

Supporting Information for

Community-level sanitation coverage is more strongly associated with child growth and household drinking water quality than access to a private toilet in rural Mali

Authors

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METHODS

Asset index. The following assets were recorded during the household survey: radio, television, DVD player, oil lamp, gas lamp, bed, mattress, carpet, flashlight, table, chair, stove, closet, mosquito net, spade, reaper, wheelbarrow, sickle, hoe, pick axe, fishing net, bicycle, and motorcycle. With the assets owned, we created an asset index by summing the total number of assets owned and standardizing to between 0 and 1 to represent wealth.

Source water quality. To assess the relationship between community sanitation coverage, indicated by household latrines and reported open defecation practices, and source water quality, we used linear multivariate regression with *E. coli* and total coliform concentrations as the dependent variables. Source water quality regression models also controlled for the type of water source—surface water, shallow unprotected well, shallow protected well, borewell, or piped water.

RESULTS

Child health. In a first-order linear regression without interaction terms, we found that increased latrine coverage within 200-meters was significantly and positively associated with child height-for-age z-scores and significantly and negatively associated with prevalence of child stunting and underweight conditions. A change from 0% to 100% community-latrine coverage was associated with a 0.28 (p-value=0.024) standard deviation increase in height-for-age z-scores, a 21% (p-value=0.057) decrease in stunting prevalence, and a 28% (p-value=0.024) decrease in underweight prevalence (regression coefficients shown in Table S3 and S4). Latrine ownership at the child's household was significantly associated with underweight prevalence and diarrhea prevalence; a change from no latrine to owning a latrine at the household level was marginally associated with an 8.2% (p-value=0.067) reduction in underweight prevalence and significantly associated with a 13.8% (p-value=0.047) reduction in diarrhea prevalence. Diarrhea prevalence did not have a statistically significant association with latrine coverage in a 200-meter radius.

Using a first-order linear regression, we found an increase in open defecation practices surrounding a household from 0% to 100% was marginally associated with a 0.19 decrease in weight-for-height z-score (p=0.053) but was not significantly associated with height-for-age or weight-for-age z-scores (Table S5). An increase in open defecation practices surrounding a household from 0% to 100% was associated with a 29% increased prevalence of underweight children (p=0.021) but was not associated with the prevalence of stunting, wasting, or diarrhea. Open defecation at the household level did not have a statistically significant association with any child growth outcomes or diarrhea prevalence.

Stored drinking water quality. In a first-order linear regression without interaction terms, a change in latrine coverage within a 200-meters-radius of the household from 0% to 100% was not significantly associated with a reduction in *E. coli* or total coliform concentrations (Table S7). We found an increase in open defecation practices surrounding a household from 0% to 100% was significantly associated with a 0.037 (p-value=0.042) log increase in *E. coli* concentration in stored drinking water and marginally associated with a 0.011 (p-value=0.068) log increase in total coliform concentration in stored drinking water (Table S8). Reported open defecation at the household level was associated with a 0.127 (p-value=0.089) log increase in *E. coli* concentration; there was not a significant association between

household open defecation and total coliform concentration (Table S7). Including a second-order latrine coverage term in the infrastructure model marginally increased the significance of the association between community-latrine coverage and *E. coli* concentration but did not change the association with total coliform concentration (Table S6).

Source water quality. Source water samples were collected from 2 surface waters, 249 unprotected wells, 41 protected wells, 86 borewells, and 5 piped water system taps (Table 1). Source water samples had a geometric mean of 191 MPN *E. coli* per 100 ml sample and 764 MPN of total coliform per 100 ml sample. When excluding piped water, borewells, and protected wells from the sample, the geometric mean was 876 MPN *E. coli* per 100 ml sample and 2,273 MPN total coliform per sample. Water sources had an average of 57 percent latrine coverage (SD = 30.8 percent) within a 200-meters radius. Unimproved sources were 15 percent more likely to have the closest study household practicing open defecation ($p = 0.012$). We were unable to detect any significant relationships between latrine coverage or prevalence of open-defecation within 200-meters and source water quality as indicated by *E. coli* concentrations. The linear regression results are provided in Table S9.

DISCUSSION

Source water quality. We did not identify significant correlations with sanitation infrastructure or self-reported open defecation rates and source water quality as indicated by *E. coli* concentrations. While we observed statistically significant relationships between total coliform concentrations and both latrine coverage and open defecation rates, the association decreased in magnitude and was no longer significant when excluding improved water source types—borewell and piped water. While this association is interesting, it was not supported by both water quality indicators and was limited by a number of factors. Notably, the source water quality models may have been limited in the ability to detect water source contamination pathways due to the limited sample size and data collection at a single-time point. Both the infrastructure and behavior models were most strongly influenced by source water type, which was expected.

Tables

Table S1: A comparison of mean open defecation rates between sanitation access levels.

Reported Mainly Practicing Open Defecation	Own latrine, private (Reference)		Neighbor's latrine, share		Own latrine, share		Neighbor to Own Private Comparison	Own, share to own, private Comparison
Demographic group	Mean (SD)	N	Mean (SD)	N	Mean (SD)	N	Difference (95% CI)	Difference (95% CI)
Child (<5 years)	0.871 (0.335)	1232	0.935 (0.246)	2299	0.905 (0.293)	1394	0.064 (0.047,0.081)	0.034 (0.015,0.053)
Girl (5-15 years)	0.248 (0.432)	1000	0.542 (0.498)	1556	0.304 (0.46)	1132	0.294 (0.261,0.328)	0.056 (0.02,0.092)
Boy (5-15 years)	0.252 (0.434)	1049	0.534 (0.499)	1560	0.297 (0.457)	1137	0.282 (0.25,0.315)	0.046 (0.011,0.081)
Elderly (>65 years)	0.024 (0.153)	710	0.053 (0.224)	716	0.006 (0.08)	772	0.029 (0.005,0.054)	-0.017 (-0.042,0.007)
Adult male	0.01 (0.100)	1182	0.058 (0.233)	2274	0.011 (0.103)	1396	0.047 (0.034,0.06)	0.001 (-0.014,0.015)
Adult female	0.011 (0.103)	1205	0.05 (0.218)	2321	0.01 (0.102)	1430	0.039 (0.026,0.052)	0.000 (-0.014,0.014)
Individual (>=5 years)	0.329 (0.47)	1256	0.531 (0.499)	2369	0.366 (0.482)	1463	0.202 (0.173,0.23)	0.038 (0.006,0.069)

Table S2: Correlations between the main reported open defecation practices for different age groups and genders within study households.

