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Improving state effectiveness in environmental risk mitigation: Experimental evidence from Bangladesh

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Improving state effectiveness in environmental risk mitigation: Experimental evidence from Bangladesh

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ARRP Arsenic Screening Data 2023

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Bangladesh faces a critical public health crisis with over 60 million people exposed to arsenic-contaminated water. While the Department of Public Health and Engineering (DPHE) mitigates this environmental disaster by installing deep tube wells, its allocation has historically not prioritized high-arsenic villages. This Small Project Facility (SPF) study piloted a web-based "arsenic dashboard" designed to improve the allocative efficiency of these wells by providing local bureaucrats with granular contamination data. We have adapted the project to the significant political shifts following recent developments, shifting the focus from elected politicians to administrative officials—specifically Upazila Nirbahi Officers (UNOs) and Sub-Assistant Engineers (SAEs).

The SPF engaged in two major activities. First, under close partnership with DPHE, Key Informant Interviews (KIIs) were conducted across six upazilas to assess the exact dynamics between UNOs and SAEs and to understand their decision-making process. Second, to improve the efficiency of SAEs and UNOs' decisions, the team utilized a dataset of 6.0 million wells' arsenic test results to train a Random Forest machine learning (ML) model. This model successfully "gap-filled" arsenic contamination data for the one-third of villages that were previously untested, consistently outperforming traditional OLS methods (kriging) in predicting village-level risk.

Results from the pilot indicate that while SAEs possess general knowledge of high-risk areas, they lack specific village-level data—a gap the dashboard effectively closes. Feedback from the pilot led to the simplification of the dashboard interface to ensure high usability for government engineers. With strong buy-in from central DPHE leadership and successful model validation, these findings have established the foundation for a scaled nationwide experiment involving 142 upazilas. This larger study aims to optimize water infrastructure allocation for 42 million rural residents, leveraging data to drive state effectiveness in environmental risk mitigation.

1. INTRODUCTION

In Bangladesh, more than 60 million people are exposed to drinking water in arsenic concentrations above the WHO guideline (10μg/L, Flanagan et al. 2012), leading to approximately 100,000 annual deaths (Quansah et al., 2015) and significant losses in labor productivity and income (Pitt et al., 2021). The government of Bangladesh has duly recognized this problem and has allocated millions of dollars for arsenic risk reduction over two decades. In particular, Bangladesh Department of Public Health and Engineering (DPHE) constructs public wells that draw water from arsenic-safe deep aquifers. Such wells are significantly costlier for households (about USD 1,000 each), implying that public provision of deep wells becomes an effective way to mitigate arsenic risk.

Despite DPHE allocating a fixed number of public deep wells to upazilas (sub-districts) every year, there is little effort paid on optimizing the location of wells within upazilas. The resulting inefficiencies in well allocation, with many wells not being installed to locations where their returns were highest (i.e., villages with high arsenic contamination) has implications for arsenic risk mitigation for the population. Administrative data and prior research both indicate that the allocation of such public wells has little consideration of the impact and is prone to elite capture (e.g., van Geen et al., 2016). Usually, local politicians and bureaucrats together make decisions on well allocation, which has leaned more on the latter due to the 2024 uprising.

This SPF project constitutes the initial, pilot stage of a larger project that ultimately aims to improve the state effectiveness of arsenic risk mitigation in Bangladesh, through the provision of a web-based application on local arsenic contamination ("arsenic dashboard") to local bureaucrats. To this end, the team carried out 6 different Key Informant Interviews (KIIs) with key stakeholders and decisionmakers in the DPHE well allocation system, all at the upazila (sub-district) level. The lessons learned from KIIs and the pilot interventions have now been incorporated to a large-scale, nationwide experiment across DPHE engineers in 142 upazilas, who combined oversee public well allocation to 42 million people in rural Bangladesh.

Note on intervention adjustments. We note that the SPF's activities were considerably adjusted following the July Mass Uprising of 2024, which has been communicated to IGC previously (see Appendix for "Update on timeline for IGC grant project 'Improving state effectiveness in arsenic risk mitigation: experimental evidence from Bangladesh (P-0004652)'"). While the core research objective remained the same, we needed to tweak the design in two ways, to address the changes due to the Uprising and the ensuing retreat from public eye of most Union Parishad (UP) chairmen and Members of Parliament (MP). First, we targeted UNO and DPHE engineers, instead of elected politicians. Second, we replaced "bonus" wells incentives with non-financial incentives for higher compliance. The activities discussed below highlight and summarize the research team's efforts to comprehend the changed environment and to adapt the intervention accordingly.

2. LITERATURE REVIEW

The pilot project, and its larger-scale intervention targeting 142 upazilas, make three significant contributions to the literature. First, the research speaks to the rapidly expanding literature on the role of bureaucrats in public sector performance (Greenstone et al. 2018; Bandiera et al. 2021; Besley et al 2022; Best et al. 2023; Aneja and Xu 2024). Such studies have revealed that public-sector bureaucrats operating as “agents” for superior officers (who are in turn “principals”) possess important information that can improve the allocative efficiency of government resources, while institutional barriers (e.g., red tape) can discourage the application of such useful information. This project explores whether providing a web-based application (see below for details on the intervention) to middle-level bureaucrats can improve state capacity in environmental risk mitigation, especially in a policy environment where the institutions and conventions are in flux.

More broadly, our project also relates to the vast literature on the optimal targeting of governmental resources (Alatas et al. 2012; Haushofer et al. 2022). Such studies highlight the utility of alternative methods of targeting (e.g., proxy means testing) in developing countries where precise estimations of household wealth remain challenging. Recent studies have also explored the use of satellite imagery and machine-learning methods for such targeting purposes (Abelson et al. 2014; Burke et al. 2021; Athey et al. 2025). In a similar vein, our intervention faces a similar challenge, where the well-level arsenic field test results that we use to construct the web application are incomplete in their coverage (around one third of villages left untested per upazila). We thus develop and evaluate a machine learning-based prediction method to fill in the gaps in the arsenic testing results.

Second, the research is related to the vast literature on the effect of information on health outcomes in developing countries (Thornton 2008; Dupas 2011; Barnwal et al. 2017), which has identified the potential of individualized health information to deliver significant behavioral changes and risk mitigation. Contrary to such studies, which primarily focus on private information regarding individual health risk, our project assesses whether information on *aggregate* risk (i.e., village-level well-water arsenic contamination) can improve the bureaucrats' allocative efficiency.

