LEAD LEVERAGING EVIDENCE FOR ACCESS AND DEVELOPMENT
KREA UNIVERSITY

Research
BRIEF

Increasing Awareness about Arsenic Contamination

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Summary:

This brief presents preliminary findings from an experimental study that attempts to understand how increasing awareness about water quality influences household behaviour relating to water treatment and use, and leads to positive health externalities.

BACKGROUND

Arsenic contamination has serious health implications. WHO has marked arsenic as one of the 10 chemicals of major public health concern[1]. Common symptoms of arsenic contamination include: anaemia, diarrhoea, gastritis, hyperkeratosis, melanosis, different types of cancer, skin warts, discoloration as well as irregular menstrual cycle. Arsenic has adverse effect on child health and infant mortality leading to detrimental health issues in adulthood[2]. In women, arsenic is associated with adverse pregnancy outcomes and mental health issues[3]. These health issues also create economic burden on the household where the arsenic affected person is able to work only fewer days as compared to non arsenic affected person and the household seems to spend more money on health[4]. Studies have also found lack of awareness of the ill effects of arsenic contamination amongst the people as source of illness and defensive activities[5].

The arsenic contamination of groundwater in Bihar is a rising concern in the health and water spheres. Studies have shown high arsenic presence in tubewells in the Ganges plains in Patna, Bihar, with 61% and 44% ofthe tube wells having above normal level arsenic at 10 and 50 mg/litres respectively[6]. At least 15 districts and 57 blocks of Bihar are affected by the presence of arsenic in groundwater, and the highest concentration of 1810 and 1630 parts per billion (ppb) has been found in Maner block (1,810 parts per billion) in Patna district and Shahpur block (1,630 ppb) of Patna and in Bhojpur district have the highest concentration of arsenic in groundwaters[7].

Max Plank Institute for Research on Collective Goods (MPI) in collaboration with LEAD at Krea University undertook the study to examine how information interventions work in the health context. The study thus attempts to understand how increasing awareness about water quality influences the adoption of healthier water treatment practices, affects people's behaviour, and leads to positive health externalities. The intervention consisted of a behaviour change communication video that was shown to respondents explaining the ill effects of arsenic contamination in drinking water. Respondents were made aware of the arsenic content in their own drinking water.

[1] https://www.who.int/news-room/fact-sheets/detail/arsenic
[2] https://www.tandfonline.com/doi/pdf/10.1080/19396368.2018.1480076
[3] https://ehp.niehs.nih.gov/doi/10.1289/ehp.1307894
[4] Barun Kumar Thakur, Vijaya Gupta; Arsenic concentration in drinking water of Bihar: health issues and socio-economic problems. Journal of Water, Sanitation and Hygiene for Development 1 June 2016; 6 (2): 331–341. doi: https://doi.org/10.2166/washdev.2016.047
[5] Thakur BK, Gupta V. Valuing health damages due to groundwater arsenic contamination in Bihar, India. Econ Hum Biol. 2019;35:123-132. doi:10.1016/j.ehb.2019.06.005
[6] https://www.sciencedirect.com/science/article/abs/pii/S0045653516302922
[7] https://www.researchgate.net/publication/281865761_Groundwater_Arsenic_Contamination_in_Bihar_Causes_Issues_and_Challenges

RESEARCH METHODOLOGY

Study setting

The randomised evaluation was conducted in two districts in Bihar – Samastipur and Begusarai, covering 150 villages. The treatment arm was further divided into two segments: individual and group, where, in the individual treatment a treatment video was shown only to the selected respondents individually and in the group treatment the video was shown to three respondents together. In the control arm, a video of similar length on wildlife conservation was shown. A total of 2,333 households were covered in the baseline survey, of which 2,316 households were covered in the endline survey. Of these 2,316 households, 1,263 households were surveyed on field and 1,053 households were surveyed over the phone.

Table 1:
Total number of households surveyed

	Baseline	Endline (field)	Endline (Phone)
Individual	792	430	286
Group	781	380	344
Control	760	453	303

Intervention

The intervention was implemented along with the baseline data collection. The members of the household were shown a video (5-8 mins) explaining the ill effects of arsenic contamination in drinking water and were made aware of the arsenic content in their own drinking water. The control group were shown a video of the same length on wildlife conservation. In the individual treatment arm, the video was shown only to the main respondent of the household and in the group treatment arm the video was shown to 3 respondents from different households.

Randomisation and Data Collection

At the village level, treatment was assigned based on a treatment order list shared by MPI. Based on the list, villages were mapped and assigned treatment (Fig 1). In every village, 15 households from lower caste hamlets were selected using the right-hand rule[8]. In the endline survey, the same households were revisited. Spillover surveys were also carried out in the treatment villages.

