Impact of community health clubs on child diarrhea, nutritional status, and water quality in western Rwanda

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Methods

Methods: Variables

- Predictor: Intervention status of the village

- Main and secondary outcomes:
  - Caregiver-reported diarrhea among children under 5 in the past 7 days
  - Height/length-for-age z-score (HAZ/LAZ)
  - Weight-for-height/length z-score (WHZ/WLZ)
  - Colony forming units (CFU) of thermotolerant (fecal) coliforms (TTC) per 100mL water

Variables

- Intermediate outcomes:
  - WASH: improved drinking water source; household water treatment; improved sanitation facility; sanitary disposal of children's feces; structure of sanitation facility (presence of floor, walls, and a roof); presence of human and/or animal feces in the household courtyard; presence of a handwashing station with soap and water
  - Nutrition and food security: exclusive breastfeeding for children <6 months; minimum dietary diversity for children 6-23 months (≥4 of 7 food groups in previous day); household food security (Household Hunger Scale)
- Attendance at community health club sessions
  - Classic arm *only*: household-level self-reported attendance at any (≥1) or all (20) sessions

Statistical analysis

- Intention to treat analysis
  - Diarrhea: log-binomial regression with a log link function and generalized estimating equations (GEE); coefficients exponentiated to obtain prevalence ratios (PRs)
  - All other dichotomous outcomes: binomial regression with an identity link function and GEE to obtain risk differences (RDs)
  - Ordinal outcome (household food security): ordinal logistic regression; coefficients exponentiated to obtain odds ratios
  - Continuous outcomes (HAZ/LAZ, WHZ/WLZ, and TTC): linear regression with GEE
  - No adjustments for baseline values *except* for HAZ and WHZ in children who were measured at baseline

Statistical analysis

- Per-protocol analysis ("as-treated" or "treatment on the treated"):
  - Classic arm only, defining compliance at *household* level according to *self-reported* attendance of any household members at any (≥1) or all (20) sessions
  - Only done for variables for which we have baseline data
  - Adjusted for baseline values of outcome variables to reduce bias

Results

Descriptive statistics

- Main and secondary outcomes at baseline, by study arm
- Results are from 8,734 households

Background characteristic	Control		Lite		Classic	
	n	Percent	n	Percent	n	Percent
Diarrhea in previous 7 days (children <5)	4,307	8.7	3,954	8.8	4,312	8.8
LAZ (children <2) (mean (SD))	1,615	-1.47 (1.41)	1,421	-1.53 (1.36)	1,550	-1.49 (1.43)
WLZ (children <2) (mean (SD))	1,619	0.28 (1.12)	1,422	0.23 (1.14)	1,557	0.30 (1.14)
TTC/100ml water (mean (SD))	426	126.1 (216.7)	431	136.2 (230.1)	448	156.9 (258.1)

Sinharoy SS, Schmidt WP, Cox K, Clemence Z, Mfura L, et al. Child diarrhea and nutritional status in rural Rwanda: a cross-sectional study to explore contributing environmental and demographic factors. Tropical medicine & international health: 2016;21(8):956-64.

Descriptive statistics

- Selected intermediate outcomes at baseline, by study arm

	Control		Lite		Classic	
	n	Percent	n	Percent	n	Percent
Source of drinking water						
Improved	2,989	75.0	2,808	71.5	3,051	74.6
Reported adequate treatment of drinking water						
Yes	2,948	31.6	2,760	31.5	2,988	32.0
Observed handwashing station with soap and water						
Yes	2,948	1.6	2,760	1.0	2,988	1.0
Sanitation facility						
Improved	2,948	66.2	2,760	67.7	2,989	67.9
Sanitation facility structure						
Has floor + walls + roof	2,911	5.1	2,733	6.7	2,939	6.7

Descriptive statistics

- Main and secondary outcomes at endline, by study arm
- Re-enrolled 7,934 of 8,734 (91%) households

