The Impact of School Water, Sanitation, and Hygiene Interventions on the Health of Younger Siblings of Pupils: a Cluster-Randomized Trial in Kenya

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Objectives. We examined the impact of school water, sanitation, and hygiene (WASH) interventions on diarrhea-related outcomes among younger siblings of school-going children.

Methods. We conducted a cluster-randomized trial among 185 schools in Kenya from 2007 to 2009. We assigned schools to 1 of 2 study groups according to water availability. Multilevel logistic regression models, adjusted for baseline measures, assessed differences between intervention and control arms in 1-week period prevalence of diarrhea and 2-week period prevalence of clinic visits among children younger than 5 years with at least 1 sibling attending a program school.

Results. Among water-scarce schools, comprehensive WASH improvements were associated with decreased odds of diarrhea (odds ratio [OR] = 0.44; 95% confidence interval [CI] = 0.27, 0.73) and visiting a clinic (OR = 0.36; 95% CI = 0.19, 0.68), relative to control schools. In our separate study group of schools with greater water availability, school hygiene promotion and water treatment interventions and school sanitation improvements were not associated with differences in diarrhea prevalence between intervention and control schools.

Conclusions. In water-scarce areas, school WASH interventions that include robust water supply improvements can reduce diarrheal diseases among young children. (*Am J Public Health.* 2014;104:e91–e97. doi:10.2105/AJPH.2013.301412)

Diarrhea accounts for 700 000 deaths per year among children younger than 5 years,[1] or 10.5% of total under-5 mortality.[2] These deaths are largely preventable. An estimated 85% of diarrhea mortality is attributed to unsafe drinking water, inadequate sanitation, and substandard hygiene practices.[3] A recent meta-analysis calculated reductions in diarrhea associated with hand-washing promotion, water quality improvements, and improvements in excreta disposal of 48%, 17%, and 36%, respectively.[4] These estimates have been widely adopted in the international health community.[5,6] Although some studies have found limited evidence of health impact associated with water supply improvements,[7] emerging research suggests that relationships between water supply and diarrhea may be mediated by several factors, including collection time and distance to source.[8,9]

Estimates of the health impact of water, sanitation, and hygiene (WASH) interventions on children younger than 5 years are derived from interventions that promote or improve services and practices in domestic environments.[4] The impact of WASH improvements at institutions—such as schools—on child diarrhea remains underexplored. WASH interventions in schools can influence diarrheal outcomes among children younger than 5 years who themselves are not attending school through 2 primary pathways. First, these interventions may result in the diffusion of improved practices and behaviors to domestic environments and the broader community. Studies have documented both the transfer of knowledge about proper hygiene and point-of-use water treatment practices from school-based[10,11] and clinic-based[12] interventions. Second, interventions may interrupt pathogen transmission within the public sphere, reducing transmission to and exposures in domestic environments.[13] Water supply improvements in schools may also serve broader community needs, resulting in changes in both domestic and public settings. The potential for domestic or public WASH improvements to reduce disease burden depends on several factors, including background disease burden and baseline WASH access.[14]

School WASH interventions have been associated with improvements in educational outcomes[11,15,16] and reductions in absence caused by illness[17,18] and diarrhea[19] among school-aged children. Because the majority of the WASH-attributable disease burden involves children younger than 5 years,[20,21] it is important to understand the extent to which school interventions affect younger children. We analyzed data from a cluster-randomized trial in Kenya to quantify the impact of school WASH improvements on parent-reported diarrhea and clinic visits for gastrointestinal symptoms among children younger than 5 years living in households within the catchment areas of study schools.