Lastly, the research also contributes to the rapidly growing literature on the role of information in adapting to large-scale environmental disasters, such as climate change (Burlig et al. 2024; Shrader 2024) or saltwater intrusion from sea-level rise (Patel 2025). Such studies have highlighted the importance of information (e.g., weather forecasting) on private, household and firm-level adaptation. In contrast, our study is squarely focused on public adaptation to environmental risk–arsenic-safe public wells. To the best of our understanding, this project is the first experimental evaluation of the impact of information in promoting public adaptation (i.e., using public goods) to a wide-scale environmental risk affecting hundreds of millions of people worldwide (Podgorski and Berg 2020).

3. METHODOLOGY

Key informant interviews (KIIs). As alluded to above, the July Student Uprising greatly transformed the policy landscape surrounding the allocation of DPHE public wells. This motivated the KIIs with key stakeholders in public well allocation in DPHE wells, in 6 different upazilas. For each upazila, we conducted individual interviews with the upazila-level DPHE engineer (henceforth "Sub-Assistant Engineer (SAE)"[1]) and the upazila executive officer (henceforth "Upazila Nirbahi Officer (UNO)"). While SAEs are middle-level technical bureaucrats in charge of DPHE-related operations (e.g., DPHE well installations, well maintenance, and other miscellaneous water source management), UNOs–especially under the interim government–hold the final authority and discretion in approving the DPHE well allocation.

In this context, the KIIs aimed to understand the exact method through which DPHE wells are allocated, following the July Uprising. The KIIs were conducted in close cooperation with central DPHE, with (the Project Director of UNICEF-GoB sending official signed letters to the 6 upazila SAEs requesting their cooperation. See Appendix for a sample of two different letters, sent to Following the transmission of signed letters via courier and email, enumerators from the NGO Forum for Public Health set up schedules for Key Informant Interviews, with the first interview taking place on July 16, 2025. In order to assess the efficacy of our web-based "arsenic dashboard" application and to pilot-test the intervention, we randomly assigned the 6 upazilas, drawn from Narayanganj and Feni districts (outside of the 142 upazilas), into 3 "treatment" and "control" upazilas. The upazilas were:

- Treatment: Araiahzar, Sonargaon, Sonagazi
- Control: Bandar, Feni Sadar, Daganbhuiyan

A specific KII questionnaire was developed for SAEs and UNOs. The SAEs were inquired on the public well allocation process, their means of obtaining arsenic-related information, and their feedback on the arsenic dashboard (the latter not included for control upazilas). The UNOs were inquired on the factors of consideration in their well-allocation decision.

Development and refinement of a web-based application. Our intervention, whose feasibility was tested through the SPF project, focuses on a web-based application to DPHE's upazila-level SAEs. The application is in turn developed using data from well-level field arsenic

[1] Strictly speaking, the term "sub-assistant engineers" is a misnomer, as the upazila-level DPHE offices are in principle held by Assistant Engineers (AEs), the entry-level position for engineers having passed the national Bangladesh Civil Service (BCS) exam. In practice, upazila DPHE offices are largely occupied by SAEs, recruited by DPHE-specific exams and targeted for lower-ranking (non-cadre) positions. The upazila-level DPHE officers are thus colloquially referred to as "SAEs."

test data, collected under the auspices of the DPHE's Arsenic Risk Reduction Program (ARRP). Field testers involved in the ARRP campaign collected, The ARRP data covered approximately 300 upazilas and 6.3 million drinking-water wells over three years (2021 to 2023). We conducted extensive data cleaning processes on the raw data to remove duplicates, drop outliers in geographic coordinates, and non-drinking water wells–resulting in a data set of 6.0 million wells.

Crucially, despite its unprecedented nature both in its coverage and its systematic collection of arsenic data (i.e., using mobile applications installed on field enumerators), ARRP data do not constitute a "census" of all drinking-water wells. Rather, the number of tests per union (a collection of villages) were capped at 2,500 wells, leading to approximately one third of all villages not being included in the ARRP data. The absence of data for this significant segment of rural Bangladesh poses a significant challenge to the applicability of the (village-aggregated) ARRP data for the web application, which aims to optimize the within-union, between-village distribution of DPHE wells (i.e., prioritize high-arsenic *villages* within each union).

We thus develop and evaluate a separate machine learning (ML) based model that predicts the arsenic concentration of wells in the untested villages. In particular, we use longitude, latitude, and depth of the wells as predictors of the outcome variable, "well arsenic safety" (with respect to the Bangladesh government standard of 50ppb). Following lab-based tests of field samples (Khan et al. 2025), we define the outcome variable to be value 1, 0.5, and 0 when the test results were below (or equal to) 10ppb, either 25 or 50ppb, and strictly larger than 50ppb (e.g., 250ppb). The random forest model then consists of 500 decision trees using longitude, latitude, and depth of wells as the predictor variables, where the 500 trees are trained on a random subset of the entire data set–the randomization process is meant to reduce the overfitting behavior common in ensemble tree models (Breiman 2001).

Importantly, we evaluate the capacity of the models to predict village-level probability of arsenic contamination by conducting "group cross-validation." Contrary to the conventional cross-validation approach, which involves splitting the individual observations (i.e., the 6 million wells), to "training" and samples use wells from a randomly selected two thirds of the **villages** to be used as "training" data set. We then use the wells in the remaining one-third of the villages to be the "test" data set, where the true "percentage of % wells unsafe" in the previously unseen villages are compared to their predicted counterparts. The method hence directly measures the capacity of the ML model to predict the *village*-level average contamination rate.[2]

[2] Note that the method is analogous in spirit to the spatial cross-validation methods used in ecological studies (Meyer et al., 2019); as in the ecological literature, the approach rules out the possibility of the ML models simply memorizing that certain villages are high in arsenic contamination levels–and using this information when asked to predict on the "test" data set.

We repeat the cross-validation exercise 50 different times to obtain the point estimate and confidence interval of the RMSE. As the sheer size of the data set precludes fitting the model multiple times to the entire data set of 6 million wells, we fit the ML models for individual districts, using wells from both the district itself and its neighbors (in order to capture continuous spatial patterns at the borders of each district).

