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REAL-WATER -
RURAL **E**VIDENCE **A**ND **L**EARNING FOR **W**ATER

EVALUATION OF WATER SAFETY PLANS IN RURAL GHANA: PRELIMINARY RESULTS OF A BASELINE ASSESSMENT

KNUST/AQUAYA

MOLE XXXIV CONFERENCE: BUILDING INCLUSIVE AND RESILIENT WASH SYSTEMS TO REACH THE UNSERVED

01.11.2023

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OUTLINE

- Background
- Key Research Questions
- WSP Evaluation Framework
- Study Design
- Description of Water Systems
- Baseline Data Collection
- Key Findings
- Implications
- Next Steps

BACKGROUND

- Access to drinking water is improving, but there are high levels of microbial and chemical contamination partly due to overreliance on traditional approaches to water quality management.

- Ghana, in 2015, adopted a risk-based approach for ensuring water quality management and safety – the National Drinking Water Quality Management Framework (NDWQMF).

- The NDWQMF adopted the **WSP approach** as the primary tool for systematic risk identification, prioritization, and mitigation across the water supply delivery chain.

- WSPs are a systematic, risk-based approach to managing drinking water quality, applied from catchment to the point of use (Baum and Bartram 2018).

BACKGROUND

- WSPs are advocated for systematic risk assessment and management, yet implementation and effectiveness remain understudied in Ghana (REAL-Water, 2023b).

- Key barriers to implementing the WSP are weak regulatory enforcement and insufficient capacity (human, **financial (WQAF)**, and infrastructural) (Peletz et al., 2018).

- Expanding evidence on WSP implementation's efficacy could guide national adoption and benefit the water sector.

KEY RESEARCH QUESTIONS

Water Safety Plan: Implementation and Impact on Water Services and Public Health

- Are Water Safety Plans (WSPs) effective forms of risk mitigation for rural water supplies in low-resource settings?

- What is the relationship between WSPs and improved water supply services, consumer satisfaction and improved health?

