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Session: Chlorine production and Water Quality Control

ensuring safe services through systems for treatment and monitoring in Ghana

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Presentation: Onsite chlorine generation for Ghana health care facilities

Observational findings from the introduction of the Aqua Research STREAM™ Disinfectant Generator in HCFs

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1. Contents

Introduction

Gaps in environmental hygiene services in health care facilities (HCFs)

- Globally, **36% of HCFs are not able to provide basic environmental hygiene services**.
- Poor environmental hygiene contributes to the estimated **15% of inpatients** in low- and middle-income countries (LMICs) who will develop health care–associated infections (HAIs) during their stay. The overall HAI prevalence rate in Ghana has been reported to be 8.2%.
- **Two primary transmission routes for pathogens** that cause HAIs: direct transmission (e.g., delivery bed, linen) or indirect transmission (e.g., provider hands, contaminated water, instruments). These pathogens can be inactivated by chlorine and proper infection prevention and control (IPC) practices.
- Improved water, sanitation, and hygiene (WASH) and IPC practices in health facilities can **reduce HAI prevalence rates by 10% to 70%** depending on the setting, baseline infection rates, and type of infection.

Gaps in IPC in health facilities

- Chlorine is a widely used, effective chemical disinfectant recommended for IPC in health care settings, yet it is **not consistently available**.
    - Results from a 2019 PATH study of 10 Ghana district hospitals found those facilities faced an average of **28 days or 1 month per year** in which they did not have chlorine.
- **Chlorine quality** (degradation of concentration) and **problems with dilution calculations** due to varying chlorine stock concentration (3% to 70%) pose additional challenges.
- **Root causes of stockouts** include:
    - Erratic supply chains
    - Transportation challenges
    - Limited forecasting
    - Insufficient budgets

Health service impact

- Chlorine availability issues described by nurses, orderlies, pharmacy staff, and hospital medical supply store managers point to three clear themes:

(1) HCFs often receive **lower volumes of chlorine supply** from suppliers than requested. Data shows this occurs with other medical supplies and medication, such as antibiotics.

(2) Reduced volume of chlorine supply received leads to **chlorine rationing and stockouts** by health staff

(3) Patients are asked to bring chlorine for their medical procedures during chlorine stock out periods

Aqua Research STREAM Disinfectant Generator

The STREAM Disinfectant Generator provides a continuous flow of 0.5% hypochlorite solution generated from common salt (NaCl) and water through electrolysis.

Chlorine concentration (FAC)	0.5%
Brine salinity	15 g/L
Chlorine production rate	4.8 L/hour
Chlorine generation mode	Continuous
Drinking water treatment rate	Up to 230,000 L per day
Input power	110/220 V AC, 2 A, 50/60 Hz, 12 V DC, 16 A
System weight	8.2 kg
Dimensions	42 x 33 x 17.3 cm

Abbreviation: FAC, free available chlorine.

Aqua Research STREAM Disinfectant Generator

- **Continuous flow:** The STREAM produces a continuous flow of 0.5% chlorine solution that can immediately be used for disinfection and water treatment.
- **Consistent concentration**: The STREAM automatically adjusts production and consistently produces a 0.5% (± 0.1%) chlorine solution. No dilution is needed for disinfection.
- **User-centered design**: A single on/off button and clear error messages simplify use.
- **Cost-effective**: Evaluations have shown a potential chlorine cost savings of >50% per liter compared to liquid chlorine.
- **Production monitoring**: Integrated monitoring system allows owners to track total production. Remote transmission of performance data (production and error codes) currently undergoing testing in Ghana.

Rationale and objectives for the Chlorine Generation Project

Project overview

PATH seeks to strengthen the delivery of infection prevention and control practices in HCFs by collaborating with the Ghana Health Service to evaluate and introduce the Aqua Research STREAM Disinfectant Generator into the public health system.

The project has three objectives:

1. Generate national-level support for STREAM system adoption and develop national introduction and scale-up plans
2. **Generate evidence through pilot evaluations in Ghana and Uganda**
3. Support additional market priming and advocacy efforts

Pilot evaluation in Ghana

A total of 12 STREAM devices were installed in 8 HCFs in the Eastern region of Ghana

Objectives

1. Validate the performance of the STREAM
2. Assess effect of the STREAM on chlorine availability and stockouts
3. Assess effect of the STREAM on chlorine supply costs

*PATH supported the Institutional Care Division of Ghana Health Service (GHS/ICD) with IPC training and acceptability data collection on the STREAM devices.

Location

No.	Region	District	Facility name	Facility level	Ownership
1	Eastern	Lower Manya Krobo	Akuse Government Hospital	District hospital	Public
2	Eastern	Atiwa	Enyiresi government Hospital	District hospital	Public
3	Eastern	Kwahu South	Kwahu Government Hospital	District hospital	PNFP
4	Eastern	Lower Manya Krobo	St. Martin Hospital	District hospital	Public
5	Eastern	Kwaebibirem	Asuom Health Center	Health center	Public
6	Eastern	Nsawam-Adoagyiri Municipality	Adoagyiri Health Center	Health center	Public
7	Eastern	New Juaben North	Oyoko Health Center	Health center	Public
8	Eastern	Yilo Krobo	Nkurakan Health Center	Health center	Public

Timeline

- December 2020–June 2021: Initial 8 units installed and monitored
- June 2021: Dissemination meeting in Eastern region on interim results
- July 2021–present: Continued monitoring and support to GHS

Key study partners

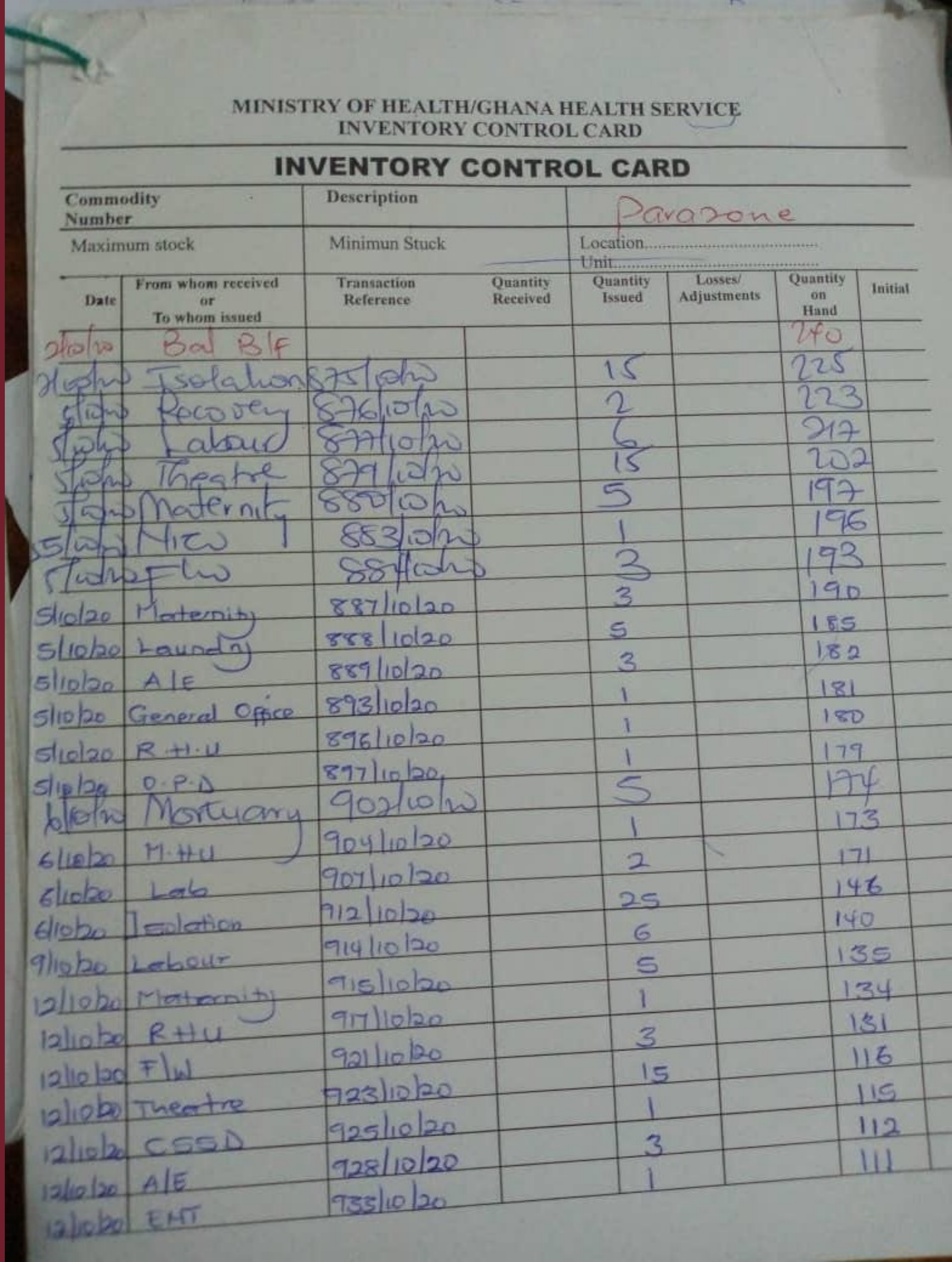
- GHS/ICD team
- Health facility administrators
- In-charge nurses
- STREAM device operators
- STREAM chlorine users
- STREAM maintenance staff

Methods

Chlorine inventory and costs: Chlorine inventory and costs data were extracted from chlorine stock cards located in each hospital store. PATH staff collected the past 12 months (as available and with a minimum of 3 months of data) of chlorine inventory to develop a baseline denominator.

Chlorine production data: Chlorine generated by the STREAM during the pilot was collected from the STREAM unit itself and through user-completed chlorine monitoring forms capturing 2 weeks of chlorine production data.

Acceptability data: Collected by the GHS through in-depth interviews with device users, hospital administrators, and clinical managers.



Results

Components of pilot evaluation

Device installation and training

GHS-led IPC supportive supervision PATH study site monitoring

Device maintenance and repair support

GHS-led IPC training

Results: Chlorine stockout

Chlorine inventory data from participating HCFs show the facilities face an average of 44.8 days per year without chlorine

The duration and frequency of stockouts varied by health facility, though averages show each stockout lasted roughly 28 days and facilities faced an average of 1.6 stockouts per year.

	Average stockout length (days)	Average stockouts per year (n)	Average days per year without chlorine (n)
Ghana overall average (n=8)	28.0	1.6	44.8

Health centers face fewer, though longer, chlorine stockouts compared to district hospitals.

	Average stockout length (days)	Average stockouts per year (n)	Average days per year without chlorine (n)
Health center (n=4)	47.5	1.3	61.8
District hospital (n=4)	18.3	1.8	32.9

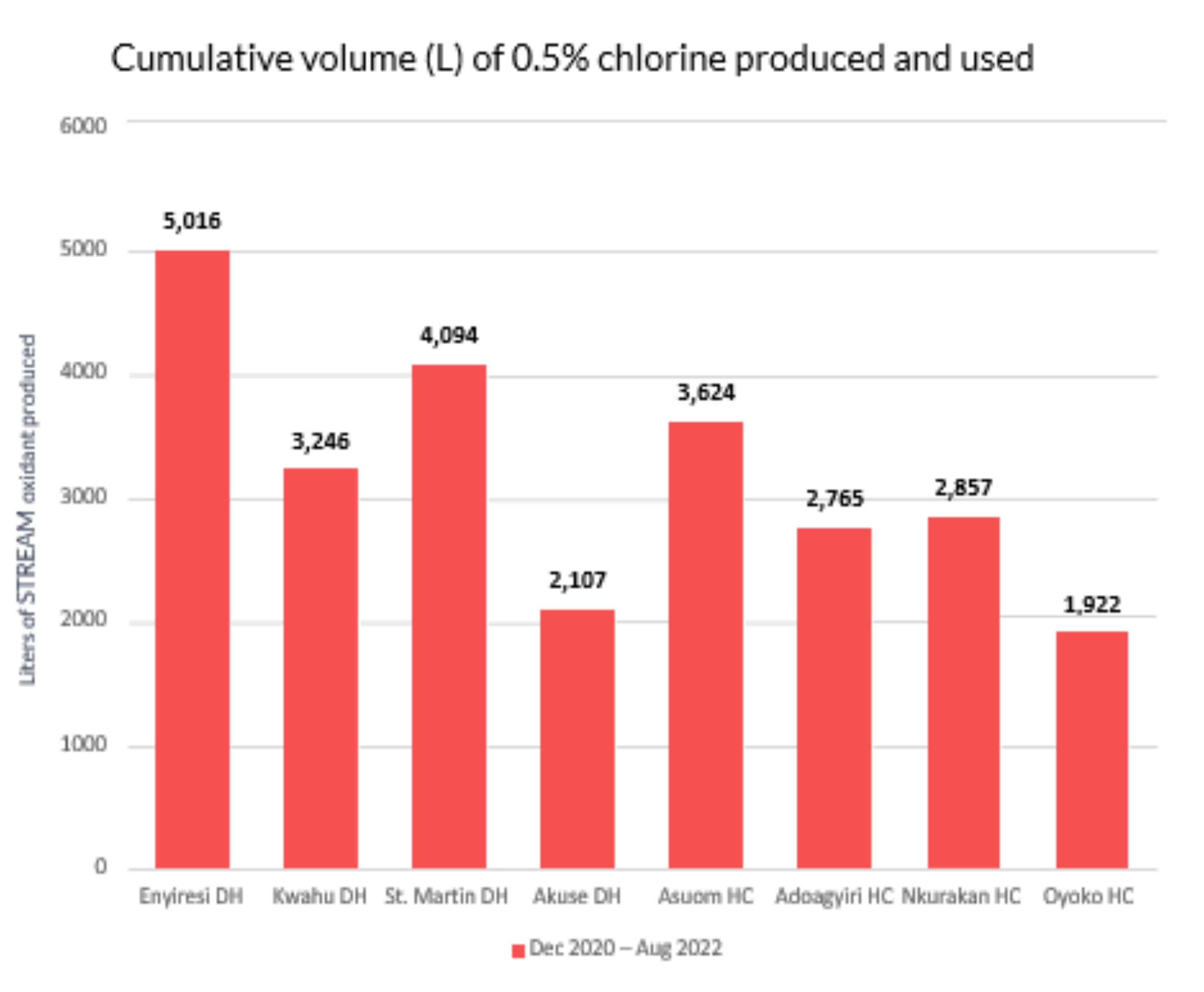
Results: Device performance

- **25,632 liters** of 0.5% chlorine disinfectant produced to date (Dec 2020–Aug 2022).
- During the pilot period, **none of the eight HCFs experienced a chlorine stockout.**