We then apply the ML-based method to all untested mauzas in the 6 upazilas targeted by the KIIs, hence forming a spatially continuous, gap-filled data set of mauza-level arsenic contamination rate for all mauzas in the 6 upazilas.

4. RESULTS

4.1 Key informant interview results

The SAE-UNO dynamic. The KIIs with 6 different upazila-level engineers (SAEs) and chief bureaucrat (UNOs) yielded multiple interesting insights. First, the interviews clearly revealed that in the decision-making process of DPHE well allocation, UNOs act as “principals” and SAEs as “agents,” with the two bureaucrats’ incentives not always being aligned. Under the new political regime after the July Uprising, the UNOs were the chief officers in the upazila exercising unilateral and final discretion on the allocation of DPHE wells. In contrast, SAEs play the role of lower-level technocrat who collect applications for DPHE well installations from villagers, conduct feasibility studies once the final allocation is decided, and (depending on the practices of the upazila) provide the UNOs with initial recommendations on which well applications should be approved for final approval.

Multiple SAEs report while they produce the first draft of the well allocation list, the final authority to decide on well locations ultimately lies with UNOs. Both in the process leading up to the approval (i.e., solicitation of applications from villagers) and in the final decisions, it was clear that local political leaders (such as village representatives and remaining union parishad leaders) still played an influential role–with the leaders referring to certain applications as having “stronger demand.” .

SAEs’ considerations in formulating recommendations. As alluded to above, SAEs frequently provide the UNOs with the set of public well applications to be approved. The

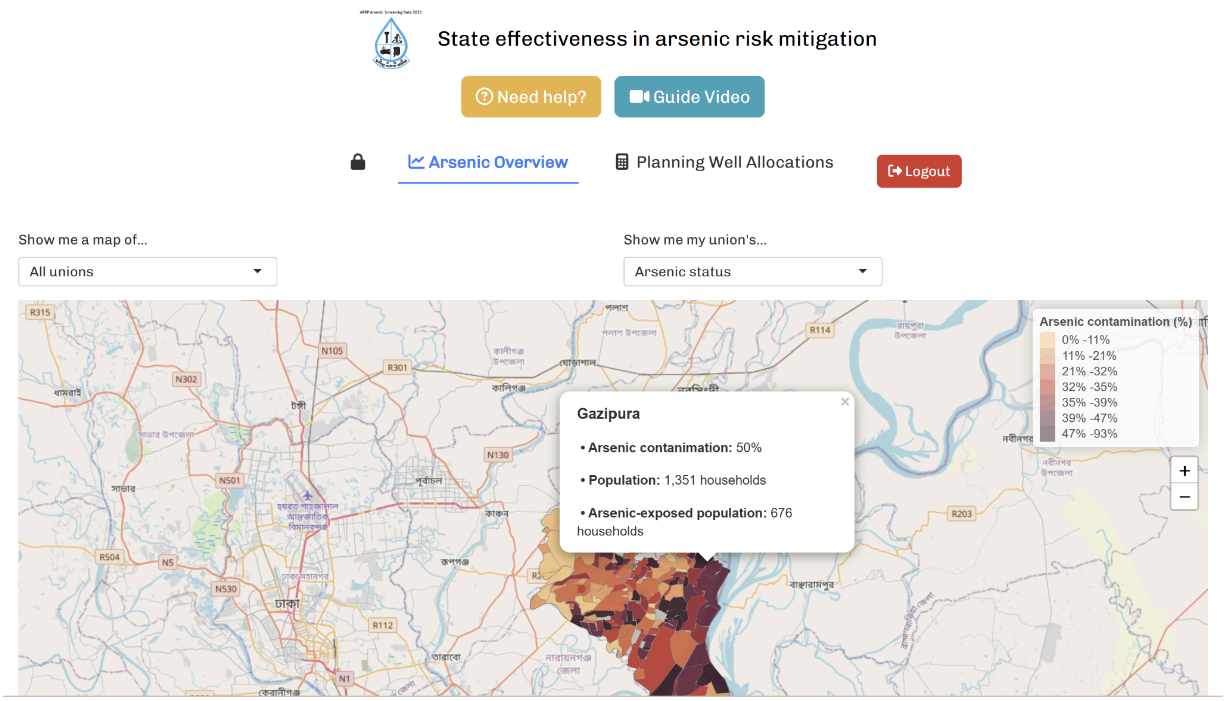

Figure 1. Example of the arsenic dashboard website, for Araihazar upazila

enumerators thus posed open-ended questions on the factors that are taken into account in the SAEs' recommendations.

While we observed significant heterogeneity in the SAEs' responses, some common aspects considered were the socioeconomic conditions of the households neighboring the prospective wells, discussions with the DPHE mechanics (SAEs' subordinates). The discussions also revealed that the SAEs are multitasking agents, involved in not only public well operations but also in receiving villager complaints on other DPHE operations.

SAEs' understanding of arsenic levels and their response to arsenic dashboard website. For the 3 "treatment" upazilas, the SAEs were also provided with a demonstration session on the web application and their reactions solicited. Figure 1 shows a sample screenshot of the website that was provided to the SAEs. The responses from the SAEs were largely positive, and their feedback on bugs and errors greatly stabilized the app features. Their feedback on the application being too complex (with four different panels and functionalities) led to the simplification of the website, to only have two panels and functions.

Importantly, prior to providing the web application, the SAEs were prompted to produce an estimate of arsenic contamination rate in two to four randomly selected mauzas in their upazila. We only focused on ARRP-tested mauzas (i.e., excluded gap-filled mauzas). Although a systematic analysis is not feasible due to limited sample size, we found evidence suggesting strong knowledge of high-arsenic *unions*, but not high-arsenic *mauzas* within each union. When asked the same question after the “arsenic dashboard” demonstration session, the SAEs responded accurately with the correct rate, suggesting that they found the dashboard’s information credible.

Well installation data compilation practices. The KII questionnaire also included items pertaining to the upazilas’ DPHE well data record practices. We found strong differences in the data management practices, with some SAEs having an electronic copy of the past fiscal year’s DPHE installation records (with each row representing individual wells), with their coordinates and depth in hand. In contrast, some SAEs disclosed that they have no such records, and would require additional clearance from central DPHE and the district-level DPHE office (headed by Executive Engineer) to share the information.

