

# COMPARING METHODS FOR TARGETING **WATER SUBSIDIES** TO THE **POOREST HOUSEHOLDS**

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*With funding from the Conrad N. Hilton Foundation (CNHF), The Aquaya Institute (Aquaya) supports government agencies in selected districts of Ghana and Uganda in their efforts to achieve 100% coverage of safe, sustainable, and equitable drinking water supplies. As part of this effort, Aquaya collaborates with Safe Water Network to develop a blueprint for implementing targeted subsidies at rural water systems.*



## MOTIVATION

In Ghana, the poorest households tend to have lower access to safe drinking water, in part due to the cost of improved sources such as piped water systems. Subsidizing safe water services for the poorest can help to address these inequities, but water subsidies are commonly ineffective due to the financial constraints of service providers and unsuccessful targeting that benefits high-income groups. It is critical to find appropriate targeting methods that can accurately predict household poverty, are acceptable to community members and other stakeholders, and can be scaled efficiently.

## RESEARCH QUESTION

**WHAT IS THE BEST METHOD TO IDENTIFY POOR AND VULNERABLE HOUSEHOLDS FOR WATER SUBSIDIES?**

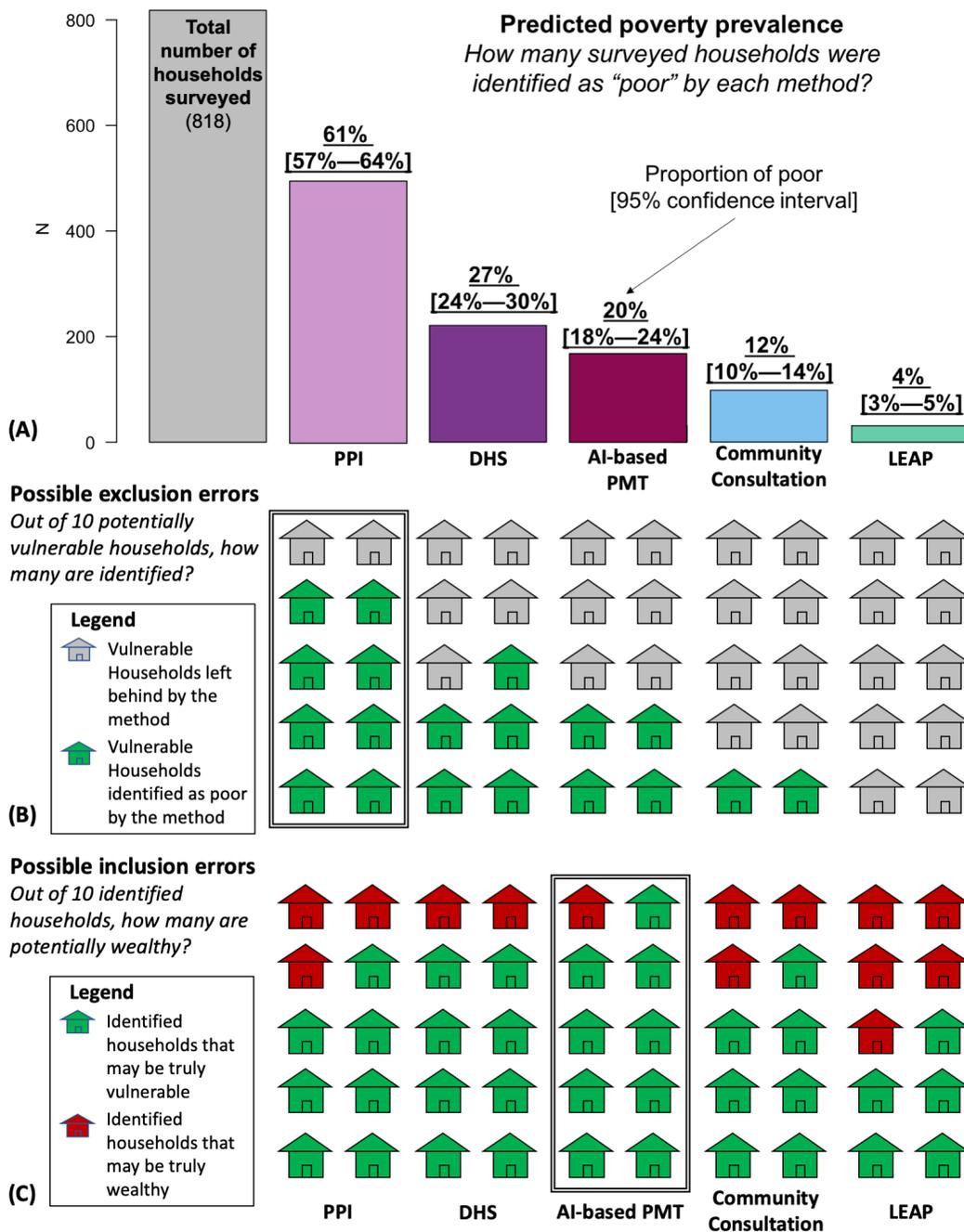
In this study, we compared the performance of five methods for targeting the poorest for water subsidies, identified through the literature and existing practice in Ghana (Table 1).