METHODS

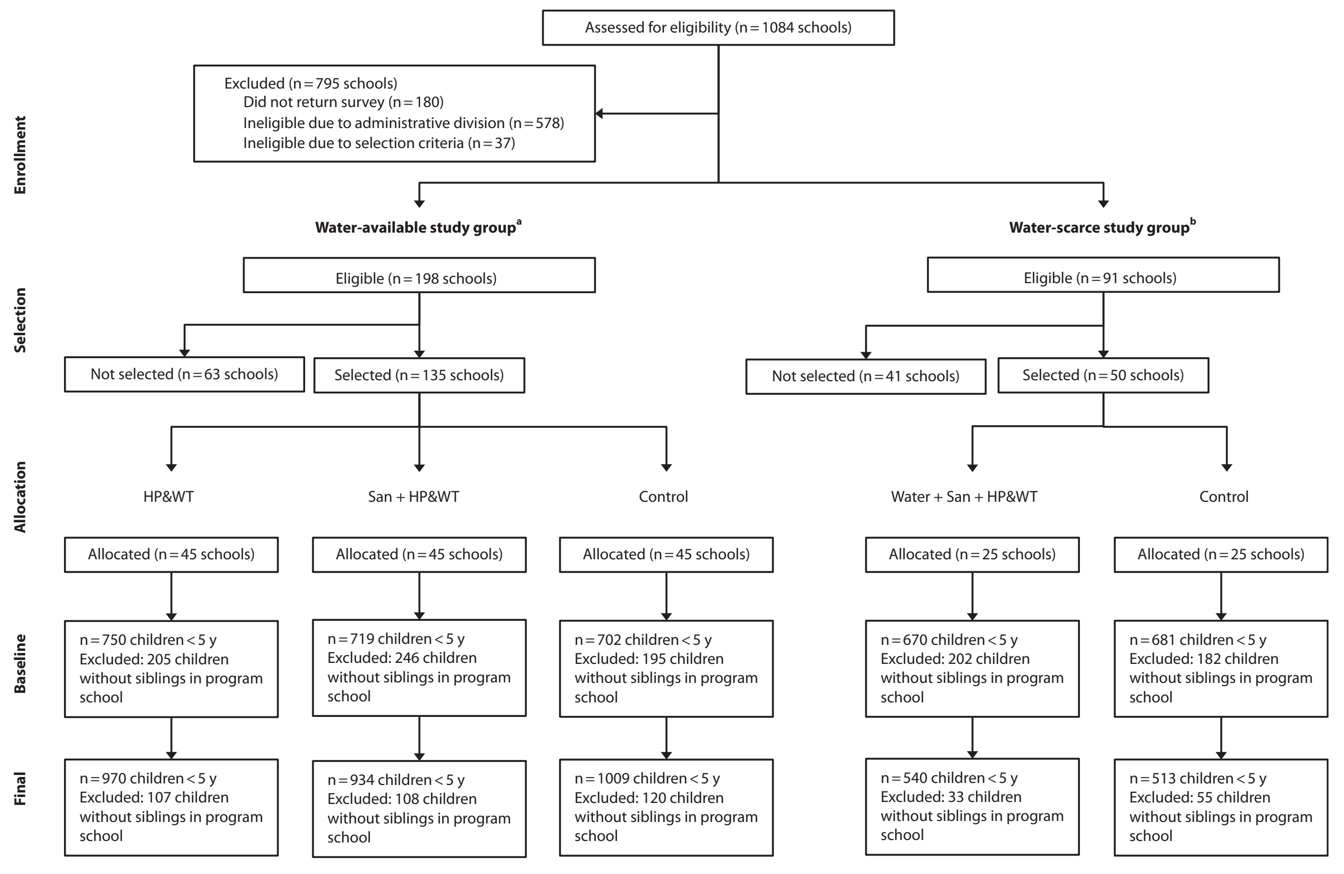
Our study was embedded within a larger trial that assessed the health and educational impacts of WASH improvements carried out in schools in Nyanza Province, Kenya. Following a rapid assessment of school conditions conducted by the Ministry of Education, we divided schools into 2 study groups according to water availability: water-available schools had a dry season water source within 1 kilometer; water-scarce schools had no improved water source within 2 kilometers and no dry season source of any kind within 1 kilometer. We excluded schools that met government-mandated pupil-to-latrine ratios (25 to 1 for girls, 30 to 1 for boys) from the study.[22]

From the 198 schools that met inclusion criteria for the water-available study group, we randomly selected 135 and allocated them to 1 of 3 study arms of 45 schools each: (1) hygiene promotion and water treatment (HP&WT), (2) HP&WT plus additional school latrines (Sanitation + HP&WT), and (3) control. From the 98 schools that met criteria for the water-scarce study group, we randomly selected 50 schools. We randomly allocated 25 to a treatment arm that received water supply improvements in addition to the Sanitation + HP&WT intervention (Water + Sanitation + HP&WT). We allocated the remaining 25 schools to the control arm of the water-scarce study group. We implemented 1 of 2 water supply interventions according to groundwater availability: a machine-dug borehole with a hand pump located either on school property or in an adjacent community with guaranteed access for the school (n = 12) or 60-cubic-meter-capacity rainwater-harvesting (RWH) tanks that primarily served the school population (n = 13). Water supply improvements were intended to serve schools and neighboring communities. Participant selection and randomization occurred in March 2007, and implementation was completed by June 2008 (Figure 1).