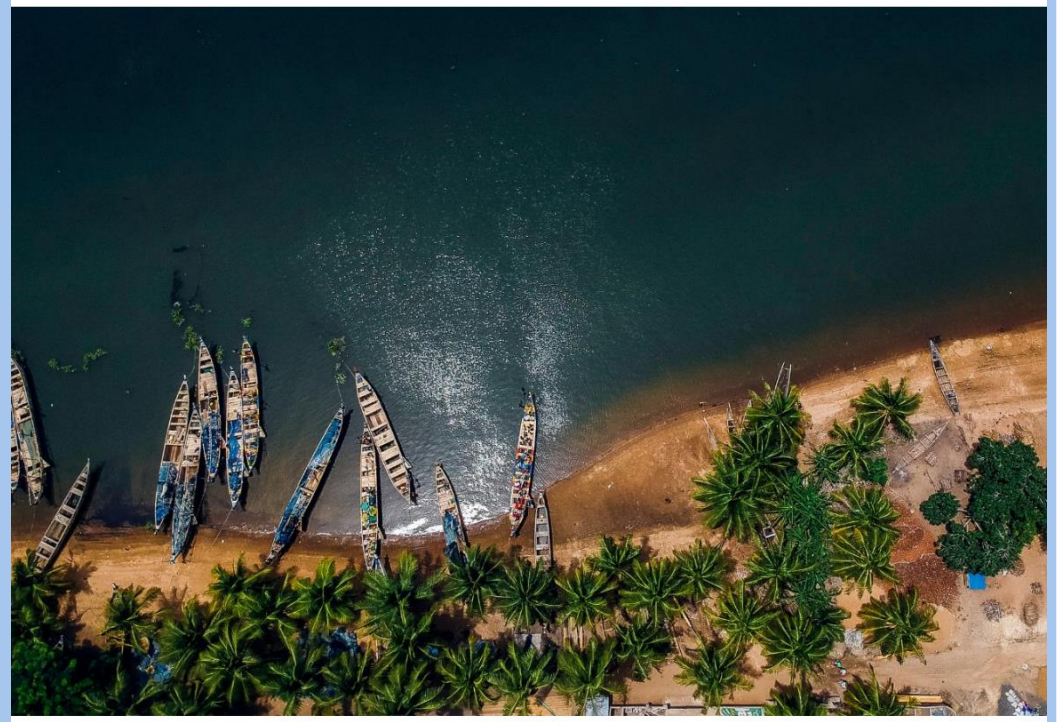


IMAGE: KWAME KWEGYIR-ADDO

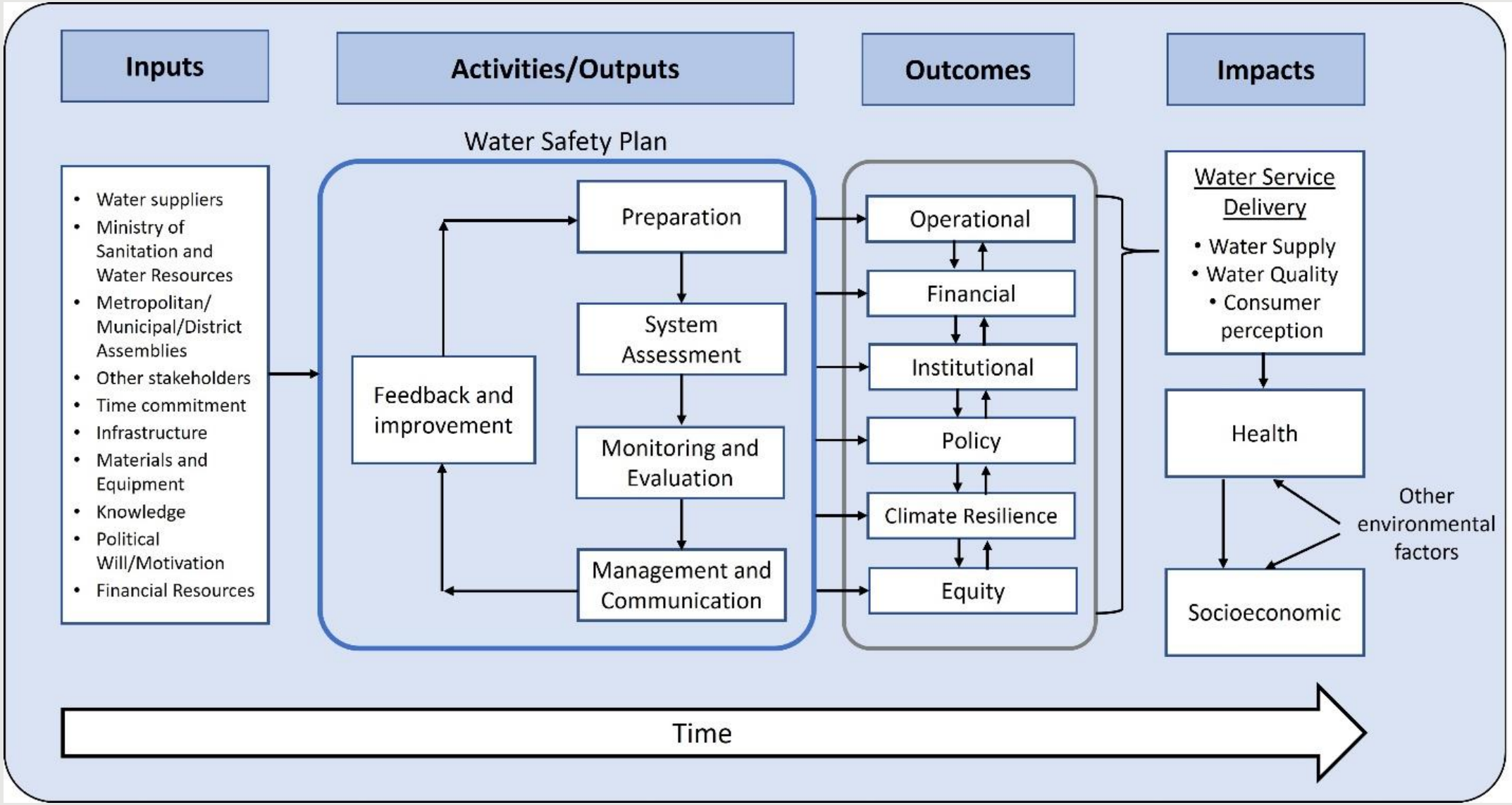
SYNTHESIS OF WATER SAFETY PLANNING EFFORTS IN GHANA

