Metric for Assessing the Sustainability of Safe Water Provision in Healthcare Facilities

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Water in Healthcare Facilities – A Neglected Crisis

• An estimated 61% of healthcare facilities have access to an improved water source within 500m\(^1\)
  • year-round access to water on premises drops by more than half

Meeting the Fundamental Need for Safe Water in Healthcare Facilities

• The 2015 Sustainable Development Goals include target to achieve “universal access to safe drinking water in health facilities by 2030.”

• **Majority of healthcare facilities will require onsite treatment** in order to meet safe drinking water guidelines.

• Need to better understand the sustainability of water treatment systems to improve provision of safe water in healthcare facilities.
Failure rates for water systems are still high after decades of intervention.

Globally, 1/3 of rural water infrastructure is not functional or has major problems (Akvo, 2015).
<table>
<thead>
<tr>
<th><strong>Purpose of Use</strong></th>
<th>Evaluation of sustainability of safe water provision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level of Use</strong></td>
<td>Service provision in institutional (healthcare facility) setting with a centralized or ward-level water treatment system (any type of system)</td>
</tr>
<tr>
<td><strong>Target User</strong></td>
<td>Those interested in understanding the current sustainability of safe water provision at a healthcare facility with an installed water treatment system (MoH, MoE, NGOs, academia, donors)</td>
</tr>
<tr>
<td><strong>Frequency of Use</strong></td>
<td>Post-implementation; Annually</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td>Survey Questions (mobile data collection), Observations, Water Quality Testing</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>Radar plot with sustainability Score 0-4, 4 domains of sustainability</td>
</tr>
<tr>
<td><strong>Time and Resources</strong></td>
<td>½ day at each hospital site (2 enumerators); analysis and data visualization pre-programmed based on inputs</td>
</tr>
</tbody>
</table>
Since 2011, the Center for Global Safe WASH (CGSW) has partnered with GE Foundation (GEF) to evaluate and improve the sustainability of GEF’s water in healthcare facilities program.

- Past research in Ghana, Honduras, Rwanda (20 hospitals)
  - Sustainability metric developed and vetted
- New projects in Cambodia and Uganda (15+ hospitals)
  - Sustainability metric informed new donation program
Overview

1. Development and Organization of the Sustainability Metric
2. Application at hospital sites in Cambodia
3. Lessons Learned from application at hospital sites in Honduras and Ghana
Sustainability Domains

- Technical Feasibility
- On-Site Capacity
- Financial and Operational Accountability
- Institutional Engagement
Sustainability Sub-Domains

Technical Feasibility
- Water Quantity and Availability
- Availability of Supplies, Parts and Equipment
- Plumbing Infrastructure
- Water Quality

On-Site Capacity
- Communication
- Operation
- Preventative Maintenance and Repair
- Training

Financial and Operational Accountability
- Monitoring Performance
- Internal Oversight
- External Oversight
- Budgeting

Institutional Engagement
- Staff Awareness and Support
- Staff Participation in Use of Treated Water
- Satisfaction
- Ownership
When the water stops flowing, for how long is there not any water from the taps in the hospital?
0) a week or more
1) a day
2) half a day
3) an hour
4) a few minutes or water does not stop flowing
Each survey question is associated with answer choices with point values from 0-4.

• The greater the number, the greater evidence of an enabling environment for sustainability.
• By averaging the score a hospital receives for each indicator (survey question, observation, water quality) within a subdomain, a subdomain score is created.
• Subdomain scores are averaged to form a domain scores.
Methods

Surveys with:
• Hospital director (30 minutes)
• Maintenance staff (20 minutes)
• Hospital staff (5 minutes each)
  • 5 clinical staff
  • 5 non-clinical staff

Observations of:
• Functionality of water infrastructure
• Record keeping related to hospital water

Water quality testing (10 samples):
• $E. \text{coli}/100\text{ml}$
• Chlorine residual (if applicable)

Collecting a water sample
Conducting observations
Technical Development

- Open Data Kit (ODK) to collect data on mobile phones and a custom Excel dashboard to automatically generate sustainability scores and data visualizations.

- Next steps: Developing an Android App that will allow for data collection and analysis/result generation
Customization of Sustainability Metric

• Customize based on relevant:
  • Water treatment equipment and parts
  • Water quality outcomes
  • Key leadership and operation and maintenance staff
# Sustainability Scores for a Cambodian Hospital