Cumulative volume (L) of 0.5% chlorine disinfectant produced and used

Facility name	Dec 2020–Aug 2022
Enyiresi DH	5,016
Kwahu DH	3,246*
St. Martin DH	4,094
Akuse DH	2,107
Asuom HC	3,624
Adoagyiri HC	2,765
Nkurakan HC	2,857**
Oyoko HC	1,922
Total	**25,632 L**

*Missing performance data for June 2021–July 2022
**No performance data after June 2021



Results: Sizing the right location

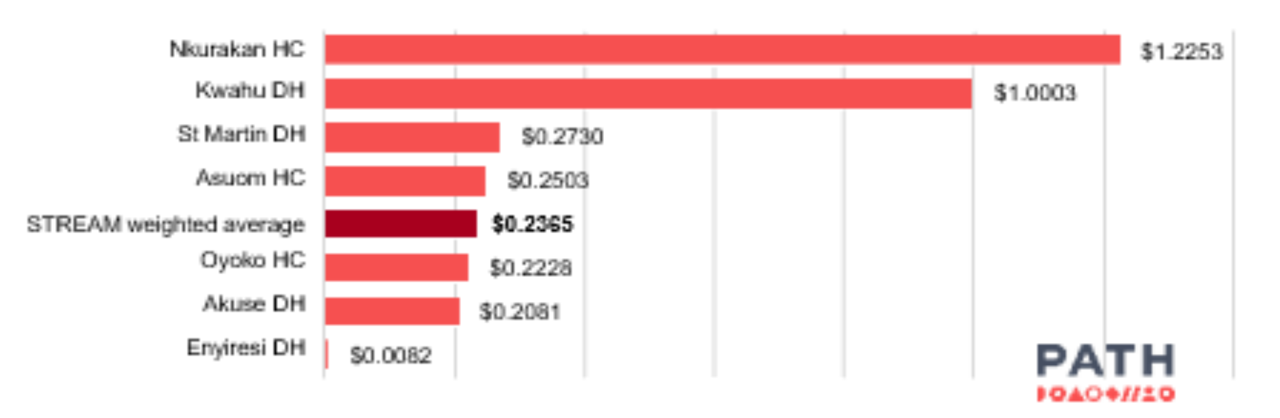
Optimal locations for the STREAM depend on chlorine demand and expected costs

- Commercial chlorine use and STREAM production vary widely by health level and across similar level facilities.
- STREAM chlorine production of 5,000 L per year or more would address 66% of health facility chlorine demand and 25% of district health chlorine demand. Production in other facilities can be increased with greater advocacy and support.
- District hospitals, on average, may need two STREAM units (or larger), compared to health centers.
- Commercial chlorine costs vary widely between facilities: $0.0082 to $1.2253 per L of 0.5% chlorine. Variance is due to inflation and whether procuring from open market or government.

Chlorine demand in health care facilities

	District hospitals (n=4)	Health centers (n=3)
Average annual liters of 0.5% chlorine volume used [min–max]	18,420 [4,668–36,900]	6,325 [622–15,041]
Projected annual STREAM liters of 0.5% production [min–max]	3,237 [971–5,313]	2,639 [879–5,293]
% of facilities where STREAM can address demand at 5,000 L per year	25%	66%

Baseline cost per L of 0.5% chlorine



Results: Cost analysis

Average cost savings of 47.5% across facilities using liquid chlorine due to STREAM

Cost of chlorine: commercial chlorine vs STREAM

	Commercial liquid chlorine (GHS)	STREAM liquid chlorine	Cost savings USD (GHS)
Total cost of 25,632 L of 0.5% chlorine volume produced to date	$11,536 (115,363)	$6,061 (60,610)	$5,475 (54,753)
Average cost per liter of 0.5% chlorine	$0.45 (4.50)	$0.24 (2.36)	$0.21 (2.14)

Chlorine cost savings from STREAM across facility levels

	Modeled 5-year chlorine cost savings from STREAM (0.5%; USD)	Modeled 5-year chlorine cost savings from STREAM (0.5%; %)
District hospital (n=4)	$20,035	58%
Health centers (n=3)	($4,364)	-83%

- Adoagyiri and Enyiresi are not included in cost savings analysis because the baseline chlorine cost of using HTH/tablets is inconsistent.
- Facilities using chlorine tablets or HTH will not save by using STREAM. Average cost savings would drop from 47.5% to 39.5% after including Enyiresi DH (HTH).
- Cost saving is observed in district hospitals that use more chlorine. Health centers may see cost savings with hub-spoke distribution models.

Results: Device hardware issues

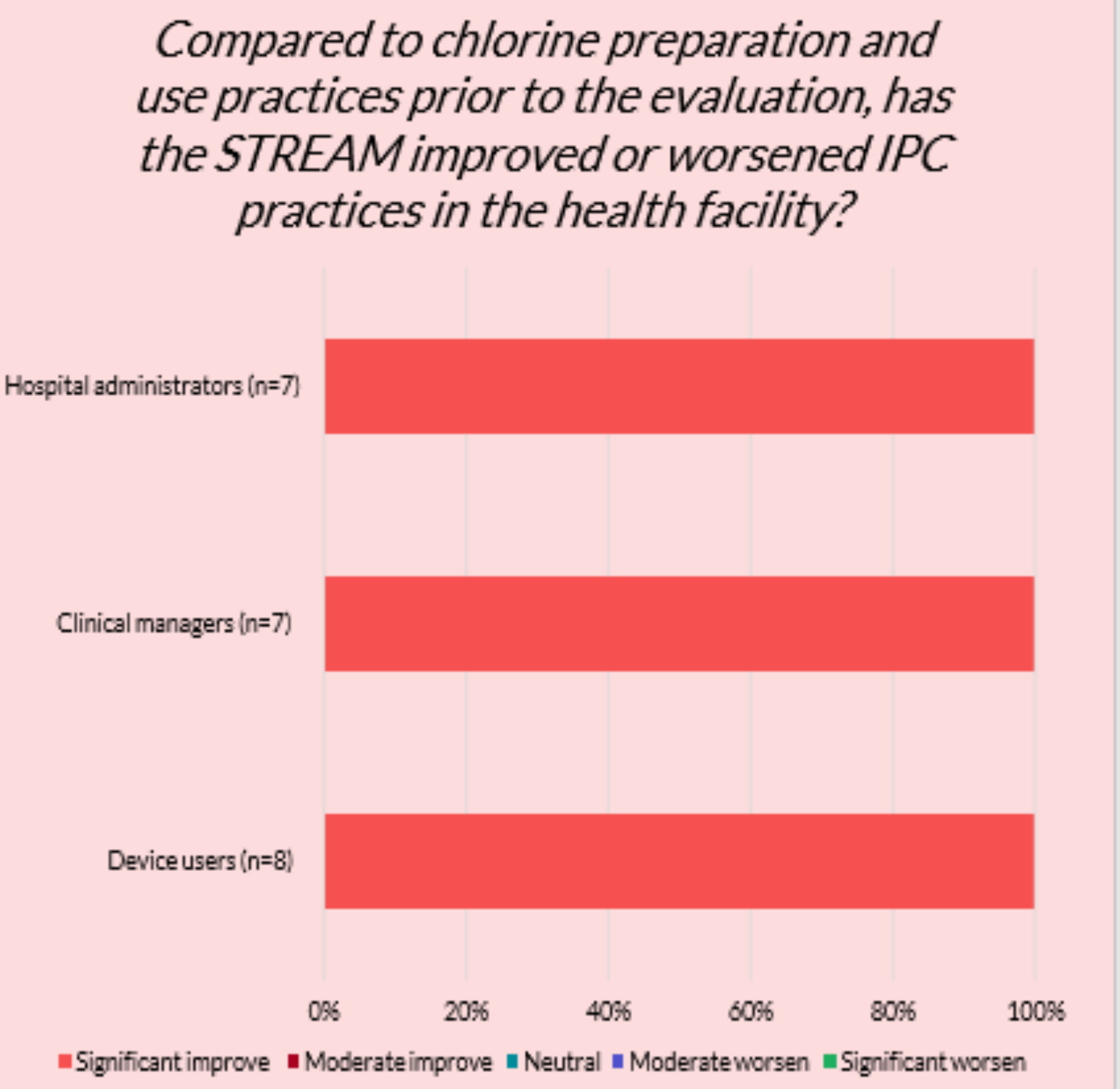
- The STREAM devices experienced three main hardware issues.
- Aqua Research redesigned these components, and all STREAM devices that were experiencing challenges were upgraded with the redesigned components in October 2021.

Issue	Cause	Mitigation strategy
Leaking reaction chamber	Scaling in the reaction chamber and/or the outlet ports led to clogging and buildup of pressure inside the cell, which led to leaking.	• Internal cell housing strengthened by adding boss sections to the bolts. • Emergency pressure relief rupture disk added to the brine inlet port of the cell. • Outer titanium plate added to the cathode housing to prevent warping.
Power supply and voltage stabilizers failed	Severe power surges led to tripped thermal switches, damaged power supplies, and failed surge protectors.	• 10,000 V surge protector and 42A connector added to the power supply.
Control box issues	Weak connections in the circuit boards.	• Stronger socket connections and click-to-connect connectors added to prevent accidental shorts and wires becoming dislodged during transport. • 42A connector added to power supply to control box to prevent overheating; all connections will be soldered.

Results: Acceptability

- 100% of clinical managers (n=7), hospital administrators (n=7), and device users (n=8) agreed the STREAM has improved IPC practices in three ways:
  - Increased chlorine availability has led to increased IPC practices and cleaning
  - Perception that patient environments are safer and cleaner
  - Simplified chlorine distribution processes and cost savings

"The ready availability of chlorine has made it easier for staff to carry out IPC practices as compared to previously where there was acute shortage occasionally."
— Hospital administrator



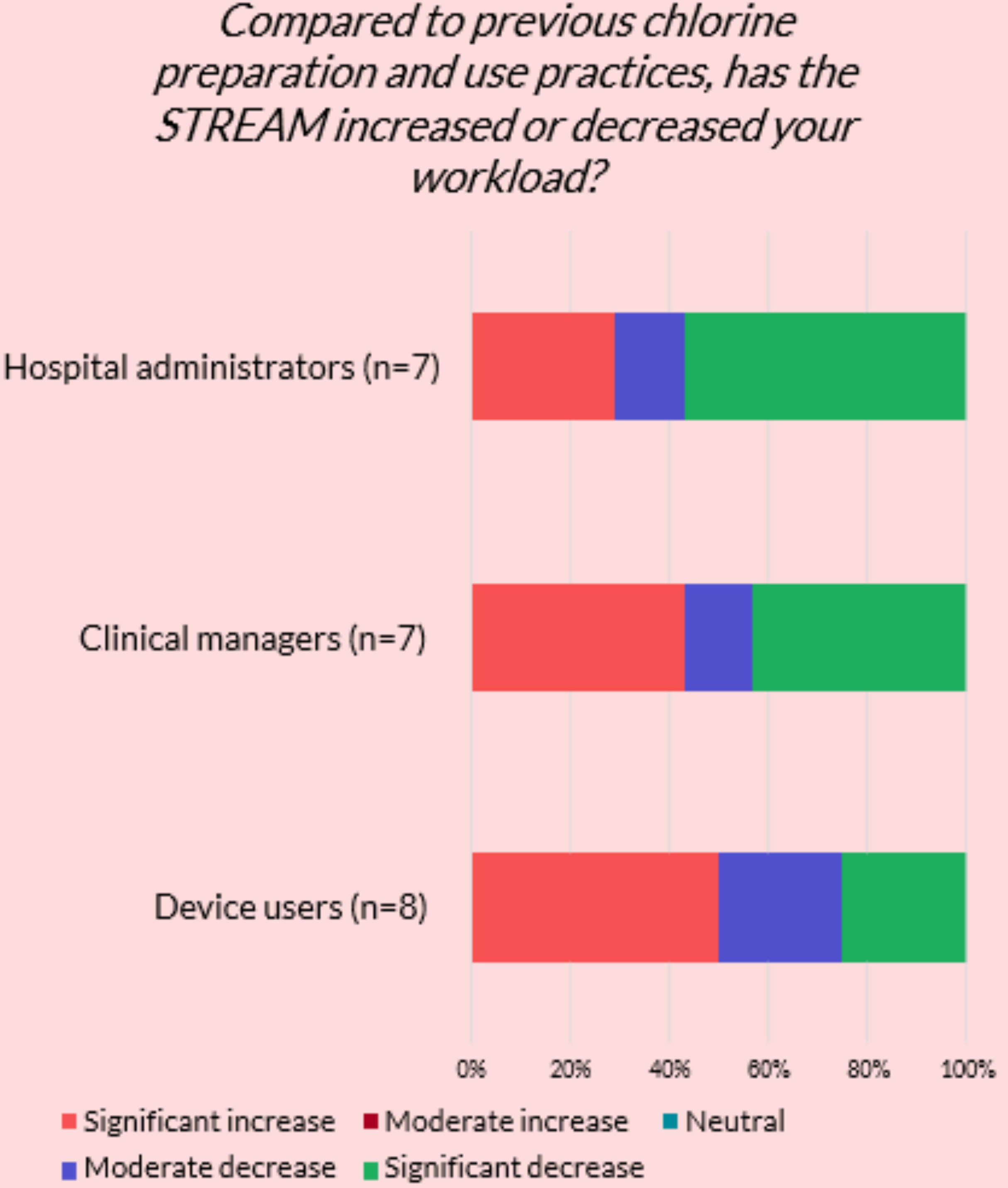
Results: Workload

Mixed feedback on the STREAM's effect on workload:

- + Increased chlorine availability led to completion of more disinfection practices
- + STREAM requires a dedicated operator
- – No dilution required for disinfection (also eliminating errors)
- – Quality of chlorine from STREAM was visibly noticed (previous chlorine required multiple applications to see effect)
- – Elimination of lengthy procurement process

"It has increased workload because the availability of chlorine is consistent and there's no need to be economical with applying it in IPC practices hence increased workload with practices."