# METHODS

Targeting method	Description
<b>AI-based proxy means test (PMT)</b> 	<p>A PMT predicts household poverty status by collecting easily quantifiable proxy indicators for wealth through surveys. As part of this research, Aquaya developed a new PMT using machine learning techniques and data from the 2016-2017 Ghana Living Standards Survey (GLSS 7) to predict household poverty status relative to the Ghana national poverty line. This approach resulted in a survey that assessed 47 variables to predict poverty.</p>
<b>Demographic and Health Survey (DHS) wealth index</b> 	<p>The DHS Wealth Index is an existing PMT producing an index value for each surveyed household based on a set of 142 variables in rural Ghana. Households in the bottom 20% of the national index are typically considered as poor.</p>
<b>Poverty Probability Index (PPI)</b> 	<p>The PPI is an existing PMT that consists of 10 country-specific questions about household characteristics and asset ownership, and the responses are used to calculate a household's likelihood of falling below the national poverty line.</p>
<b>Community consultation</b> 	<p>Community members come together in a meeting to agree on a definition of poverty and designate households that meet this definition. In this study, consultation meetings typically lasted one hour with 40-120 participants in attendance, and members defined poor households as <b>(i)</b> households that could not feed themselves year-round, or <b>(ii)</b> households that contained an elderly person, a person with a severe disability or chronic illness, a widow, or an orphan and did not receive support from relatives.</p>
<b>Livelihood Empowerment Against Poverty (LEAP) enrollment</b> 	<p>Ghana's existing LEAP program uses a combination of proxy means testing and community consultation to identify poor households for cash transfers and free health insurance. This program was specifically designed to target people who are elderly (&gt;65 years old), disabled without productive capacity, and orphaned. Other interventions (such as water subsidies) may consider targeting households that LEAP has already identified.</p>

**Table 1.** The five targeting methods assessed in this study.

This study took place in three small towns in the Ahafo and Ashanti Regions of southwestern Ghana. We held six community consultation meetings in neighborhoods within these towns, and surveyed all 818 households in these communities. Surveys included questions to assess eligibility with respect to all three proxy-means tests (PMT) and enrollment in the Livelihood Empowerment Against Poverty (LEAP) program. To assess the acceptability of each method, we also conducted qualitative interviews with nine households identified as poor through community consultation, eight households not identified as poor, and six local government officials. We also tracked the costs of implementing each approach.



We used the GLSS 7 dataset to estimate which households might be truly vulnerable and which might be wealthy.

- Vulnerable: Household meets one of the following criteria (household head works in agriculture on own land and has limited education, or household has more than 6 members but only 1 room for sleeping, or household cannot feed itself year round) AND does not meet any of the wealthy criteria
- Wealthy: Household owns a computer, refrigerator, freezer, or generator, or has spent money on organic fertilizer

**Figure 1.** Performance of each targeting method, with respect to (A) the proportion of households identified as poor, (B) the degree to which each method leaves behind potentially vulnerable households (exclusion errors), and (C) the degree to which each method identifies wealthy households as poor (inclusion errors).

## COMPARING PERFORMANCE

**The five methods identified very different proportions of households as poor, ranging from 4% (LEAP) to 61% (PPI) of all households** (Figure 1A). Our AI-based PMT and the DHS wealth index identified much smaller proportions (20-27%) than the PPI, while community consultation identified only 12% of households. Only two households (<1%) were identified as poor by all five methods, while 18 (2%) were identified by all the methods excluding LEAP (which was very restrictive). 109 households (13%) were identified by all three PMTs. The small overlap between PMTs and Community consultation revealed a different poverty concept: communities tended to more effectively identify households affected by chronic poverty that may not be associated with assets and other standard proxies for wealth, while PMTs identified poor households based on their assets and their expenditures explaining the larger overlap between these three methods.

Because the PPI identified many households as poor, it had the lowest risk of leaving out truly vulnerable households (exclusion errors) but a higher risk of including households that are not actually vulnerable (inclusion errors) (Figure 1B). LEAP performed the worst for both of these risks. In contrast, the **AI-based PMT and DHS methods performed relatively well, leaving out fewer vulnerable households (fewer exclusion errors) and including relatively few non-vulnerable households (few inclusion errors). Particularly, the AI-based PMT was the best method in terms of not including potentially wealthy households (fewest inclusion errors).**

## COMPARING ACCEPTABILITY

**Community members** overwhelmingly preferred PMT methods, because they felt that people would be more honest in a survey, whereas during community consultation, vulnerable households may be afraid to share their true poverty status, or others may forget to include them. **Local officials** were split between preferring PMT surveys or community consultation, being concerned about the possibility of lying, and accusations of bias with each method. No local officials would rely on the LEAP program, while 16 of 17 interviewed community members did not see it as an appropriate method because they perceived it as being influenced by politics and as leaving behind vulnerable households.