<table>
<thead>
<tr>
<th>Overall Sustainability</th>
<th>2.6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domain Scores</strong></td>
<td></td>
</tr>
<tr>
<td>Technical Feasibility</td>
<td>3.2</td>
</tr>
<tr>
<td>On-site Capacity</td>
<td>2.6</td>
</tr>
<tr>
<td>Financial and Operational Accountability</td>
<td>3.0</td>
</tr>
<tr>
<td>Institutional Engagement</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Subdomain Scores</strong></td>
<td></td>
</tr>
<tr>
<td>Water Quantity and Availability</td>
<td>4</td>
</tr>
<tr>
<td>Availability of Supplies and Equipment</td>
<td>3</td>
</tr>
<tr>
<td>Plumbing Infrastructure</td>
<td>3</td>
</tr>
<tr>
<td>Water Quality</td>
<td>3</td>
</tr>
<tr>
<td>Communication</td>
<td>4</td>
</tr>
<tr>
<td>Operation</td>
<td>2</td>
</tr>
<tr>
<td>Preventative Maintenance and Repair</td>
<td>1</td>
</tr>
<tr>
<td>Training</td>
<td>4</td>
</tr>
<tr>
<td>Monitoring Performance</td>
<td>4</td>
</tr>
<tr>
<td>Internal Oversight</td>
<td>4</td>
</tr>
<tr>
<td>External Oversight</td>
<td>0</td>
</tr>
<tr>
<td>Budgeting</td>
<td>4</td>
</tr>
<tr>
<td>Staff Awareness and Support</td>
<td>2</td>
</tr>
<tr>
<td>Staff Participation in Use of Treated Water</td>
<td>3</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>2</td>
</tr>
<tr>
<td>Ownership</td>
<td>0</td>
</tr>
</tbody>
</table>

![Cambodian Hospital A](diagram.png)
**Sustainability Scores for Cambodian Hospitals**

- **Hospital A**
  - Technical Feasibility: 4.0
  - On-site Capacity: 2.6
  - Institutional Engagement: 1.8
  - Financial and Operational Accountability: 3.0

- **Hospital B**
  - Technical Feasibility: 3.9
  - On-site Capacity: 1.9
  - Institutional Engagement: 1.8
  - Financial and Operational Accountability: 3.0

- **Hospital C**
  - Technical Feasibility: 2.7
  - On-site Capacity: 2.5
  - Institutional Engagement: 2.0
  - Financial and Operational Accountability: 1.5

- **Hospital D**
  - Technical Feasibility: 3.0
  - On-site Capacity: 2.3
  - Institutional Engagement: 2.0
  - Financial and Operational Accountability: 1.5

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**Sustainability Cut-Point:** *Basic*

Evidence for an enabling environment for sustainability.
Sustainability Scores for a Honduran Hospital from 2012-2015

**Sustainability Cut-Point:** Basic evidence for an enabling environment for sustainability.
Sustainability Scores for a Ghanaian Hospital from 2013 to 2015

- **Accountability**
  - 2013: 4
  - 2014: 4
  - 2015: 4

- **Technical Feasibility**
  - 2013: 2
  - 2014: 3
  - 2015: 3

- **On-Site Capacity**
  - 2013: 1
  - 2014: 2
  - 2015: 2

- **Institutional Engagement**
  - 2013: 0
  - 2014: 1
  - 2015: 1
Sustainability Scores for a Ghanaian Hospital from 2013-2015

**Mampong 2013**
- Accountability: 4
- Technical Feasibility: 3
- On-Site Capacity: 2
- Institutional Engagement: 1

**Mampong 2014**
- Accountability: 4
- Technical Feasibility: 3
- On-Site Capacity: 2
- Institutional Engagement: 1

**Mampong 2015**
- Accountability: 4
- Technical Feasibility: 3
- On-Site Capacity: 2
- Institutional Engagement: 1
Examples of Problems that are Identified through Sustainability Metric

Technical Feasibility
- Insufficient and unreliable water supply
- Sub-standard and poorly maintained piped water infrastructure
- Limited access to parts for repair

Accountability
- Limited availability and funds for parts and chlorine
- Limited or no monitoring of water quality and enforcement of water quality standards

On-Site Capacity
- Lack of or infrequent routine maintenance
- High staff turn-over

Institutional Engagement
- Water quantity is a higher priority over water quality
- Need for promotion of importance of safe water for drinking, hygiene and medical purposes
Examples of how results of sustainability assessment improve sustainability at hospital level

A nurse motivates her colleagues to take action to improve their water quality after viewing water quality testing results. (Institutional Engagement and Technical Feasibility)

A maintenance officer practices chlorine residual testing in front of administrative staff to improve monitoring capacity and oversight. (Accountability and On-Site Capacity)
Improving Sustainability at the Donor Level

• The sustainability metric provides evidence for targeted and informed action for existing and future programs.

• Based on recommendations identified through use of the sustainability metric....

Manual controls replaced automated backwash so treatment can occur without electricity and repairs are easier. (Technical Feasibility)

Rotating field technician hired to build capacity and help resolve technical issues. (On-Site Capacity)

Hospital selection criteria and implementation guidelines developed for future GEF donation program; applied in Uganda and Cambodia
Strengths and Limitations

Strengths

• **Metric design**
  – Simple and systematic approach
  – Rapid data collection and automated analysis
  – Linked to sustainability theories and extensive pilot testing

• **Flexibility**
  – Can be used with any level of healthcare facility; customizable to various water treatment systems

• **Identifies target areas for improvement**

Limitations

• **Fixed weighting of subdomains/domains**
  – Assumes that all sub-domains of sustainability are equally important (weighted equally)

• **Implementation**
  – Needs further testing with other types of water treatment systems in hospitals
• The 2015 Sustainable Development Goals include a target to achieve “universal access to safe drinking water in health facilities.”

