | |
| Acute respiratory infection (ARI)* | | | | | | | |
| Control | 1693 | 49.3% | | 3076 | 44.2% | | |
| Water | 521 | 51.2% | 0.02 (-0.04 - 0.07) | 1024 | 46.7% | 0.01 (-0.03 - 0.06) | 0.922 |
| Sanitation | 501 | 46.9% | -0.03 (-0.09 - 0.03) | 1045 | 42.5% | -0.01 (-0.05 - 0.03) | 0.677 |
| Handwashing | 525 | 45.0% | -0.04 (-0.09 - 0.01) | 971 | 43.2% | -0.01 (-0.05 - 0.04) | 0.362 |
| Nutrition | 553 | 44.3% | -0.06 (-0.12 - 0.00) | 919 | 41.6% | -0.03 (-0.07 - 0.02) | 0.382 |
| WSH | 634 | 42.4% | -0.07 (-0.12 - -0.02) | 929 | 46.6% | 0.02 (-0.02 - 0.06) | 0.006 |
| WSHN | 615 | 45.9% | -0.04 (-0.09 - 0.02) | 1042 | 44.6% | 0.00 (-0.04 - 0.04) | 0.298 |
| Panting, wheezing or difficulty breathing | | | | | | | |
| Control | 1691 | 14.7% | | 3074 | 12.5% | | |
| Water | 520 | 15.6% | 0.01 (-0.04 - 0.06) | 1024 | 13.2% | 0.00 (-0.03 - 0.03) | 0.754 |
| Sanitation | 500 | 12.8% | -0.02 (-0.04 - 0.01) | 1045 | 10.1% | -0.02 (-0.05 - 0.01) | 0.835 |
| Handwashing | 525 | 14.9% | 0.00 (-0.03 - 0.03) | 971 | 12.0% | -0.01 (-0.03 - 0.02) | 0.791 |
| Nutrition | 552 | 12.3% | -0.03 (-0.06 - 0.01) | 918 | 12.0% | 0.00 (-0.04 - 0.03) | 0.271 |
| WSH | 634 | 11.5% | -0.03 (-0.07 - 0.00) | 929 | 14.3% | 0.02 (0.00 - 0.05) | 0.012 |
| WSHN | 615 | 14.6% | 0.00 (-0.04 - 0.04) | 1042 | 11.5% | -0.01 (-0.04 - 0.02) | 0.655 |
| Fever and ARI | | | | | | | |
| Control | 1693 | 26.5% | | 3071 | 23.8% | | |
| Water | 521 | 29.9% | 0.04 (-0.01 - 0.09) | 1023 | 25.5% | 0.01 (-0.02 - 0.04) | 0.226 |
| Sanitation | 501 | 25.0% | -0.02 (-0.06 - 0.03) | 1045 | 23.9% | 0.00 (-0.03 - 0.04) | 0.552 |
| Handwashing | 525 | 24.6% | -0.02 (-0.07 - 0.03) | 971 | 23.2% | 0.00 (-0.04 - 0.03) | 0.551 |
| Nutrition | 553 | 23.7% | -0.04 (-0.10 - 0.01) | 917 | 21.3% | -0.02 (-0.06 - 0.01) | 0.556 |
| WSH | 634 | 23.2% | -0.03 (-0.07 - 0.01) | 929 | 25.2% | 0.01 (-0.02 - 0.04) | 0.071 |
| WSHN | 615 | 25.7% | -0.02 (-0.07 - 0.03) | 1041 | 24.8% | 0.00 (-0.03 - 0.04) | 0.473 |
| Visibly runny nose | | | | | | | |
| Control | 1444 | 6.0% | | 2978 | 7.1% | | |
| Water | 437 | 7.6% | 0.02 (-0.01 - 0.05) | 970 | 6.3% | -0.01 (-0.03 - 0.02) | 0.169 |
| Sanitation | 424 | 9.4% | 0.04 (0.00 - 0.08) | 992 | 4.8% | -0.02 (-0.04 - 0.00) | 0.012 |
| Handwashing | 465 | 7.1% | 0.00 (-0.02 - 0.03) | 932 | 6.4% | -0.01 (-0.03 - 0.01) | 0.355 |
| Nutrition | 455 | 8.6% | 0.03 (-0.01 - 0.07) | 891 | 6.2% | -0.01 (-0.03 - 0.01) | 0.104 |
| WSH | 541 | 7.0% | 0.02 (-0.02 - 0.05) | 880 | 6.3% | 0.00 (-0.02 - 0.02) | 0.324 |
| WSHN | 508 | 6.1% | 0.01 (-0.03 - 0.04) | 992 | 5.7% | -0.01 (-0.04 - 0.01) | 0.325 |

*An ARI was defined as caregiver-reported cough or difficulty breathing, including panting and wheezing, within the past seven days prior to the interview

