

Chlorine, Commitment, and Collaboration are Making Zambian Healthcare Facilities Safer for Mothers and Newborns

Like many low-income countries, healthcare facilities in Zambia often lack safe water for hand washing or cleaning newborns, materials for disinfecting birthing and other surfaces, latrines or toilets (especially ones dedicated for female use), and standards or guidelines for water, sanitation, and hygiene (WASH) facility infrastructure and services. Zambia, with support from UNICEF and European Union funding, developed a WASH Package that emphasizes infection prevention and control (IPC) that is currently being implemented in 55 healthcare facilities. Key to the IPC effort, is the implementation of on-site chlorine production, which is expected to have the highest impact on reducing the risk of infection among mothers, newborns, and healthcare facility staff.

A two-step approach was implemented in Zambia to create clean and safe healthcare facility environments for pregnancy and delivery.

Step 1: Developing, Pilot Testing and Generating Evidence for Implementing a WASH-IPC Package

Baselines Assessments

A *Health Facility WASH-IPC Assessment* was

conducted in four vulnerable healthcare facilities, Kanyama and Chipata in Lusaka Province, and Mahatma Ghandi and Chipokota Mayaba in Ndola Province. The focus of this baseline assessment was on water quality management, hygiene and hand hygiene practices, including swabs of hand-touch surfaces within the facilities, and on the assessment of the WASH infrastructure. Findings from the *Assessment* showed that, at baseline, some

- 73% of hand-touch sites were contaminated with pathogens.¹
- 50% of the hand-touch sites were contaminated with antimicrobial resistant “super-bugs,” that is, bacteria resistant to selected antibiotic treatments commonly used in the health facilities.
- only 1% of healthcare facility workers washed their hands with soap.

Barriers to hand washing by healthcare workers included “the discomfort of standing up to reach the hand washing station, limited, inconveniently located or broken sinks, and the absence of soap.”² Lack of monitoring was also a factor in low hand washing performance.³ These findings were critical to identifying the specific elements that would make up the WASH-IPC Package.⁴

1 Namely, *Staphylococcus aureus*, *Acinetobacter baumannii*, *Klebsiella pneumonia* and *Pseudomonas aeruginosa*.

2 Chipungu J, Scott Moncrieff I, Verstraete L, Osbert N, Manchikanti W, Rudd C, Chilengi R (unpublished). An Observational Study of Hand Hygiene Behaviours amongst Healthcare Workers in four Peri-urban Health Facilities in Zambia. Lusaka: Centre for Infectious Disease Research in Zambia.

3 Chipungu J et al. (unpublished). An Observational Study of Hand Hygiene Behaviours amongst Healthcare Workers in four Peri-urban Health Facilities in Zambia. Lusaka: Centre for Infectious Disease Research in Zambia.

4 Simuyandi M, Chibwe B, Makabilo Laban N, Krunner A, Verstraete L, Phe A, Manchikanti S, Osbert N, Rudd C, Chilengi R (unpublished). Effectiveness of a comprehensive infection prevention and control WASH package at reducing the bio-burden of pathogens associated with healthcare associated infections within healthcare facilities in Zambia.

Developing the WASH-IPC Package

Based on evidence from the baseline assessments and other relevant research studies, six WASH components were identified as priorities for creating barriers to disease transmission, and a specific intervention was designed to address each component (Table 1).

A key intervention was training healthcare facility workers to produce liquid chlorine on-site using cost-effective chlorine production units (CPUs), and to routinely use the chlorine produced to clean surfaces and dose the water supplies. The CPU uses electricity to convert water and salt into chlorine. Each unit can produce up to 125 litres of concentrated active chlorine in 10 hours. The resulting sodium hypochlorite solution can be used to treat and render safe up to 500,000 liters of drinking water, and can be used directly on floors or walls as a disinfectant.

Pilot Testing the WASH-IPC Package

In 2015, the WASH-IPC Package was pilot tested in the four healthcare facilities where the baseline assessments were conducted, with support from UNICEF and in partnership with a local NGO. Over a period of nine months, water supply, sanitation and waste management improvements were completed; hand washing stations were installed and healthcare staff were trained in WASH-IPC and in the operation and maintenance of the chlorine production units.

Following the pilot test, a *Health Facility WASH-IPC Assessment* was conducted in each pilot healthcare facility to determine the effectiveness of the comprehensive WASH-IPC Package in reducing the bio-burden of pathogens associated with healthcare associated infections. Findings showed that after chlorinating water sources and flushing water systems, the minimum water quality “standard” (i.e., <1 Coliforms/100mL) was achieved in the four healthcare facilities. The

Table 1. Six Components of the WASH-IPC Package.⁵

Barriers to Disease Transmission	Interventions
1. Disinfection & cleaning	Provision of liquid chlorine production units + Training on the operation and maintenance of the units and the cleaning and disinfection SOP
2. Safe drinking water	Provision of adequate water supply, storage, and water treatment
3. Hand washing	Supply of hand washing stations and sanitizers and training on hand hygiene practice
4. Toilet sanitation	Rehabilitation/construction toilets and training on maintenance
5. Safe medical waste disposal	Provision of equipment for solid waste collection, storage, and disposal (pits and incinerators) and training on maintenance
6. Standard operating procedures (SOP) for infection prevention and control	Simplified standards and SOP guidelines, and capacity building of 50 to 100% of health facility staff in implementing standards

5 WHO/UNICEF (March 28-30, 2017). WASH in HCF Global Learning Event: Scaling up an Evidence-Based Package for WASH in Zambia to Mitigate Healthcare Associated Infections; https://www.washinhcf.org/documents/Zambia_20170329_Nepal_LearningEvent_v3.pdf.