July 2023

EVALUATION OF WATER SAFETY PLANS

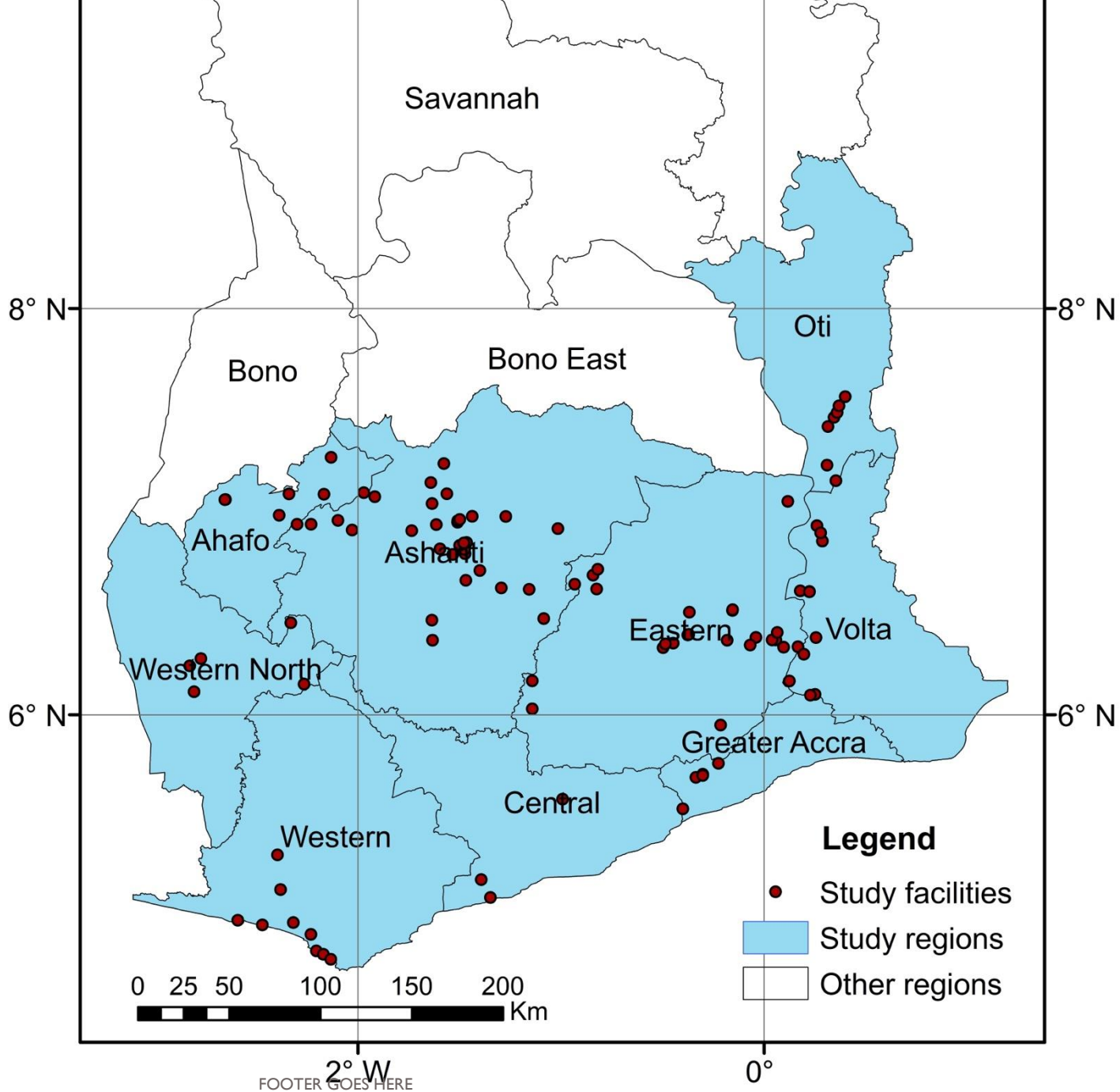
- This study has the following overall research objectives:
    - Evaluate the impact of WSPs on
        - water supply system infrastructure,
        - water availability and reliability,
        - water quality,
        - consumer perceptions,
        - water service provider management and financial sustainability,
        - climate resilience,
        - equity, and
        - consumer health.
    - Examine WSP implementation processes and challenges in rural Ghana, and explore specific aspects of water system management and intervention delivery which lead to better outcomes and impacts.