Table S12: Prevalence of breastfeeding indicators

| Outcome, Arm | N | Prev. |
|---|----------|--------------|
| Any breastfeeding in past 24 hours, year one | | |
| Control | 1184 | 78.0% |
| Water | 535 | 80.8% |
| Sanitation | 540 | 76.7% |
| Handwashing | 542 | 81.2% |
| Nutrition | 531 | 76.8% |
| WSH | 582 | 81.3% |
| WSHN | 559 | 78.4% |
| Any breastfeeding in past 24 hours, year two | | |
| Control | 1541 | 28.8% |
| Water | 703 | 31.0% |
| Sanitation | 730 | 27.8% |
| Handwashing | 698 | 31.2% |
| Nutrition | 669 | 31.5% |
| WSH | 693 | 29.7% |
| WSHN | 747 | 31.9% |
| Early initiation of breastfeeding | | |
| Control | 1499 | 52.3% |
| Water | 693 | 51.5% |
| Sanitation | 692 | 53.6% |
| Handwashing | 695 | 48.2% |
| Nutrition | 678 | 78.3% |
| WSH | 729 | 50.2% |
| WSHN | 744 | 76.5% |
| Exclusive breastfeeding for 6 months | | |
| Control | 1495 | 32.4% |
| Water | 691 | 38.8% |
| Sanitation | 688 | 39.7% |
| Handwashing | 694 | 36.3% |
| Nutrition | 676 | 56.1% |
| WSH | 727 | 30.8% |
| WSHN | 742 | 50.5% |

Table S13: Prevalence of breastfeeding indicators, stratified by child sex

| Outcome | Male | | Female | |
|--|-------------|--------------|---------------|--------------|
| | N | Prev. | N | Prev. |
| Any breastfeeding in past 24 hours, year one | 2097 | 81.8% | 2196 | 82.6% |
| Any breastfeeding in past 24 hours, year two | 2604 | 32.7% | 2720 | 32.5% |
| Early initiation of breastfeeding | 2803 | 56.9% | 2927 | 58.7% |
| Exclusive breastfeeding for 6 months | 2793 | 39.7% | 2920 | 39.3% |

Table S14: Unadjusted effects of interventions on prevalence of reported runny nose, intervention vs. control

| Arm | N | Prev. | Prev. Ratio (95% CI) | P-value | Prev. Difference (95% CI) | P-value |
|-------------|----------|--------------|---------------------------------|----------------|--------------------------------------|----------------|
| Control | 4769 | 60.5% | | | | |
| Water | 1545 | 59.9% | 0.99 (0.94 - 1.04) | 0.611 | -0.01 (-0.04 - 0.02) | 0.610 |
| Sanitation | 1546 | 61.9% | 1.04 (0.98 - 1.09) | 0.133 | 0.02 (-0.01 - 0.05) | 0.138 |
| Handwashing | 1497 | 58.3% | 0.98 (0.93 - 1.03) | 0.335 | -0.01 (-0.04 - 0.01) | 0.330 |
| Nutrition | 1472 | 57.1% | 0.94 (0.88 - 1.00) | 0.045 | -0.04 (-0.07 - 0.00) | 0.041 |
| WSH | 1563 | 59.4% | 0.98 (0.93 - 1.04) | 0.576 | -0.01 (-0.04 - 0.02) | 0.574 |
| WSHN | 1658 | 59.3% | 0.98 (0.93 - 1.02) | 0.334 | -0.01 (-0.04 - 0.01) | 0.332 |

Table S15: Reported runny nose prevalence ratios and differences by malaria seasonality interventions vs. control

| Subgroup | Malaria Season | | | | Not Malaria Season | | | | Interaction P-value |
|-----------------|-----------------------|--------------|---------------------------------|--------------------------------------|---------------------------|--------------|---------------------------------|--------------------------------------|--------------------------------|
| | N | Prev. | Prev. Ratio (95% CI) | Prev. Difference (95% CI) | N | Prev. | Prev. Ratio (95% CI) | Prev. Difference (95% CI) | |
| Control | 1693 | 64.3% | | | 3076 | 58.4% | | | |
| Water | 521 | 61.4% | 0.96 (0.90 - 1.02) | -0.03 (-0.07 - 0.01) | 1024 | 59.2% | 1.00 (0.94 - 1.07) | 0.00 (-0.04 - 0.04) | 0.313 |
| Sanitation | 501 | 65.3% | 1.02 (0.93 - 1.12) | 0.01 (-0.05 - 0.08) | 1045 | 60.3% | 1.05 (0.99 - 1.11) | 0.03 (0.00 - 0.06) | 0.654 |
| Handwashing | 526 | 57.4% | 0.91 (0.83 - 0.99) | -0.06 (-0.11 - -0.01) | 971 | 58.8% | 1.02 (0.95 - 1.09) | 0.01 (-0.03 - 0.05) | 0.062 |
| Nutrition | 553 | 58.8% | 0.92 (0.84 - 1.00) | -0.05 (-0.11 - 0.00) | 919 | 56.0% | 0.95 (0.88 - 1.03) | -0.03 (-0.07 - 0.02) | 0.520 |
| WSH | 634 | 59.3% | 0.93 (0.86 - 1.01) | -0.04 (-0.09 - 0.01) | 929 | 59.4% | 1.02 (0.95 - 1.10) | 0.01 (-0.03 - 0.05) | 0.112 |
| WSHN | 615 | 62.1% | 0.96 (0.89 - 1.04) | -0.02 (-0.07 - 0.03) | 1043 | 57.6% | 0.98 (0.92 - 1.05) | -0.01 (-0.05 - 0.03) | 0.718 |

Interaction P-value corresponds to prevalence ratio.

Figure S1: Acute respiratory infections by calendar month

Individual children were measured once at each round of follow-up, but due to the large study size each follow-up measurement spanned approximately one calendar year. Control and intervention clusters were geographically matched, and matched clusters were measured concurrently. All intervention arms had similar prevalence during follow-up (Figure 2) and were combined into a single data series in this figure to have sufficient observations to estimate monthly prevalence. The control data series has a median of 213 observations per month (first quartile (Q1): 193, third quartile (Q3): 267) and the intervention data series has a median of 418 observations per month (Q1: 337, Q3: 507).