— Clinical manager



Transitioning to government ownership

PATH donating STREAM units to Eastern Region Health Directorate

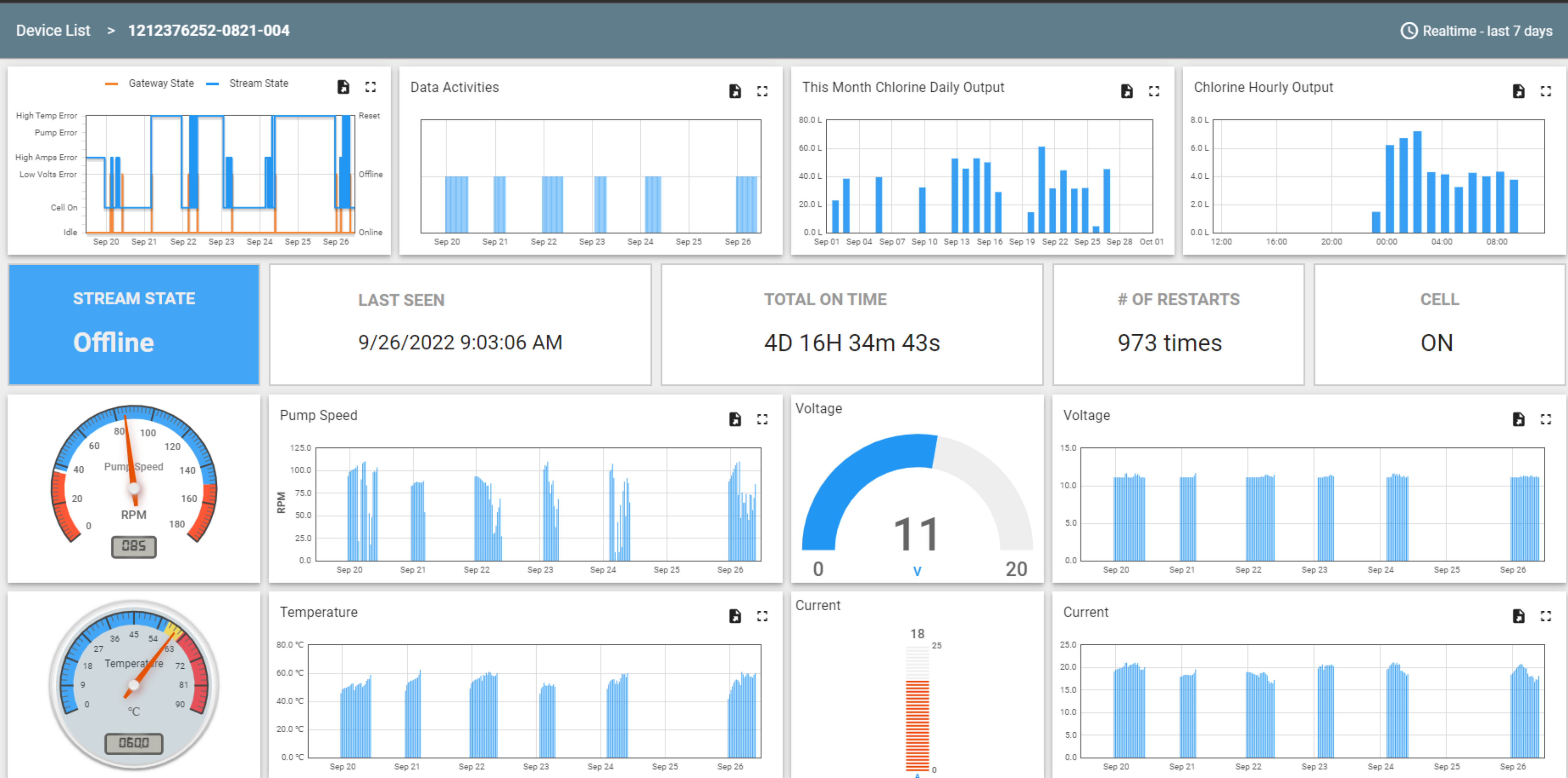
Eastern region ownership

- All Eastern region HCFs are using their own funds to purchase STREAM chlorine inputs (i.e., salt and vinegar).
- Eastern region biomedical engineers are the primary technical agents responsible for STREAM maintenance and repair.
- Installed 4 additional STREAM units in Eastern region health facilities, totaling 12 in the region under the supervision of GHS.
- Launched an innovative remote monitoring tool (IoT) in 4 Eastern region HCFs operating STREAMs to generate additional data and insights on performance and use.

National introduction and ownership

- Dr. Samuel Kaba (Director, ICD/GHS) called for national introduction of the STREAM across Ghana.
- Expanded introduction confirmed for Volta, Central, and Ahafo regions.

STREAM dashboard



Conclusion

- Health care facilities are **generating significant volumes of chlorine** with the STREAM devices and
  eliminating chlorine stockouts.
- The STREAM is generating an average of **39.5% cost savings for health facilities** on chlorine supply costs. After excluding facilities using tablets and HTH, the average cost savings becomes 47.5%.
- **Performance issues led to redesigned components**, which will improve STREAM robustness and demonstrate the commitment of the manufacturer.
- **Aqua Research is committed and responsive** to addressing performance and design issues. The company invested a significant amount in design modifications and seeking to establish long-term market presence in Ghana.
- The STREAM has led to **increases in workloads** but also **increases in the delivery of IPC practices**.

Proposed next steps toward scale

Advancing toward scale in Ghana

- **Expand dataset on reliability, total cost of ownership, and health impact** with expanded introduction in Volta, Central, and Ahafo regions. Replicate and adapt Eastern region transition and ownership models in these regions.
- Advocate for **GHS/ICD policy recommendation** approving HCFs to procure STREAM devices.
- **Support GHS/ICD with developing national and district-level strategy** for STREAM introduction across public health system.
- Provide technical support to Aqua Research to **operationalize post-sale service support model**.
- Immediately explore, test, and implement approaches applying **the STREAM chlorine device for water treatment and deepen link with GHS-led IPC training.**

Funding and partners

Support for this work was made possible by the Conrad N. Hilton Foundation.

We thank our key partners:

- Ghana Health Service (Director General, Deputy Director General, Integrated Care Division)
- Regional Health Administration (Regional director health services and team)
- Clinical Engineering Unit
- Health care facilities management
- PATH project team (Ghana and US team)
- Aqua Research, LLC

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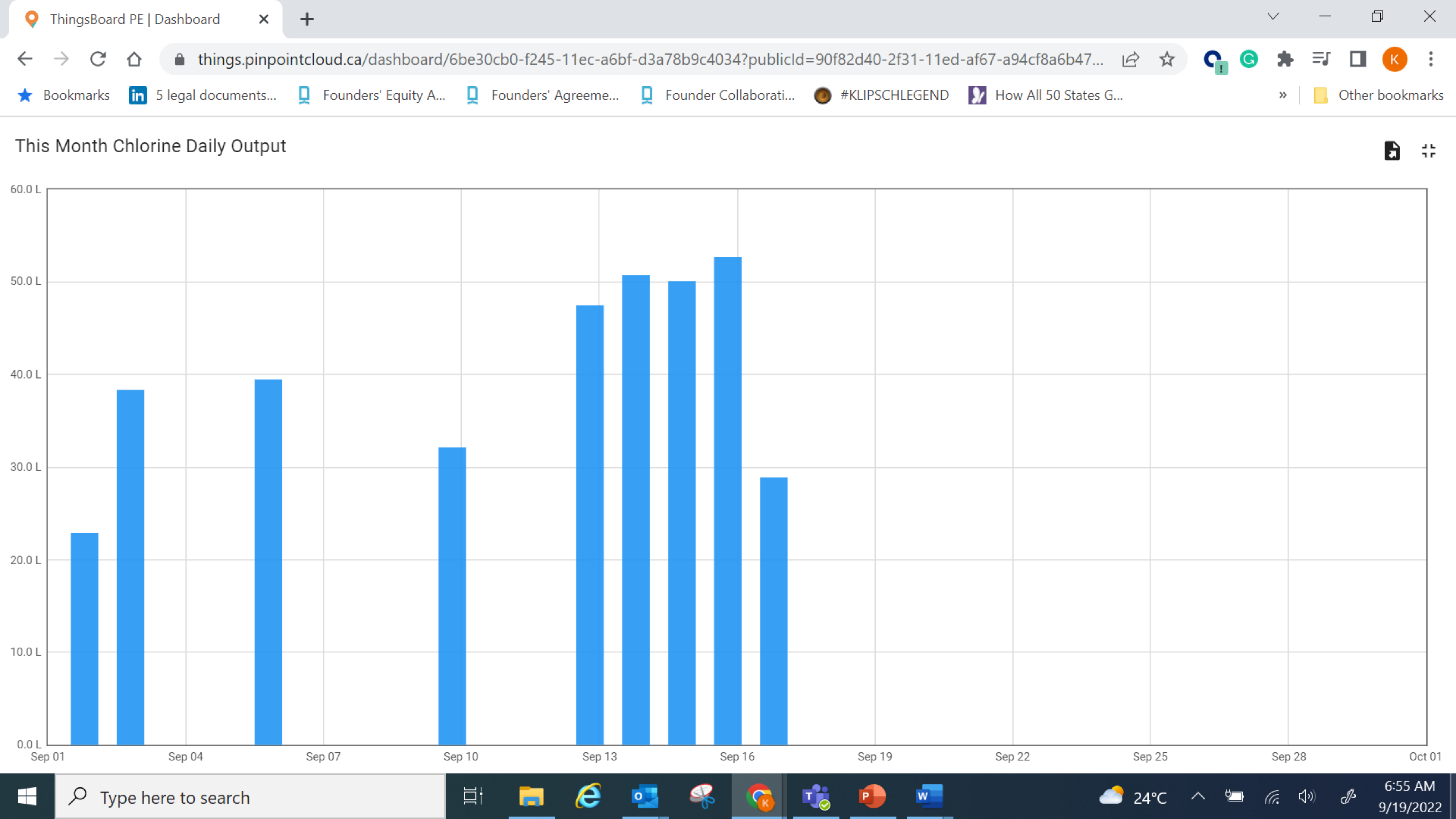

ThingsBoard PE | Dashboard
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Water Quality Testing and Monitoring in Ghana

Juliet Ewool, Jones K. Quartey, Emmanuel R. Blankson, Francis Gbogbo and Rosina Kyerematen

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19-21 October 2022

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Outline of Presentation


Anne MImault for IRC

1. Introduction
2. Materials and Methods
3. Results and Discussion
4. Conclusions

Introduction

- Water quality is important to ensure sustainable development, thus the need for its monitoring and ensure portable supply.
- However despite this effort, some communities still depend on surface waterbodies and dugouts for their drinking water supplies.
- Some studies have shown that, some treated drinking water is also contaminated.
- There is therefore the need to continually test and monitor drinking water at various institutions and water point sources.
- This study therefore tested the quality of drinking water by measuring the microbial, biological, physical and chemical indicators of drinking water quality.
- This was done in households, surface waterbodies, schools and community water point sources within the Densu river basin catchment area.