[8] Every nth household was interviewed starting from the right hand side, the household selection was done based on the formula, where n= Total number of households in the tola / 15. Similarly for the spillover survey, household selection was done based on the formula n= Total number of households in a village -15/5

Phone Survey

Due to the outbreak of Covid-19 during the endline survey data collection, field surveys were transitioned to phone surveys. Robust protocols were designed to support the implementation of the phone surveys, which covered aspects such as guidelines for administering the surveys, when the respondents should be called, feedback and quality control mechanisms to ensure surveyor productivity and data quality. Since the survey was administered remotely, components such as water tests, observational questions and other components that required in-person measurement were excluded from the study.

Survey Instrument

The survey instrument was designed by MPI. The instrument captured information about household characteristics, social norms, water use practises and water tests for arsenic contamination. The instrument was piloted extensively in the field prior to baseline data collection to ensure its reliability and validity. For the phone surveys, the survey instrument was shortened to reduce respondent fatigue over phone. The survey instrument was translated to the local language (Hindi) and was digitised using the Survey CTO platform.

The survey instrument also had three experiment modules on social norms, time preferences and risk preferences.

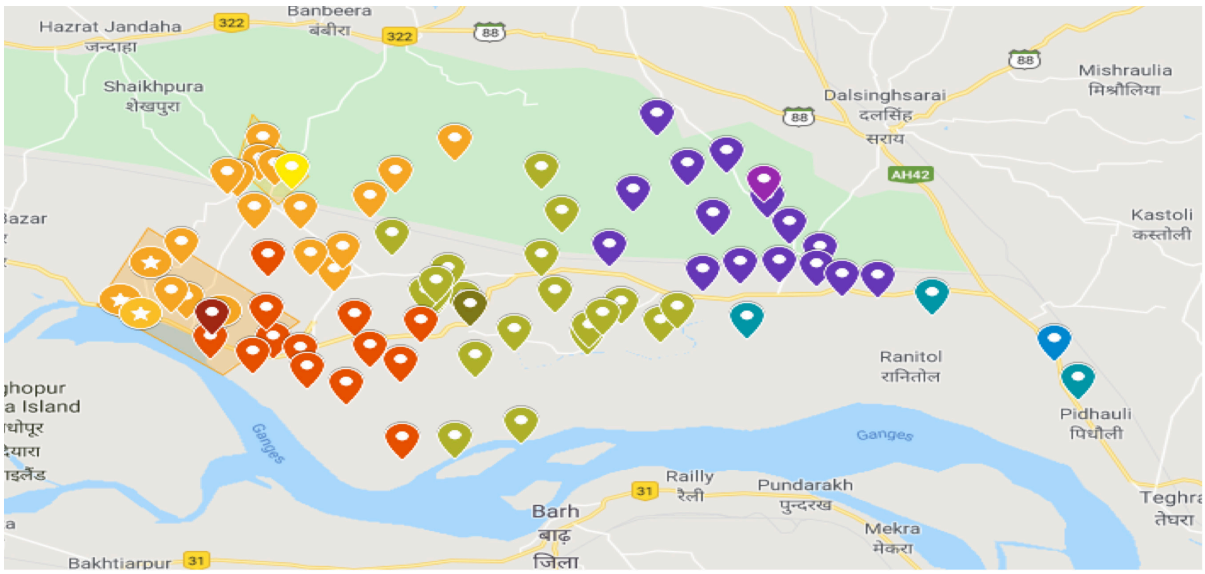
- The social norms experiment tried to capture the social norm beliefs of the household around water use practises through a likert scale
- The time preference experiment captured households preference to money, where the households were given three choice sets and from each choice set the household had to choose between having money in the present versus future
- The risk preference experiment captured the households risk preference when presented with options of different monetary options.

The study was granted ethical approval by the Human Subjects Committee of the Institute for Financial Management and Research[9]. Participants were made aware of the benefits and risks of participating in the study and informed consent was obtained from the respondents prior to data collection. Every household was identified

by unique ids which were linked to personal identifiers. For transitioning to phone surveys during the endline data collection, an amended application was submitted to the IRB which included the adapted instrument along with the phone survey protocols. The amendment required highlighting the protocol changes, measures taken to ensure the safety of the enumerators, data security and the processes for transitioning to phone surveys. Following are the key amendment points highlighted:

- Informed Consent-Verbal consent was obtained from all the selected respondents over phone.
- Respondent Incentive-Participatory incentive of Rs. 50 was given to all respondents who took part in the phone survey. This incentive was in addition to the incentive given for the experiment modules.
- Audio Recording-For the purpose of quality control audits, the audio recording feature was enabled. This recorded only the voice of the surveyor.