Open Defecation	Non-child	child, <5 years	girl, 5-15 years	boy, 5-15 years	man	woman	Elder, >65 years
Non-child	1						
child, <5 years	0.25	1					
girl, 5-15 years	0.88	0.24	1				
boy, 5-15 years	0.87	0.24	0.81	1			
man	0.61	0.16	0.58	0.61	1		
woman	0.61	0.16	0.58	0.61	0.98	1	
Elder, >65 years	0.55	0.16	0.58	0.58	0.87	0.86	1

Table S3: Continuous child growth outcomes regression results.

Variable ^a	Height-for-age z-score ^b		Weight-for-age z-score		Weight-for-height z-score	
Own latrine	0.036 (0.053) ^d	0.087 (0.121)	0.067 (0.043)	-0.120 (0.202)	0.023 (0.043)	-0.038 (0.190)
% latrine coverage ^c	0.275** (0.122)	0.307** (0.148)	0.177 (0.109)	1.034** (0.365)	0.092 (0.103)	0.904** (0.367)
% latrine X ^f own latrine		-0.096 (0.218)		0.622 (0.735)		0.175 (0.702)
(% latrine coverage) ²				-0.853** (0.345)		-0.794** (0.339)
(% latrine) ² X own latrine				-0.490 (0.619)		-0.147 (0.604)
# households	-0.001 (0.002)	-0.002 (0.001)	-0.001 (0.001)	-0.002 (0.001)	0.001 (0.001)	0.000 (0.001)
Asset ownership	-0.144 (0.195)	-0.142 (0.195)	-0.081 (0.182)	-0.058 (0.181)	0.052 (0.167)	0.071 (0.167)
Read and write	0.111** (0.051)	0.111** (0.051)	0.059 (0.049)	0.060 (0.049)	0.035 (0.046)	0.036 (0.046)
Improved water source	0.015 (0.059)	0.015 (0.059)	0.012 (0.043)	0.012 (0.042)	-0.079* (0.045)	-0.078* (0.044)
Child age, months	-0.020*** (0.001)	-0.020*** (0.001)	-0.002 (0.001)	-0.002 (0.001)	0.0162*** (0.001)	0.016*** (0.001)
Child gender, male	-0.176*** (0.037)	-0.177*** (0.038)	-0.025 (0.036)	-0.026 (0.036)	0.025 (0.043)	0.023 (0.043)
Average literacy, village	-0.323 (0.266)	-0.323 (0.265)	-0.032 (0.196)	-0.041 (0.198)	0.421** (0.187)	0.416** (0.182)
Average wealth, village	0.822 (0.700)	0.764 (0.698)	1.091** (0.488)	0.425 (0.516)	1.004** (0.498)	0.378 (0.536)
Constant	-0.901*** (0.281)	-0.886*** (0.279)	-1.75*** (0.179)	-1.56*** (0.183)	-2.01*** (0.206)	-1.83*** (0.206)
N	5947	5947	5953	5953	5757	5757

* p<0.10, ** p<0.05, *** p<0.01

^a Latrine ownership and number of households are defined by a 200m radius around an index household.^b Coefficients were estimated using linear regression for continuous variables – height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ).^c Coefficients were estimated using Poisson regression for binary variables – stunted, underweight, wasting, and diarrhea.^d Standard errors in parentheses.^e Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.^f X indicates an interaction between two variables.

Table S4: Child growth outcomes and diarrhea prevalence regression results.

Variable ^a	Stunted ^c prevalence		Underweight prevalence		Wasting prevalence		Diarrhea prevalence	
Own latrine	-0.072 (0.052)	-0.113 (0.111)	-0.086* (0.047)	0.084 (0.193)	-0.030 (0.060)	-0.256 (0.292)	-0.148** (0.073)	-0.195 (0.165)
% latrine coverage ^e	-0.217* (0.115)	-0.242* (0.127)	-0.282** (0.126)	-1.128*** (0.349)	-0.088 (0.133)	-0.398 (0.552)	0.268 (0.231)	0.243 (0.245)
% latrine X ^f own latrine		0.078 (0.189)		-0.422 (0.718)		0.631 (1.118)		0.087 (0.256)
(% latrine coverage) ²				0.906*** (0.330)		0.232 (0.536)		
(% latrine) ² X own latrine				0.215 (0.615)		-0.315 (1.019)		
# households	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.002 (0.001)	-0.001 (0.002)	-0.001 (0.002)	0.004* (0.002)	0.004* (0.002)
Asset ownership	-0.029 (0.180)	-0.030 (0.180)	0.126 (0.197)	0.107 (0.198)	0.107 (0.246)	0.098 (0.247)	-0.157 (0.253)	-0.159 (0.252)
Read and write	-0.011 (0.042)	-0.011 (0.042)	-0.034 (0.050)	-0.035 (0.050)	-0.043 (0.065)	-0.043 (0.065)	0.054 (0.061)	0.054 (0.061)
Improved water source	0.043 (0.057)	0.043 (0.057)	0.034 (0.044)	0.035 (0.044)	0.069 (0.063)	0.069 (0.063)	-0.075 (0.093)	-0.075 (0.093)
Child age, months	0.011*** (0.001)	0.011*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.028*** (0.002)	-0.028*** (0.002)	-0.012*** (0.002)	-0.012*** (0.002)
Child gender, male	0.141*** (0.035)	0.142*** (0.035)	0.078** (0.038)	0.078** (0.038)	0.036 (0.060)	0.037 (0.060)	0.128** (0.054)	0.129** (0.054)
Average literacy, village	-0.004 (0.237)	-0.004 (0.237)	-0.036 (0.214)	-0.030 (0.223)	-0.672*** (0.250)	-0.682*** (0.253)	-0.656* (0.376)	-0.656* (0.377)
Average wealth, village	-0.472 (0.608)	-0.427 (0.615)	-1.055* (0.560)	-0.458 (0.602)	-1.268** (0.609)	-0.948 (0.738)	0.701 (1.118)	0.747 (1.114)
Constant	-1.25*** (0.241)	-1.26*** (0.241)	-0.589*** (0.203)	-0.768*** (0.210)	-0.210 (0.238)	-0.296 (0.257)	-1.63*** (0.487)	-1.64*** (0.485)
N	5942	5942	5953	5953	5757	5757	6188	6188

* p<0.10, ** p<0.05, *** p<0.01

^a Latrine ownership and number of households are defined by a 200m radius around an index household.^b Coefficients were estimated using linear regression for continuous variables – height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ).^c Coefficients were estimated using Poisson regression for binary variables – stunted, underweight, wasting, and diarrhea.^d Standard errors in parentheses.^e Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.^f X indicates an interaction between two variables.