Materials and Methods – Study Area and Sites

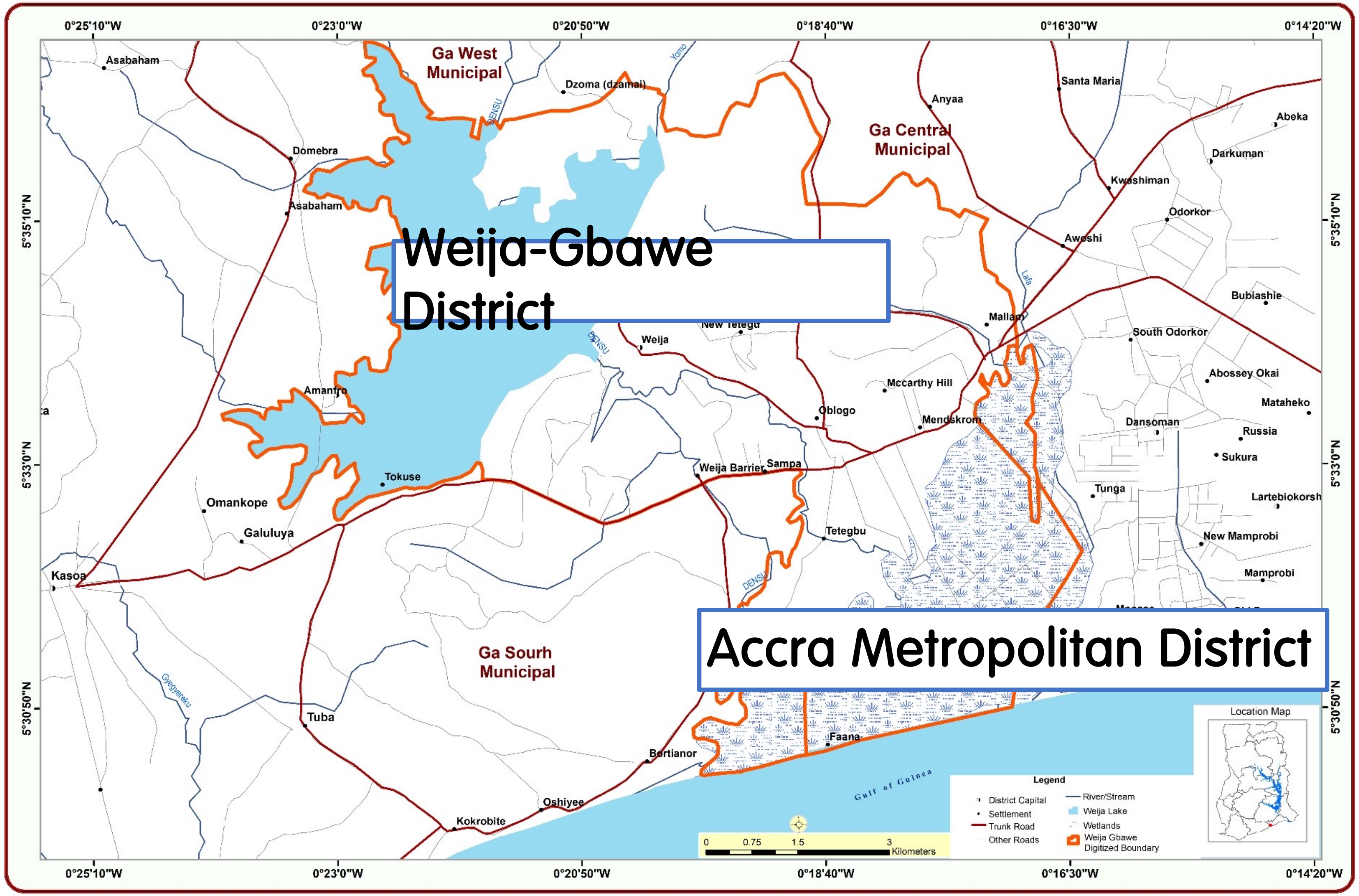


Figure 1 Map of study area showing the two districts

Materials and Methods – Study Sites

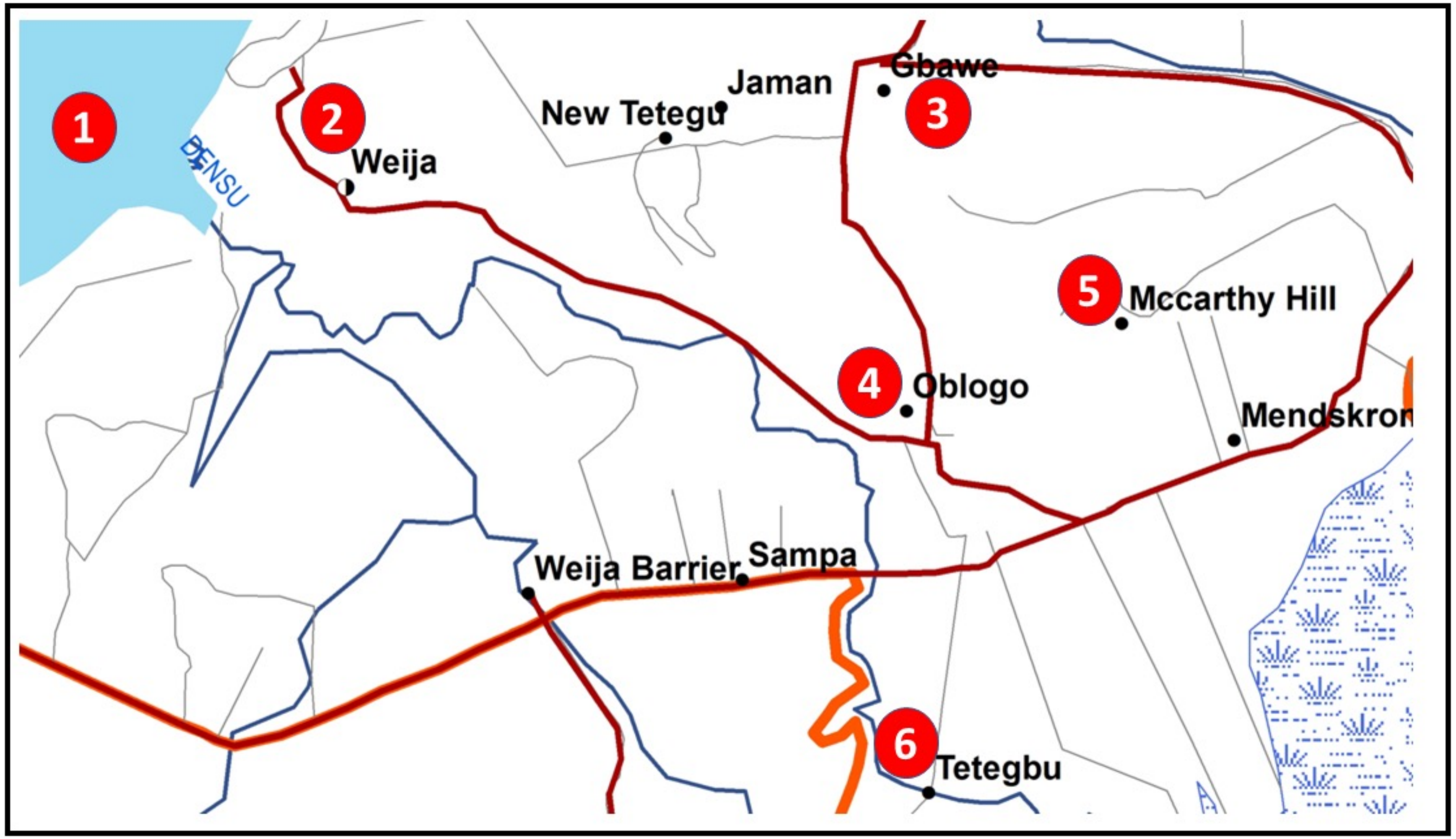


Fig 2A Map of Weija-Gbawe district with sampling sites

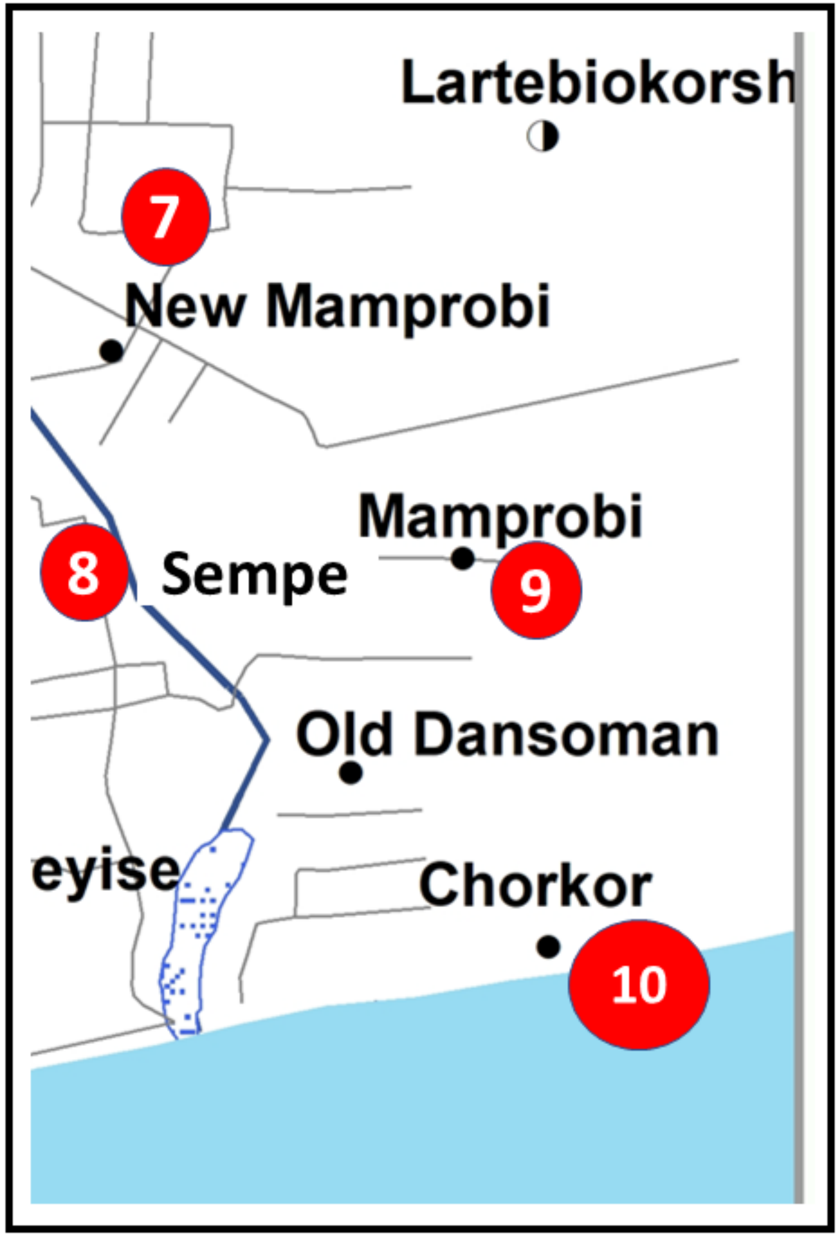


Fig 2B Map of Accra Metropolitan district with sampling sites

Materials and Methods – Data Collection

- Data collection – 6th to 13th June, 2022
- A total of 180 samples
  - ✓ Households
  - ✓ Schools
  - ✓ Hospitals
  - ✓ Surface waterbodies
  - ✓ Community water point sources

Materials and Methods - Microbial Contamination

- Membrane filtration method used in identifying *E-coli* presence in different water samples

- *E-coli* colonies presence were counted

Materials and Methods - Physico-chemical properties

- Physico-chemical parameters measured include;
  - Temperature
  - Total dissolved solids (TDS)
  - pH
  - Turbidity
  - Conductivity
  - Salinity