Background characteristic	Control		Lite		Classic	
	n	Percent	n	Percent	n	Percent
Children <5						
Diarrhea in previous 7 days	3,616	14.2	3,196	14.2	3,464	14.3
HAZ/LAZ (mean (SD)	3,318	-1.74 (1.18)	2,962	-1.77 (1.20)	3,190	-1.75 (1.22)
WHZ/WLZ (mean (SD)	3,282	0.077 (0.98)	2,927	0.075 (0.98)	3,134	0.051 (1.00)
Household						
TTC/100ml water (mean (SD))	2,388	139.5 (230.5)	2,291	155.6 (243.9)	2,460	161.3 (247.3)

Descriptive statistics

- Selected intermediate outcomes at endline, by study arm

	Control		Lite		Classic	
	n	Percent	n	Percent	n	Percent
Source of drinking water						
Improved	2,723	78.4	2,474	73.4	2,720	81.8
Reported adequate treatment of drinking water						
Yes	2,720	40.6	2,469	45.5	2,719	48.8
Observed handwashing station with soap and water						
Yes	2,723	1.8	2,473	1.1	2,720	1.5
Sanitation facility						
Improved	2,723	29.6	2,474	29.6	2,720	37.1
Sanitation facility structure						
Has floor + walls + roof	2,638	26.4	2,417	25.7	2,619	32.4

Descriptive statistics

- Selected intermediate outcomes at endline, by study arm

	Control		Lite		Classic	
	n	Percent	n	Percent	n	Percent
Exclusive breastfeeding (<6 mos.)	311	77.5	283	77.0	302	76.5
Min. dietary diversity (6-23 mos.)	930	36.2	844	37.9	909	38.8
Household hunger (ref: Little to none)	2,723		2,473		2,720	
Moderate		37.5		39.1		40.3
Severe		8.3		6.3		9.0

Intention to treat analysis

Main outcomes		Effect size: Lite compared to Control			Effect size: Classic compared to Control		
	n	Estimate	95% CI	P value	Estimate	95% CI	P value
Children <5							
Diarrhea	10,276	0.97	(0.81, 1.16)	0.74	0.99	(0.85, 1.15)	0.87
Height-for-age z-score	9,473	-0.0048	(-0.16, 0.15)	0.95	-0.019	(-0.16, 0.12)	0.79
Weight-for-height z-score	9,346	-0.016	(-0.095, 0.062)	0.68	-0.013	(-0.091, 0.065)	0.75
Children <2 years							
Diarrhea	3,492	1.07	(0.86, 1.32)	0.57	1.08	(0.89, 1.32)	0.42
Length-for-age z-score	3,178	-0.036	(-0.18, 0.11)	0.63	-0.077	(-0.23, 0.075)	0.32
Weight-for-length z-score	3,073	-0.0096	(-0.12, 0.10)	0.87	-0.069	(-0.18, 0.045)	0.23
Household							
TTC/100ml water	1,082	23.47	(-18.19, 65.14)	0.27	11.93	(-30.51, 54.38)	0.58

Intention to treat analysis

Intermediate outcomes		Effect size: Lite compared to Control			Effect size: Classic compared to Control		
Household level: WASH	n	Estimate	95% CI	P value	Estimate	95% CI	P value
Improved drinking water source	7,917	-0.057	(-0.16, 0.046)	0.28	0.028	(-0.066, 0.12)	0.56
Reported adequate water treatme	7,908	0.048	(-0.0086, 0.11)	0.10	0.086	(0.029, 0.14)	0.003
Improved sanitation facility	7,917	0.0054	(0.054, 0.065)	0.86	0.085	(0.015, 0.16)	0.017
Structurally complete sanitation facility	7,675	-0.0046	(-0.060, 0.051)	0.87	0.065	(0.0013, 0.13)	0.046
Feces visible in courtyard	7,916	0.014	(-0.0080, 0.036)	0.21	0.00077	(-0.020, 0.021)	0.94
Observed handwashing station with soap + water	7,916	-0.0049	(-0.020, 0.011)	0.53	-0.0021	(-0.016, 0.012)	0.77
Sanitary disposal of child feces	5,142	0.0094	(-0.036, 0.055)	0.69	-0.012	(-0.056, 0.033)	0.61