• Majority of healthcare facilities will need to gain access to and maintain a safe water source.

• Despite improved water sources and on-site treatment systems, there exist persistent challenges to sustained safe water provision.

• The Sustainability Metric provides data to improve and maintain safe water provision, a necessary step in attaining universal and sustained safe water in healthcare facilities.
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Appendix
2015 Sustainable Development Goals: Focus on WASH in HCFs and Schools

• The 2015 Sustainable Development Goals include a proposed provision to “provide universal access to safe drinking water in health facilities by 2030”
  – Improved water source on premises
  – Water available year-round
  – Water accessible to all users at all times
• Once access is obtained, significant barriers exist to ensuring sustained water quality, access, and proper use.
In 2012, most sustainability domain scores were near the cut-off for sustainability, indicating that the hospitals were vulnerable to becoming unable to sustain safe water provision.

**Sustainability Cut-Point:** Basic evidence for an enabling environment for sustainability.
Most Ghanaian hospitals did not meet the basic requirements for sustainability in all 4 domains.

- **Sustainability Cut-Point:** *Basic* evidence for an enabling environment for sustainability.
No evidence of enabling environment for sustainability

1

Sustainability Cut-Point: Basic evidence for an enabling environment for sustainability.

2

3

Evidence of a strong enabling environment for sustainability
recommendations

• Need for greater recognition and advocacy by healthcare providers for improved WASH in healthcare facilities
  – Impact of poor WASH on health service delivery
  – Impact of poor WASH on infection control
• Need to develop, monitor, and enforce standards and guidelines for WASH in healthcare facilities
• Need to assess water access, quality, and use practices within healthcare facilities
• Build an evidence base for promoting safe water in health facilities not only as a priority within the global water sector but also within the global healthcare sector.
Tool Design

• Review of Tools for Measuring Sustainability of WASH Infrastructure
  • Lack of tools to assess sustainability at institutional level
• Literature review and pilot fieldwork were used to identify the key components of sustainability that would be relevant for this evaluation.
global advocacy and action

Previous meetings to discuss knowledge gaps and set priorities
- Madrid (April 2014) – WHO, UNICEF
- The Hague (July 2014) – UNICEF, IRC, Emory, USAID
- UNC Water and Health Conference (October 2014) – Emory, UNICEF, UNC, WHO, CDC

Critical information needs:
1. Current WASH coverage and practices in healthcare facilities
2. The health impact and costs associated with poor WASH
3. Successful strategies to improve WASH in healthcare facilities
4. Cost and cost-effectiveness of improved WASH in healthcare facilities

Reliable safe water is a fundamental requirement on which other health programs must rely. Interdisciplinary collaboration across environmental health and healthcare sectors is necessary to address this crisis in a comprehensive and effective manner.
How the GE Homespring Filter Works:

- The Homespring can remove >99.999% of bacteria and viruses and improves water taste.
- Uses activated carbon and a hollow fiber ultrafiltration membrane.
- Requires backwashing each day, which can be automatic or manual.
- Uses pressure from the source water to purify water.
  - In the absence of adequate flow from a distribution system, a pump is necessary.
- Filter Fibers: 0.01-0.05 μm.
- Maximum peak flow rate of 42 L/min, a continuous flow rate of 17 L/min. Maximum daily water production of 24,480 L, (enough to serve 245 people for ideal drinking and hygiene needs (100 L/person/day) as recommended by the WHO.)
- Filters last 5 to 10 years when used with surface water, depending on the turbidity and mineral content in the water.
Differences between Pilot and New Version of Sustainability Metric

- Less subjective; scores automatically assigned based on survey responses
- Less time consuming
- Based on 4 years of pilot work and extensive literature review regarding WASH sustainability.
- Mobile data collection
- Automated analysis
The sustainability metric provides **evidence for targeted and informed action** for existing and future programs.

- **2004**
  - GEF Water Treatment Donation Program 2004-2010
  - Many treatment systems were in disrepair 2010

- **2011**
  - GEF partners with CGSW for to evaluate and improve sustainability 2011
  - Based on recommendations, technology was simplified, capacity building program initiated, improvements made to infrastructure 2012-2013

- **2012-2013**
  - Site selection criteria and implementation guidelines developed and program expanded to Cambodia and Uganda 2014

- **2014**
  - Site selection criteria and implementation guidelines developed and program expanded to Cambodia and Uganda 2014

**2015**

- Discussing water quality prior and technical feasibility prior to installation in Uganda

- Rotating field technician hired to build capacity and help resolve technical issues. *(On-Site Capacity)*

- Manual controls replaced automated backwash so treatment can occur without electricity and repairs are easier. *(Technical Feasibility)*