Table S5: Child growth outcomes and diarrhea prevalence as a function of community open defecation rates.

Variable ^a	HAZ ^b	WAZ ^b	WHZ ^b	stunted ^c	under-weight ^c	wasting ^c	diarrhea ^c
Household reports open defecation (>5yrs)	-0.053 (0.058) ^d	-0.069 (0.044)	-0.039 (0.040)	0.070 (0.056)	0.078 (0.053)	0.049 (0.065)	0.031 (0.065)
% Households reporting open defecation, >5 yrs ^c	-0.075 (0.144)	-0.120 (0.105)	-0.191* (0.098)	0.062 (0.132)	0.284** (0.123)	-0.014 (0.137)	0.261 (0.264)
# households	-0.001 (0.002)	-0.001 (0.001)	0.001 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.002)	0.004 (0.002)
Asset ownership (wealth)	-0.076 (0.192)	-0.047 (0.175)	0.024 (0.166)	-0.080 (0.178)	0.121 (0.199)	0.093 (0.245)	-0.202 (0.251)
Read and write (education)	0.106** (0.053)	0.064 (0.050)	0.047 (0.047)	-0.008 (0.042)	-0.045 (0.052)	-0.054 (0.066)	0.044 (0.062)
Asset ownership (wealth)	-0.076 (0.192)	-0.047 (0.175)	0.024 (0.166)	-0.080 (0.178)	0.121 (0.199)	0.093 (0.245)	-0.202 (0.251)
Read and write (education)	0.106** (0.053)	0.064 (0.050)	0.047 (0.047)	-0.008 (0.042)	-0.045 (0.052)	-0.054 (0.066)	0.044 (0.062)
Improved drinking water source	0.018 (0.061)	0.007 (0.044)	-0.0811* (0.045)	0.043 (0.059)	0.041 (0.047)	0.071 (0.064)	-0.083 (0.092)
N	5862	5864	5675	5857	5864	5675	6096

* p<0.10, ** p<0.05, *** p<0.01

^a A constant is included in the regression. Child age in months, child gender, village-level average asset ownership, and village-level average literacy were included as a covariate.

^b Coefficients were estimated using linear regression – height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ).

^c Coefficients were estimated using Poisson regression – stunted, underweight, wasting, and diarrhea.

^d Standard errors shown in parentheses.

^e Values represent a change from 0 percent open defecation to 100 percent open defecation.

Table S6: Continuous child growth outcomes as a function of community and individual household latrine access, stratified by child gender.

Variable ^a	HAZ ^b		WAZ ^b		WHZ ^b	
	Female	Male	Female	Male	Female	Male
Own latrine	0.014 (0.147) ^d	0.150 (0.158)	-0.079 (0.257)	-0.145 (0.256)	0.177 (0.270)	-0.213 (0.221)
% latrine coverage ^c	0.199 (0.185)	0.416** (0.174)	1.030** (0.482)	1.056** (0.482)	1.094* (0.557)	0.783 (0.482)
% latrine X ^f own latrine	-0.028 (0.264)	-0.141 (0.281)	0.892 (0.947)	0.289 (0.946)	-0.315 (1.007)	0.497 (0.892)
(% latrine coverage) ²			-0.731 (0.467)	-0.985** (0.461)	-0.831 (0.525)	-0.821* (0.470)
(% latrine) ² X own latrine			-0.853 (0.782)	-0.075 (0.828)	0.098 (0.824)	-0.242 (0.843)
# households	-0.002 (0.002)	-0.002 (0.002)	-0.003* (0.002)	-0.001 (0.002)	0.000 (0.002)	-0.001 (0.001)
Asset ownership	-0.008 (0.237)	-0.293 (0.250)	-0.140 (0.224)	0.038 (0.263)	0.107 (0.210)	0.040 (0.244)
Read and write	0.141* (0.073)	0.084 (0.068)	0.047 (0.068)	0.075 (0.065)	-0.003 (0.061)	0.072 (0.064)
Improved water source	0.047 (0.072)	-0.017 (0.070)	0.069 (0.057)	-0.044 (0.059)	-0.001 (0.060)	-0.155** (0.064)
N	2924	3023	2933	3020	2843	2914

* p<0.10, ** p<0.05, *** p<0.01

^a A constant is included in the regression. Child age in months, child gender, village-level average asset ownership, and village-level average literacy were included as a covariate.

^b Coefficients were estimated using linear regression – height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ).

^c Coefficients were estimated using Poisson regression for binary variables – stunted, underweight, wasting, and diarrhea.

^d Standard errors in parentheses.

^e Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.

^f X indicates an interaction between two variables.

Table S7: Binary child growth outcomes and diarrhea prevalence as a function of community and individual household latrine access, stratified by child gender.

Variable ^a	Stunted ^c		Underweight ^c		Wasting ^c		Diarrhea ^c	
	Female	Male	Female	Male	Female	Male	Female	Male
Own latrine	-0.145 (0.144)	-0.068 (0.146)	-0.131 (0.254)	0.271 (0.238)	-0.451 (0.420)	-0.117 (0.376)	-0.175 (0.233)	-0.165 (0.236)
% latrine coverage ^c	-0.376** (0.177)	-0.151 (0.149)	-1.087** (0.483)	-1.162*** (0.434)	-0.730 (0.819)	-0.116 (0.671)	0.314 (0.289)	0.191 (0.282)
% latrine X ^f own latrine	0.282 (0.268)	-0.124 (0.258)	0.095 (1.008)	-0.874 (0.887)	1.324 (1.398)	0.138 (1.523)	0.214 (0.351)	-0.133 (0.380)
(% latrine coverage) ²			0.692 (0.514)	1.080*** (0.393)	0.296 (0.776)	0.167 (0.664)		
(% latrine) ² X own latrine			-0.063 (0.881)	0.477 (0.764)	-0.684 (1.149)	-0.091 (1.414)		
# households	0.000 (0.002)	0.001 (0.001)	0.002 (0.001)	0.002 (0.002)	-0.001 (0.002)	0.000 (0.002)	0.005** (0.002)	0.003 (0.002)
Asset ownership	-0.168 (0.261)	0.112 (0.229)	0.081 (0.257)	0.125 (0.284)	0.047 (0.336)	0.154 (0.355)	-0.503 (0.391)	0.180 (0.316)
Read and write	0.013 (0.070)	-0.030 (0.059)	-0.005 (0.066)	-0.066 (0.067)	-0.058 (0.091)	-0.027 (0.085)	0.087 (0.103)	0.024 (0.088)
Improved water source	0.050 (0.074)	0.038 (0.068)	-0.020 (0.062)	0.085 (0.063)	-0.028 (0.086)	0.168** (0.085)	-0.093 (0.114)	-0.055 (0.100)
N	2921	3021	2933	3020	2843	2914	3041	3147

* p<0.10, ** p<0.05, *** p<0.01

^a A constant is included in the regression. Child age in months, child gender, village-level average asset ownership, and village-level average literacy were included as a covariate.

