IMPROVING MATERNAL AND NEWBORN HEALTH IN ZANZIBAR:

A needs assessment of IPC and WASH across maternity units

Dr Said M. Ali[1]
Siti M. Ali[2]
Dr Ali O. Ali[2]
Sally Faulkner[3]
Giorgia Gon[4]
Prof Wendy J. Graham[4]
Haji S. Haji[1]
Dr Ibrahim Kabole[3]
Catherine Kahabuka[5]
Emma Morrison[4]
Namwaka Omari[3]
Rukaiya M. Said[1]
Amour Tato[1]
Dr Catriona Towriss[4]

Acknowledgements

We also thank you Dr Mohammed Dahoma[1], Dr Sira[1], Dr Mkasha H. Mkasha[1], Dr Zuhura M. Nassor[1], Sharifa Hamoud Rashid[1], Shaali M. Ame[2], Dr Sue Cavill[6], Yael Velleman[6], Dr Susannah Woodd[4] and Suzanne Cross[4], for their key contribution to the project.

A special thank you to the SHARE Consortium for providing the funding through which this project was possible.

[1]Public Health Laboratory Ivo de Carneri [2] Ministry of Health of Zanzibar
[3]WaterAid Tanzania, [4]The Soapbox Collaborative, [5]CSK Research Solutions, [6] WaterAid UK
For information please contact: giorgia.gon@lshtm.ac.uk

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Abstract

The needs assessment examined infection prevention control (IPC), water, sanitation and hygiene (WASH) and solid waste disposal services in maternity units in Zanzibar. The assessment incorporated both quantitative and qualitative elements. First, a questionnaire was delivered to all facilities in Zanzibar. Second, an in-depth assessment combined the walkthrough methodology, which consisted of recording observations in a checklist and collecting swab and water samples for microbiological analysis, and semi-structured interviews with healthcare facility staff and female clients. The analysis focused on describing and explaining the state of WASH, IPC and waste management with the aim of informing a phased improvement plan for quality of care within maternity units.

Key findings were identified in the following areas: hand hygiene and environmental hygiene. In addition, important results were identified in the area of cord care. The availability of infrastructure for hand washing was found to be poor, especially in smaller health facilities. Over 30% of facilities had no functional hand washing station and water availability and quality were both found to be major issues especially in maternity units without a theatre. Reported practices on some of the five key moments for hand hygiene were poor, suggesting that training (which was reportedly widespread) may not be of sufficient quality. With regards environmental hygiene, low levels of cleanliness of delivery beds, client toilets and cleaning equipment were found. This appears to be related to staff shortages and the lack of training of health orderlies. In addition, issues were identified with the maintenance of toilet, water and solid waste disposal systems. In relation to cord care, the needs assessment identified that 65% of facilities had access to the necessary equipment for clean cord care (either disposable or sterile cord clamps and blades). Of particular concern was the finding that 73% of facilities report not performing cord preparation before cord cutting. Together, results of the needs assessment suggest that both hand hygiene and environmental hygiene represent key strategic areas for the improvement of facility-based maternity services in Zanzibar.

Acronyms

CFU	Colony Forming Units
CI	Confidence Interval
DHMT	District Health Management Team
HLD	High Level Disinfection
IPC	Infection Prevention and Control
NGO	Non-Governmental Organisation
OR	Odds Ratio
PHCU(+)	Primary Health Care Unit (Plus)
WASH	Water, Sanitation and Hygiene
WHO	World Health Organisation
ZAMREC	Zanzibar Medical Research and Ethics Committee

Introduction

Background

The association between hygiene and sepsis

The link between poor hygiene and sepsis was established as early as the 18th century with the work by Semmelweiss and Gordon[1]. Faecal-oral infections driven by poor domestic and personal hygiene (for example, lack of hand-washing by the person assisting labour) can lead to sepsis[2]. Hand hygiene is currently considered the primary measure necessary for reducing healthcare associated infections[3]. Although the action of hand hygiene is simple, the lack of compliance among health workers continues to be a problem throughout the world.

Another important gateway for infection is poor environmental hygiene. While microbiological contamination will always present to a certain level, highly contaminated surfaces due to a lack of cleaning or poor cleaning practices are known to result in 'hygiene failures'. Hygiene failures increase infection risk since the microbiological contamination of hand-touch sites make it more likely for hand contamination to take place. Pathogen transmission between the surface and the client can happen directly from the surface itself or via the hands of health workers. There is robust evidence suggesting that improved surface cleaning and disinfection reduces disease incidence[4].

The link between water and sanitation and maternal mortality

A systematic review (with 14 studies identified) has been conducted to explore the link between poor water and toilet access and maternal mortality[5]. A meta-analysis of the two individual-level studies that adjusted for potential confounders suggest that households with poor toilet facilities have three times (odds ratio (OR)=3.07, 95% Confidence Interval (CI) 1.72-5.49) the odds of maternal mortality compared to those with improved toilet facilities[6]. The single adjusted individual-level study that investigated water found that women in households with unimproved water have 1.5 (95% CI 1.1-2.1) the odds of maternal mortality compared to those with improved water facilities[7].

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[1] Gould IM (2010) "Alexander Gordon, puerperal sepsis, and modern theories of infection control—Semmelweis in perspective", *Lancet Infect Dis*. Apr 10 (4), pp. 275-8.

[2] Ali TS, Fikree FF, Rahbar MH and Mahmud S. (2006), "Frequency and determinants of vaginal infection in postpartum period: a cross-sectional survey from low socioeconomic settlements, Karachi, Pakistan" *J Pak Med Assoc.* Mar, 56(3), pp. 99–103.