Results and Discussion

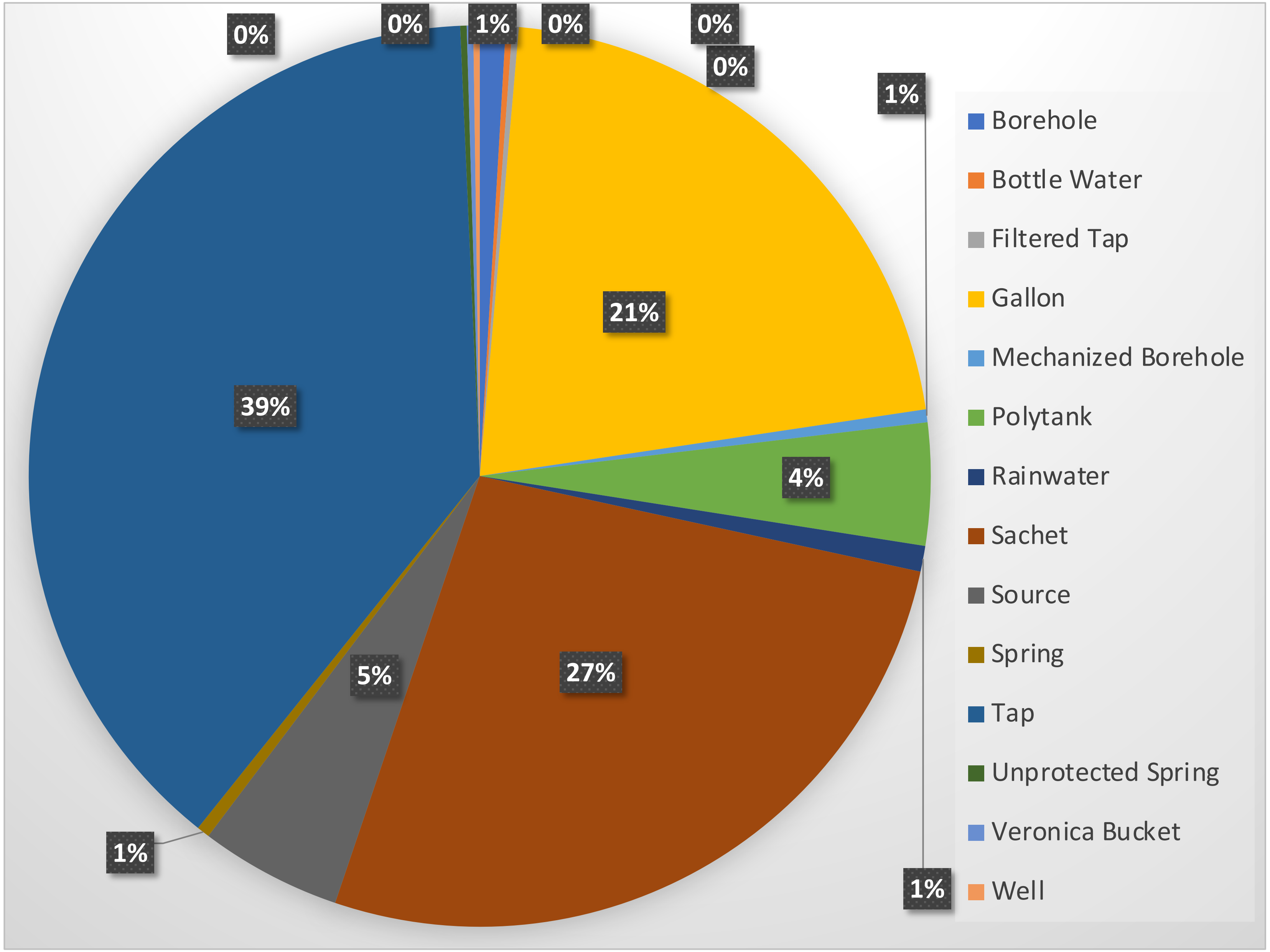
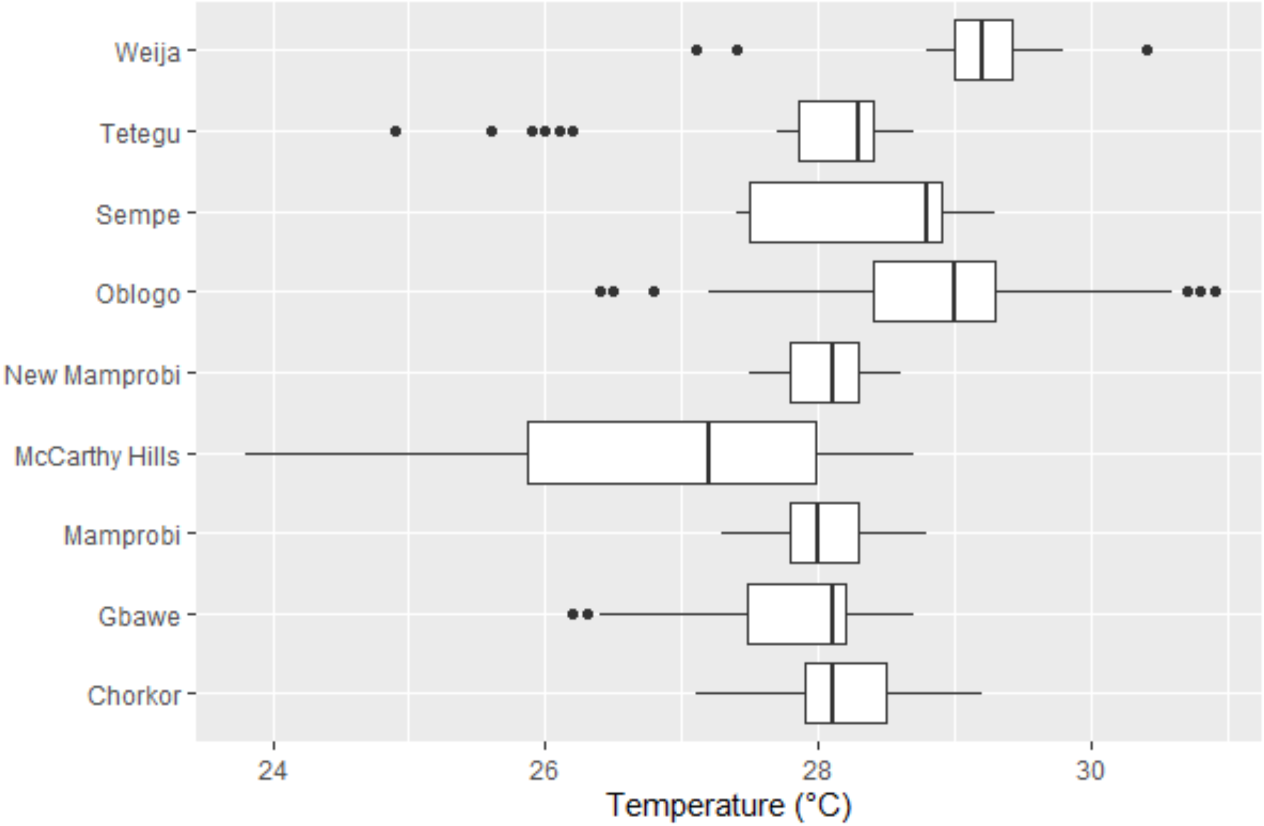


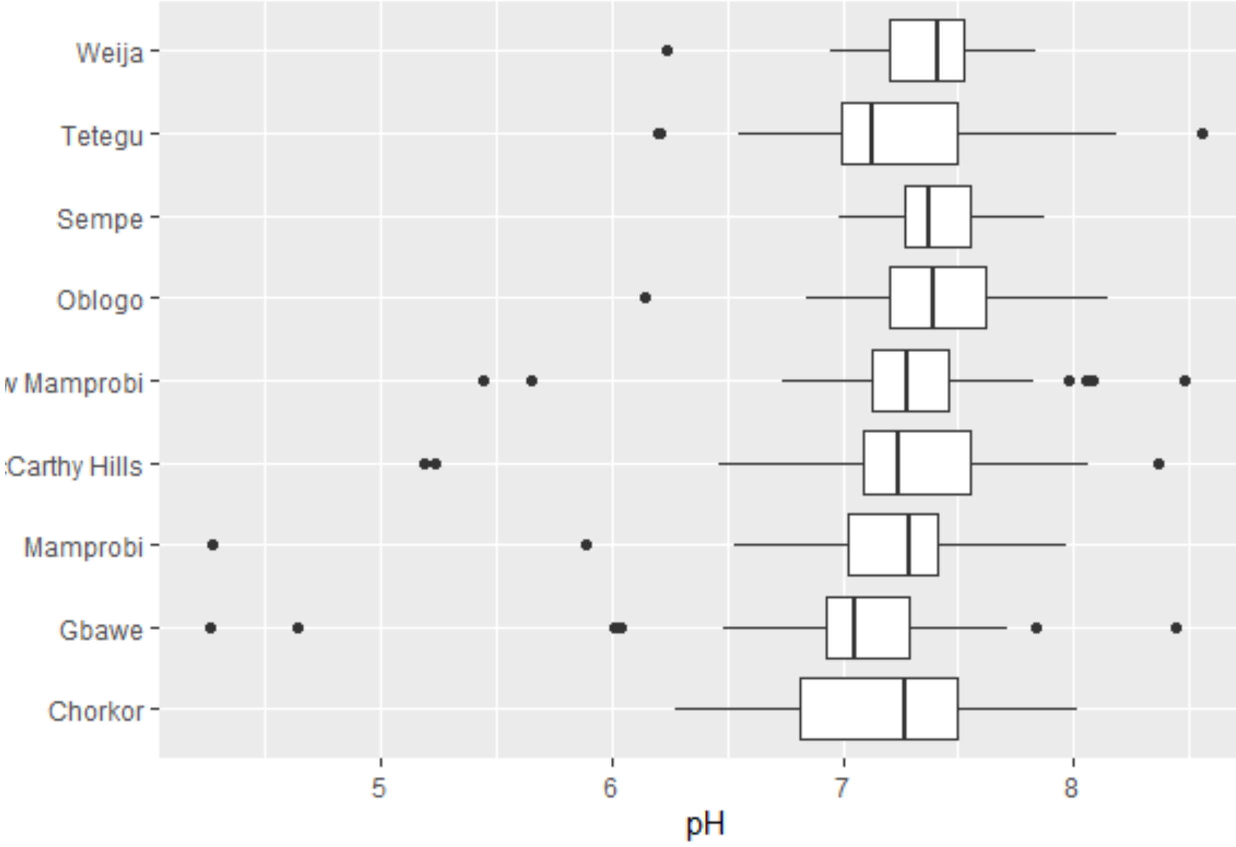
Figure 2 A pie chart showing the different water sources and storage facilities in the various households

Results and Discussion – Physico-chemical parameters of water in Households (1)

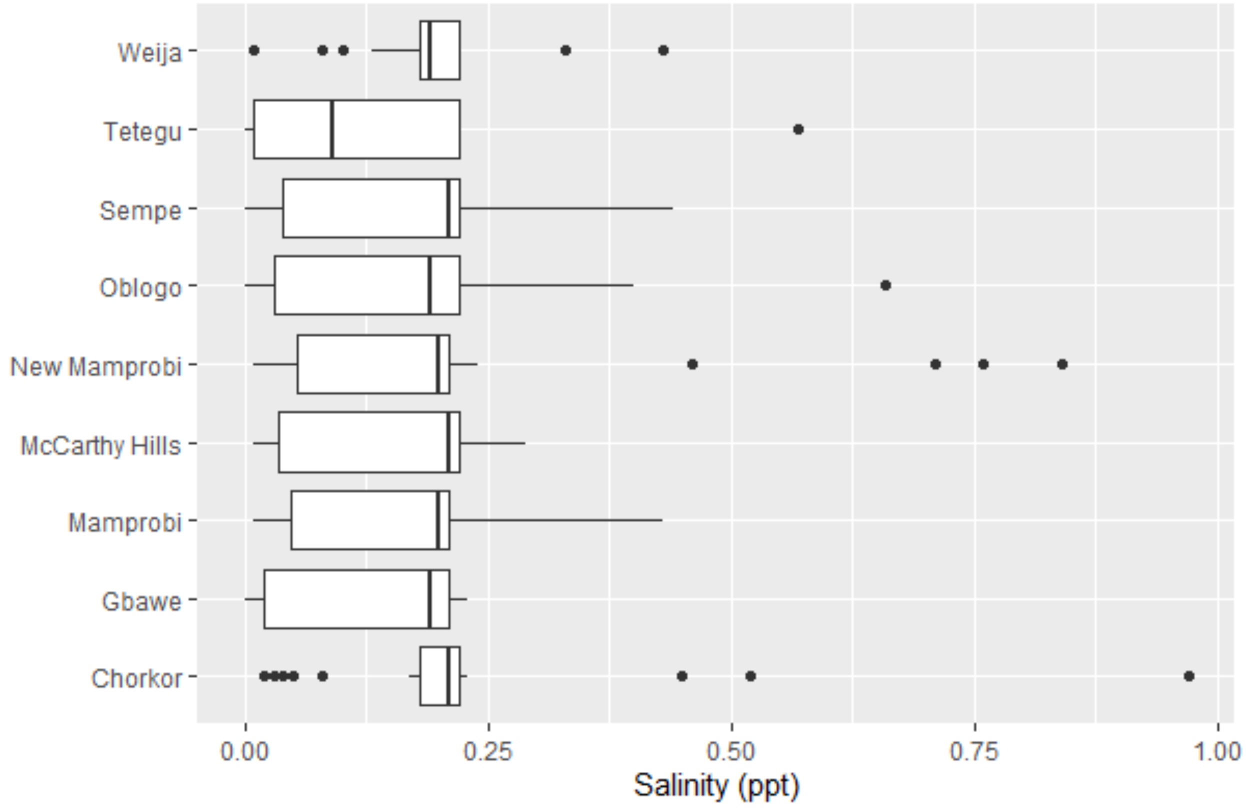


Temperature: *H = 127.77, df = 8, p < 0.001*

pH: *H = 31.51, df = 8, p < 0.001*

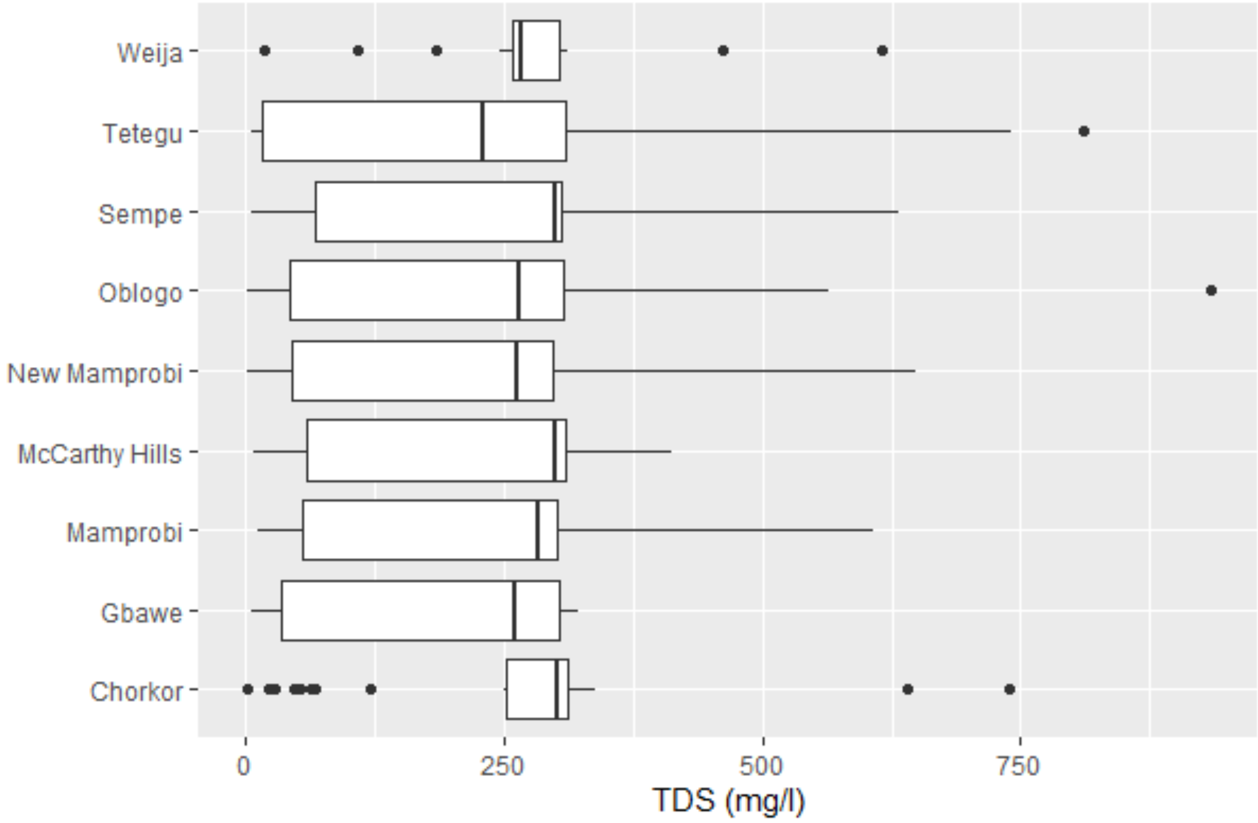


Results and Discussion – Physico-chemical parameters of water in Households (2)