^b Coefficients were estimated using linear regression – height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ).

^c Coefficients were estimated using Poisson regression for binary variables – stunted, underweight, wasting, and diarrhea.

^d Standard errors in parentheses.

^e Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.

^f X indicates an interaction between two variables.

Table S8: Household stored water quality as a function of community latrine coverage.

Variable ^a	Log <i>E. coli</i> , MPN per 100ml		Log total coliform, MPN per 100ml	
Own latrine	-0.018 (0.074)	0.418 (0.275)	-0.028 (0.033)	0.074 (0.112)
% latrine coverage ^f	-0.232 (0.191)	-1.161* (0.664)	-0.068 (0.053)	-0.322 (0.218)
% latrine X ^g own latrine		-1.713 (1.122)		-0.234 (0.490)
(% latrine coverage) ²		0.950 (0.698)		0.308 (0.230)
(% latrine) ² X own latrine		1.451 (1.063)		0.073 (0.436)
# households	0.001 (0.002)	0.003 (0.002)	0.000 (0.001)	0.000 (0.001)
Asset ownership	-0.719** (0.288)	-0.770*** (0.287)	-0.240* (0.125)	-0.248* (0.125)
Improved water source	-0.565*** (0.090)	-0.562*** (0.088)	-0.068* (0.035)	-0.066* (0.034)
Water container, covered	-0.289* (0.152)	-0.260* (0.149)	-0.027 (0.067)	-0.025 (0.067)
Treat water, boil or chlorine	-0.337 (0.299)	-0.312 (0.312)	-0.040 (0.101)	-0.034 (0.101)
Average literacy, Village	0.313 (0.340)	0.322 (0.342)	-0.184 (0.124)	-0.181 (0.123)
Average wealth, Village	-0.995 (1.049)	-0.303 (1.202)	0.102 (0.307)	0.227 (0.355)
Constant	3.450*** (0.468)	3.217*** (0.498)	3.444*** (0.152)	3.407*** (0.161)
N	773	773	773	773

* p<0.10, ** p<0.05, *** p<0.01

^b Standard errors shown in parentheses.

^c Values represent a change from 0 percent open defecation to 100 percent open defecation.

Table S9: Household stored water quality as a function of community open defecation rates.

Variable ^a	Log <i>E. coli</i> , MPN per 100ml	Log total coliform, MPN per 100ml
Household reports open defecation (>5yrs)	0.127* (0.074) ^b	0.034 (0.030)
% Households reporting open defecation, >5 yrs ^c	0.367** (0.179)	0.112* (0.061)
# households	0.001 (0.002)	0.000 (0.001)
Asset ownership (wealth)	-0.664** (0.283)	-0.239** (0.120)
Cover water storage container	-0.333** (0.151)	-0.036 (0.066)
Treat water, boil or chlorine	-0.317 (0.320)	-0.039 (0.105)
Improved drinking water source	-0.583*** (0.090)	-0.070* (0.036)
N	761	761

* p<0.10, ** p<0.05, *** p<0.01

^a A constant is included in the regression. Village-level average asset ownership, and village-level average literacy were included as covariates.

^b Standard errors shown in parentheses.

^c Values represent a change from 0 percent open defecation to 100 percent open defecation.

Table S10: Source water quality as a function of sanitation infrastructure and defecation behavior.

Variable	All Sources		Shallow Wells and Surface Water	
	Log <i>E. coli</i> , MPN per 100ml	Log Total Coliform, MPN per 100ml	Log <i>E. coli</i> , MPN per 100ml	Log Total Coliform, MPN per 100ml
Latrine				
% latrine coverage ^a	0.056 (0.142) ^b	-0.244 ^{**} (0.105)	0.144 (0.109)	0.027 (0.024)
# households	-0.002 (0.002)	-0.006 ^{**} (0.002)	0.000 (0.002)	-0.001 (0.001)
Shallow unprotected well	0.226 (0.185)	0.006 (0.065)	0.205 (0.173)	0.031 (0.022)
Protected well	-0.177 (0.204)	-0.044 (0.090)	-0.223 (0.193)	-0.067 (0.067)
Borewell	-2.627 ^{***} (0.248)	-2.036 ^{***} (0.155)		
Piped Water	-3.018 ^{***} (0.204)	-1.891 ^{***} (0.535)		
Average literacy, village	0.331 (0.270)	0.185 (0.214)	0.269 (0.254)	0.109 (0.075)
Average wealth, village	-1.311 ^{**} (0.573)	-0.314 (0.429)	-1.242 ^{**} (0.533)	-0.101 (0.101)
Constant	3.301 ^{***} (0.322)	3.707 ^{***} (0.221)	3.205 ^{***} (0.295)	3.361 ^{***} (0.039)
N	393	393	302	302
Open Defecation				
% Households reporting open defecation (>5 yrs) ^c	0.039 (0.132)	0.218 ^{**} (0.109)	-0.122 (0.096)	0.038 (0.046)
# households	-0.003 (0.002)	-0.006 ^{**} (0.002)	0.000 (0.002)	-0.002 (0.001)
Shallow unprotected well	0.200 (0.181)	-0.007 (0.066)	0.211 (0.176)	0.012 (0.024)
Protected well	-0.202 (0.200)	-0.064 (0.097)	-0.212 (0.197)	-0.084 (0.080)
Borewell	-2.652 ^{***} (0.241)	-2.050 ^{***} (0.153)		
Piped Water	-3.044 ^{***} (0.197)	-1.875 ^{***} (0.539)		
Average literacy, village	0.325 (0.270)	0.122 (0.220)	0.305 (0.257)	0.101 (0.080)
Average wealth, village	-1.225 ^{**} (0.542)	-0.356 (0.423)	-1.209 ^{**} (0.515)	-0.040 (0.104)
Constant	3.315 ^{***} (0.331)	3.512 ^{***} (0.203)	3.316 ^{***} (0.290)	3.361 ^{***} (0.041)
N	393	393	302	302

* p<0.10, ** p<0.05, *** p<0.01

^a Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.^b Standard errors in parentheses.^c Values represent a change from 0 percent open defecation to 100 percent open defecation.