[3] World Health Organization (2014), "Clean Care is Safe Care" [online] Available at http://www.who.int/entity/gpsc/country_work/en/ (accessed 2 December 2014)

[4] Rutala, W. (2013), "Does Improving Surface Cleaning and Disinfection Reduce HAI?" A Webber Training Teleclass. Lecture on 25th of April 2013. Available on http://www.webbertraining.com/recordingslibraryc4.php

[5] Benova, L. Cumming, O. and Campbell OM. (2014), "Systematic review and meta-analysis: association between water and sanitation environment and maternal mortality", *Trop Med Int Health*, Apr;19(4):368-87

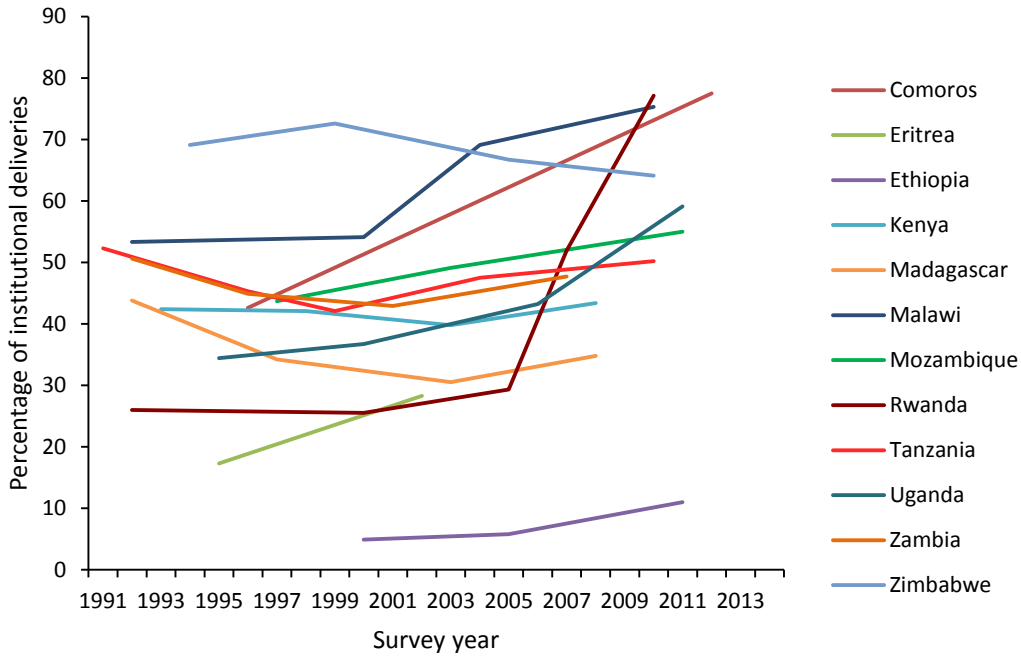
[6] Ibid

[7] Ibid

Institutional deliveries, water and sanitation and hospital associated infections

The proportion of women delivering in an institution has been increasing and is projected to increase further in the future in low and middle-income countries[8]. The picture for East Africa, and in particular Tanzania (shown in bright red in Figure 1), has been following these trends (Figure 1).

Figure 1 – Trends of institutional deliveries 1990-2011 for Eastern Africa*.



*Percentage of births in the three years preceding the survey which took place in a health facility
Source: DHS Stat compiler (accessed December 2014)

The improvement of maternal and newborn health is a key priority for the government of Zanzibar. Many efforts have been implemented in Zanzibar in order to reduce maternal and neonatal mortality. These efforts, as in many other countries, have focused on increasing the proportion of births attended by skilled health staff, and on increasing the coverage of facility-based maternity services and emergency obstetric care. Currently about 50% of deliveries in Zanzibar occur in facilities[9]. There is increased recognition that further efforts are needed to improve the quality of these services (including the quality of water, sanitation and hygiene services), as well as the further utilization of facilities by expectant mothers.

A recent publication on the water and sanitation standards within the facilities (which focused particularly on the maternity and labor wards) suggests that basic requirements for infection prevention for assisting deliveries may not be met. Only 24% of delivery rooms across Tanzania were found to have an improved water source (a source, which

[8] Victora, G.C., Barros, A.J.D. & et. al (2012), "How changes in coverage affect equity in maternal and child health interventions in 35 Countdown to 2015 countries: an analysis of national surveys", *The Lancet*, 380 (9848). pp. 1149-1156

[9] National Bureau of Statistics (2011) *Tanzania Demographic Health Survey 2010* (ICF Macro Calverton, Maryland) Available at: http://dhsprogram.com/pubs/pdf/FR243/FR243%5B24June2011%5D.pdf

by nature of its construction or through active intervention, is likely to be protected from outside contamination, in particular from contamination with fecal matter[10]) at the facility, a water source within 500m of facility, running water within the delivery room, soap for hand washing and a functional latrine for clients[11].

Hospital-associated infections are particularly high in several low and middle-income countries. A systematic review on the topic suggests that the prevalence of health-care-associated infection (pooled prevalence in high-quality studies, 15.5 per 100 patients [95% CI 12·6–18·9]) and was much higher than proportions reported from Europe and the USA. However, lack of good data does not allow to quantify the burden of hospital-associated infection with regards to sepsis[12]. Beyond the facility setting however, evidence suggests that at the population level the burden of sepsis contributes to 10-15% of maternal deaths and 16% of newborn deaths; these estimates are likely to be underestimates[13].

The basic and most fundamental principle of healthcare provision is "do not harm" and it is widely agreed that "prevention is better than cure". With these principles in mind, reducing the burden of hospital-associated infections and enabling providers to guarantee a client-safe environment in the maternity unit has become a priority for the Ministry of Health of Zanzibar. In the fall of 2013, the Ministry commissioned a needs assessment to examine the standards of infection prevention control (IPC), water, sanitation and hygiene (WASH) and solid waste management across Zanzibar's maternity units. Zanzibar Medical Research and Ethics Committee (ZAMREC) approved the needs assessment in April 2014 (See Appendix 14). Four key partners collaborated with the Ministry of Health to accomplish the project implementation: WaterAid, the Pemba Health Laboratory – Ivo de Carneri Foundation, the Soapbox Collaborative, and the funding agency SHARE.

Needs Assessment objectives

The overall objective was to support the Ministry of Health's wider plans to improve Quality of Care in maternity units through an assessment of WASH services in health facilities. The specific objectives were:

- To assess the coverage of functional WASH facilities in maternity units across Zanzibar
- To assess the range of stakeholders perception of cleanness and infection prevention control system failures
- To inform the design of a phased improvement plan in support of improving the quality of care in maternity units specifically with regards to WASH in Zanzibar.

[10] WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (2008) Available at: http://www.wssinfo.org/definitions-methods/ (Accessed 12th December 2014)

[11] Benova, L., Cumming, O., Gordon, B.A., Magoma, M. & Campbell, O.M.R. (2014), "Where There Is No Toilet: Water and Sanitation Environments of Domestic and Facility Births in Tanzania", *PLoS ONE,* 9 (9), e106738.