In discussions with national stakeholders such as the Community Water & Sanitation Agency (CWSA), interviewees noted that their first priority would be targeting accuracy (i.e., few inclusion and exclusion errors), but it is also important to have transparent targeting criteria. This transparency condition may be difficult for PMT methods to meet, as they often rely on combining a large number of household characteristics using “black-box” models. National stakeholders also stated they would prioritize accuracy over cost, noting the possibility of using multiple methods together to better identify eligible households.



**Image 1 & 2.** Community consultation meetings in Asutifi North.

## COMPARING EFFICIENCY

Targeting methods involving PMT surveys were the most expensive and time-consuming (Table 2) due to the need to survey every household. A shorter survey such as the PPI may be somewhat more efficient with respect to time and cost if more surveys can be completed each day, but the cost also depends on the spatial distribution of households (e.g., a lower household density will result in higher logistical costs and time requirements). In contrast, using existing LEAP enrollment would be the least expensive (in areas where the LEAP program has been rolled out), as it would simply require obtaining the LEAP household lists from local government offices.

Method	Time (days)	Targeting Cost (USD)	One year of water subsidies (USD)
AI-based PMT	7	\$760	\$1,720
PPI	7	\$760	\$5,230
DHS	7	\$760	\$2,320
LEAP	7	\$89	\$340
Community Consultation	3	\$412	\$1,030
AI-based PMT + Community Consultation in parallel	9	\$1,172	\$2,745

**Table 2.** Cost and time requirements per neighborhood for each targeting method during this study. The costs associated with one year of subsidies reflect the cost of the water only, without any additional implementation or logistical costs.

However, targeting expenses tend to be relatively small compared with the actual costs of providing the subsidy. Conservatively, one year of water subsidies providing 20 liters per person per day (including only the value of the water provided, without any implementation expenses) would cost 2-7 times as much as the targeting itself (Table 2), depending on the method and the number of households identified. The cost of subsidies is higher for targeting methods that identify a larger proportion of the population as poor (i.e., PPI identified 61% as poor) compared to methods that identify a smaller proportion as poor (i.e., LEAP identified 4% as poor).



**Image 3.** A customer (right) and a water vendor (left) at a standpipe in Asutifi North.

## TARGETING RECOMMENDATIONS

**There are tradeoffs across the five methods (Figure 2), so a singular recommendation would depend on a stakeholder’s top priorities.** If high targeting performance is the main priority, survey methods (particularly the AI-based PMT) may be the best approach, while community consultation would likely provide better transparency and scalability, with clear eligibility criteria.

**Given stakeholders’ openness to the use of multiple methods (and willingness to prioritize performance over cost), a combination of the AI-based PMT and community consultation may be especially effective.** Selecting households identified by either method results in a good performance, with relatively low risks of including non-poor households (inclusion errors) and excluding truly vulnerable households (exclusion errors). Implementing both methods would likely be costlier than any single method (Table 2), but it could also provide a good balance of performance and acceptability, especially if communities participate in the validation of results from the AI-based PMT selection. It is also possible to include households enrolled in the LEAP program in the final list that would be generated from this hybrid approach.

**A next step may involve conducting a pilot study in collaboration with Safe Water Network or CWSA, to implement the AI-based PMT and community consultation as a combined approach.** Households identified through the survey, community consultation, or LEAP enrollment would be included in the list. We could then validate this final list in a meeting with community members. This step would help provide evidence regarding the feasibility, acceptability, and scalability of this combined approach before implementation at a large scale. Furthermore, if the combination of the AI-based PMT and community consultation performs well, it could represent one approach for refining the LEAP selection process as it is rolled out nationally.

Criterion	Rank (best = 1, worst = 5)				
	Survey methods			Community consultation	LEAP
	AI-based PMT	PPI	DHS		
<b>Performance</b>	(A) 1	3	2	4	5
Exclusion errors	1	3	2	4	5
Inclusion errors	1	3	2	4	5
<b>Acceptability</b>	3	3	3	(B) 1	5
Perceived fairness	3	3	3	1	5
Perceived transparency	3	3	3	1	5
<b>Scalability</b>	5	4	5	3	1
Ease of implementation	5	4	5	3	1
Targeting affordability	5	4	5	3	1

**Recommendation:**

**(A)** If prioritizing targeting performance: **AI-based PMT**

**(B)** If prioritizing transparency and/or efficiency: **Community consultation**

**Figure 2.** Comparison of the five targeting methods with respect to predictive performance, acceptability among community members and local and national stakeholders, and scalability.