6 Namonje, L (2017). WASH in HCF Global Learning Event. Kathmandu, Nepal: UNICEF.

proportion of key hand-touch sites that were free of bacteria increased from 27% at baseline to 50% at the end of the pilot test.⁶

A rapid assessment (using observations and informal interviews) was conducted of the chlorine production unit operations at 11 health centers in Zambia in July-August 2017.⁷ The findings showed that the chlorine produced increased the overall amount of chlorine being used in each facility. A positive unintended consequence of on-site chlorine production has been that facilities with surplus chlorine have been giving chlorine to nearby healthcare facilities that do not have a chlorine production unit. Zambia women no longer needed to bring their own chlorine for childbirth to facilities that were producing chlorine on-site, as is common practice throughout Zambia.

Step 2: Scaling up the WASH-IPC Package to 55 Healthcare Facilities

In January 2016, the WASH-IPC Package started rolling out to 51 additional healthcare facilities. By mid-2018, each facility will have a waste storage structure and incinerator, improved water supply facilities and storage, a chlorine production unit, and a chlorine dosing unit (a device designed to pump a precise flow rate of chlorine solution into the health facility's water supply system).

Building WASH-IPC Capacity Among Healthcare Facility Staff

UNICEF developed and supported training for a pool of 37 national coaches made up of government staff from each of the target provinces, in how to implement the WASH-IPC Package. The national coaches were then tasked with training healthcare facility workers. The Zambian Ministry of Health has since taken responsibility for the



Lavuun Verstraete, UNICEF Zambia, 2017

Photos (from left to right): (1) Chlorine production room in Makeni Health Center in Chilanga District where 30l of chlorine solution is produced daily for water treatment and decontamination purposes), (2) Testing of the residual chlorine in the chlorine solution produced on-site in Kamuchanga Suburbs Health Center in Mufulira District, (3) Overhead tank stand equipped with chlorine dosing unit in Kansuswa Rural Health Center in Mufulira district. The chlorine solution used for the water treatment is produced on-site.

training component. More than 1,800 healthcare facility staff from the 55 target healthcare facilities participated in a 5-day WASH-IPC training, including instruction on how to correctly use and maintain the WASH-related equipment.⁸

Operations and Maintenance of WASH-IPC Infrastructure and Services

On-site training on the operations and maintenance (O&M) of the WASH equipment installed in the 55 healthcare facilities (i.e., chlorine production units, chlorine dosing units and incinerators) is being provided by the suppliers in order to ensure the sustainability of equipment use. Eight

⁷ Voillat, J (2017). WATA Zambia – Impact Assessment Report: PPT Presentation. Geneva: Antenna Foundation.

⁸ At least 50% of staff in large healthcare facilities (mostly staff responsible for maternal and newborn care) and 100% of staff in smaller facilities were trained in WASH IPC.

Medical Equipment Technicians (METs) at the province and district levels have been trained and will serve as on-call technicians that can service and maintain the WASH equipment beyond the program implementation.

Key Challenges to Implementing the WASH-IPC Package

Implementing the WASH-IPC Package has entailed overcoming specific challenges at the government and facility levels. Following are some of the specific challenges at each level:

- Importing chlorine stocks into Zambia (a land-locked country) depends on coordinating logistics with neighboring countries (e.g., Tanzania, South Africa) and port authorities/customs, which has meant that the flow of chlorine stocks into the country can be unreliable. There is no industrial level production of chlorine in Zambia. Producing on-site chlorine within healthcare facilities is proving to be a practical way of freeing the facilities from their dependence on imported stocks of the disinfectant.
- Facility management plans and budgets tend not to include money for monitoring WASH-IPC activities to ensure accountability for implementing WASH-IPC minimum standards.

Finalizing and integrating a monthly monitoring system that links implementation of the WASH-IPC Package with performance indicators will serve to (1) track activities in a timely manner, (2) flag any necessary changes to how the Package and/or WASH-IPC practices are being implemented, and (3) provide evidence for the effects of the WASH-IPC Package (e.g., consistent on-site production and use of chlorine leads to a decrease in antibiotic resistant infections). This

evidence can be used for advocacy to increase government support for the WASH-IPC Package.

UNICEF is undertaking a cost-benefit analysis of the WASH-IPC Package, specifically assessing the “up-time” for equipment (i.e., the amount of time that CPUs, dosing pumps, and incinerators are in use) in order to provide evidence for the cost efficiencies and positive health outcomes related to maintaining the WASH equipment. This evidence will be presented to the Zambia Ministry of Health to help them make an informed decision about creating full-time MET positions within the Ministry.

Facilitating Factors for Implementing the WASH-IPC Package

Key facilitating factors have been government commitment, presence of facility level Environmental Health Technologists, inclusion of on-site chlorine production technology and collaboration between WASH and health sectors through a technical working group.

Implementing the WASH-IPC Package underscored the importance of inter-sectoral collaboration between government agencies, and with UN agency sections and all partners for removing barriers and achieving implementation objectives. A robust evaluation is planned to guide scaling up.

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