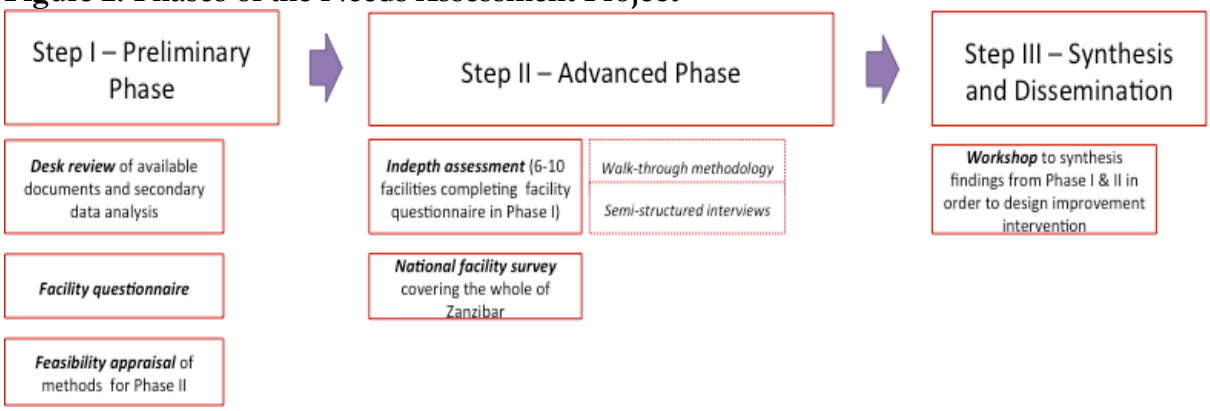
[12] Allegranzi, B. et al. (2011), "Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis", *The Lancet*, 377 (9761), pp. 228–241

[13] Kassebaum, N. J. *et al.* (2014), "Global, regional, and national levels and causes of maternal mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013". *The Lancet* , 384 (9947), 980–1004

Methods for data collection and analysis

The needs assessment took place in three phases, as illustrated in Figure 2 below. The first was the preliminary stage, comprised of a desk review of relevant documentation and secondary data analysis, a pilot of the tools and a feasibility appraisal of the methods to be used in the second phase. Following phase one, phase two comprised the national facility questionnaire and the in-depth assessment; the latter included a workshop with key stakeholders to make sure tools were appropriate to the context. The in-depth assessment is formed by two types of data collection: the walk through checklist and semi-structured interviews. These methods will be described in greater detail below. The third stage of the project was the synthesis and dissemination of the findings. This comprised of the interpretation workshop, where the major findings from the first two phases were presented and an improvement intervention planned.

Figure 2: Phases of the Needs Assessment Project



National Facility Questionnaire

The purpose of the national facility questionnaire was to assess the coverage of WASH and IPC determinants and solid waste management systems across maternity units in Zanzibar. The following are the themes investigated:

- Respondent Information (R section)
- Facility Information (G section)
- Delivery and Maternity Area Information (D section)
- Water and Sanitation Supply (W section)
- Policies and Procedures (Q section)
- Training on Infection Prevention and Control (T section)
- Infection Prevention and Control (I section)
- Waste Management (M section)
- Patient Practice on the Delivery Unit (P section)
- Newborn care and Postpartum Care (N section)
- Care provided to Mothers or Newborns with Infections (C section)
- Challenges (B section)

A copy of the national facility questionnaire is given in appendix 1. In May and June 2014, all 37 facilities with maternity units across Zanzibar were surveyed. This figure includes 4 facilities which were not equipped to be assisting deliveries due to falling below the standard for basic delivery care and 1 facility which was undergoing

reconstruction of their maternity unit. Table 1 shows a breakdown of the facilities surveyed by the type of facility. The most common category of facility surveyed was the PHCU+ (Primary Health Care Unit Plus).

Table 1: Types of facilities surveyed

PHCU	PHCU+	Cottage Hospital	District Hospital	Maternity	Referral Hospital	Other	Total
7	18	4	3	2	1	2	37

The questionnaire primarily focused on collecting information from the in-charge of the maternity unit. A small number of observations were also conducted, although there were not included in the results due to data-quality issues. Table 2 below shows a breakdown of the cadre of staff who responded to the survey.

Table 2: Characteristics of the Facility Questionnaire Respondents

Cadre of staff	Number	Percent
Senior Nurse	6	16.22
Nurse Midwife	13	35.14
PHNB	14	37.84
MCHA	3	8.11
Other	1	2.70
Total	37	100

The analyses of the national facility questionnaire focused on the description of WASH facilities and IPC determinants. Descriptive statistics were carried out on the responses to all questions, if data quality permitted. In the following stage, indices and composite variables were constructed. These are outlined in detail in appendix 2. In this report, proportions are reported for the entire census when there is not much variation between the different facilities. When there is variability between facilities, proportions are reported by facility type.

Walkthrough

The Walkthrough is an overarching method that involves recording various aspects of WASH, IPC and solid waste management at specific locations while passing (walking) through the maternity unit. Data was collected using three specific tools: first, through observation and recording in the walkthrough checklist. The walkthrough checklist is shown in full in appendix 4. Second, through the collection of microbiological swab and water samples from pre-determined sites in the maternity unit. Third, through taking photographs to capture pre-determined sites in the unit. Together, the three components of walkthrough tool collected information about the following three areas:

i) Level of equipment provision for WASH, IPC and solid waste management
ii) The state of repair of equipment for WASH, IPC and solid waste management
iii) The visual and microbiological cleanliness of equipment for WASH, IPC and solid waste management

Since the walkthrough method is an in-depth research tool and, as a result, is both time and resource intensive a small subset of facilities was selected. A total of 7 facilities were

purposively sampled for the walkthrough. These 7 facilities were chosen by the Ministry of Health to capture the variety of size and quality of maternity units in Zanzibar, as well as to capture the variation in the volume of deliveries assisted.

Checklist analysis

The analysis of both the checklist and microbiological data focused on descriptive statistics describing the equipment and cleanliness at the different sites of the maternity unit. These sites were: toilets, hand washing stations, beds, birthing equipment, delivery unit waste disposal and cleaning equipment and waste disposal pits and incinerators. As with the national facility questionnaire, the analysis of the walkthrough checklist involved the construction of indices and composite variables. These are outlined in detail in appendix 5.

Swab analysis

A microbiology swab collection guide, water sample collection guide and photo guide can be seen in appendix 6, 7 and 8 respectively. The analysis of the microbiology swab data focused on two indicators of microbiological cleanliness. First, whether or not the swab site had *Staphylococcus aureus* (*S. aureus*) present. Opportunistic pathogens such as *S. aureus* are frequently shed by patients and staff in health care environments and can persist on surfaces for days posing a significant transmission risk to new patients admitted to the facility[14]. The *Staphylococcus* genus contains over 30 species. At the time of swab collection and analysis antibiotic resistance testing was not available in the laboratory. *Staphylococcus* isolates were therefore presented as either coagulase-positive or coagulase-negative. *S. aureus* is coagulase positive and is regarded as the most medically significant species of the genus; as such it is one of the most common pathogens linked to healthcare associated infections[15]. We therefore focused on *S. aureus* data as an indicator of cleanliness. The second indicator examined was whether or not multiple pathogenic organisms were identified on the swab site. Further to *S. aureus*, each opportunistic pathogen poses a clinical risk, some to a greater extent than others. If two or more such pathogens are found on a hand-touch site it indicates a lack of effective cleaning or long durations between cleans.

