Impact of Improved Community Water Sources on Water Quality at Point of Use, Consumption, Health and Income: Evidence from Ghana

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Introduction

This report provides the results from an impact evaluation of MCC water sub-activities in Ghana's first Compact. Over the course of the Compact, a total of 392 water points were constructed, reconstructed or rehabilitated, including boreholes, small town water systems and pipe extensions. Most of these water points were located in small rural communities with previously inadequate supplies of safe drinking water. The main purpose of the impact evaluation of the water activity is to assess the impact of improved community-level water systems on beneficiary households.

Theory of Change

Area	*Hypothesis*
Health	The incidence of diarrhea will decline, particularly in children five years old and younger.
Time saving	Time devoted to acquiring water will fall significantly. Time freed through more efficient water collection will be shifted significantly to income producing activities.
Water price	The price paid for drinking water will decline significantly, where water has been previously purchased .
Quantity of water consumed	Households will consume a greater quantity of water for domestic purposes.
Household welfare	Household consumption expenditure will increase as a result of more income and time.

Sample Size & Power

- Communities: 50 treatment, 50 control
- Respondents: 12 per community
- Longitudinal data: followed up with baseline households
- Power: 80% power, MDES=.29*

Data Collection	Time Period	# of Observations: Treatment	Control	Total
Questionnaires				
Community Questionnaire	*Baseline*	50	50	100
	End-line	50	50	100
Household Questionnaire	*Baseline*	600	600	1200
	End-line	600	600	1200
Water Testing				
Community water Quality test	*End-line*	140	107	247
Household Water Quality test	*End-line*	448	457	905

*assuming $\rho = 0.30$, $\sigma_\delta^2 = 0.01$, $B = 0.40$ and $R_{L2}^2 = 0.25$, $n = 10$, $J = 2$, $K = 50$ and $\alpha = 0.05$

Data Collection & Tools

- *Behavior and Economic Outcomes:*

Household and Community Questionnaire, implemented February-March 2015

- *Water Quality Outcomes:*

IDEXX Colilert 18® Test, implemented May 2015

Longitudinal Data Rates	Count	Percent
The same family in the same dwelling	894	74.5%
The same family in different location	44	3.67%
The same dwelling but different family	59	4.92%
A replacement dwelling (next right neighbor)	203	16.92%
TOTAL	1200	100%

Methodology

The research presented here builds on a baseline study conducted by NORC in 2010. NORC created matched-pairs among treatment and control communities, utilizing a **nearest-neighbor matching methodology** to create pairs, specifying matches based on the following criteria: .

- Adequacy of Water
- Presence of Guinea worm disease
- Quality of Water (observed)
- Distance to water source
- Community Participation

We specify a model that accounts for the nesting of households within communities within matched pairs. The model presented here represents a regression analysis of means at the community level, which includes a lagged variable for the treatment outcome and with fixed effects at the matched pair-level (not reported). Similar analysis was performed using difference-in-difference and instrumental variable methodologies, and impacts did not vary in magnitude or significance.

Preliminary Analysis

Water Quality Outcomes

Mean Counts of E.Coli and Coliform Counts, by Region

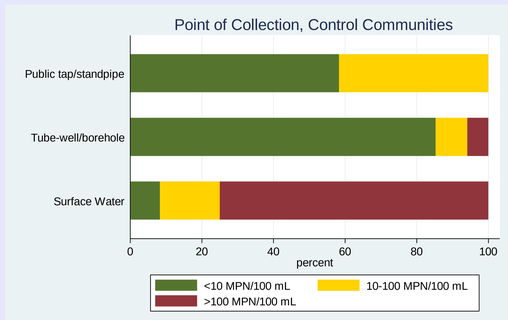
Region	E. Coli			Coliforms		
	Most Probable Number	*Large*	*Small*	*Most Probable Number*	*Large*	*Small*
Ashanti	368.48	24.45	11.1	1941.05	47.51	41.15
Central	639.25	31.40	17.76	1830.31	47.48	41.13
Eastern	360.29	23.54	11.68	2004.37	46.6	42.71
Northern	264.15	24.63	9.77	1777.39	46.38	39.46
Volta	323.22	22.41	10.51	1874.878	46.85	40.74

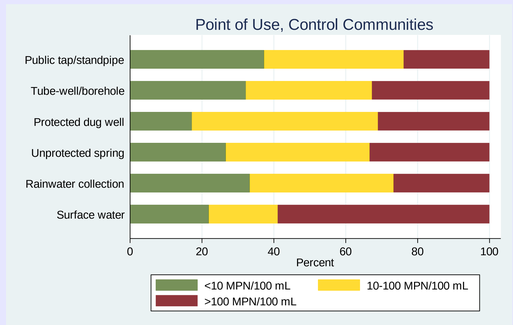
Household-Level Outcomes

VARIABLES	(1) Volume Collected Per Day	(2) Time Spent Per Day Collecting Water (minutes)	(3) Expenditures on Water per month	(4) Price Paid per Liter of Water
Treatment	-8.267	-11.32***	4.418	0.00673
	(12.56)	(2.997)	(6.450)	(0.00562)
Lagged Outcome Variable	0.0719	0.174***	0.134	-0.114
	(0.0594)	(0.0599)	(0.231)	(0.429)
Constant	65.51*	31.89***	-2.835	0.00209
	(39.30)	(10.65)	(7.885)	(0.00520)
Observations	100	100	100	100
R-squared	0.598	0.750	0.738	0.679

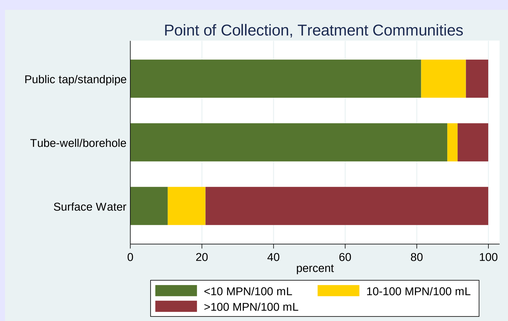
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

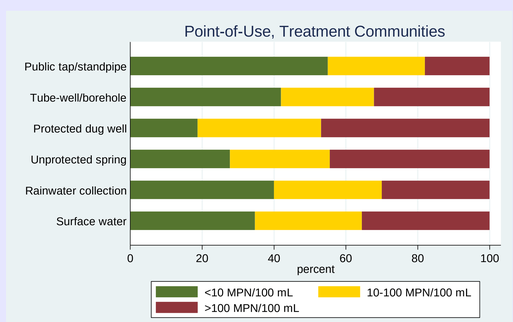
Comparison Area





Treatment Area





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Baseline data was collected by NORC in 2010.