**Background**

- 86% of Latin America has access to improved water sources. In urban areas, the majority of these sources are piped distribution networks.
- However, water in piped networks may not be treated and quality can be rapidly degraded by pipe breakages and pressure drops.
- Water treatment at the point-of-use (POU) can assure water quality.
- In recent years, NGOs have donated water treatment devices to institutions (such as hospitals and schools); however, evaluation of the sustainability and impact of these systems in low-income settings is lacking.

**Objectives**

1. Evaluate water quality in 4 hospitals in Honduras where ultrafiltration (UF) water treatment systems have been implemented by GE Foundation. Installation range years from 2007 to 2011.
2. Evaluate the environment and knowledge, attitudes and practices (KAP) that enable or limit the sustainable operation and use of the water treatment systems in these 4 hospitals.
3. Compare KAP and water quality to 2 matched control hospitals without UF systems.

**Methods**

6 district-level government hospitals participated:
- 4 hospitals with UF systems (blue)
- 2 without UF systems (red)

Facility inspections and interviews (n=150) were conducted with staff and patients regarding safe water knowledge, attitudes, and practices.

Water samples (n=200) were collected and analyzed for E. coli, total coliforms, chlorine residual and turbidity.

A metric was developed to evaluate environments that enable or limit the sustainability of water systems using four domains of sustainability. Each domain is associated with four subdomains (below).

**Results**

**Water Quality, Infrastructure, and Usage and Sustainability Scores:**

<table>
<thead>
<tr>
<th>Hospital Location</th>
<th>Water Treatment</th>
<th>% of samples that meet microbial standards</th>
<th>% of samples that meet chlorine residual standards</th>
<th>% of functional taps</th>
<th>% of patients and staff who drink tap water</th>
<th>Sustainability Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>La Esperanza</td>
<td>UF and chlorination</td>
<td>88%</td>
<td>31%</td>
<td>83%</td>
<td>32%</td>
<td>2.3</td>
</tr>
<tr>
<td>Gracias</td>
<td>UF and chlorination</td>
<td>80%</td>
<td>43%</td>
<td>79%</td>
<td>11%</td>
<td>2.4</td>
</tr>
<tr>
<td>San Lorenzo</td>
<td>POU UF at 4 taps with centralized chlorination</td>
<td>90%</td>
<td>65%</td>
<td>100%</td>
<td>4.0%</td>
<td>2.0</td>
</tr>
<tr>
<td>Olancho</td>
<td>UF and chlorination</td>
<td>17%</td>
<td>1%</td>
<td>130%</td>
<td>19%</td>
<td>1.7</td>
</tr>
<tr>
<td>La Paz</td>
<td>Cholorination 1x per week</td>
<td>7%</td>
<td>0%</td>
<td>82%</td>
<td>13%</td>
<td>NR</td>
</tr>
<tr>
<td>Danil</td>
<td>Cholorination 1x per week</td>
<td>47%</td>
<td>60%</td>
<td>86%</td>
<td>13%</td>
<td>NR</td>
</tr>
</tbody>
</table>

Comparing proportions in hospitals with and without UF systems (z-test):

- p-value=0.005
- p-value=0.05
- p-value=0.03
- p-value=0.60
- NR

**Sustainability domain score diagrams for 4 hospitals with UF systems**

**Interview Results**

- Staff in hospitals that have UF systems were more likely to believe that hospital tap water was safe to drink in comparison to staff in hospitals that do not have UF systems (24% and 0%, respectively, \( p \)-value = 0.02).

- 62% (±20%) of staff working in hospitals with UF systems are aware that the water in their hospital is treated.

**Results, cont.**

**Sustainability Metric**

- Sustainability domain score diagrams show differing strengths and challenges related to the sustainability of the water system within each hospital.
- A score of 2.0 was defined as the cut-off for sustainability. Below this point, there is no evidence of an enabling environment for sustainability within a particular domain. The hospital with the poorest water quality (Olancho) also had sustainability score below 2.0.

**Conclusions**

- Hospitals with UF systems donated by GE Foundation have significantly cleaner water than control hospitals without UF systems.
- Based on the metric, the hospitals with UF systems are near the cutoff for sustainability (score of ≥2) and are vulnerable to becoming unable to sustain safe water provision.
- There was no difference in infrastructure upkeep or staff and patient drinking water habits between hospitals with and without UF systems.
- The hospitals with UF systems, and efforts to support these hospitals, should focus on targeting specific domains to improve the sustainability and impact of safe water provision.
- Institutional engagement could be increased by developing staff awareness about safe water provision at the hospital. Future donations should be coupled with staff education.
- Best practices from each hospital (evidenced by high domain score) can be adapted to increase the impact and sustainability of water treatment systems in other institutional sites and improve future donations.

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