Water sample analysis

The water analysis focused on the total bacterial count in the water samples, as well as looking at the presence of enterococcus and fecal coliform. These bacteria all live naturally in the intestines, but their presence in water samples shows contamination by fecal matter. Fecal coliform, which includes coliform such as E-Coli, was measured because any presence of these bacteria is dangerous for deliveries as they are a major cause of urinal tract infections and sepsis. It should therefore be zero in all samples for the water to be safe. If enterecoccus is present in the water sample it suggests the water has been contaminated for some time, as it is one of the few bacteria that can survive in water for some time.

The samples were all filtered and places on Slanetz Barley agar before being incubated for 48 hours. The characteristic colonies were then counted, with pink, red and brownish

[14] Dancer, S. (2014) "*Staphylococcus aureus* antibiotic resistance." In Clinical Insights: Staphylococcus Aureus Antibiotic Resistance. Future Medicine, pp 2-4.

[15] Wenzel, R. P. (2007) "Health care-associated infections: major issues in the early years of the 21st century", *Clinical Infectious Disease,* 15(45) Supplement 1: S85-88.

colonies suspected to be enterococci. The membranes with suspected coloniees were then transfered onto a Bile Esculina azide agar plate and incubated for a further 2 hours. A black halo below the membrane confirmed the presence of enterococcus. For the fecal coliform we followed the same process but the medium used is chromogenic coliform agar.

Sanitary Inspection

A sanitary inspection was carried out in the 7 facilities that were selected for the in-depth assessment (i.e. those facilities which also received the Walkthrough). Enumerators were asked to observe which water sources were used in each facility, and then answer a number of questions relating to each of the sources. These were "yes" or "no" questions designed to assess the risk of water contamination. The full list of questions can be seen in appendix 11, which has a copy of the sanitary inspection form.

The analysis of this information involved summing the total number of positive answers to the questions about contamination to give a total score which was then used to assess the likelihood of the water being contaminated. Water samples were taken where possible to see if the assessed risk correlated with the actual contamination.

The Qualitative Assessment

In-depth interviews were conducted with facility staff, including facility in-charges, midwives, orderlies and the person responsible for the maintaining facility WASH conditions. One staff under each category above was invited for the interview based on their availability during the time the research team visited the facility. Pre-piloted interview guides were used to guide the discussions and additional relevant issues that arose during the discussions were added to the guides and followed up in subsequent interviews. Questions focused on policies, guidelines and protocols for IPC, WASH and solid waste management; training on IPC, WASH and solid waste management; and barriers to maintaining good practice in these areas and the actions needed to overcome them. The complete set of qualitative data collection tools is found in appendix 12. Pictures of clean and unclean environments in maternity wards were used to prompt the discussions among care providers and orderlies.

Semi-structured interviews were conducted with a purposely selected sample of women attending the vaccination centres at the visited facilities. Interviews were conducted with women who delivered within the past 8 weeks at given facilities or at home. The women's interviews sought to capture their perception of a good versus bad delivery environment as well as their experiences during their most recent child birth, particularly in relation to IPC on the delivery unit. These questions are shown in full in appendix 12. As with the interviews with facility staff, pictures of clean and dirty environments in maternity units were used to prompt the discussions.

All the interviews were conducted on site in a quiet environment and lasted between 39min and 1 hour and 45min. Interviews were all conducted in Swahili (the national language) and were all digitally recorded. The analysis of the qualitative materials commenced with word-for-word transcriptions of the audio files in their original language. These Swahili transcripts were later translated into English. The transcribed data was then analyzed manually using qualitative *content analysis* method. The analysis focused on extracting the manifest content (the visible and obvious information) and the latent content (the

underlying and hidden meaning of the text) from the interviews. The data was then organised thematically.

Stakeholder interviews

The aim of the stakeholder interviews was to map out the roles and responsibilities of the health system and the water authority around IPC, WASH and solid waste management at the facility level. Interviews were conducted with engineers, the district medical officer, the water authority (ZAWA), the zonal officer and DHMT in April and May 2014. Each interview focused on responsibilities for macro-level frameworks and guidelines, equipment, training, day-to-day operations, financing and monitoring. Respondents were asked about support is available to health providers to construct, operate, maintain and replace water, sanitation, hygiene and solid waste management services. Finally, they were asked to give information about who provides such services: the Government, private sector, Non-governmental organisations (NGOs) or a combination.

Results

Two key cross-cutting issues – hand hygiene and environmental cleaning – were identified as potential strategic priorities for change. These are pivotal areas in the transmission pathways between healthcare provision and nosocomial infections. In addition to these two main findings, an additional third section on cord care is presented, as this also has key relevance for IPC.

1: Hand Hygiene

Knowledge of key moments for hand washing

In line with the recommendations of the World Health Organisation (WHO), the facility questionnaires asked whether staff wash their hands during the *five moments of hand hygiene* i.e. before and after patient contact, after body fluid exposure, before a clean or aseptic procedures, and after touching patient surroundings. In addition, the facilities questionnaire asked whether staff wash their hands before and after wearing gloves and after using the toilet. The results should be interpreted as a marker of knowledge rather than practice. This reflects the way the questions are formulated (yes/no questions), and consultations with the enumerators that conducted the interviews.

The results suggest that there is good knowledge around the following key moments: after patient contact, after body fluid exposure, after wearing gloves and after using the toilet. Indeed, all facilities surveyed responded that their staff wash their hands on these occasions.[16] The qualitative interviews support these conclusions by showing that the majority of health care providers interviewed knew the appropriate techniques to wash hands (i.e. washing between fingers, around thumbs and the washing of nails and fingers) as the following quote confirms.

> *"First you put water then soap and rub it like this* [showing how to rub fingers and hands with the appropriate technique]…*we have napkins to wipe hands, you close tap then wipe your hands, you close the tap by using the elbow."* (CARE PROVIDER)

However, the results from the facility questionnaire also suggest that knowledge was poorer for the following key moments: washing hands before touching patients and before wearing gloves (10% of facilities reported they do not), after touching patients surrounding (only 70% of facilities reported that they do). The knowledge gaps were more pronounced for PHCU and PCHU+. The discrepancy in knowledge around the key moments for hand washing seems to fall within the following categories: good knowledge around moments involving *after* patient contact, but poorer knowledge around moments involving *before* patient contact.