Diarrheal disease among children younger than 5 years was a secondary outcome measure for the larger intervention trial, constraining sample size. We used data from the 2003 Kenya Demographic and Health Survey to calculate a baseline 1-week period prevalence of diarrhea of 15% and a design effect of 1.6.[23] At $\alpha = 0.05$ and power of 80%, an average of 20 children in each of 45 clusters per treatment arm in the water-available study group allowed us to detect a 40% difference in diarrhea prevalence between either intervention arm and the control arm. In the water-scarce study group, an average of 20 children in each of 25 clusters per arm allowed us to detect a 54% difference in diarrhea prevalence.

Data Collection

We completed surveys in a systematic sample of households in the catchment area of each participating school at baseline (February–March 2007) and approximately 1 year after interventions had been completed in schools (June–July 2009). We used the catchment area of participating schools, comprising 1 or more



Note. HP&WT = hygiene promotion and water treatment; san = sanitation; water = water supply.
[a]Schools having no water source within 1 kilometer and no improved source within 2 kilometers were classified as water scarce and all others were classified as water available.
[b]Selection was stratified across 3 geographic clusters covering contiguous administrative divisions in 4 districts: Nyando, Kisumu, Rachuonyo, and Suba.

FIGURE 1—Design of study of impact of school sanitation improvements on health of younger siblings of school-going children: Kenya, 2007–2009.

villages, as the cluster in all subsequent analyses. At both baseline and end line, we identified a sampling frame for each cluster from the estimated number of households and surveyed a systematic sample of 25 households. At baseline, we oversampled households in the water-scarce study group to capture a sufficient number of children younger than 5 years. We excluded sampled households without at least 1 child younger than 18 years from data collection.

Enumerators collected data on household demographics, water source availability, and hygiene and water treatment practices. Enumerators directly observed household sanitation facilities, household possessions, and structured hand-washing demonstrations in each household. The primary respondent, typically the female head of household, provided details on all school-aged children, including whether the child was enrolled in the local study school. For each child younger than 5 years, we collected data on age, gender, diarrhea episodes in the past week, clinic visits in the past 2 weeks, and, if applicable, reasons for visiting the clinic, such as diarrhea or vomiting. We used a 1-week recall period for diarrhea events to limit potential recall bias.[24–27] For clinic visits, which are less prone to errors with longer recall periods,[26] we used a 2-week recall to capture sufficient events for analysis.

We collected data on personal digital assistants with Syware Visual CE software (Cambridge, MA) and uploaded them to a Microsoft Access 2007 database (Microsoft Corp, Redmond, WA) weekly.

Analyses

We cleaned data with SAS 9.2 (SAS Institute, Cary, NC) and analyzed them with Stata/IC 11 (StataCorp, College Station, TX). We considered children younger than 5 years with a sibling attending a school participating in the larger cluster-randomized trial the primary population for this analysis. Outcome measures were period prevalence of diarrhea in the week before data collection and of clinic visits for gastrointestinal symptoms (vomiting, diarrhea, or both) in the past 2 weeks. We performed analysis at the level of each child. We developed multilevel logistic regression models with the XTMELOGIT procedure with cluster-specific random intercepts. We modeled intervention impact with a standard difference-in-differences model on the logit scale, which compares changes in treatment and control groups over time through the interaction between intervention group assignment and data collection round.[28]

Because of different school eligibility criteria and separate selection and randomization procedures, we ran models separately for children in the water-scarce and water-available study groups. We used an intention-to-treat approach to analysis in which we analyzed data according to study group and treatment arm assignment.[29] Our first set of models assessed differences in outcomes without adjustment for any potential confounding variables. Our second set of models adjusted for several participant-specific covariates and aggregate cluster-specific characteristics at baseline, which we selected a priori as possible confounders. Child-specific covariates were age, gender, total number of children in the household, maternal education, and household wealth. We analyzed maternal education as a categorical variable corresponding to less than primary education, completion of primary education, and no education information available or mother had died. We estimated household wealth via principal components analysis of a list of household possessions,[30,31] categorized as wealth quintiles.