EVALUATION FRAMEWORK OF WSP IN GHANA



Adapted from Gelting et al. 2012.

STUDY AREAS


Savannah
Bono
Bono East
Oti
Ahafo
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8° N
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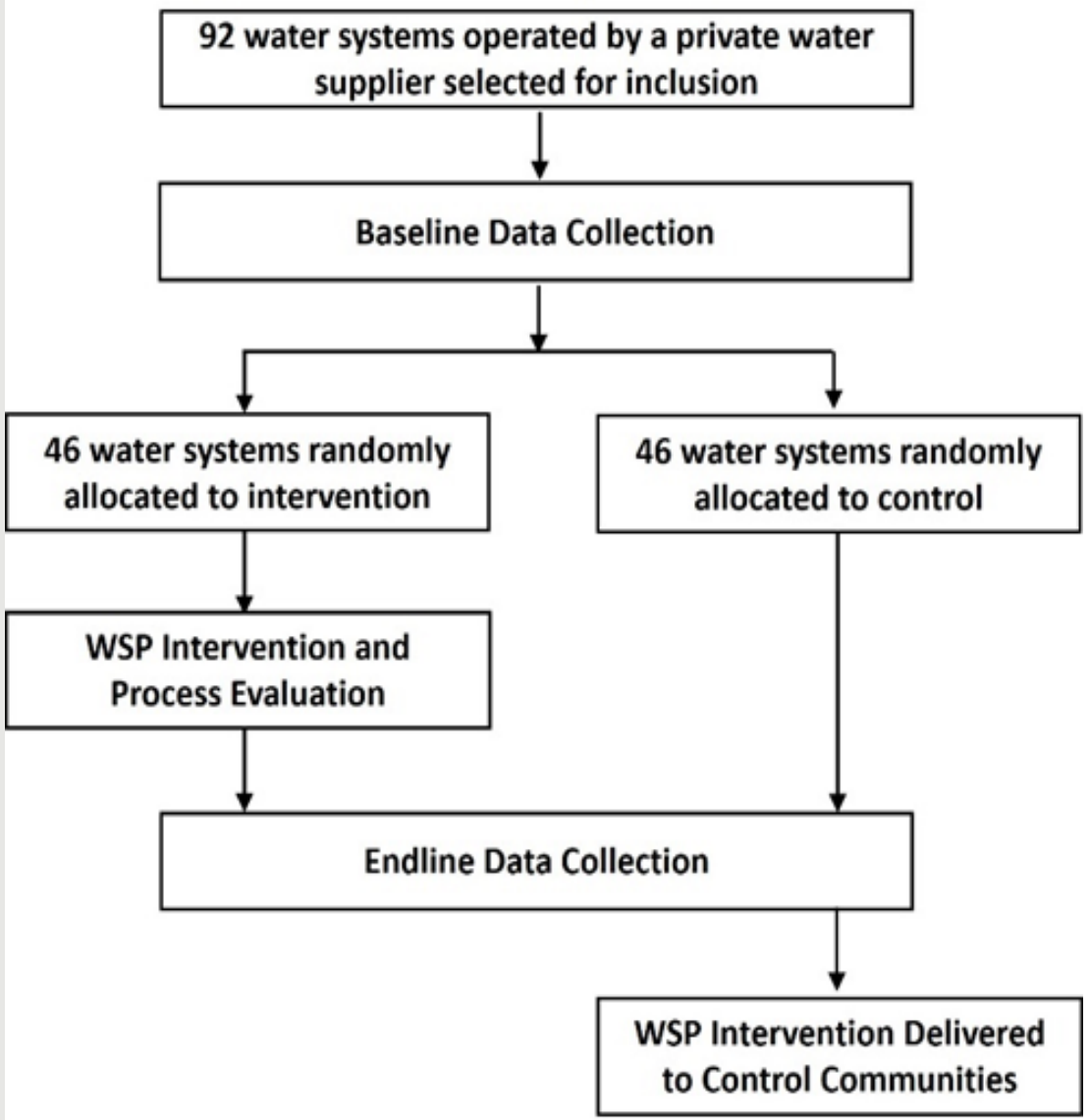
0 25 50 100 150 200
Km
Legend
Study facilities
Study regions
Other regions