The facility questionnaire also asked how frequently staff change their gloves between different patients. As with the results for hand washing, this should be better interpreted as a marker of knowledge than practice. Only 75% of facilities reported changing gloves between patients *always* or *most of the time*; 8% of facilities reported that this is *never* done and 13% of the facilities reported that this is done sometimes. The majority of facilities

[16] The quality of the data for washing hands before a clean or aseptic procedure were deemed too poor to be interpreted.

(91%) reported wearing disposable gloves for vaginal examination at every delivery. The high level of knowledge about the importance of wearing disposable gloves for vaginal examination is also supported by the qualitative results:

> *"And before we do anything we also ask them* [the clients] *to go to the toilets to clean themselves first then we cover them with screen, then we examine her while wearing gloves."* (HEALTH CARE PROVIDER)

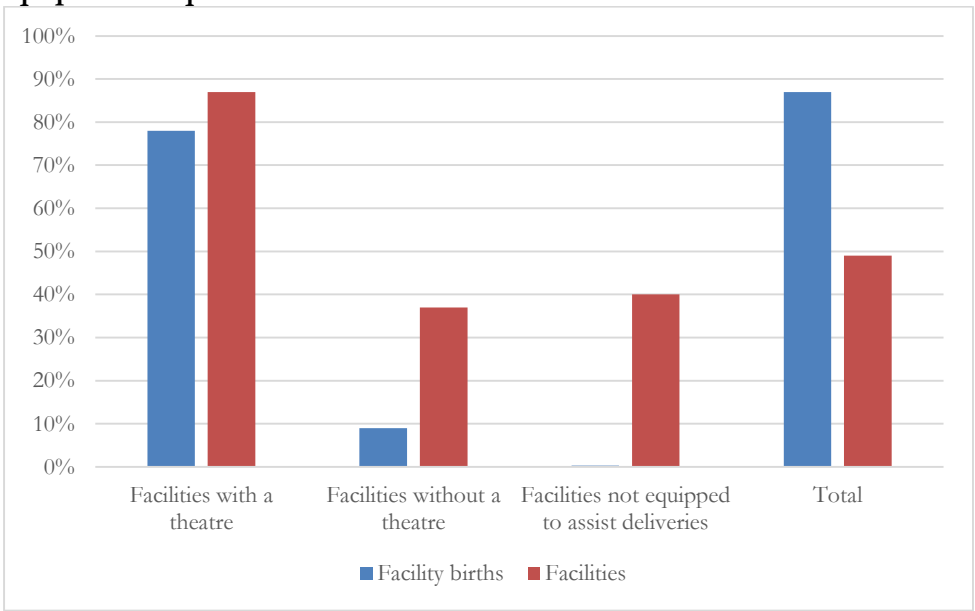
Infrastructure for hand hygiene

An index of basic hand-washing equipment was constructed, which included having the following in the maternity:

- Soap,
- Improved water source,
- Piped water does not interrupt more than once a week,
- 24h water availability,
- At least one functional hand-washing sink,
- Disposable gloves.

We found that about 50% of facilities met these requirements. Among those with an operating theatre, only one did not meet the requirements. Because most of the facility births occur in facilities with a theatre, 87% of facility births were attended in a facility that met these basic requirements.

Figure 3: Proportion of facility births and facilities where basic hand washing equipment requirements were met



Water availability in the maternity

Good infrastructure for water supplies were found across all facilities. The data revealed that all facilities had an improved source of water. Table 3 shows the Joint Monitoring Programme's classification for improved water sources.

Table 3 - Improved water – Joint Monitoring Program classification

Unimproved	Improved
Surface water	Tap into the facility
Spring	Public taps
Dug well (unprotected)	Protected well
Water brought by tankers, trucks or containers	Rainwater
Other	Borehole

However, a key challenge faced by the majority of the facilities surveyed was consistent availability of running water in the maternity unit. This was a major challenge in particular for PCHUs and PCHU+ (classified as facilities without a theatre). Among those, 46% of facilities reported that the water system does not usually work and has insufficient water for hand washing. 24-hour availability of water on the maternity unit was available for only 60% of facilities without a theatre. In addition, interruption of piped water occurred more than once a week for 20% of facilities without a theatre. When the water supply was interrupted, 24% of facilities reported not having an alternative plan; whereas half of the facilities reported having some form of water stored in the facility. Out of the 22 hand washing stations surveyed in the walkthrough checklist 15 had water available.

In addition to the supply of water, the quality of the water was also found to be a major issue. Information on water quality was collected through the sanitary inspection form and through the analysis of microbiological data collected from water samples. All seven facilities received their main water supply from a borehole, but in addition, one facility had piped water, while a further two used rainwater harvesting. Four of the facilities also had onsite water storage tanks. The results show that of the six samples from boreholes, three had bacteria counts of over 100 colony forming units (CFU)/ml, and one of those was over 300 CFU/ml. Although total bacterial counts can be higher if they contain no coliforms (which must be zero) this is still very high. However, only one borehole sample had any trace of fecal coliform (1 CFU/ml).

It was only possible to collect one sample from the rainwater harvesting tanks, and it was from the one which was considered to be of lowest risk. Despite this, the sample still had a total bacterial count of over 300 CFU/ml. The water samples taken from the facility water storage containers also had high levels of contamination. The types of containers used in the facilities varied, and included concrete and iron tanks in two facilities, one concrete tank and one plastic tank in another facility, and just a bucket and plastic bowl in the last facility. We were only able to take samples from two of the containers (due to the others being too difficult to take a sample from), which were taken from a plastic bucket and a larger plastic container. Although three of the four containers were ranked as low risk according to our assessment, the water samples of the two containers that were taken showed that the total bacterial count was over 300 CFU/ml, and one sample had the highest presence of enterococcus of any of the samples that were taken (100 CFU/ml). No other facility had any samples with enterococcus higher than 40 CFU/ml. This sample was taken from a large plastic container that supplies water to elsewhere in the facility. It is therefore not surprising that 6 of the other 7 samples that were taken at the facility also had this same high level of contamination. The other water sample was

taken from a container which was used for deliveries when tap water goes off, and on top of the high bacteria count had and a fecal coliform count of 3 CFU/ml.