Aggregate cluster-specific WASH covariates in our analysis were the percentage of households at baseline in each cluster with an observed latrine, detectable chlorine residue in drinking water, a primary water source that was protected from runoff or surface contamination, a less than 30-minute walk to the current primary water source, and a respondent who used soap during a structured hand-washing demonstration. Because these covariates represented possible intermediate impacts of our intervention, we incorporated only baseline values in our analysis. Household WASH characteristics were not available for some baseline records; however, because household WASH covariates were limited to aggregated cluster measures, we retained these records in our analysis and adjusted them by cluster means.

In line with the emergent hypothesis that school-based RWH interventions were fundamentally different than community borehole interventions, we assessed the proportion of children in households that reported using a protected water source for current drinking water and that reported traveling less than 30 minutes to the current drinking water source for each of the 2 water supply intervention types and the control group in the water-scarce study arm. We modeled diarrhea and clinic visits for each intervention type against the control group. Our analysis was below the unit of randomization, however, limiting interpretation.

RESULTS

We collected information on 3523 children younger than 5 years with an older sibling attending a program school in our study at baseline and on 3969 at project end line. At baseline, individual and household characteristics were generally similar across intervention arms in each study group (Table 1).

Water-Available Group

In the water-available study population, baseline 1-week period prevalence of diarrhea was 18% in the HP&WT group, 23% in the Sanitation + HP&WT group, and 22% in the control group (Table 2). At project end line, prevalence of diarrhea declined to 11% in the HP&WT arm, 10% in the Sanitation + HP&WT arm, and 11% in the control arm. Two-week period prevalence of clinic visits for gastrointestinal illness symptoms went from 13% to 7% (baseline to end line) in the HP&WT arm, 12% to 6% in the Sanitation + HP&WT arm, and 12% to 9% in the control arm.

We found no evidence of differences in the odds of diarrhea among children in the HP&WT (adjusted odds ratio [AOR] = 1.21; 95% confidence interval [CI] = 0.81, 1.80) or Sanitation + HP&WT (AOR = 0.76; CI = 0.51, 1.13) arm and children in the control arm. We noted larger and more consistent declines in the 2-week period prevalence of clinic visits for diarrhea or vomiting. In the HP&WT and Sanitation + HP&WT arms, odds of a child visiting a clinic declined by 36% (AOR = 0.64; CI = 0.40, 1.03) and 35% (AOR = 0.65 CI = 0.40, 1.06), respectively; however, these declines were not statistically significant.

TABLE 1—Baseline Characteristics by Intervention Group in Trial of School Sanitation Improvements and Impact on Diarrhea Among Younger Siblings of Pupils: Kenya, 2007

	Water-Available Group			Water-Scarce Group	
Characteristic	HP&WT (n = 750), Mean (SD) or %	San + HP&WT (n = 719), Mean (SD) or %	Control (n = 702), Mean (SD) or %	Water Supply + San + HP&WT (n = 671), Mean (SD) or %	Control (n = 681), Mean (SD) or %
Individual					
Age, mo	27.2 (16.5)	27.4 (16.4)	27.6 (16.0)	28.2 (15.1)	27.2 (15.8)
Male	51	53	53	51	51
Household					
Children in household	4.3 (1.6)	4.1 (1.5)	4.1 (1.5)	4.2 (1.5)	4.2 (1.6)
Mothers with completed primary education	47	41	43	44	47
Lowest wealth quintile	20	27	22	19	20
Has latrine	36	34	35	36	43
Mother used soap during hand-washing demonstration	79	70	71	71	68
Detectable chlorine residual in household stored drinking water	4	5	7	5	4
Using protected water source	60	57	59	60	65
Has water source > 30 min away	17	20	14	27	25

Note. HP&WT = hygiene promotion and water treatment; san = sanitation. Diarrhea outcomes were diarrhea in the past week and clinic visit for diarrhea or vomiting in the past 2 weeks among children younger than 5 years. Water-available schools had a dry season water source within 1 km; water-scarce schools had no improved water source within 2 km and no dry season source of any kind within 1 km. Not all household data were available for all children at baseline.