4.2 Machine learning model for arsenic contamination: Performance and application

The ML algorithm for gap-filling ARRP testing data showed reliable prediction capacity, consistently outperforming conventional OLS methods (i.e., kriging), which in turn predicted arsenic contamination rate by linear and quadratic transformations of longitude, latitude, depth, and their interactions.

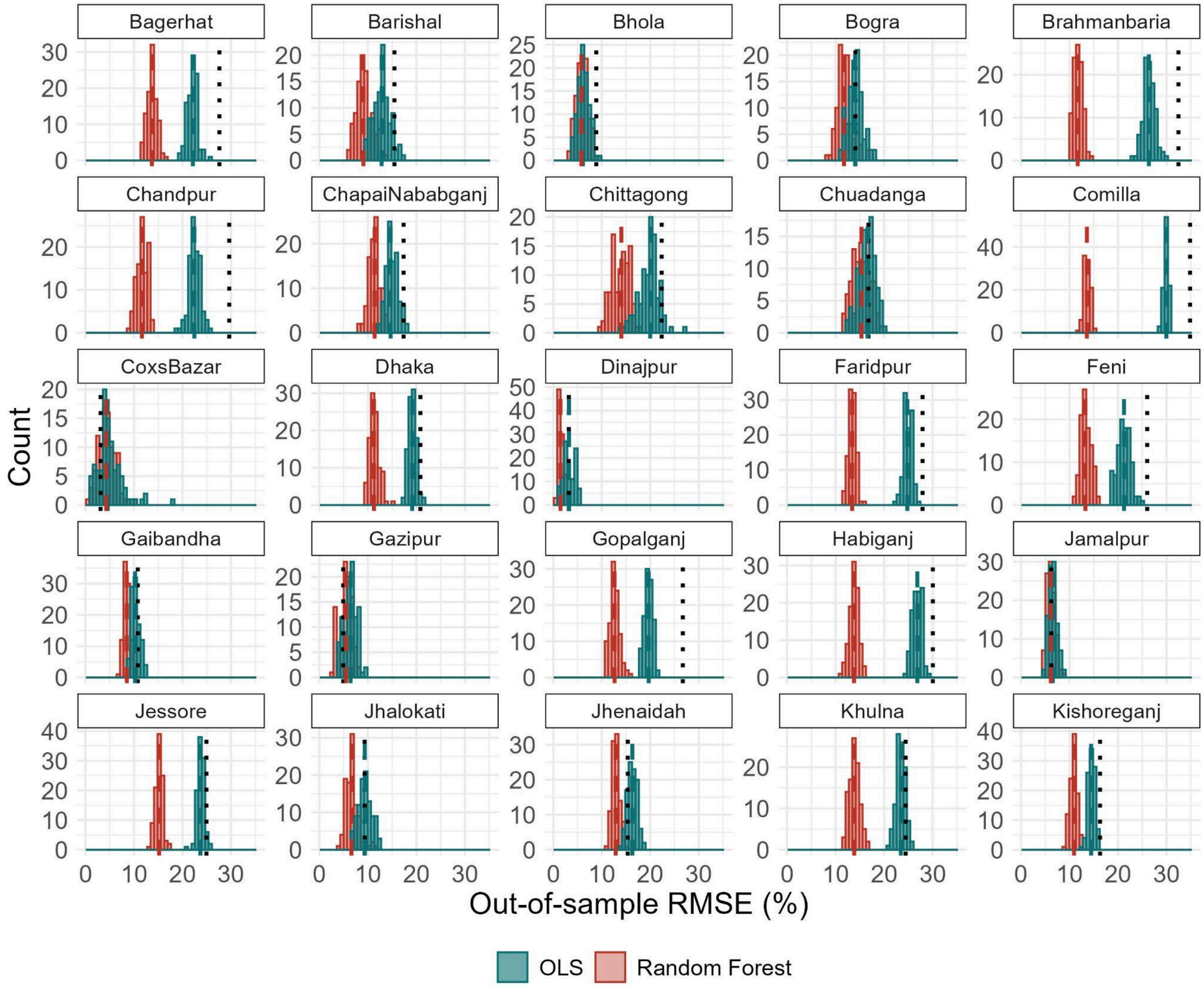

Figure 2. Out-of-sample performance of ML and OLS models, first 25 districts.

Notes: Figure presents the histogram of out-of-sample RMSE of predictions from ML (red) and OLS (green) models, on village-level arsenic contamination rate (%), over 100 different random splitting of data into training-testing data sets. The splits followed villages to directly evaluate the models' capacity to predict village-level outcomes (see main text for details). Standard deviation of village-level contamination rate shown in dotted black vertical lines.

To be more precise, Figures 2 and 3 present the out-of-sample RMSE of village-level arsenic contamination rate predictions, for the one-third of villages that were held out from observation. Over 100 independent random splits, the ML models' RMSE (red) are almost always smaller than that of OLS (green), over most districts. Some notable exceptions include Jamalpur and