STUDY DESIGN

- A cluster-randomized controlled trial used to assess the effectiveness and outcomes of (WSPs) using a staged implementation approach.

- The study design includes:
  - intervention and control groups,
  - half of the water supply systems implementing WSPs immediately and
  - the other half waiting until after data collection.

- Process evaluation will measure implementation quality, and a total of 92 water supply systems in 9 regions.



Study flow diagram for WSP evaluation study in Ghana

DESCRIPTION OF WATER SYSTEMS

- Most of the systems were located in small towns, with each system operated by a local operator overseen by a cluster manager .
- The systems are managed by an NGO with external donor support
- Mostly serve population around 1,000 to over 10,000 people per community.
- About 74 systems were limited mechanized; and 14 systems have surface water sources
- Treatment processes included 2 or more combination of;
  - ultrafiltration,
  - rapid sand filtration
  - chlorination

BASELINE DATA COLLECTION

SUMMARY OF BASELINE DATA COLLECTED

	SOURCE	DATA COLLECTED
Water systems (N = 92)	System operator	System characteristics
	Regional manager	Management practices
	Central management	Revenue and financials
	System infrastructure	Observed condition of borehole, surface water intake, water tank, distribution system, and standpipe infrastructure
	5 standpipes/taps per system*	Water quality (chlorine residual, *E. coli*, pH, conductivity/TDS/salinity, turbidity)
Households (N = 1,840)	20 households per water system	Consumer practices and perceptions
		Chlorine residual and *E. coli* in stored water
		Self-reported water-related diseases
Focus group discussion (N = 45)	At least 3 per geographic cluster	Consumer perceptions
Healthcare facilities (N = 78)	Administrator or head	Water access
		Clinic-visits for water-related diseases

Enumerators measure chlorine residual in a water sample (top) and conduct a FGD (down).

KEY FINDING 1: WATER SOURCES ARE FUNCTIONAL MOST DAYS, BUT RELIABILITY COULD BE IMPROVED

- **Only half** of households (48%) reported that water was available from the piped water source **every day.**
- Almost **two-thirds** (63%) indicated that the water supply had **been interrupted or stopped** within the month before the survey, typically for **1–4 days** per month.
- **Only half** of respondents reported being **satisfied or very satisfied** with the water supplier's response to system breakdowns and emergency repairs.
- Water operators reported **higher functionality and reliability** of water systems and less frequent **water service interruptions** than household perceptions.
- 45% of service interruptions for the past 3 months were due to **technical problems**, typically for 3 days or less,
- 10% of operators reported interruptions lasting more than 10 days. About **one-third** (34%) of system operators reported interruptions to the water supply within the past 12 months due to weather events such as **droughts, storms, wind, or floods**.