Water-Scarce Group

In the water-scarce study group, baseline period prevalence of diarrhea was 26% in the intervention and 20% in the control arm (Table 2). At end line, period prevalence of diarrhea declined to 8% in the intervention and 12% in the control arm. The baseline 2-week period prevalence of clinic visits for gastrointestinal symptoms was 14% in the intervention and 10% in the control arm, with marked declines in the intervention arm (to 5%) and only a small decline (to 8%) in the control arm.

We found statistically significant differences in the odds of both recent diarrhea and recent clinic visits between water-scarce intervention and control groups. For a child in the Water + Sanitation + HP&WT treatment arm, we found 56% lower odds of a child having diarrhea than for a child in the control arm (AOR = 0.44; CI = 0.27, 0.72) and a 66% difference in the odds of a clinic visit in the past 2 weeks (AOR = 0.36; CI = 0.19, 0.68).

Water Supply Improvement Types

To assess changes in domestic water access associated with each of the water supply intervention arms, we compared the proportion of children living in households at project end line reporting (1) a travel time to a water source of less than 30 minutes and (2) use of a protected water source. At the end of the study, we found that more households in both the borehole intervention group (52%) and the RWH intervention group (40%) than in the control group (35%) used a protected water source. However, fewer households in the borehole (26%) and RWH (31%) groups than in the control group (35%) were closer than a 30-minute walk to a water source. Changes in measures of domestic water access for either water supply intervention did not differ statistically significantly from the control group in the water-scarce study arm.

Both water supply interventions were associated with statistically significant differences from the control group in the odds of diarrhea (Table 3). Odds of diarrhea were 44% lower (AOR = 0.54; CI = 0.29, 0.99) in the borehole group than in the control arm. In the RWH arm, odds were 65% lower than in the control arm (AOR = 0.35; CI = 0.18, 0.66). Differences from the control arm in the odds of a clinic visit for diarrhea or vomiting in the past 2 weeks were significant for the RWH treatment arm (AOR = 0.25; CI = 0.10, 0.55) but not for the borehole treatment arm (AOR = 0.54; CI = 0.25, 1.18).

We found no evidence of changes in diarrhea or recent clinic visits among children younger than 5 years without a sibling attending a program school in any treatment arm in both study groups (data not shown).

DISCUSSION

Our results suggest that interventions that promote improved hand washing and water treatment in schools, improve the quantity of available latrines, and improve the availability of safe drinking water at school can result in measureable improvements in diarrheal diseases among children younger than 5 years whose siblings attend intervention schools. By contrast, interventions that only improve hygiene and water treatment interventions at the school and the quantity of sanitation facilities may not.

Our findings are consistent with other results from this trial. Freeman et al. found a 66% reduction in the period prevalence of diarrhea among pupils in the Water + Sanitation + HP&WT schools relative to control participants, but sanitation and hygiene interventions alone had no measureable effect on pupil-reported diarrhea.[19] Greene et al. reported that pupils in HP&WT schools were as likely as

TABLE 2—Diarrhea Outcomes Among Younger Siblings of Pupils at Water-Available or Water-Scarce Sanitation Intervention Schools: Kenya, 2007–2009