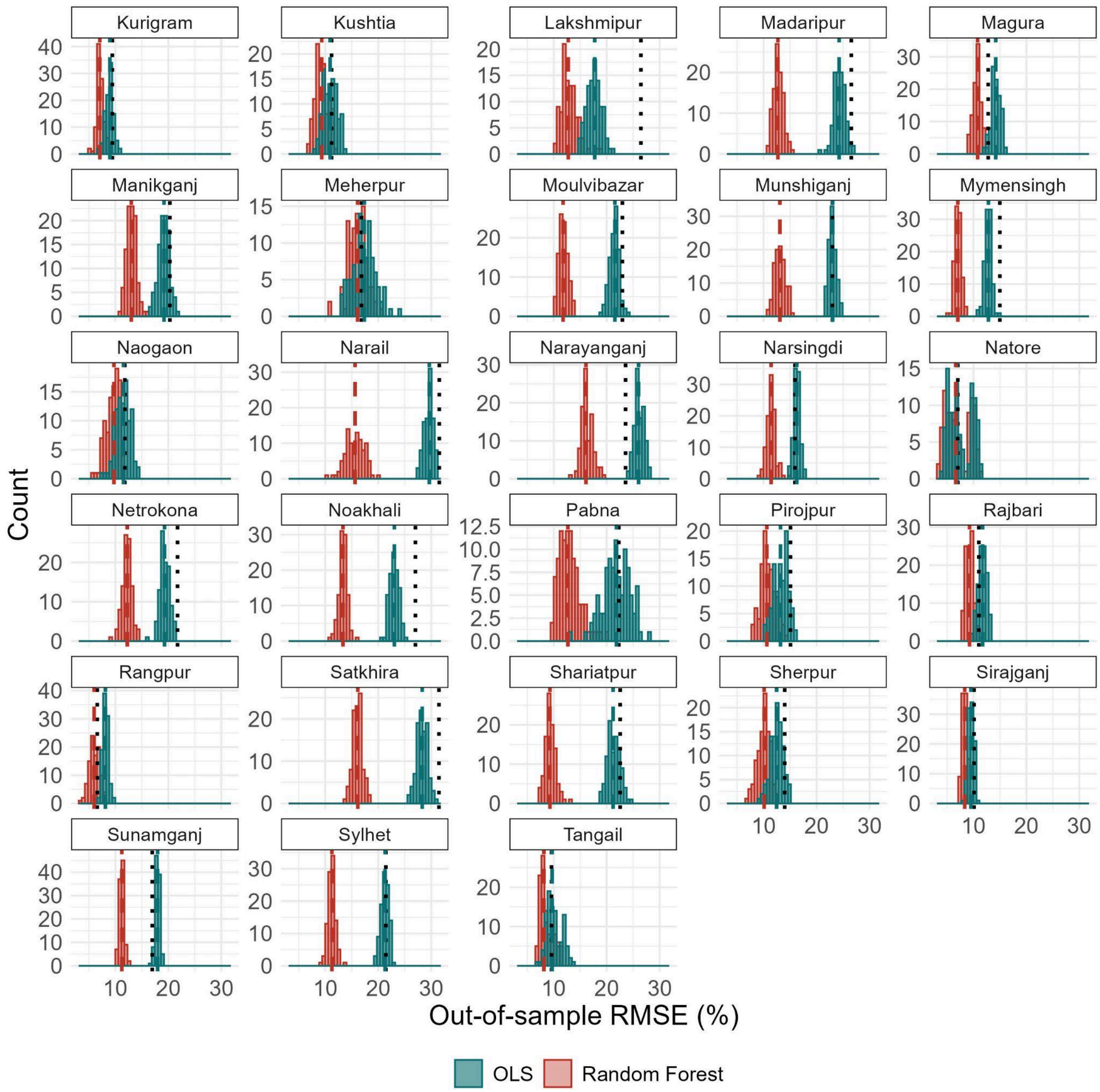

Figure 3. Out-of-sample performance of ML and OLS models, remaining districts

Notes: Figure shows out-of-sample performance of ML and OLS models as in Figure 2, but for the remaining districts.

Natore districts, where the two models are similar in performance. The RMSEs of models are on average smaller than the standard deviation of contamination rates.

4.3 Policy outreach

As previously discussed, the KIIs were organized under the auspices of the central DPHE, with the letter from the Project Director proving to be integral to the project's progress. All findings from the KII and the ML analysis, including the arsenic dashboard website, were shared with DPHE (see Appendix "Report on Takeaways from Key Informant Interviews regarding Deep Well Allocation"). Further, Co-PI Alexander van Geen and Research Assistant Mr. Seung Min Kim visited DPHE three times throughout the SPF project, as follows:

1. December 2024 (van Geen and Kim): Explored the changing decision-making process after the uprising and discussed with Chandina upazila SAE.
2. January 2025 (van Geen): Met with the Chief Engineer (CE, highest executive) of DPHE, once again receiving the CE's approval of the larger project targeting 142 upazilas.
3. May 2025 (van Geen): Met with the outgoing CE and the incoming CE, and were assured continuity under the transition. Held a meeting and an informal interview with a SAE in Narayanganj district on the well allocation process.

Throughout the SPF project, Co-PI Md. Ahasan Habib (NGO Forum for Public Health) and his colleagues played a key role in facilitating the cooperation with DPHE and other governmental bodies. Overall, the pilot project has strengthened the partnership between the research team and the central DPHE in Dhaka. The cooperation will culminate in an upcoming public high-level meeting between the Co-PI van Geen, DPHE, and its supervising governmental ministry (Ministry of Local Government, Rural Development and Co-operatives).

5. CONCLUSION

This pilot study successfully validates the feasibility and utility of a web-based "arsenic dashboard" to enhance the allocative efficiency of public deep tube wells in Bangladesh. By leveraging machine learning to fill critical data gaps and adapting the intervention to the post-July 2024 political landscape, the research demonstrated that providing granular contamination data to local bureaucrats effectively supplements their existing knowledge and supports more objective decision-making.

The next phase of the research project, which targets 142 upazilas covering 42 million people (with 70 upazilas randomly selected as "treatment" upazila), is now underway, with the arsenic dashboard developed based on the lessons learned from this project. Results from the larger research project will form the basis of a working paper in economics for peer review.

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APPENDIX

Update on timeline for IGC grant project "Improving state effectiveness in arsenic risk mitigation: experimental evidence from Bangladesh (P-0004652)"

Recent developments in Bangladesh

The aftermath of the Monsoon Revolution (MR) of July 2024, which removed the Awami League (AL) government from power and introduced an interim government led by Dr. Muhammad Yunus, has obliged the research team to change its intervention plan. Our original plan focused on elected union parishad (UP) leaders and provision of "bonus wells" as non-monetary incentives to improve the effectiveness of DPHE deep tubewells, and as of September 2024 when we submitted our application, the signals we were getting from Bangladesh still suggested that this would be feasible. However, UP leaders (both inside and outside the intervention Cumilla district) have gone into hiding. The DPHE well allocations will now be decided by non-elected Upazila Nirbahi Officers (UNO) of the Bangladesh civil service as well as upazila-level DPHE sub-assistant engineers (SAEs).

We learned from recent visits that UNOs are under a lot of pressure to deliver as there no longer are elected officials to share responsibility with. The MR has unleashed a strong desire to hold politicians (eventually) and bureaucrats (now) accountable for their performance as providers of public goods. The MR thus provides both a challenge and an opportunity for our project to test interventions on improving government effectiveness. We highlight below our efforts to evolve our intervention under the changed environment below.