Image of the mapped study villages



[9]Approval #IRB00007107

PRELIMINARY RESEARCH FINDINGS

Basic Household Characteristics

Total of 2401 households were approached in the baseline, of which 2333 households and 13,579 individuals were interviewed. The eligibility for the main respondent in the household was being head of the household. In cases where the household head was either not present or>60 years of age, the spouse of the household head was interviewed. From Table 1 it is evident that these key covariates are comparable across the three treatment arms. The same households were approached in the endline - out of the 2333 households completed in baseline, 2316 households were completed of which- 1263 were completed on field and 1053 were completed over phone surveys. During the field endline round of data collection, there was high attrition rate due to migration. These respondents were approached again using phone surveys.

Table 2:
Basic Household Characteristics

	Treatment (Individual)	Treatment (Group)	Control
Number of individuals	4703	4441	4417
Number of households	793	780	761
Age	12.30%	12.20%	12.19%
Less than 20	48.44%	48.44%	48.15%
20-29 years	16.22%	17.61%	17.5%
30-39 years	12.52%	11.6%	12.07%
>=40 years	22.82%	22.36%	22.28%
Gender of household head			
Male	73.9%	66.79%	69.91%
Female	26.1%	33.21%	30.09%
Education			
No education	29.54%	29.12%	26.28%
1-8	24.44%	26.14%	25.47%
More than 8 years	46.02%	44.74%	48.25%
Marital status			
Married, living with spouse	63.04%	63.11%	62.9%
Married, not living with spouse	0.32%	0.09%	0.41%
Widowed	3.67%	4.13%	4.22%
Single	32.94%	32.67%	32.41%

Water use practices

The primary drinking water source in the surveyed villages are tube wells commonly known as chappakal[10] (Table 2). The average depth of these tube wells is 95 feet. It is observed from the data that 95.8% of the people do not treat their primary drinking and cooking water. When asked about the willingness to treat the water, 59% of respondents were not willing to treat the water.

Table 3:
Primary Drinking Water Source-Baseline

Primary Drinking Water Source	Individual	Group	Control
Tube well (chapakal)	759 (97.5%)	733 (95.7%)	705 (95.1%)
Piped water	5 (0.64%)	11 (1.44%)	16 (2.16%)
Well	1 (0.15%)	9 (1.17%)	
Buy bottle water	10 (1.3%)	8 (1.04%)	14 (1.9%)
Borewell	2 (0.26%)	4 (0.52%)	6 (0.8%)

Arsenic knowledge

Comparing the arsenic knowledge[11] of the individuals in the treatment arm between the baseline and endline surveys suggests that while the awareness has increased post the treatment in all groups, it has increased much more in the treated group. Table 4 reports the change in drinking water source in the endline. We find that 54.5% and 46.4% from the individual and group treatment arms report 'old source contains arsenic' as the reason for change.

[10] Tubewells are called chappakal in Bihar
[11] Proportion of people answering 'yes' to knowing anything about arsenic