	Baseline, No. (%)	End Line, No. (%)	Difference, %	OR (95% CI)	AOR[a] (95% CI)	ICC
		Water-available study group[b]				
Diarrhea in past wk						0.0701
HP&WT group	138 (18)	104 (11)	−8	1.23 (0.82, 1.83)	1.21 (0.81, 1.80)	
Sanitation + HP&WT group	165 (23)	90 (10)	−13	0.77 (0.51, 1.14)	0.76 (0.51, 1.13)	
Control group	153 (22)	109 (11)	−11	1.00 (Ref)	1.00 (Ref)	
Clinic visit for diarrhea or vomiting in past 2 wk						0.0737
HP&WT group	97 (13)	62 (6)	−7	0.65 (0.41, 1.04)	0.64 (0.40, 1.03)	
Sanitation + HP&WT group	83 (12)	57 (6)	−6	0.64 (0.39, 1.05)	0.65 (0.40, 1.06)	
Control group	81 (12)	85 (9)	−3	1.00 (Ref)	1.00 (Ref)	
		Water-scarce study group[c]				
Diarrhea in past wk						0.0415
Water + Sanitation + HP&WT group	177 (26)	44 (8)	−18	0.45 (0.27, 0.73)	0.44 (0.27, 0.72)	
Control group	135 (20)	61 (12)	−8	1.00 (Ref)	1.00 (Ref)	
Clinic visit for diarrhea or vomiting in past 2 wk						0.0626
Water + Sanitation + HP&WT group	91 (14)	42 (5)	−9	0.36 (0.19, 0.68)	0.36 (0.19, 0.68)	
Control group	67 (10)	24 (8)	−1	1.00 (Ref)	1.00 (Ref)	

Note. AOR = adjusted odds ratio; CI = confidence interval; ICC = intraclass correlation coefficient; HP&WT = hygiene promotion and water treatment; water = water supply. Siblings were younger than 5 years. Water-available schools had a dry season water source within 1 km; water-scarce schools had no improved water source within 2 km and no dry season source of any kind within 1 km.
[a]Adjusted for age, gender, maternal education, household size, wealth quintile and baseline cluster-specific proportion of households with detectable chlorine residuals, soap used during hand-washing demonstration, water source greater than 30-min round trip, water source protected, and latrine observed on compound.
[b]Baseline was n = 2171; end line, n = 2910.
[c]Baseline was n = 1351; end line, n = 1053.

pupils in control schools to have detectable *Escherichia coli* bacteria on hands, and risk of contaminated hands was more than twice as high among girls in the Sanitation + HP&WT group as among girls in control schools, suggesting that our HP&WT and Sanitation + HP&WT interventions may have done little to reduce the presence, and potentially the transmission, of enteric pathogens in study schools and subsequently in homes.[32]

Studies suggest that the combined effect of multiple WASH interventions is no greater than the effect of the individual components.[7,33] Water supply improvements in the water-scarce study group may have been a necessary precursor for improved hygiene practices at both school and home; thus the large measured reduction in diarrhea may have resulted from a cumulative effect among intervention components. Studies have documented reduced impact of hygiene and handwashing improvements when water availability or water consumption is low.[29,34,35] Water supply improvements, which can result in improvements in both water quality and water quantity, may have had an independent effect on health outcomes.[7,8] Because we used water scarcity criteria to define separate study arms, each with a unique control group, direct comparisons between study groups should be made with caution.

TABLE 3—Logistic Regression Models of Diarrhea Outcomes Among Younger Siblings of Pupils Attending Water-Scarce Intervention and Control Schools: Kenya, 2007–2009

Variable	OR (95% CI)	AOR[a] (95% CI)	ICC
Diarrhea in past wk			0.0401
Borehole intervention	0.55 (0.31, 0.99)	0.54 (0.29, 0.99)	
RWH intervention	0.35 (0.19, 0.66)	0.35 (0.18, 0.66)	
Clinic visit for diarrhea or vomiting in past 2 wk			0.0626
Borehole intervention	0.49 (0.23, 1.02)	0.54 (0.25, 1.18)	
RWH intervention	0.26 (0.12, 0.59)	0.25 (0.10, 0.54)	

Note. AOR = adjusted odds ratio; CI = confidence interval; ICC = intraclass correlation coefficient; OR = odds ratio; RWH = rainwater harvesting. Scarce-water intervention schools received guaranteed access to machine-dug boreholes as part of the water supply intervention or 60-cubic-meter-capacity RWH tanks that primarily served the school population.
[a]Adjusted for age, gender, maternal education, household size, wealth quintile and baseline cluster-specific proportion of households with: detectable chlorine residuals, soap used during handwashing demonstration, water source greater than 30 min round trip, water source protected, latrine observed on compound.