Progress after December 2024

Despite significant upheaval in the bureaucracy's leadership positions following MR, our main point of contact at DPHE (Superintending Engineer Mr. Md. Saifur Rahman) and the Chief Engineer of DPHE (Mr. Tushar Khan) retained their positions. Co-PI Alexander van Geen and PhD student Seung Min Kim hence traveled to Bangladesh in **December 2024** to gather information on the evolving situation and reconfirm DPHE's engagement. The visit allowed the team to make the following progresses:

- DPHE was informed of the new intervention plan on a large-scale (quasi-nation wide) intervention targeting upazila-level bureaucrats (see below). DPHE reaffirmed its interest and commitment.
- The research team traveled to Araiahzar Upazila, an upazila outside the original intervention area, and delivered the web application as a pilot. The UNO and SAE showed their interest.

The DPHE meeting and Araihzar meetings were accompanied by Co-PI Md. Ahasan Habib, the former also being accompanied by Co-PI Md. Ahasan Habib.

Following the December meeting, in **January 2025** Co-PI Alexander van Geen traveled to Bangladesh once more to make progress on the project. During the trip, Co-PIs van Geen and Habib met with the Director of NGO Affairs Bureau of Bangladesh, in which the director allowed Co-PI Habib to work with district-level officials to accelerate the administrative progress.

Changes in the intervention plan

The absence of UP leaders meant that the research team had to devise a new intervention plan. Namely, we now intend to work with UNOs and their representatives by providing them with a "scoring" application (click here for an example, for Muradnagar upazila in Cumilla district). The application allows the UNO leaders to understand the public health consequences of different DPHE well allocations. The application also "scores" the allocation proposed by the UNOs based on the number of arsenic-exposed households reached by the allocation.

We intend to disseminate the scoring application to a randomly selected 108 upazilas across the country, with 107 control upazilas. The 215 upazilas cover all upazilas that were tested by the Arsenic Risk Reduction Program (ARRP) outside the Barishal, Rangpur, and Rajshahi divisions (three divisions dropped to reduce logistical costs).

Unfortunately, the focus on upazila-level leaders means that the original bonus well budget is no longer strong enough to prompt a meaningful response from UNOs. Contrary to elected UP leaders, who were assigned an annual budget of 13 DPHE wells to distribute within their jurisdiction, UNOs on average have around 120 DPHE wells in their budget. Our original plan awarded 110 bonus wells for 40 top union leaders (2.75 wells per awardee, or 21% of their budget). To reach an intervention of similar intensity, we would have had to provide 25 bonus wells per upazila, which translates to 750 bonus wells (750,000 USD) assuming 30 awardees. We have also been told that providing bonus wells to UNOs would be considered inappropriate.

We thus aim to incentivize the UNOs instead by organizing a public "award ceremony" for top 30 UNOs that have delivered the highest performance. We are also currently devising a cross-randomization plan that would treat some upazilas with a public-facing campaign which will increase UNO's accountability for their DPHE well allocations.

Future steps/timeline

We intend to move the project forward as follows, with the ultimate goal of having a working paper available for circulation as of **September 2026**:

- **Before April 2025**: Finalize the intervention plan and randomization

- **April 2025:** Work with NGO Bureau for clearance on intervention and notify DPHE with the final plan
    - PhD student Seung Min Kim (and potentially other members of the research team) will travel to Dhaka to facilitate this process
- **May 1-June 30 2025**: Start disseminating the application to UNOs, with the 2025/26 fiscal year installations as the target
- **July 2025-June 2026 (Fiscal year 2025/26)**: UNOs assign and install DPHE wells
- **June 2026:** Research team collects data on well allocation through Grameen Pani (DPHE network on public tubewells) and conduct analysis
- **July-September 2026**: Research team works on producing the working paper, with a deadline of **September 30, 2026.**

Sample DPHE letters for Key Informant Interviews

For “Control” upazila - Feni Sadar upazila, Feni district

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
প্রকল্প পরিচালকের দপ্তর
বাংলাদেশ জলবায়ু সহিষ্ণু টেকসই পানি সরবরাহ, স্যানিটেশন ও হাইজিন প্রকল্প (জিওবি-ইউনিসেফ)
১৪ শহীদ ক্যাপ্টেন মনসুর আলী সরণি
কাকরাইল, ঢাকা-১০০০।

স্মারক নং - তারিখ: ০১- ০৭ - ২০২৫

বিষয়: গবেষণা কার্যক্রম অবহিতকরন এবং জনস্বাস্থ্য প্রকৌশল অধিদপ্তর এর মাধ্যমে উপজেলা পর্যায়ে নীতি নির্ধারন প্রসঙ্গে।

বরাবর,
উপ-সহকারী প্রকৌশলী
ফেনী সদর উপজেলা, ফেনী।

জনস্বাস্থ্য প্রকৌশল অধিদপ্তর (স্বারক নং:৪৬.০৩.২৬০০.০৪৩.৩৩.০০১.১৮-৩৬৫) সহ ঢাকা বিশ্ববিদ্যালয়, ইউএসএ এর কলম্বিয়া বিশ্ববিদ্যালয় ও মিশিগান স্টেট বিশ্ববিদ্যালয় এবং এনজিও ফোরাম ফর পাবলিক হেলথ্ এর যৌথ উদ্যোগে **“Improving State Effectiveness in Environmental Risk Mitigation-2”** শীর্ষক একটি গবেষণা কার্যক্রম বাস্তবায়িত হচ্ছে। এই কার্যক্রমটি এনজিও অ্যাফেয়ার্স ব্যুরো কর্তৃক অনুমোদিত (স্মারক নং: ০৩.০৭.২৬৬৬.৬৬৩.৬৮.০৩৮.২৫-১২৪৭) ।

আপনার উপজেলায় জনস্বাস্থ্য প্রকৌশল অধিদপ্তরের নলকূপ বরাদ্দ ব্যবস্থাপনার অংশ হিসেবে ১) ফোকাস গ্রুপ ডিসকাশন (FGD) এবং ২) উপজেলা নির্বাহী কর্মকর্তার সাথে সাক্ষাৎকার আয়োজনের পরিকল্পনা গ্রহন করা হয়েছে। এই উদ্দেশ্যে এনজিও ফোরাম ফর পাবলিক হেলথ্ এর একজন কর্মকর্তা আগামী ২ সপ্তাহের মধ্যে আপনার সাথে যোগাযোগ করবেন