Intention to treat analysis

Intermediate outcomes		Effect size: Lite compared to Control			Effect size: Classic compared to Control		
Household level: Food security	n	Estimate	95% CI	P value	Estimate	95% CI	P value
Household hunger	7,920	0.95	(0.75, 1.22)	0.70	1.15	(0.88, 1.49)	0.31
Child level: Nutrition							
Exclusive breastfeeding (<6 mos.)	896	-0.0027	(-0.074, 0.069)	0.94	-0.00047	(-0.081, 0.080)	0.99
Minimum dietary diversity (6-23 mos.)	2,683	0.024	(-0.032, 0.080)	0.40	0.025	(-0.035, 0.085)	0.41

Intention to treat analysis

- No association between the microbiological indicator of water quality and adequate water treatment (β= -19.3; 95% CI: -51.0-12.4)
  - This indicates that people who report adequate water treatment methods do not have better water quality than people who report inadequate water treatment methods.

Per-protocol analysis: Classic arm only

Main outcomes	Effect size: Attended ≥1 session compared to control				Effect size: Attended all 20 sessions compared to control			
	n	Estimate	95% CI	P value	n	Estimate	95% CI	P value
Children <5 years								
Diarrhea	5,864	0.99	(0.85, 1.16)	0.93	4,044	0.96	(0.77, 1.20)	0.75
Height-for-age z-score	5,388	-0.050	(-0.19, 0.093)	0.50	3,709	-0.13	(-0.31, 0.039)	0.13
Weight-for-height z-score	5,318	-0.034	(-0.12, 0.055)	0.45	3,668	-0.024	(-0.17, 0.12)	0.74
Children <2 year								
Diarrhea	1,980	1.08	(0.87, 1.34)	0.50	1,349	1.15	(0.78, 1.68)	0.49
Length-for-age z-score	1,806	-0.073	(-0.25, 0.10)	0.41	1,221	-0.18	(-0.42, 0.056)	0.13
Weight-for-length z-score	1,745	-0.093	(-0.23, 0.042)	0.18	1,187	-0.13	(-0.39, 0.13)	0.34
Household								
TTC/100mL water	599	6.99	(-40.57, 54.54)	0.77	415	21.70	(-48.72, 92.12)	0.55

Per-protocol analysis: Classic arm only

Intermediate outcomes	Effect size: Attended ≥1 session compared to control				Effect size: Attended all 20 sessions compared to control			
Household level: WASH	n	Estimate	95% CI	P value	n	Estimate	95% CI	P value
Improved drinking water source	4,406	0.043	(-0.026, 0.11)	0.22	3,020	0.054	(-0.018, 0.13)	0.14
Adequate water treatment	4,402	0.12	(0.061, 0.18)	<0.001	3,017	0.20	(0.12, 0.28)	<0.001
Improved sanitation facility	4,406	0.089	(0.021, 0.16)	0.01	3,020	0.14	(0.053, 0.22)	0.001
Structurally complete sanitation facility	4,208	0.062	(0.0057, 0.12)	0.03	2,895	0.075	(0.0014, 0.15)	0.046
Observed handwashing station with soap + water	4,405	-0.0005	(-0.014, 0.013)	0.94	3,020	0.013	(-0.012, 0.039)	0.30
Sanitary disposal of child feces	2,903	0.004	(-0.042, 0.051)	0.85	1,997	0.040	(-0.026, 0.11)	0.24

Discussion

Summary of findings

- No impact on any main or secondary health outcomes

- Positive impacts in <u>classic</u> intervention arm on three intermediate outcomes: reported adequate household water treatment, improved sanitation facility, and structure of sanitation facility

Limitations

- Potential bias in self-reported data for key variables including attendance at community health club sessions, treatment of drinking water, and diarrhea.

- Limitations of per-protocol analysis include that it is prone to bias and that compliance is not easily defined.

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Questions