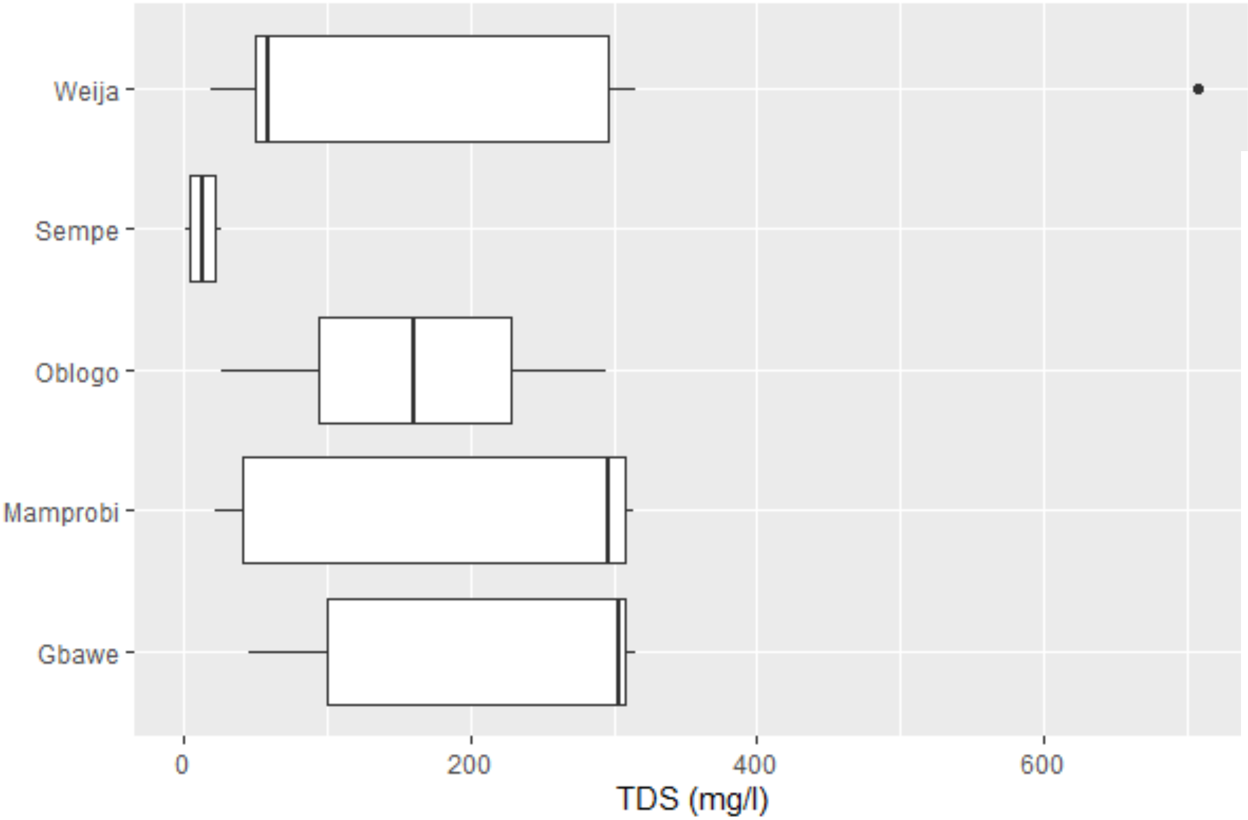


Salinity: *H = 16.18, df = 8, p = 0.04*

TDS: *H = 15.56, df = 8, p = 0.05*

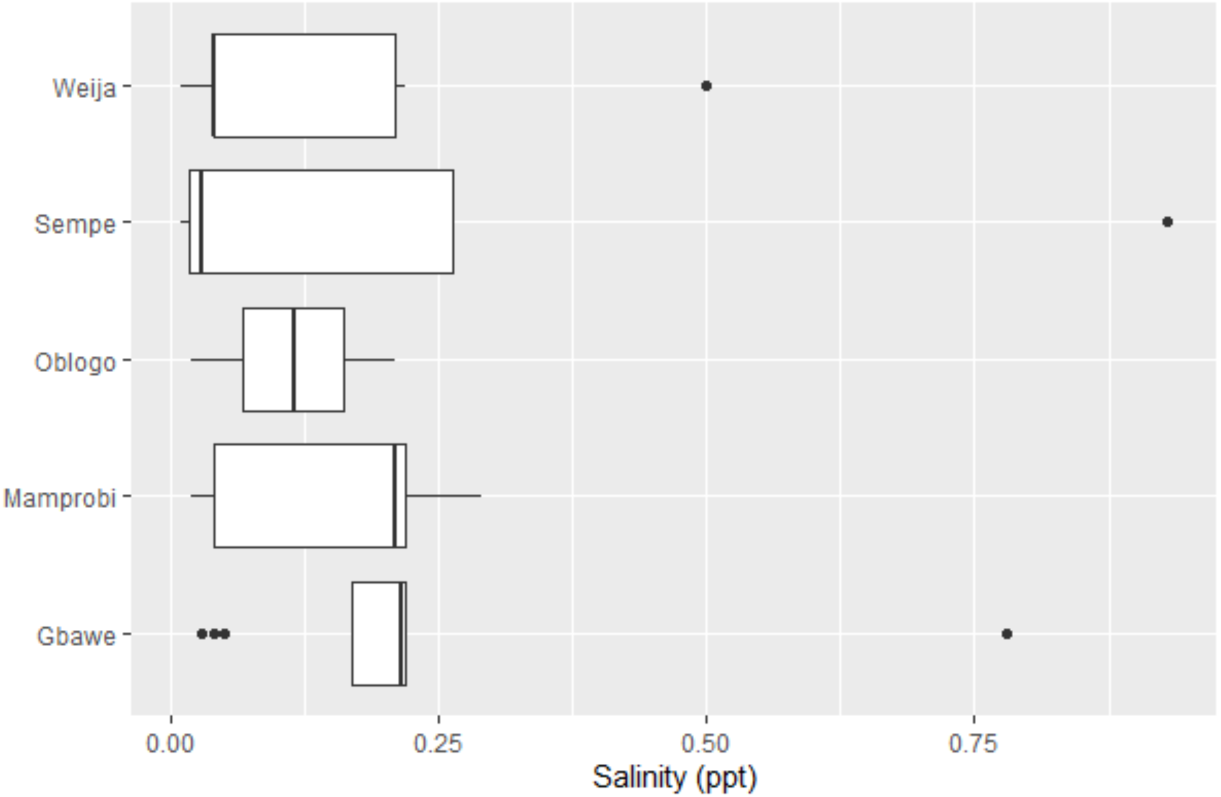


Results and Discussion – Physico-chemical parameters of water in Schools

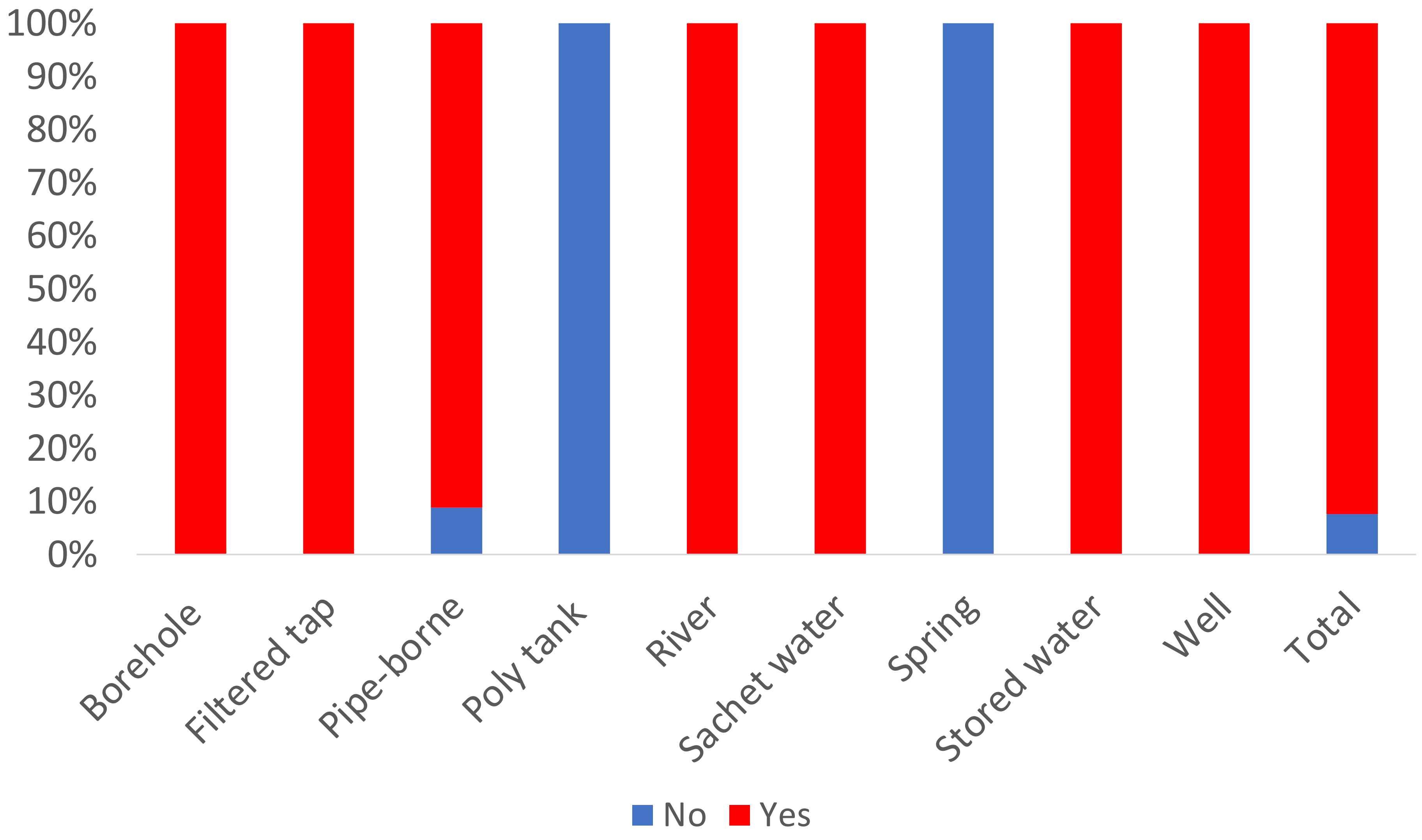


TDS: *H = 15.77, df = 4, p = 0.003*

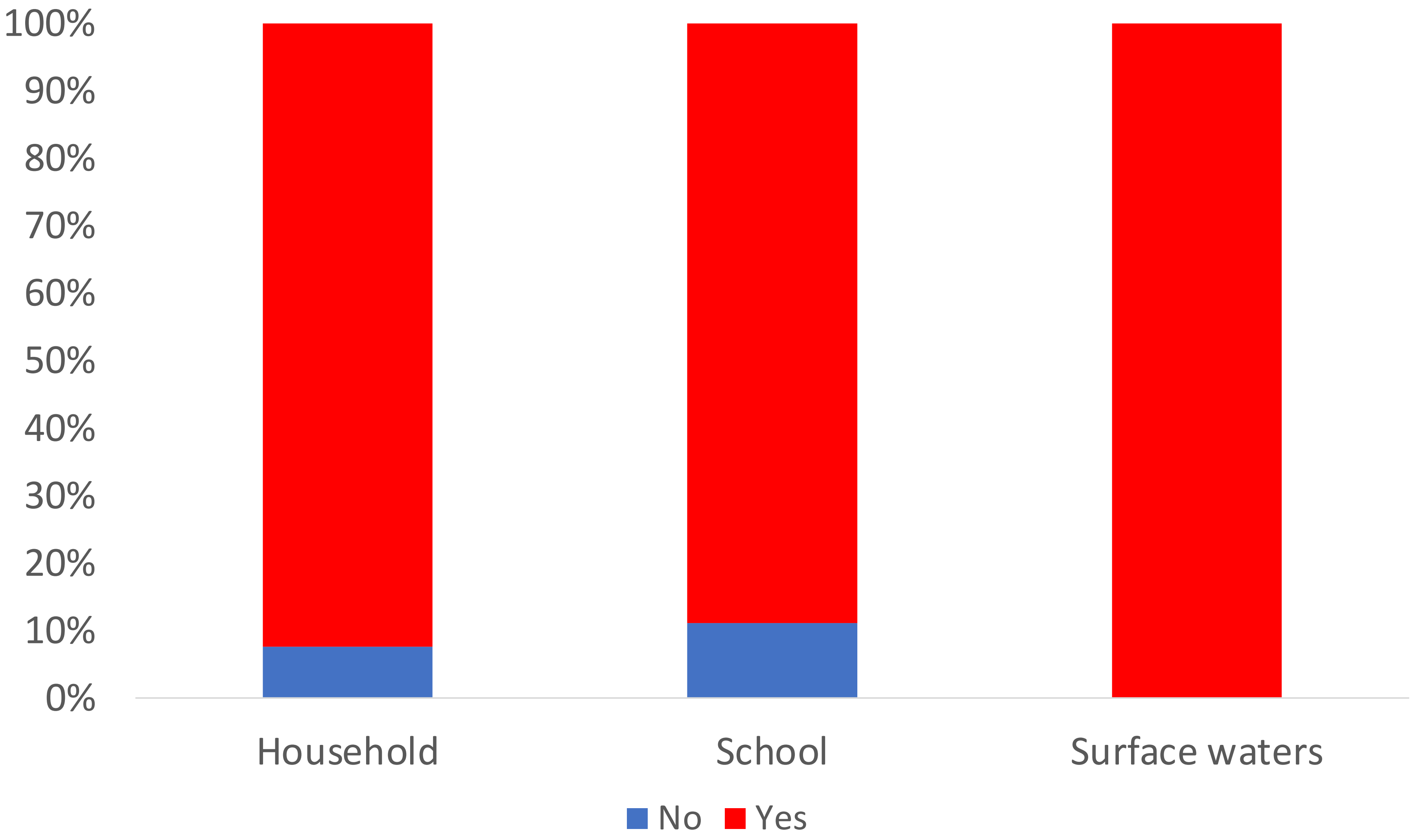
Salinity: *H = 7.23, df = 4, p = 0.12*



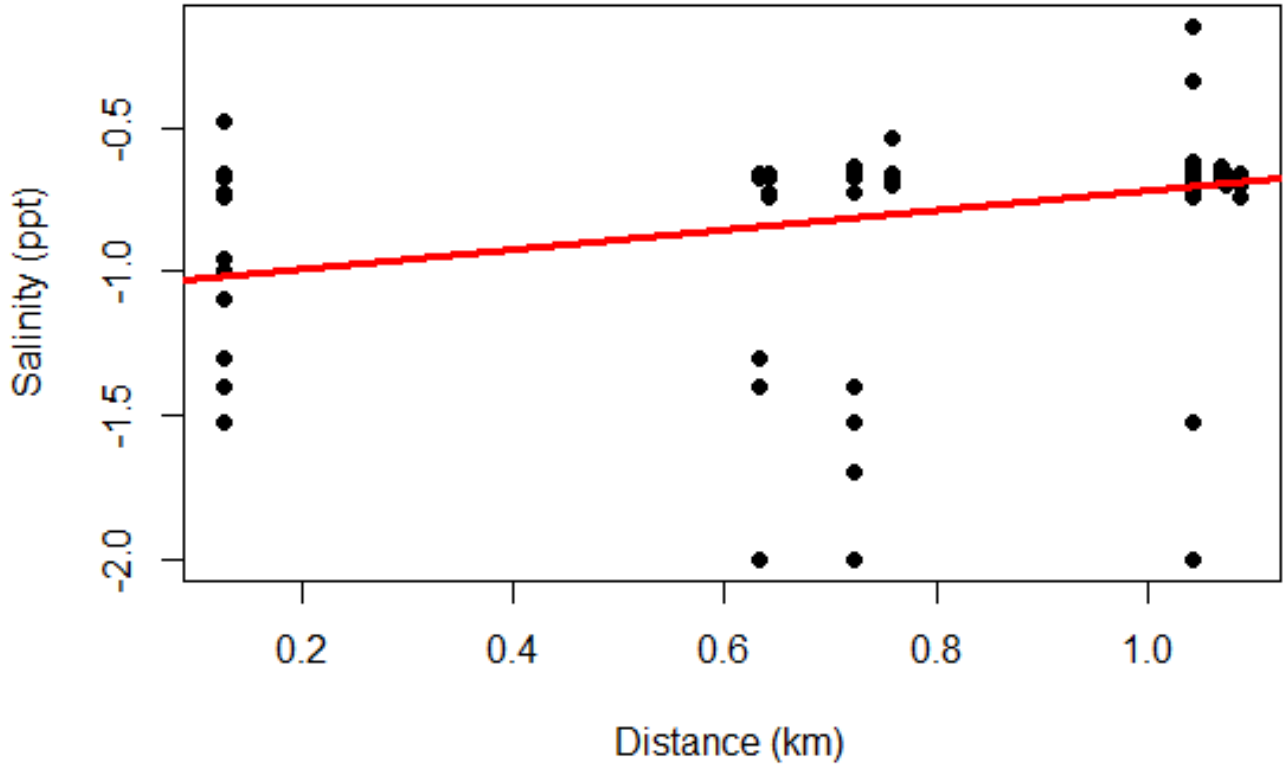
Results and Discussion – Microbial contamination of water sources



Results and Discussion – Microbial contamination of water from various institutions

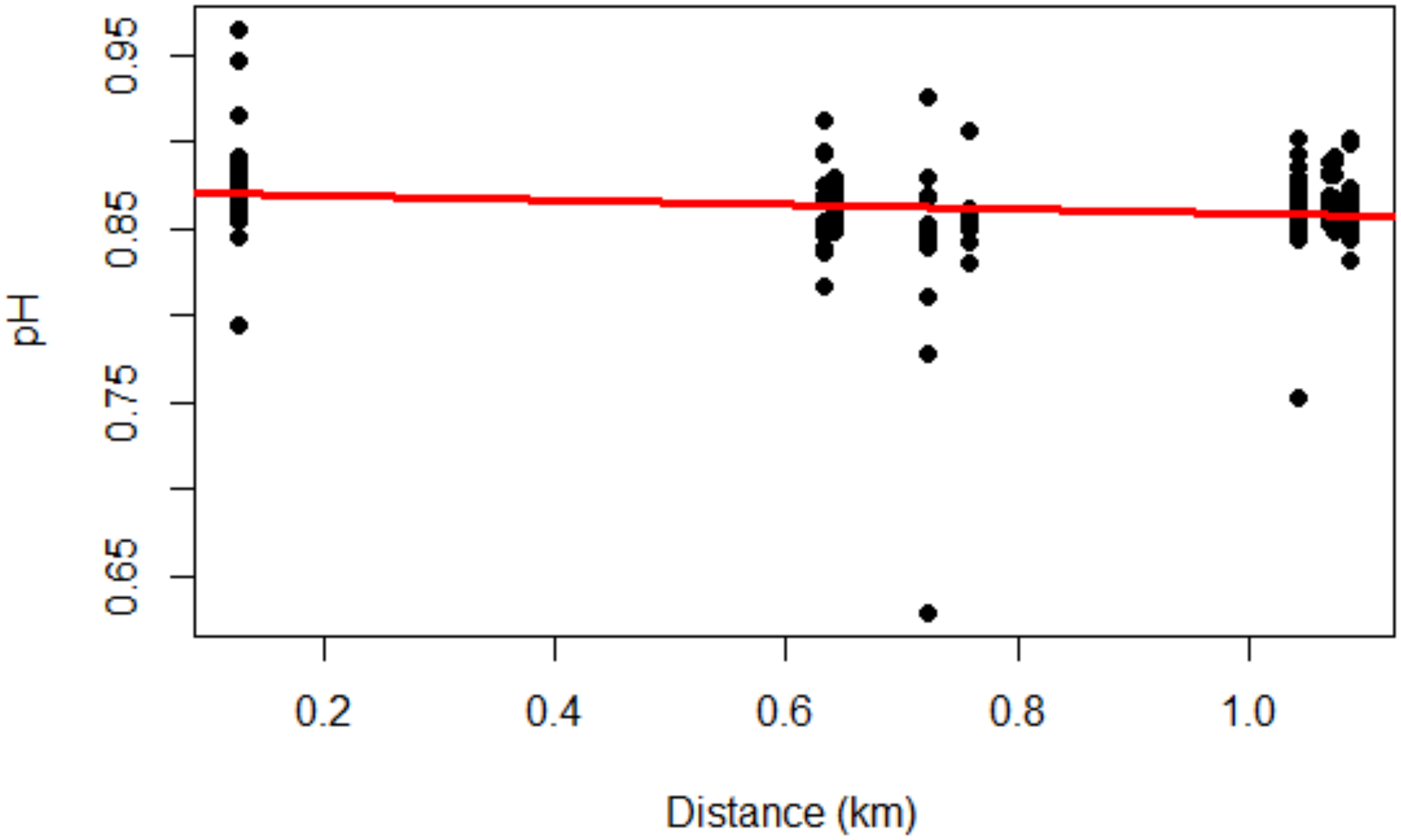


Results and Discussion – Physico-chemical parameters and distance from Treatment plant (1)



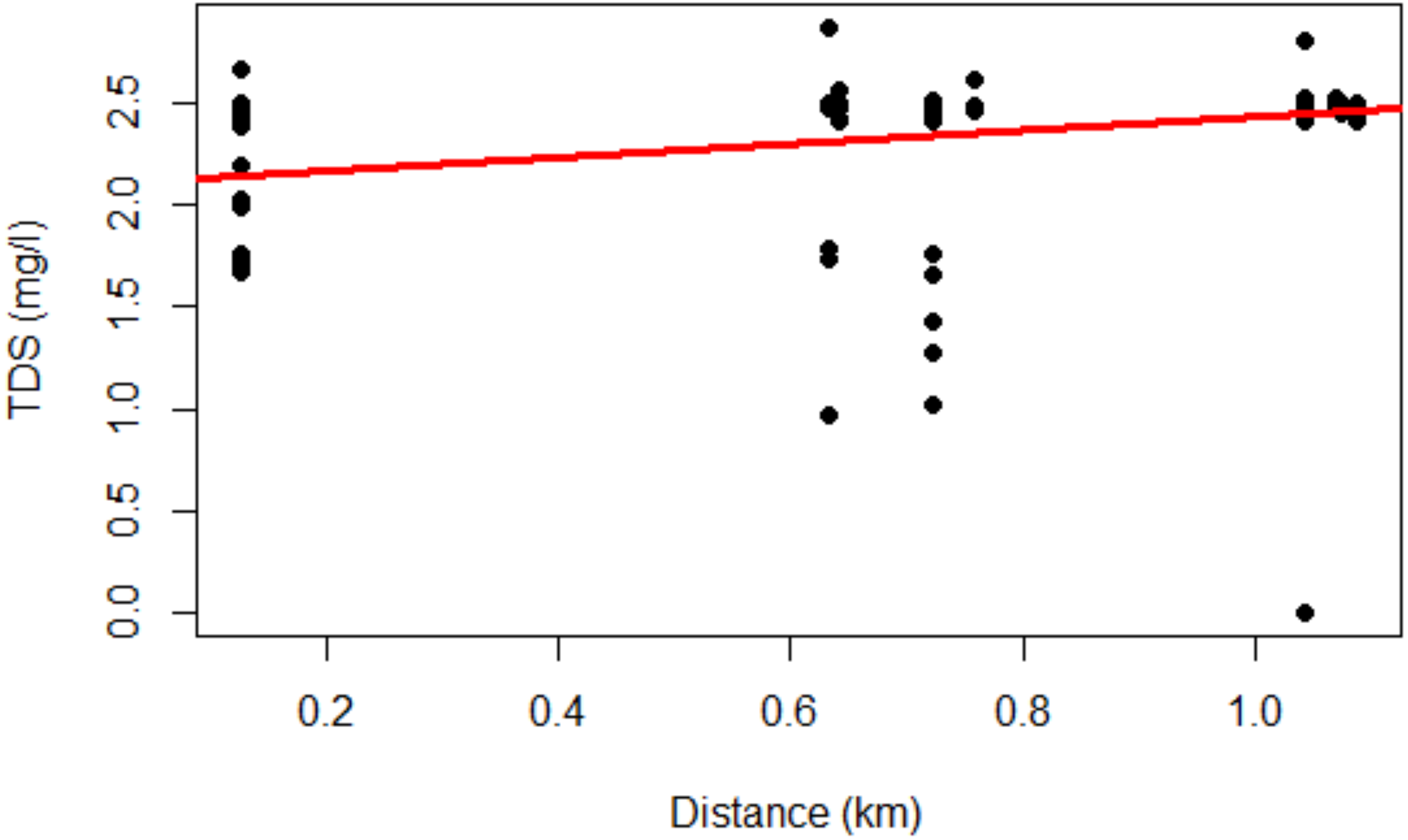
The model line is represented by $log\ Salinity = 0.09\ -\ 0 \cdot 34\ log\ D\ istance, p < 0.001$

Results and Discussion – Physico-chemical parameters and distance from Treatment plant (2)



The model line is represented by $log\, pH = 7.44 - 0 \cdot 01\, log\, Distance, p = 0.04$

Results and Discussion – Physico-chemical parameters and distance from Treatment plant



The model line is represented by $log\,TDS = 0 \cdot 33\,log\,D\,istance\ +\ 127.06, p < 0.001$

Conclusion

- Generally, physico-chemical parameters were within accepted WHO limits except for turbidity.
- Water quality is compromised with distance from the treatment plant
- The *E-coli* levels from drinking water samples from households and schools within the Densu river catchment area suggest feacal contamination.
- Effort and policy needs to made to reduce feacal contamination and turbidity of drinking water from Densu river basin catchment area.