Table S11: Child growth outcomes as a function of percent latrine coverage, using radii of 200-meters, 500-meters and 1-kilometer (estimated by linear regression).

Variable ^a	200-meters radius			500-meters radius			1-kilometer radius		
	Height-for-age	Weight-for-age	Weight-for-height	Height-for-age	Weight-for-age	Weight-for-height	Height-for-age	Weight-for-age	Weight-for-height
Own latrine	0.087 (0.121) ^b	-0.120 (0.202)	-0.038 (0.190)	0.172 (0.140)	-0.275 (0.206)	-0.278 (0.197)	0.205 (0.151)	-0.349 (0.229)	-0.363* (0.210)
% latrine coverage ^c	0.307** (0.148)	1.034*** (0.365)	0.904** (0.367)	0.366** (0.168)	0.835** (0.387)	0.709* (0.379)	0.422** (0.190)	0.648 (0.434)	0.639 (0.399)
% latrine X ^d own latrine	-0.096 (0.218)	0.622 (0.735)	0.175 (0.702)	-0.242 (0.262)	1.352* (0.763)	1.107 (0.742)	-0.309 (0.285)	1.821** (0.894)	1.569* (0.807)
(% latrine coverage) ²		-0.853** (0.345)	-0.794** (0.339)		-0.628 (0.393)	-0.609* (0.352)		-0.375 (0.490)	-0.479 (0.387)
(% latrine) ² X own latrine		-0.490 (0.619)	-0.147 (0.604)		-1.21* (0.690)	-0.945 (0.671)		-1.77** (0.870)	-1.47* (0.753)
# households	-0.002 (0.001)	-0.002 (0.001)	0.000 (0.001)	-0.002* (0.001)	-0.002 (0.001)	0.000 (0.001)	-0.002* (0.001)	-0.002 (0.002)	-0.001 (0.001)
Asset ownership	-0.142 (0.195)	-0.058 (0.181)	0.071 (0.167)	-0.148 (0.194)	-0.075 (0.183)	0.064 (0.167)	-0.123 (0.194)	-0.067 (0.183)	0.069 (0.169)
Read and write	0.111** (0.051)	0.060 (0.049)	0.036 (0.046)	0.112** (0.051)	0.062 (0.049)	0.036 (0.046)	0.111** (0.052)	0.062 (0.049)	0.036 (0.046)
Improved water source	0.015 (0.059)	0.012 (0.042)	-0.078* (0.044)	0.021 (0.059)	0.017 (0.042)	-0.076* (0.045)	0.022 (0.060)	0.021 (0.042)	-0.068 (0.045)
N	5947	5953	5757	5947	5953	5757	5947	5953	5757

* p<0.10, ** p<0.05, *** p<0.01

^a A constant is included in linear regression (continuous outcome variables). Child age in months, child gender, village-level average asset ownership, and village-level average literacy were included as a covariate.

^b Standard errors in parentheses.

^c Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.

^d X indicates an interaction between two variables.

Table S12: Child growth outcomes as a function of percent latrine coverage, using radii of 200-meters, 500-meters, and 1-kilometer.

Variable ^a	200-meters radius				500-meters radius				1-kilometer radius			
	Stunted	Under-weight	Wasting	Diarrhea	Stunted	Under-weight	Wasting	Diarrhea	Stunted	Under-weight	Wasting	Diarrhea
Own latrine	-0.113 (0.111) ^b	0.084 (0.193)	-0.256 (0.292)	-0.195 (0.165)	-0.114 (0.131)	0.227 (0.198)	0.081 (0.256)	-0.266 (0.184)	-0.171 (0.140)	0.281 (0.213)	0.222 (0.236)	-0.251 (0.200)
% latrine coverage ^c	-0.242 [*] (0.127)	-1.13 ^{***} (0.349)	-0.398 (0.552)	0.243 (0.245)	-0.233 (0.144)	-0.941 ^{***} (0.357)	-0.301 (0.569)	0.230 (0.273)	-0.283 [*] (0.160)	-0.893 ^{**} (0.391)	-0.149 (0.575)	0.224 (0.314)
% latrine X ^d own latrine (% latrine coverage) ²	0.078 (0.189)	-0.422 (0.718)	0.631 (1.118)	0.087 (0.256)	0.069 (0.237)	-1.067 (0.753)	-0.639 (1.056)	0.209 (0.294)	0.180 (0.256)	-1.481 [*] (0.828)	-1.552 (0.972)	0.189 (0.334)
(% latrine) ² X own latrine		0.906 ^{***} (0.330)	0.232 (0.536)			0.728 ^{**} (0.351)	0.184 (0.534)			0.634 (0.412)	-0.132 (0.560)	
		0.215 (0.615)	-0.315 (1.019)			0.801 (0.678)	0.723 (1.050)			1.327 [*] (0.782)	1.840 [*] (0.977)	
# households	0.000 (0.001)	0.002 (0.001)	-0.001 (0.002)	0.004 [*] (0.002)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.002)	0.003 (0.003)	0.000 (0.001)	0.001 (0.002)	0.000 (0.002)	0.003 (0.003)
Asset ownership	-0.030 (0.180)	0.107 (0.198)	0.098 (0.247)	-0.159 (0.252)	-0.028 (0.179)	0.124 (0.197)	0.100 (0.247)	-0.141 (0.255)	-0.044 (0.182)	0.113 (0.198)	0.087 (0.248)	-0.127 (0.252)
Read and write	-0.011 (0.042)	-0.035 (0.050)	-0.043 (0.065)	0.054 (0.061)	-0.010 (0.041)	-0.037 (0.050)	-0.044 (0.065)	0.047 (0.061)	-0.010 (0.042)	-0.038 (0.050)	-0.041 (0.065)	0.048 (0.061)
Improved water source	0.043 (0.057)	0.035 (0.044)	0.069 (0.063)	-0.075 (0.093)	0.039 (0.058)	0.033 (0.044)	0.069 (0.064)	-0.064 (0.092)	0.040 (0.059)	0.031 (0.045)	0.062 (0.065)	-0.064 (0.093)
N	5942	5953	5757	6188	5942	5953	5757	6188	5942	5953	5757	6188

* p<0.10, ** p<0.05, *** p<0.01

^a A constant is included in the regression. Child age in months, child gender, village-level average asset ownership, and village-level average literacy were included as a covariate.