Water supply interventions were intended to provide a source of improved water to all members of the community, not just pupils or their households. Reductions in diarrhea among the Water + Sanitation + HP&WT group may, in fact, have reflected improvements in water quantity and water quality in the domestic setting alone, independent of school improvements. We found a larger proportion of households associated with schools where boreholes were implemented than of control households with access to an improved water source at end line. However, the proportion of households reporting a travel time to the current water source greater than 30 minutes also increased. Greater time or distance to a water source is associated with increased water contamination and risk of diarrhea.[8,9,36] Improvements in domestic water access associated with borehole interventions were also far from universal. At end line, almost half of children in our borehole treatment arm lived in households that were using unimproved water sources. Domestic water access in the RHW treatment group was similar to that of control groups. Improvements in water access among the RWH schools were primarily limited to the school.

Our data also provide evidence on the potential mechanisms through which school interventions may affect diarrheal outcomes among children younger than 5 years: either diffusion of practices to the domestic environment or improvements in the school environment itself. Community behavior change components in the larger school program were minimal: community mobilization regarding the management and operation of new water points and suggestions to teachers during training that they encourage children to share WASH knowledge and messages with their families. The extent of household behavior change and adoption of improved hygiene, sanitation, and water treatment practices associated with our intervention was very limited.[37]

Our 2 water supply improvements may have benefited different populations, with borehole interventions benefiting both the domestic and school environments and the RWH interventions primarily benefiting the school. That our RWH intervention, which provided only minimal improvements in domestic water access, resulted in the largest and most robust reductions in diarrhea at home suggests that improvements in water quantity or quality in the school environment may have accounted for a large portion of disease reduction in our study. Results from our additional analysis of water supply intervention types must be interpreted with caution. We also found no difference in health outcomes among children younger than 5 years without a sibling attending a program school, suggesting that any measureable improvements in health outcomes in our study were attributable to changes at the school itself.

Limitations

It was not possible to blind community members to the intervention status of their local schools. This, combined with our subjective self-reported diarrhea and clinic visit outcomes, has been shown to lead to overestimation of intervention effects.[38] The level of blinding across study populations and within study groups may have varied according to the extent to which programs provided visible infrastructure improvements in schools or expanded services to associated communities. Machine-dug boreholes serving both the community and the school were likely the most visible intervention component, contributing to the large reductions in reported diarrhea among this group. However, RWH interventions, which were limited to school grounds, were no more visible to community members than were other school infrastructure improvements, and this intervention was associated with significant health gains, whereas sanitation improvements were not. The effect of recall bias was minimized by the selection of a 1-week recall period for diarrhea and a 2-week recall for clinic visits.[24]

We found intervention compliance to be low in some schools, which may have reduced impact.[13] Our classification of schools into water scarce and water available was limited to governmental recommendations and may have resulted in misallocation of schools and communities into inappropriate study groups. Therefore, direct comparisons of impacts between study populations should be made with caution.

Conclusions

Our results provide evidence that school WASH interventions may reduce diarrhea and gastrointestinal-related clinic visits among children younger than 5 years. Most school WASH interventions focus on effects among school-aged children; ours was the first study to assess the impact on those most vulnerable to diarrhea-related morbidity and mortality: children younger than 5 years. Our data suggest that impact is limited to specific circumstances, and the potential influence of reporting bias should be considered. The strongest reductions in diarrhea and clinic visits were found in clusters in which the water supply was improved in addition to school sanitation, hygiene promotion, and water treatment improvements.

Our study adds to the growing body of literature highlighting the importance of water supply improvements—in both schools and communities—either as an individual factor or as a means of achieving the full benefit of other WASH interventions. School interventions may serve as important barriers to public transmission of diarrheal disease pathogens among school-aged children, resulting in reduced health burden among their siblings. Understanding the impact of school WASH interventions on both school-going children and children younger than 5 years will inform cost–benefit analyses and policy considerations for school interventions. ■

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Contributors

R. Dreibelbis, M. C. Freeman, and R. Rheingans designed the study. R. Dreibelbis led data analysis and interpretation and wrote the article. M. C. Freeman, L. E. Greene, and S. Saboori managed data collection and study implementation and provided comments on the article. M. C. Freeman supported data analysis and interpretation and edited the final article. R. Rheingans was principal investigator of the study and provided comments on the article.

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Human Participant Protection

Ethical approval was provided by the institutional review board of Emory University and the ethical review committee of the Great Lakes University of Kisumu. Written authorization for the study was provided by the Kenyan ministries of Health, Education, and Water.

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