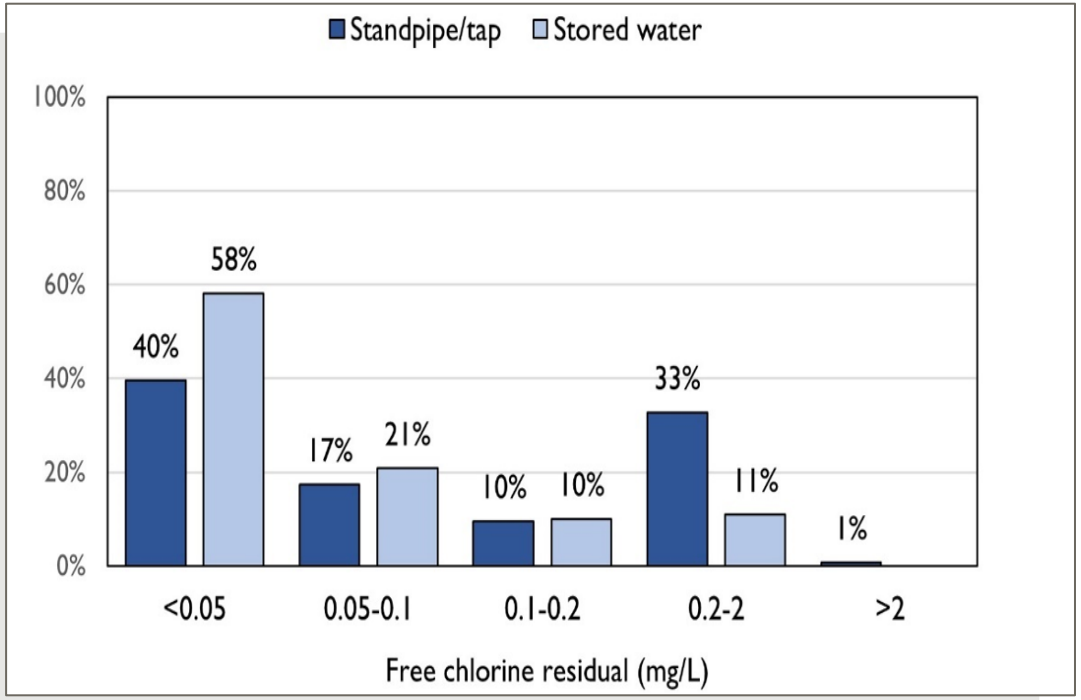
KEY FINDING 2: MICROBIAL WATER QUALITY WAS TYPICALLY GOOD AT THE POINT OF COLLECTION BUT DETERIORATED BEFORE THE POINT OF USE

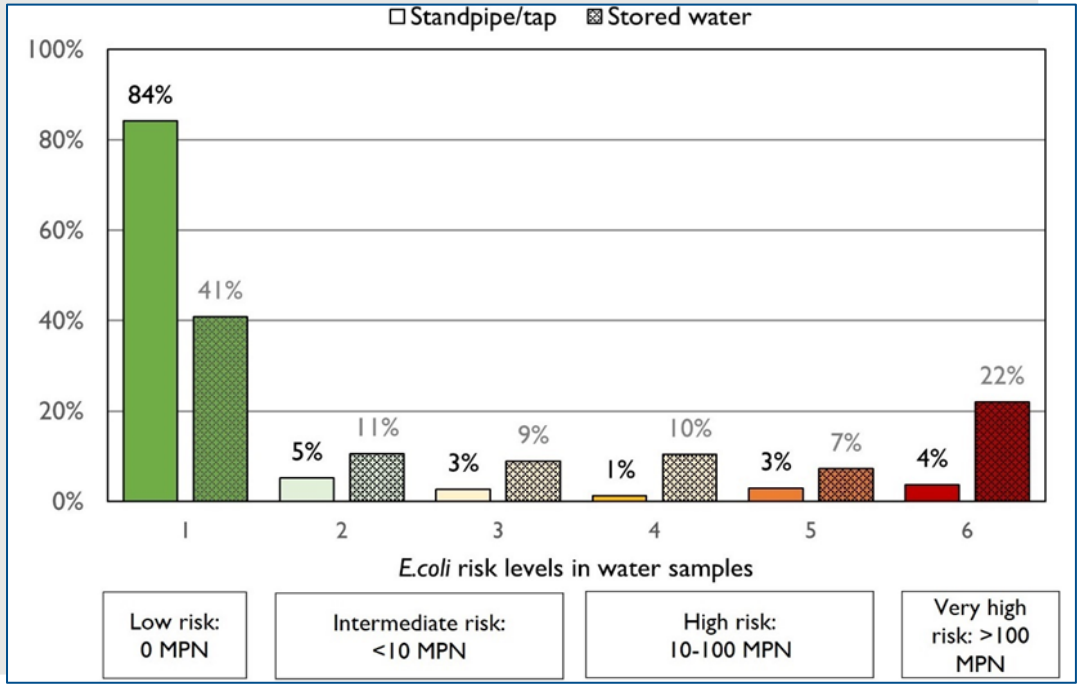
- Residual-free chlorine levels at public standpipes were often **below recommended** levels of 0.2–2.0 mg/L.