^b Standard errors in parentheses.

^c Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.

^d X indicates an interaction between two variables.

Table S13: Continuous child growth outcomes regression results controlling for wealth and literacy within 200m.

Variable ^a	Height-for-age z-score ^b		Weight-for-age z-score		Weight-for-height z-score	
Own latrine	0.028 (0.054) ^d	0.126 (0.125)	0.066 (0.044)	-0.096 (0.201)	0.034 (0.042)	-0.001 (0.194)
% latrine coverage ^e	0.326 ^{***} (0.123)	0.382 ^{**} (0.151)	0.260 ^{**} (0.113)	1.12 ^{***} (0.350)	0.164 (0.105)	1.08 ^{***} (0.359)
% latrine X ^f own latrine		-0.186 (0.233)		0.522 (0.744)		-0.032 (0.747)
(% latrine coverage) ²				-0.920 ^{**} (0.358)		-0.980 ^{***} (0.361)
(% latrine) ² X own latrine				-0.404 (0.653)		0.105 (0.679)
# households	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.001)	-0.002 (0.001)	0.000 (0.001)	0.000 (0.001)
Asset ownership	-0.037 (0.197)	-0.048 (0.197)	0.002 (0.183)	-0.046 (0.183)	0.125 (0.161)	0.075 (0.160)
Read and write	0.104 ^{**} (0.051)	0.104 ^{**} (0.051)	0.062 (0.049)	0.062 (0.049)	0.055 (0.045)	0.056 (0.045)
Improved water source	-0.020 ^{***} (0.001)	-0.020 ^{***} (0.001)	-0.002 [*] (0.001)	-0.002 [*] (0.001)	0.016 ^{***} (0.001)	0.016 ^{***} (0.001)
Child age, months	0.024 (0.062)	0.023 (0.062)	0.016 (0.044)	0.009 (0.042)	-0.075 (0.046)	-0.0816 [*] (0.045)
Child gender, male	-0.171 ^{***} (0.038)	-0.172 ^{***} (0.038)	-0.024 (0.036)	-0.025 (0.036)	0.024 (0.043)	0.023 (0.043)
Average literacy, 200m	-0.076 (0.180)	-0.086 (0.179)	0.076 (0.134)	0.041 (0.131)	0.263 ^{**} (0.127)	0.234 [*] (0.124)
Average wealth, 200m	-0.061 (0.343)	-0.081 (0.342)	0.242 (0.313)	0.045 (0.328)	0.515 [*] (0.271)	0.310 (0.290)
Constant	-0.629 ^{***} (0.170)	-0.630 ^{***} (0.169)	-1.44 ^{***} (0.149)	-1.42 ^{***} (0.151)	-1.79 ^{***} (0.157)	-1.77 ^{***} (0.162)
N	5848	5848	5855	5855	5659	5659

* p<0.10, ** p<0.05, *** p<0.01

^b Coefficients were estimated using linear regression – height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ).

^c Coefficients were estimated using Poisson regression – stunted, underweight, wasting, and diarrhea.

^e Standard errors in parentheses.

^f Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.

^g X indicates an interaction between two variables.

Table S14: Binary child growth outcomes and diarrhea prevalence regression results controlling for wealth and literacy within 200m.

Variable ^a	Stunted ^c prevalence		Underweight prevalence		Wasting prevalence		Diarrhea prevalence	
Own latrine	-0.071 (0.051)	-0.131 (0.119)	-0.083* (0.048)	0.080 (0.193)	-0.034 (0.060)	-0.302 (0.292)	-0.140* (0.075)	-0.200 (0.172)
% latrine coverage ^e	-0.244** (0.111)	-0.277** (0.124)	-0.346*** (0.119)	-1.21*** (0.319)	-0.170 (0.135)	-0.513 (0.475)	0.289 (0.240)	0.260 (0.260)
% latrine X ^f own latrine		0.116 (0.211)		-0.427 (0.734)		0.791 (1.154)		0.111 (0.281)
(% latrine coverage) ²				0.984*** (0.327)		0.287 (0.498)		
(% latrine) ² X own latrine				0.239 (0.651)		-0.440 (1.111)		
# households	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.002 (0.001)	0.000 (0.002)	0.000 (0.002)	0.004* (0.002)	0.004* (0.002)
Asset ownership	-0.077 (0.189)	-0.070 (0.188)	0.043 (0.195)	0.090 (0.197)	0.069 (0.241)	0.105 (0.241)	-0.111 (0.265)	-0.106 (0.265)
Read and write	-0.008 (0.042)	-0.008 (0.042)	-0.036 (0.049)	-0.037 (0.048)	-0.064 (0.064)	-0.066 (0.065)	0.048 (0.058)	0.048 (0.058)
Improved water source	0.011*** (0.001)	0.011*** (0.001)	-0.006** (0.001)	-0.006** (0.001)	-0.028*** (0.002)	-0.028*** (0.002)	-0.012*** (0.002)	-0.012*** (0.002)
Child age, months	0.047 (0.060)	0.047 (0.060)	0.037 (0.045)	0.044 (0.044)	0.077 (0.064)	0.079 (0.064)	-0.077 (0.094)	-0.077 (0.094)
Child gender, male	0.133*** (0.035)	0.133*** (0.035)	0.075** (0.038)	0.076** (0.038)	0.033 (0.061)	0.034 (0.061)	0.132** (0.053)	0.133** (0.053)
Average literacy, 200m	-0.078 (0.162)	-0.071 (0.161)	-0.095 (0.155)	-0.068 (0.151)	-0.535*** (0.186)	-0.516*** (0.184)	-0.588** (0.283)	-0.583** (0.285)
Average wealth, 200m	-0.081 (0.311)	-0.069 (0.315)	-0.408 (0.268)	-0.203 (0.300)	-0.830** (0.351)	-0.750** (0.372)	0.294 (0.485)	0.307 (0.482)
Constant	-1.37*** (0.149)	-1.37*** (0.148)	-0.83*** (0.134)	-0.86*** (0.137)	-0.43** (0.180)	-0.43** (0.182)	-1.48*** (0.271)	-1.48*** (0.272)
N	5844	5844	5855	5855	5659	5659	6086	6086

* p<0.10, ** p<0.05, *** p<0.01

^b Coefficients were estimated using linear regression – height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ).