Furthermore, monitoring of water quality at the facility level appears poor. From the facility questionnaire, 75% of facilities reported that treatment and testing was not carried out at the facility. In a quarter of the cases, the interviewee did not know this information.

The sink in this room was not functional; the staff used the standing water bucket to wash their hands.

The challenges around constant water availability also came out of the qualitative findings; interviewees reported this to be a major challenge and the consequence of poorly maintained or broken infrastructure. At two of the facilities where qualitative interviews were carried out, facility staff reported having to carry water in buckets from the water storage tanks outside due to blockages in pipes. This was reported to be a major challenge, especially at night.

"We get water at the facility, however not all the time. We keep water outside in a tank and use buckets to take them inside." (WASH MANTAINANCE PERSONNEL)

"It's over three months now the water pump is broken and we are carrying water by buckets. It very much affects IPC." (IN CHARGE)

The problem of water availability was not as prominent for facilities with a theatre. All of those facilities reported that water is usually working and available 24 hours a day; they all also reported having sufficient water for hand washing.

Drinking water

Very few facilities reported having a special arrangement for safe drinking water, both for the staff and clients. The facility questionnaire results suggest that only around 37% of facilities without a theatre reported sufficient drinking water for the staff. The percentage is higher at 87% for facilities with a theatre. The walkthrough checklist showed that 3 out of 7 facilities had drinking water available for staff and clients. From the qualitative interviews it emerged that clients commonly obtained drinking water from taps located anywhere within or outside the maternity unit, most times from similar taps also used for hand washing. Most commonly, facility staff reported buying bottle water from shops.

Water samples were taken from the places in facilities from where clients and staff drink, some of which were designated drinking water stations and some which were not. Regardless, all of these samples indicated that the water was not safe to drink with extremely high levels of bacteria present. Only two of the seven facilities surveyed in the walkthrough had specially filtered drinking water available for both clients and staff. The bacterial count in these cases was comparatively low (between 26-45 CFU/ml and with no trace of fecal coliform). In cases where no water was provided, clients tended to drink straight from the tap, and in these cases the bacterial count was far higher.

In one facility the staff boiled water for drinking obtained straight from the tap and kept it in the fridge. However, this water was not shared with clients, who used unboiled water from the same tap for drinking. The total bacterial count for the unboiled water was >300 CFU/ml, whereas for the boiled water it was slightly lower at 180 CFU/ml. However, the fecal coliform for the boiled water was very high – 165 CFU/ml. This may be due to some error in the data, as it is far higher than the other samples. In another facility, both staff and clients obtained drinking water straight from the tap; albeit at different sinks. Contamination in both sets of samples were high, with both having total bacterial counts of over 200 CFU/ml and fecal coliform counts of 4 CFU/ml. The source of the problem here appears to be the large underground water storage tank.

For six of the nine drinking water samples that were taken, there was no fecal coliform present. However, two samples, notably from the same facility, had a fecal coliform level of 4 CFU/ml. In one sample taken from another facility, the level was 165 CFU/ml. This was the drinking water for staff, which was taken from a tap, boiled and kept in the fridge. Interestingly, a sample was taken directly from the tap and there was no trace of fecal coliform, and no other water samples from the facility had any trace. It is therefore likely that the container the water was being kept in was contaminated. The tables below show the frequency of different levels of bacteria and fecal coliform contamination in drinking water and water for hand-washing.

Table 4: Frequency of different CFU levels of bacteria, enterococcus and fecal coliform in drinking water

	0	1-10	11-100	101-300	300+	TOTAL
B.Count	0	0	4	4	1	9
E	4	2	3	0	0	9
F.C	6	2	0	1	0	9
TOTAL	10	4	7	5	1	27

Table 5: Frequency of different CFU levels of bacteria, enterococcus and fecal coliform in hand-washing water

	0	1-10	11-100	101-300	300+	TOTAL
B.Count	0	0	13	17	4	34
E	11	10	13	0	0	34
F.C	26	8	0	0	0	34
TOTAL	37	18	26	17	4	102

In total, 19% of drinking water samples and 21% of hand washing samples had a total bacterial count of over 100 CUF/ml. None of the samples had a bacterial count any lower than 11 CUF/ml, and the WHO guidelines are 0 CUF/ml, at least with regard to drinking water.

Sinks in the maternity

The poor availability of functional sinks was highlighted across the tools. 30% of facilities without a theatre reported no functional hand washing stations in the maternity area. The walkthough checklist revealed that in one facility there was no hand washing station in either the ante/postnatal ward or delivery room. Indeed, the checklist found that 2/7 facilities did not have a hand washing station located outside the toilet within the maternity unit.

The drainage system of this sink is broken. This sink was not used.

In 22% of facilities, between a quarter and a half of their hand washing stations were non-functional. From the qualitative results, it was commonly reported that hand washing sinks were completely broken and/or non-functioning.

"We follow the process for washing hands, but here at our facility it's impossible because we don't have proper taps. If you have been to Mnazi mmoja [the main referral hospital on the island] *you will understand, the ones that you can open and close with an elbow, but here we have to use our hands to close the tap. In short, we don't have equipment as required by a procedure.*" (HEALTH CARE PROVIDER)

The practice of sharing sinks for different purposes was a common issue found in both the qualitative findings and the facility questionnaire. The facility questionnaire showed that in 60% of facilities the same sink may be used by different staff cadres – either clients and staff, or staff and orderlies (for cleaning purposes), or orderlies (for cleaning purposes) and patients.

Soap and alcohol hand rub

Only two facilities (out of 37) reported not having soap within the maternity unit. Out of the 22 hand washing stations surveyed in the walkthrough checklist, 14 had soap available. This slight inconsistency in the results of the two methods is likely to be due to the fact that the facility questionnaire did not ask about quantity of soap bars available at each sink, but rather about whether any soap was available within the maternity unit.

65% of facilities had alcohol hand rub, this is the case in only 37% of facilities with a theatre.

The sink is clean, soap is available and a poster on the appropriate technique of hand washing is available

Gloves

35/37 facilities reported having disposable gloves. Availability of disposable gloves is supported by the results from the observation checklist. 6/7 facilities had sterile gloves, which were safely stored away from contamination but close to the point of care. Where none were available (1), clients were instructed to buy their own. A similar picture is portrayed by the qualitative results. All women who delivered in hospitals reported their birth care providers having worn gloves

Pack of surgical gloves appropriately stored.

Staffing and management

Overall, there is a poor availability of staff dedicated to IPC coordination and of IPC committees. 62% of facilities with a theatre and 29% of facilities without a theatre have a dedicated person in charge of IPC. 62% of facilities with a theatre and 16% of facilities without a theatre have an IPC committee. However, the qualitative results suggest that, in spite of the lack of organised IPC management, the different staff cadres (including orderlies) felt that they play a role in IPC.