- The source water quality and chlorination levels often sufficed to **eliminate E. coli** at the **point of collection** but not to protect against recontamination.

- Most standpipes (84%) had **no E. coli** in 100-ml water samples, but only 41% of household stored water samples were free from E. coli contamination.

***Figure**: Free chlorine residual in standpipe/tap (N = 437) and household stored (N = 1,071) water samples (top); Microbial Water Quality was Typically Good at the Point of Collection but Deteriorated before the Point of Use (down)*





KEY FINDING 3: MANY RESPONDENTS COMPLAINED ABOUT WATER QUALITY AND DID NOT USE THE PIPED WATER SOURCE FOR DRINKING

- Among those who reported using the water systems investigated in this study, only **61%** used it as their **main source of drinking water**.

- Most of those not using the piped water system primarily drank **sachet water (63%),** water fetched from a handpump (12%), water from a mechanized borehole (6%), or water from other sources.

- Respondents do not use the water as their primary drinking water source for several reasons such as;
  - Do not like the smell or taste of the water;
  - Prefer the cold temperature of sachet water,
  - Think sachet water is safer or don't think the piped water supply is safe;
  - Think the water system user fees are too expensive;
  - Do not like the color of the water; or
  - Think the nearest public water standpipe is too far from their house.

KEY FINDING 4: WATER SYSTEM INFRASTRUCTURE AND MANAGEMENT PRACTICES REVEALED OPPORTUNITIES FOR IMPROVED RISK MANAGEMENT

- **Potential risks** were identified for 94% of boreholes, all surface water catchments and intakes, 76% of distribution systems, 64% of storage tanks, and 87% of standpipes.