^c Coefficients were estimated using Poisson regression – stunted, underweight, wasting, and diarrhea.

^e Standard errors in parentheses.

^f Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.

^g X indicates an interaction between two variables.

Table S15: Household stored water quality regression results controlling for wealth and literacy within 200m.

Variable ^a	Log <i>E. coli</i> , MPN per 100ml		Log total coliform, MPN per 100ml	
Own latrine	-0.013 (0.075) ^b	0.348 (0.270)	-0.027 (0.033)	0.072 (0.108)
% latrine coverage ^c	-0.235 (0.173)	-0.914 (0.585)	-0.058 (0.047)	-0.253 (0.191)
% latrine X ^d own latrine		-1.403 (1.152)		-0.131 (0.467)
(% latrine coverage) ²		0.743 (0.694)		0.287 (0.226)
(% latrine) ² X own latrine		1.176 (1.129)		-0.092 (0.429)
# households	0.002 (0.002)	0.003 (0.002)	0.000 (0.001)	0.000 (0.001)
Asset ownership	-0.773*** (0.294)	-0.766** (0.295)	-0.218* (0.120)	-0.221* (0.124)
Improved water source	-0.575*** (0.087)	-0.567*** (0.086)	-0.066* (0.036)	-0.061* (0.036)
Water container, covered	-0.271* (0.155)	-0.263* (0.154)	-0.015 (0.066)	-0.016 (0.067)
Treat water, boil or chlorine	-0.402 (0.300)	-0.366 (0.313)	-0.052 (0.103)	-0.049 (0.104)
Average literacy, 200m	0.056 (0.250)	0.094 (0.247)	-0.210* (0.109)	-0.217* (0.112)
Average wealth, 200m	-0.779* (0.450)	-0.528 (0.448)	-0.042 (0.139)	0.001 (0.142)
Constant	3.392*** (0.279)	3.323*** (0.279)	3.486*** (0.100)	3.481*** (0.098)
N	762	762	762	762

* p<0.10, ** p<0.05, *** p<0.01

^b Standard errors in parentheses.

^c Values represent a change from 0 percent latrine coverage to 100 percent latrine coverage.

^d X indicates an interaction between two variables.

Figures

Figure S1: Household density (a), percent latrine coverage (b), and percent practicing open defecation (c) within a 200-meters radius of the study households.