এই গবেষণা কার্যক্রমের আওতায় (FGD) ও উপজেলা নির্বাহী অফিসারের সাথে সাক্ষাৎকার আয়োজনে আপনার সার্বিক সহযোগিতার জন্য ধন্যবাদ।

মোঃ সাইফুর রহমান
প্রকল্প পরিচালক
ফোন নং: ০১৭১১০৩৩১১৫

For “Treatment” upazila - Araihazar upazila, Narayanganj district

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
জনস্বাস্থ্য প্রকৌশল অধিদপ্তর
প্রকল্প পরিচালকের দপ্তর
বাংলাদেশ জলবায়ু সহিষ্ণু টেকসই পানি সরবরাহ, স্যানিটেশন ও হাইজিন প্রকল্প (জিওবি-ইউনিসেফ)
১৪ শহীদ ক্যাপ্টেন মনসুর আলী সরণি
কাকরাইল, ঢাকা-১০০০।

স্মারক নং -   তারিখ: ০১ - ০৭ - ২০২৫

বিষয়: গবেষণা কার্যক্রম অবহিতকরন এবং জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কর্তৃক আর্সেনিক দূষন প্রতিরোধে উপজেলা পর্যায়ে নীতি নির্ধারন প্রসঙ্গে।

বরাবর,
উপ-সহকারী প্রকৌশলী
আড়াইহাজার উপজেলা, নারায়ণগঞ্জ।

জনস্বাস্থ্য প্রকৌশল অধিদপ্তর (স্বারক নং: ৪৬.০৩.২৬০০.০৪৩.৩৩.০০১.১৮-৩৬৫) সহ ঢাকা বিশ্ববিদ্যালয়, ইউএসএ এর কলম্বিয়া বিশ্ববিদ্যালয় ও মিশিগান স্টেট বিশ্ববিদ্যালয় এবং এনজিও ফোরাম ফর পাবলিক হেলথ্ এর যৌথ উদ্যোগে **“Improving State Effectiveness in Environmental Risk Mitigation-2”** শীর্ষক একটি গবেষণা কার্যক্রম বাস্তবায়িত হচ্ছে। এই কার্যক্রমটি এনজিও অ্যাফেয়ার্স ব্যুরো কর্তৃক অনুমোদিত (স্বারক নং: ০৩.০৭.২৬৬৬.৬৬৩.৬৮.০৩৮.২৫-১২৪৭)। উক্ত পাইলট কার্যক্রমের মূল উদ্দেশ্য হলো- জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কর্তৃক বরাদ্দকৃত আর্সেনিকমুক্ত নলকূপগুলির মাঠপর্যায়ের বিতরন ব্যবস্থাকে আরও লাগসই ও জনবান্ধব করার লক্ষ্যে কাজ করা।

এই কার্যক্রমটি বিগত ২৫ বছরের বেশি সময় ধরে বাংলাদেশের নলকূপের পানির আর্সেনিক দূষণের তথ্যের উপর ভিত্তি করে ডিজাইন করা হয়েছে। বাংলাদেশের ১২,০০০ প্রাপ্তবয়স্ক মানুষের উপর গবেষণার তথ্য থেকে দেখা যায় যে, আর্সেনিকমুক্ত নলকুপের পানি ব্যবহারকারীদের তুলনায় ১০০ (মাইক্রোগ্রাম/লিটার) এর বেশি আর্সেনিকযুক্ত নলকূপের পানি ব্যবহারকারীরা দ্বিগুণ মৃত্যুর ঝুঁকিতে থাকে*(Argos et al. 2011)*। সাম্প্রতিক একটি গবেষণায় দেখা গেছে যে, কোনও পরিবার আর্সেনিকযুক্ত নলকূপ থেকে পানি পান থেকে বিরত থাকলে, এই মৃত্যুঝুঁকি অনেকখানি কমে যায় *(Wu et al. 2024)*। **জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কর্তৃক স্থাপনকৃত নলকূপগুলি আর্সেনিকের ক্ষতিকারক প্রভাব কমাতে গুরুত্বপূর্ণ ভূমিকা পালন করে।**

গবেষক দল একটি ওয়েবসাইট তৈরি করেছে, যা (১) আপনার উপজেলার আর্সেনিক দূষণের চিত্র তুলে ধরে (২) জনস্বাস্থ্য প্রকৌশল অধিদপ্তর কর্তৃক আপনার উপজেলার আর্সেনিক দূষণ প্রতিরোধে নলকূপ বরাদ্দের মাধ্যমে কতগুলো পরিবারকে নিরাপদ পানি সরবরাহ করা যেতে পারে, তা পর্যালোচনা করে এবং (৩) প্রতিটি মৌজার আর্সেনিকযুক্ত নলকূপ দূষণের পরিসংখ্যানগত তথ্য তুলে ধরে।

এই ওয়েবসাইটটি https://nolkup.info/arrpU ডিপিএইচই -এর আর্সেনিক ঝুঁকি হ্রাস প্রকল্প (ARRP) এর তথ্যের উপর ভিত্তি করে তৈরি করা হয়েছে। নিম্নোক্ত QR কোড স্ক্যান করে আপনি ওয়েবসাইটে প্রবেশ করতে পারবেন। ওয়েবসাইট সম্পর্কিত ভিডিও টিউটোরিয়ালটি দেখার জন্য আপনি নিম্নোক্ত লিংকটি ব্যবহার করতে পারেন: https://nolkup.info/nolkuptutorial.