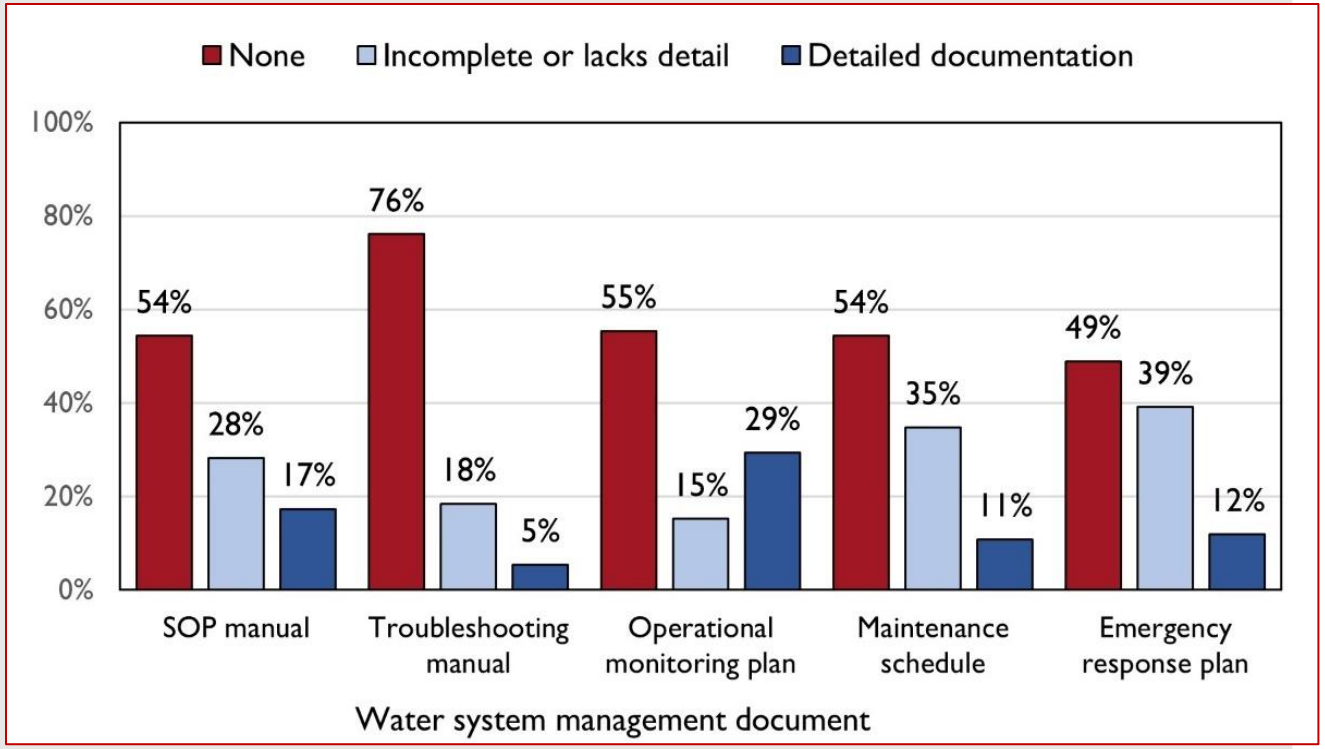
- At boreholes, risks identified were **often potential sources** of contamination within **10 or 50 meters** of the borehole, such as latrines, animals, or cultivated land.

- Risks from pipes exposed above ground were often observed for distribution systems.

- Storage tanks were;
  - commonly uncovered,
  - partially open, or
  - missing a screen on air vents.

CONT'D

- Only 17% of water systems had a detailed system's **SOPs of how to operate the water system.**
- And 5% of water systems had a **detailed troubleshooting manual.**
- Similarly, only **19%** of systems had a detailed **operational monitoring plan.**
- The majority of water system operators reported having access to **training programs** through the water supplier, with **42% reporting informal** training and **43% reporting detailed formal training**. Only 14% of operators were unaware of training programs.



Summary of system management-related docs for water systems.

IMPLICATIONS

- **System Functionality and Reliability**
  - Improved management of risks could reduce system breakdowns and improve the reliability of systems.
- **Water Quality**
  - Improved chlorination and chlorine measurement could provide a greater chlorine residual to protect against recontamination during storage.
  - Improvements to potential risks identified related to infrastructure could also reduce contamination entering the system and improve water quality.
- **Consumer Perceptions**
  - Increased engagement about water treatment and improved treatment system management to decrease variability in chlorination could increase satisfaction, increase use of safe water sources, and potentially decrease complaints related to taste or odor.
- **Documentation**
  - Development of system documents and plans covering the entire WSP process should improve institutional memory and consistency in the operation and management of systems. It can also facilitate periodic reflection and strategic planning that promotes performance improvements over time.

NEXT STEPS

- WSP implementation began in water systems in July 2023 and is currently ongoing.
- We are concurrently conducting a process evaluation of the implementation quality.
- Endline data collection is planned for 2024-2025, following 12-18 months of implementation in the intervention group
- After which the intervention will be applied in the control group

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