Acknowledgement

- Hilton Foundation Institute for Funding
- Staff and students of the Department of Animal Biology & Conservation Science
- Residents of the study communities
- Centre for Biodiversity and Conservation Research for logistic support
- Photo credits to Lawrence

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HILTON FOUNDATION AFRICA WATER QUALITY TESTING FELLOWSHIP

DEPARTMENT OF ANIMAL BIOLOGY & CONSERVATION SCIENCE

UNIVERISTY OF GHANA

19-21 October 2022

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Outline of Presentation

- Introduction/ Background Information
- UG-DABCS
- Project Personnel
- Project Objectives
- Plan of Work
- Progress of work
- Acknowledgement

University of Ghana

- University of Ghana (UG) was established in 1948
- UG's mission is to develop world-class human resources to meet global development challenges
- UG aims to produce the next generation of thought leaders to drive national development

DABCS - UG

- DABCS is one of the departments of the School of Biological Sciences (SBS) of the College of Basic & Applied Sciences (CBAS)
- DABCS is the most appropriate department at UG to train and build the capacity of students in water quality testing and monitoring
- DABCS has shown competence in hosting several fellowship programs – e.g. Environmental Science Program, Volta Basin Research Project (VBRP) and the African Regional Postgraduate Programme in Insect Science (ARPPIS)

DABCS – Water quality project personnel

- **DABCS's student population is 1,476**

✓ Level 100 – 738

✓ Level 200 – 362

✓ Level 300 – 254

✓ Level 400 - 122

- **Staff – 37**

✓ Faculty – 23

✓ Technicians – 8

✓ Administrative – 2

✓ Librarian – 1

✓ Cleaners – 2

✓ Driver - 1

General Objective

The overall aim of the Fellowship program is to **train students** to acquire **practical skills** in **water quality testing, data collection** and **analyses** at the community, household, school, and healthcare facility levels.

Specific Objectives

- To institutionalize an academic program at DABCS to provide the basic theoretical and practical concepts in drinking water quality testing and monitoring
- To work directly with local institutions with expertise in water quality testing and monitoring to build capacity of fellows in water quality data collection and monitoring and develop a short- to medium- term data base for water quality in the target districts (Wassa East and Asutifi North)
- To disseminate and share drinking water quality testing results of the target districts with the Hilton Foundation, Aquaya, regional and local partners and governments, the general public and the scientific community
- To establish a system of comparing drinking water quality data collected through this project with that of the mandated institutions within the target districts and provide recommendations for monitoring and planning purposes

Specific Activities (1)

- ❑ **Participants (*Fellows*)**
  - ✓ 20 students on the fellowship programme
  - ✓ Selection of students based on CGPA, pre-requisite course in Level 300 (Wetland Ecology & Aquatic Biology)
  - ✓ Fellows required to take new Level 400 course on Water Quality Monitoring and Assessment
  - ✓ Carry out final year projects on water quality testing within target districts

- ❑ **Capacity Building Activities**
  - ✓ ***Fellows*** – (i) take courses and field work in Level 300,

    (ii) proposed Level 400 (Water Quality Monitoring & Assessment),

    (iii) one week drinking water quality training workshop,

    (iv) bi-annual district water quality testing and data collection (final year project),

    (v) participate in conferences on drinking water testing

Specific Activities (2)

- **Capacity Building Activities (Cont'd)**

✓ ***Faculty members*** – (i) interaction with technocrats in the water quality industries,

(ii) Participate in conferences on water quality

✓ ***Partner Institutions*** – (i) sharing of lessons from project activities with other partner universities

(ii) Establishment of a water quality testing laboratory for the training of students, fellows, postgraduates students from other departments as well as serve as a general water quality testing laboratory.

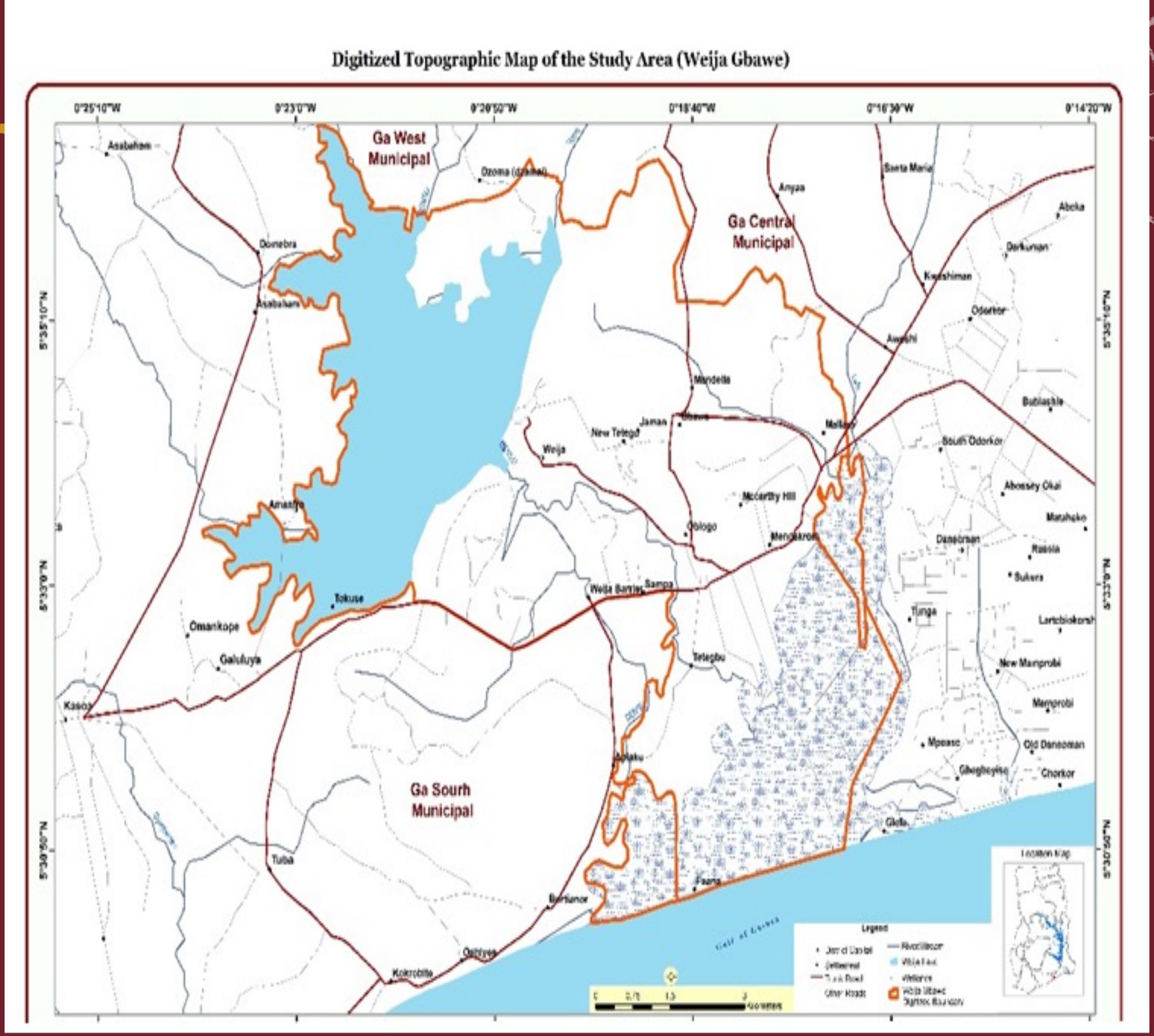
✓ ***Technicians, research assistants, national service personnel*** and ***other students*** - participate in a one-week training workshop to be equipped with needed skills in water quality testing

❖ Two main capacity building tools for this project

- Training programs for fellows (workshops, course work, fieldwork, internships)
- Short course (30 participants; water quality testing professionals from industries)

Data Collection

- ❑ **Pre-data collection**
- ✓ **Location – Weija-Gbawe District**
- ✓ Date – 6^{th} – 12^{th} June, 2022
- ✓ Sampling size – 383 samples
  - Biological communities
  - Physico-chemical properties
  - Microbial contamination
  - Trace metals and Fluoride
- ✓ **Location – Lower-Manya Krobo District**
- ✓ Date – 14^{th} – 21^{st} June, 2022
- ✓ Sampling size – 383 households
  - Biological communities
  - Physico-chemical properties
  - Microbial contamination
  - Trace metals and Fluoride



NB: A total of 39 Fellows

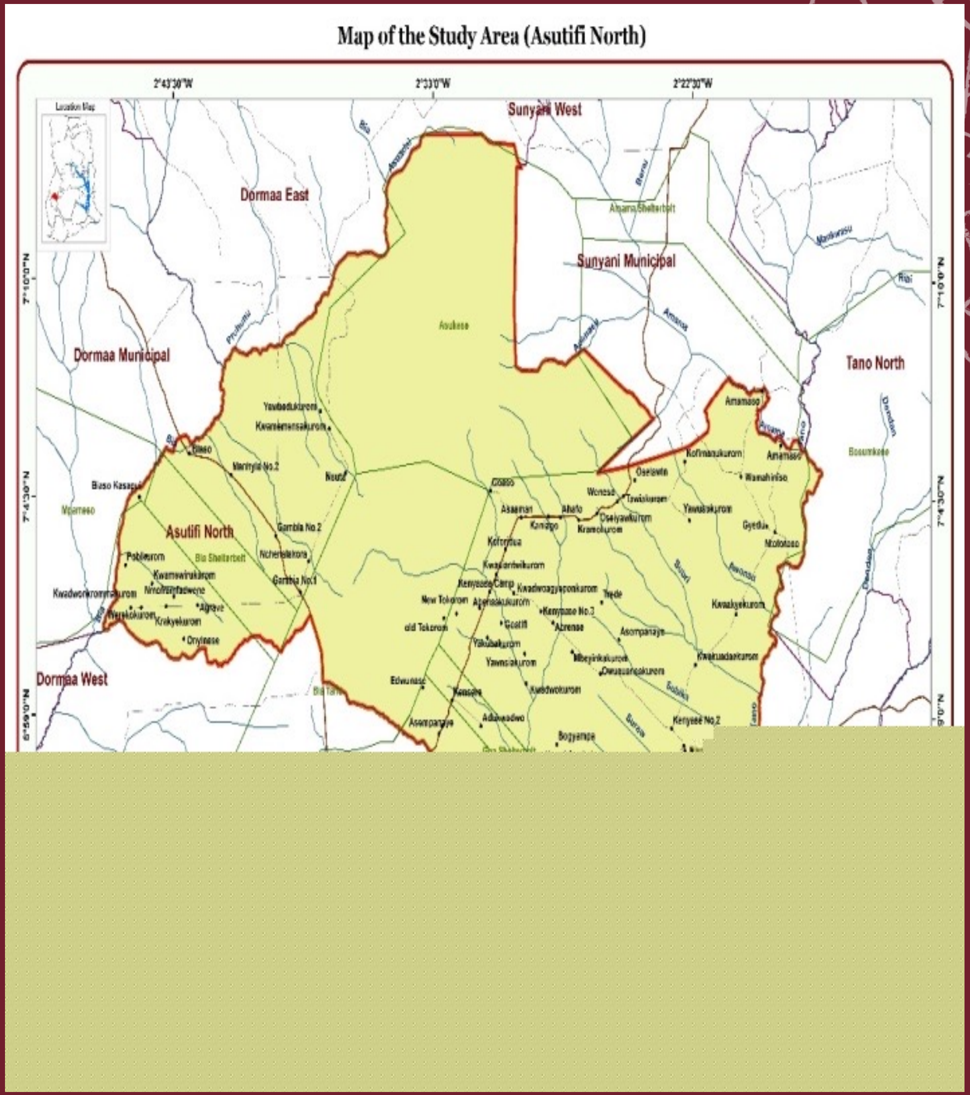
Data Collection

❑ **Data collection at Project Districts**

- ✓ **Location – Asutifi North District**
- ✓ Date – 9th – 19th November, 2022
- ✓ Sampling size – 376 households
  - Biological communities
  - Physico-chemical properties
  - Microbial contamination
  - Trace metals and Fluoride

- ✓ **Location – Wassa-East District**
- ✓ Date – 22nd November – 2nd December, 2022
- ✓ Sampling size – 372 households

NB: A total of 20 Fellows



Progress made so far

- ✓ Reconnaissance visits to Weija-Gbawe, Lower-Manya Krobo and Wassa East Districts
- ✓ Submission of Ethical Approval Forms
- ✓ Identification of Laboratory space
- ✓ Inception meetings with key stakeholders (e.g. Ghana Water Company Limited, District Assemblies, Health Directorates, School Directorates)
- ✓ Selection of students (Fellows) for Year 1
- ✓ Assignment of project topics to selected students for pre-data collection
- ✓ Number of Laboratory meetings with students to sensitize them on project
- ✓ Establishment of contact with other partner institutions (e.g. Institute of Environmental Sanitation Studies, Ecological Laboratory ECOLAB)
- ✓ New Level 400 course in water quality testing and monitoring submitted to Academic Board for approval

QUESTIONS & ANSWERS

Presentations and panelists

Presentations:

- Onsite chlorine generation for Ghana health care facilities **- Kofi Aburam, Project Coordinator (PATH) & Patience Cofie, Chief of Party (PATH)**
- Water Quality Testing and Monitoring in Ghana - **Juliet Ewool, Rosina Kyerematen (Department of Animal Biology & Conservation Science, University of Ghana)**
- Hilton foundation africa water quality testing fellowship - **Juliet Ewool, Rosina Kyerematen (Department of Animal Biology & Conservation Science, University of Ghana)**

Panelists:

- Kofi Aburam, Patience Cofie, Juliet Ewool, Rosina Kyerematen
- Nabil Chemaly (Senior Program Officer, Safe Water - Conrad H. Foundation)
- Dr. Ashinyo Mary Ayram (Ghana Health Service - Deputy Director responsible for Quality Assurance)
- Donnan Tay (Director Water - National government WASH GHANA)