Fig 1:
Arsenic Knowledge Baseline-Endline

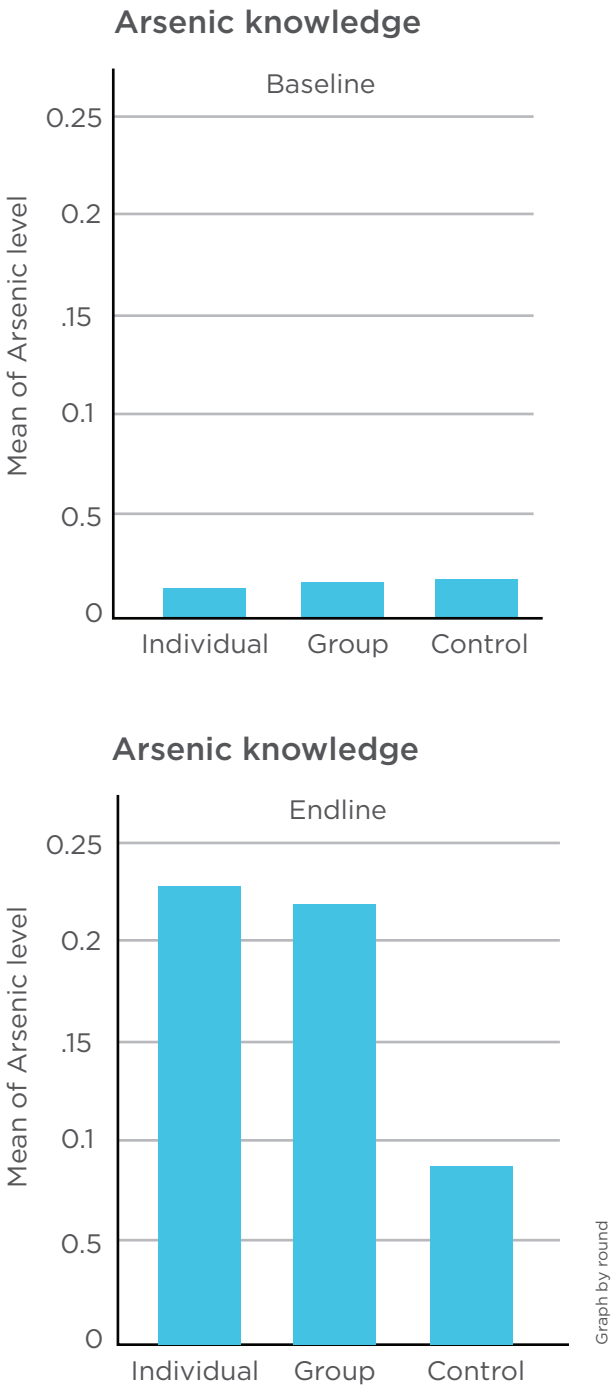


Table:4

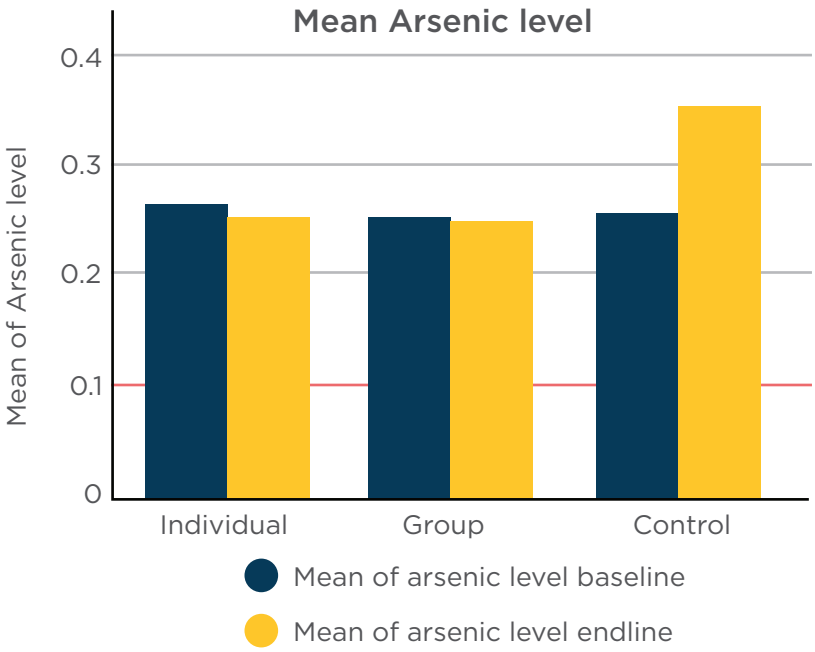
Changed drinking water source in Endline

	Individual	Group	Control
Different chappakal	26.3%	33.3%	53.8%
Deeper chappakal	15.8%	8.3%	
Piped water		16.7%	23.1%
Buy bottled water	36.8%	25%	23.1%
Borewell from neighbor's home	21%	8.3%	

Arsenic level in primary drinking water

A water test was conducted in every household during the baseline and households part of the in-person survey during the endline, where every household was asked for a glass of drinking water and a test was performed. Based on the colour change after the test, it was matched with the scale that shows arsenic quantity. The safe limit of arsenic according to WHO is 10µg / L, and a higher presence is considered harmful to health. The red line at 0.01 in Fig 2 denotes the 'safe line', arsenic levels above this line are harmful for consumption. The increase in the arsenic levels of the control could denote a seasonal change in arsenic level that takes place between winter and summer months.

Fig 2:
Arsenic levels at baseline and endline



Implications

Further rounds of data collection are required for this study since the in-person endline survey could not be conducted for the entire sample. Examining just the households where we do a have arsenic data from the endline, we find some important changes. We find that there were significant changes in the quantity of arsenic in the primary drinking water for our treatment groups (when pooled together). Our results show that there is a reduction of arsenic level by 5 microgram per liter, which is sizable considering it is half of the WHO recommended unhealthy level. This change was substantiated by a 3-percentage point increase in reported behavioral change in water treatment practices. This was achieved both with an increase in healthy water practices and a decrease in unhealthy water practices. We also find an increase in arsenic knowledge, as measured by a test administered for the information that the intervention contained. We saw a 16.5-percentage point increase in awareness about arsenic and 0.88 points increase in knowledge about arsenic. The results suggest that the low-cost/ low-effort recommendations and increasing knowledge were the most important reasons for the effectiveness of the intervention. We observe no clear effects on most health outcomes in the short-term, however, we do see a significant reduction in mental health issues in the treatment groups even in this short gestation period.

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