Training

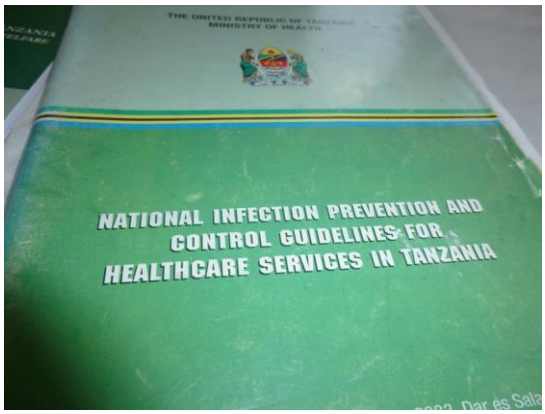
100% of facilities with a theatre, and 66% of facilities without a theatre received training on hand hygiene, and infection prevention for healthcare workers in the past year. This proportion is as low as 40% among facilities that are not equipped to assist deliveries. In spite of facilities reporting training did happen, facilities also reported that training was the most widely reported key IPC barrier across all facility types. This information

was captured from the facility questionnaire and it is not clear if this refer to the training format or quality or frequency.

The availability of training is confirmed by the results from the qualitative interviews. Almost all care providers interviewed could correctly explain the processes/procedures for implementing commonly available guidelines and protocols on IPC, including hand hygiene.

Policies, procedures and monitoring

The availability of policies, posters and protocols on IPC and hand washing is varied. Policies or posters about IPC and hand washing available in the facility in respectively 51% and 45% of facilities. This proportion is 75% for facilities with a theatre. The vast majority of the facilities where observation took place had IPC policies or posters available.



Policies guidelines available in English on Infection Prevention and Control

All guidelines relating to IPC are made at the national government level, specifically by the Environmental Unit. During the stakeholder analysis we learnt that previously these guidelines focused on HIV, but now include general IPC guidelines as well as a focus on respiratory IPC. Although the guidelines are set at the national level, the district is responsible for monitoring all guidelines and other major activities.

Summary

Knowledge around the key moments of hand hygiene and glove-use represent areas for improvement. Additional assessments involving observation may be required to assess this further. Training, which was reported as a major barrier to IPC, represents an opportunity to tackle these gaps in knowledge. With regards to infrastructure, the poor availability of water and its quality are major issues for facilities without an operating theatre. The issue of water is aggravated by the poor availability of functional sinks.

2: Environmental Hygiene

We categorized findings for the environmental hygiene into two main categories; 1) Environmental hygiene *outcomes* i.e. the condition of toilets and hand washing stations, conditions of beds, and conditions of cleaning equipment, and 2) environmental hygiene *determinants* i.e. availability of cleaning equipment, availability of good infrastructures, human resources, training, availability of policies/guidelines and waste disposal.

Outcomes

Physical Condition of toilets and hand washing stations

Findings from the assessment revealed issues around toilets and hand washing stations to be the most important challenge regarding WASH in maternity units across Zanzibar, both for the facilities with and without a theatre. Despite all facilities reporting having at least one improved type of a toilet, major challenges were reported regarding the small numbers of toilets, poor maintenance of infrastructure and poor cleanliness (in particular client's toilets). The facility questionnaire showed an insufficient number of toilets in 75% of facilities with a theatre and 59 % of those without a theatre. Moreover, 30% of facilities had no functioning hand-washing facilities inside the maternity units. 60% of the facilities had separate toilets for men and women and only 40% reported having separate toilets for clients and staff (these proportions were higher for facilities with a theatre, at 75% and 85% respectively).

Issues around poor maintenance and hence poor functioning of toilets and hand washing sinks were a common finding across all the facilities where observation took place. Findings from the walkthrough checklist (n=7) revealed that, out of the total 17 toilets observed only 2 had a functioning flush system. This was the case despite none of the toilets being pit latrines. In one facility, there was no hand washing station available in any of the client toilets, nor in the maternity ward. At this facility, it was reported that clients used water from a bottle and washed their hands outside the ward. At another facility there was only one functioning toilet, which was located in the labour room. However, this toilet was however only functional for urination as it was disconnected from the sewerage system due to the on-going construction. At this facility, staff and clients were reported to use the outside pit latrines to defecate. The non-functioning toilet had necessitated the stopping of delivery services at this facility except in emergencies.

The vast majority of toilets across the 7 facilities were free from unnecessary or unused equipment. However, the level of overall cleanliness across the 17 toilets surveyed was poor: only 4 toilets had a visibly clean floor, visibly clean door handles, visibly clean toilet seat and were free from bad odor. It was noticeable the toilet facilities for staff often had higher levels of visible cleanliness than those for clients. The levels of visible cleanliness were also poor at toilet hand washing facilities: with only 5 out of a total of 13 sites having a visibly clean general area and visibly clean taps (visible cleanliness was better in hand washing sites that were not attached to toilets: 6 out of a total of 9 sites were visibly clean).

Functioning clients' toilet at one of the visited facilities.

Blocked non-functioning toilet at one of the visited facilities by some women clothes/footwear.

Results from the microbiology data revealed that 67% of the 7 facilities surveyed had a toilet door handle that tested positive for the presence of multiple organisms. The microbiology data further showed that 2 out of 6 taps in the maternity ward had *S. aureus* present, while 3 out of 6 facilities had taps which tested positive for multiple organisms.

Findings from qualitative interviews with care providers and orderlies revealed major challenges regarding poor women's knowledge on proper use of flush toilets. Women were reported inserting khangas and pads (used to deal with post-partum bleeding) into toilets, causing them to block. It was reported by facility staff that some women were leaving fecal matter in open areas, it was also reported that clients spat and left urine containers on hand washing sinks.

"The challenges are that most women don't know how to use flush toilets, so sometimes they throw pads or clothes and toilets get blocked. We do explain to them on how to use the toilets but everyone and her brain some are just stubborn." (HEALTH CARE PROVIDER)

"Sometimes you may find used clothes and pads on the floor, on windows, on the sinks and in toilets. They do block the sinks and toilets and we find the fundi [technician], *who unblocks them. We try to tell them that they shouldn't put pads in toilets but when they leave new ones come and do the same thing."* (ORDERLY)

On the other hand, interviewed women complained about the small number of toilets in maternity units as a big challenge to them, particularly when more than one woman wanted to use the toilet at the same time.