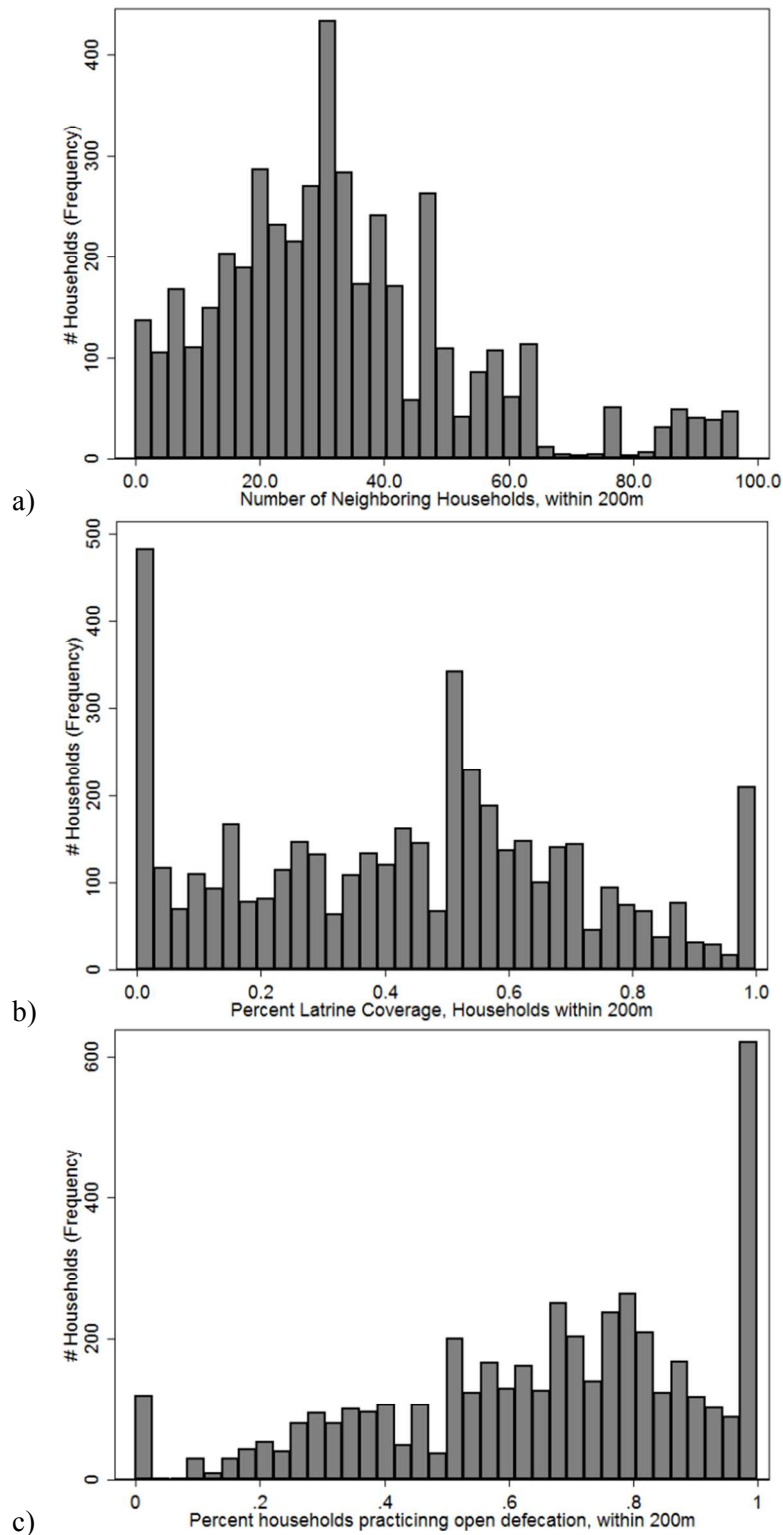
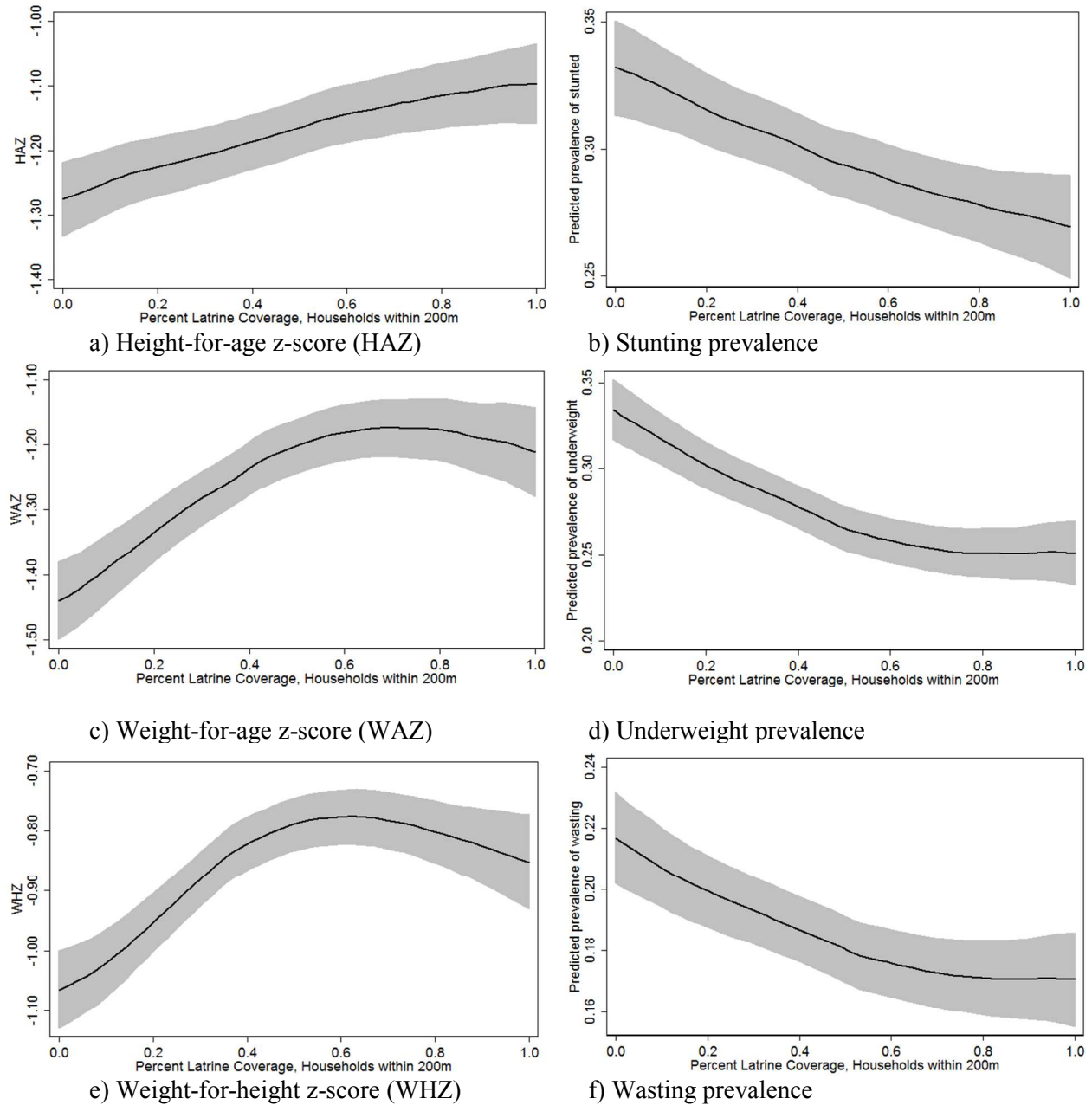
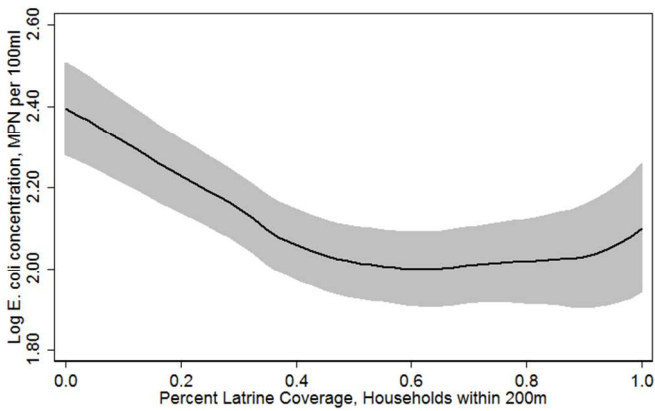


Figure S2: The association as determined with localized polynomials between percent latrine coverage and child health outcomes, including prevalence of stunting, underweight, and wasting, as well height-for-age, weight-for-age, and weight-for-height z-scores.

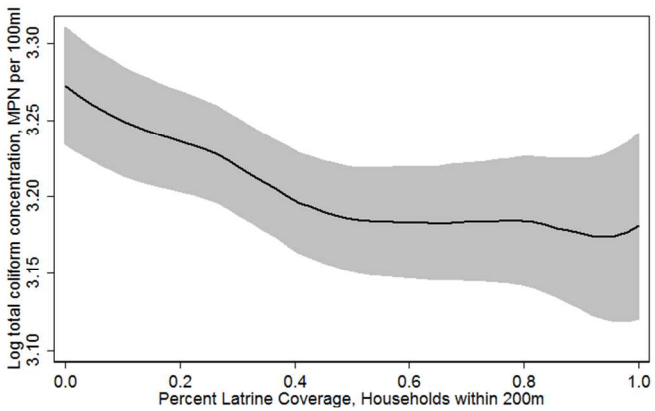


Note: The grey shaded area represents the 95% confidence interval.

Figure S3: The association as determined with localized polynomials between percent latrine coverage and household-stored water quality outcomes.



a) Log *E. coli*, MPN per 100ml



b) Log total coliforms, MPN per 100ml

Note: The grey shaded area represents the 95% confidence interval.

Figure S4: The relationship between community latrine coverage and child growth (z-scores) and water quality. Regressions are controlling for community-level averages of wealth and education.