ওয়েবসাইট ব্যবহারের উপর একটি প্রশিক্ষণ আয়োজন করতে এনজিও ফোরাম ফর পাবলিক হেলথ্ এর একজন কর্মকর্তা আগামী ২ সপ্তাহের মধ্যে আপনার সাথে যোগাযোগ করবেন এবং ওয়েবসাইটের লগইন সম্পর্কিত তথ্য প্রদান করবেন।

এই গবেষণা কার্যক্রমের আওতায় ফোকাস গ্রুপ ডিসকাশন ও উপজেলা নির্বাহী অফিসারের সাথে সাক্ষাৎকার আয়োজনে আপনার সার্বিক সহযোগিতার জন্য ধন্যবাদ।

মোঃ সাইফুর রহমান
প্রকল্প পরিচালক
ফোন নং: ০১৭১১০৩৩১১৫

ওয়েবসাইট   ইউটিউব লিংক

সংযুক্তি:
১. স্কোরিং অ্যাপস গাইডলাইন
২. স্কোরিং অ্যাপস এর ইউজারনেম এবং পাসওয়ার্ড

সংযুক্তি: ২. স্কোরিং অ্যাপস এর ইউজারনেম এবং পাসওয়ার্ড

Improving State Effectiveness in Environmental Risk Mitigation

Araihazar Upazila, Narayanganj District

https://nolkup.info/arrpU

User ID: pilotaraihazar

Password: pa23

Tutorial link: https://nolkup.info/nolkuptutorial

Report on Takeaways from Key Informant Interviews regarding Deep Well Allocation - Shared with DPHE

Report on Takeaways from Key Informant Interviews Regarding Deep Well Allocation

Date: August 2, 2025

Authored By: Columbia University and Partners, summarizing the fieldwork of Md. Mir Raihan (NGO Forum for Public Health, Bangladesh)

Prepared For: Mr. Md. Saifur Rahman, Project Director, Bangladesh Climate Resilient Sustainable Water Supply, Sanitation & Hygiene Project, DPHE

I. Introduction

This report summarizes the key findings from a series of Key Informant Interviews (KIIs) conducted to understand the deep well allocation process in several upazilas. The fieldwork, carried out by Mr. Md. Mir Raihan, involved interviews in **six** upazilas to gather insights into the current procedures regarding DPHE deep well allocation, information sources, and the potential utility of a web application designed to aid in this process.

The study distinguishes between "treatment" upazilas (Araihazar, Sonargaon, Sonagazi), where a web application was introduced, and "control" upazilas (Bandar, Feni Sadar, Daganbhuiyan), where no application was introduced. The DPHE letters were absolutely integral in setting up the interviews, and the research team conveys its deep gratitude to Mr. Md. Saifur Rahman for his engagement. The interviews were conducted during the weeks of July 14, 21, and 28.

This report outlines the dynamics between key decision-makers in DPHE well installation, the factors influencing well placement, the response to the new web application, and other relevant observations from the fieldwork.

II. Key Takeaway 1: Promising Response to the Web Application

The introduction of a web application to assist with well allocation was met with a positive response from the SAEs. One SAE from Sonargaon found it "very useful—especially the arsenic exposure maps and the contamination information". While some minor technical issues like zooming were raised and resolved, the overall feedback was encouraging.

The application has the potential to improve the SAEs' understanding of arsenic distribution. To gauge the SAEs' understanding of their upazila's arsenic contamination, the enumerator had a brief "quiz" session prior to introducing the web application—where the SAEs were asked to give a score on the arsenic contamination levels of two mauzas, one high in arsenic and the other low in arsenic. The quiz session revealed the SAEs' different levels of prior comprehension in their upazila's well-water arsenic distribution.

For example, before using the app, the Araihazar SAE's estimation of unsafe wells in two areas was significantly different from the actual data (rating a mauza with 68% unsafe wells as only 30% unsafe). After using the map, the SAE updated her assessment. Similarly, the Sonargaon SAE's initial assessment was also inaccurate, but he updated his beliefs following the actual information from the web application, and acknowledged that the updated information helps them "better understand where to focus future well installations". This suggests that the SAEs find the application reliable and are willing to update their priors based on the information it provides.

III. Key Takeaway 2: The SAE-UNO Dynamic

A central finding of the KIIs focuses on the relationship between the Upazila Nirbahi Officer (UNO) and the DPHE Sub-Assistant Engineer (SAE). The roles of UNO and SAE in the DPHE well allocation can be summarized as:

- **Upazila Nirbahi Officer (UNO):** The UNO acts as a manager overseeing all upazila operations across 14 different sectors, amongst which is the installation of DPHE wells. They hold the final authority over the installation of DPHE wells. After the Revolution, the role of the UNO has evolved to encompass the previous role held by the Union Parishad leaders, with union- and village-level local (un)elected representatives discussing their communities' DPHE well needs with the UNO.

- **Sub-Assistant Engineer (SAE):** The SAEs are the technocratic professionals who receive applications for well installations from residents, assess their feasibility and desirability, and then present recommendations to the UNO.

However, not all of the SAE's recommendations are followed. The UNO's decisions are influenced by various stakeholders.

For instance, the Sonargaon UNO reported consulting with (existing) Union Parishad Chairmen and ward members, who have direct knowledge of local needs. The Bandar Assistant Engineer (AE) noted that political leaders sometimes interfere with alternative recommendations to "maintain the balance". This political influence can lead to deviations from the SAE's recommendations. One SAE from Sonargaon estimated that only 60-70% of their proposed sites were accepted, with the remainder being altered due to political considerations or pressure from local leaders. Similarly, an SAE from Araihazar noted that due to local political influence, some technically less suitable locations still receive approval.

IV. Key Takeaway 3: Factors Influencing SAE Recommendations

The SAEs consider a variety of factors beyond just arsenic levels when making their recommendations for DPHE well placement. These include:

- The economic condition of families and the needs of the community.
- Prior well allocations in the area.
- Discussions with lower-ranking DPHE mechanics.
- Prioritizing locations near schools or health clinics, especially if project guidelines suggest it.
- Insights from local (non-elected) leaders about communities facing difficulties in accessing safe water.

V. Key Takeaway 4: Anticipating the Impact of the Full-Scale Experiment

The impact of this intervention is expected to be highly varied. The effectiveness will likely depend on several factors, including:

- The UNO's propensity to follow the SAE's recommendations.
- The SAE's and AE's familiarity with the region.
- The degree of cooperation from SAEs.
- The open-mindedness of the SAEs.
- Prior exposure to arsenic reduction campaigns.

VII. Path Forward and Recommendations

Based on these findings, the following steps are recommended:

- **Data Collection:** For a comprehensive understanding of how our intervention affects the allocation of DPHE wells, it is crucial to collect data on:
    - Applications received from residents and the information they contain.
    - Coordinates and depth of wells allocated in the previous year.
    - The background of SAEs and UNOs, including their tenure, recruitment path, and experience.
    - Other DPHE activities, such as the number of maintenance operations.
- **Website Enhancement:** Further consideration should be given to how the website can be made more directly applicable to the processing of villager applications.

The fieldwork indicates that there are no major obstacles to moving forward with the project. The insights gained will be invaluable in refining the intervention and understanding its potential impact.

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