"You may find that there is no water and there is only one toilet. It may happen that two or three women deliver at the same time and all need to use the toilet, then you all use it together. This way we may get infections from each other." (WOMAN)

The availability of anal cleansing material in both the patients' and staff toilets was generally good with 16 out of the total 17 facilities observed during the walkthrough checklist having anal cleansing materials available on the day the assessment team visited the facility. The most commonly available anal cleansing material was water in a bucket that contained a bowl.

Condition of beds

The facility questionnaire found that all but two facilities surveyed had at least one functional delivery bed available. The results from the walkthrough checklist (n=7) found the condition of the beds (both in the maternity and delivery room) to be fairly good, with most beds covered in cleanable materials and/or mackintosh. The most common challenge found was the insufficient number of beds, particularly in facilities with a theatre, where most women deliver. Issues of overcrowding were commonly reported in facilities with a theatre, with 62% of the facilities with a theatre reporting women having to share a maternity bed at least once a day.

At one of the facilities, the delivery beds were observed to be very high. Care providers complained about this during the qualitative interviews because it made deliveries more difficult. At another facility, one delivery bed had no mattress and the team observed women sleeping on top of the hard steel covered only with a light plastic mackintosh.

Very high delivery beds at one of the visited maternity units.

A delivery bed with no spongy cover at one of the visited maternity units.

Microbiology findings revealed that in 6 out of 7 of facilities, the delivery beds were highly contaminated with multiple organisms, especially around the perineal area. Moreover, *S. aureus* was identified on 3 out of 5 bedside lockers examined.

Condition of cleaning equipment

The assessment found a fairly good availability of cleaning equipment at most of the facilities. A cleaning equipment score (out of a total of thirteen) was generated, with facilities scoring one point for every item available out of a pre-specified list of essential cleaning equipment (e.g. mops and buckets, bleach, disinfectant etc.) that was available. All facilities scored between 6 to 9 points. 4 out of 7 facilities observed had at least one visibly clean mop and bucket set in the maternity unit on the day of assessment. Moreover, 5 out of 7 facilities were found to have one or more visibly clean cloths for wiping surfaces and a visibly clean storage area that was clutter free. It was a common finding however that most mops were stored inside buckets filled with moping fluid most of the time during the day.

However, where observation took place, the microbiological condition of most cleaning equipment was generally poor. Results from the swab analysis showed that 60% of mop

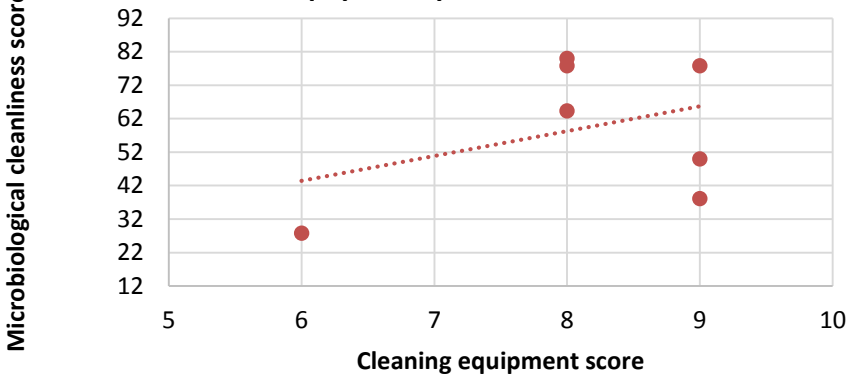
and mop bucket swab sites tested positive for multiple microbiological organisms, while levels of *S. aureus* contamination was comparatively low. Multiple organisms were further identified on 6 out of 8 surface cleaning cloths. The high levels of pathogens present on the cleaning equipment potentially explains the high levels of microbiological contamination found on the beds and bedside surfaces.

Environmental hygiene determinants

Cleaning equipment

Figure 4 below shows the relationship between microbiological cleanliness (a binary variable measured by the presence of multiple microbiological organisms) and cleaning equipment provision (using the additive score described above) in the seven walkthrough facilities.

Figure 4: Microbiological cleanliness by cleaning equipment provision



The graph suggests that there is an association between microbiological cleanliness and the provision of cleaning equipment in the 7 facilities. Facilities with more cleaning equipment scored better in terms of levels of swab sample contamination.

Water and sanitation infrastructure maintenance

During the stakeholder analysis it was noted that it is the district administration that are responsible for monitoring whether water supply systems are functional, and are expected to inform the zonal administration who release the necessary funds for necessary maintenance. However, they need to be alerted to problems by the facility staff. Follow-up visits are also conducted by the district administration for supervision, during which the condition of facilities is checked (including toilets, waste disposal, general cleanliness etc), and the staff are observed to see if any additional training is needed. All support for health providers to construct, operate, maintain and replace water and sanitation services are provided by the government.

In case of broken infrastructures, the majority of facilities (78%) reported to resort to the District Health Management Team (DHMT). Results from qualitative interviews, however, revealed significant delays in getting a response from the DHMT for some of the facilities after reporting broken WASH infrastructures. This necessitated some facilities to develop alternative mechanisms for maintaining WASH, including introducing user-fees or having the community contribute to maintenance of various broken infrastructures. In cases where the community was responsible for WASH

maintenance, it was reported that the system worked more efficiently compared to waiting for responses from the DHMT.

"No action has been taken until now, they are very irresponsible. We are everyday complaining and I think they have information a while ago. But they don't take any action. I guess it's because they are not the one doing these jobs. Action should be taken against them." (HEALTH CARE PROVIDER)

"When water infrastructure breaks, we do it ourselves because when you report it takes a long time. We get fundis [technicians] *from the community, they volunteer, but we buy the equipment using money from the community health committee."* (WASH MANTAINANCE PERSONNEL)

"the money from the community health committee is obtained when patients come to the facility. They all pay 200, but if they don't have they still get services for free." (IN-CHARGE)

"*When the water infrastructure breaks we report to our sheha* [village leader] *who immediately brings the maintenance personnel. One day does not pass without having them fixed. We thank God that we have no challenge there.*" (WASH MANTAINANCE PERSONNEL)

Findings from qualitative interviews, however, further revealed the situation to have improved at some of the facilities, where staff reported getting responses from the DHMT much earlier currently compared to previous years.

"DHMT is responsible to take action. Nowadays when we report it doesn't take long, it used to take too long to get a response in the past." (HEALTH CARE PROVIDER)

Waste disposal

Findings from the facility questionnaire found that the majority of the facilities (92%) keep infectious and non-infectious waste separately. 59% of facilities used plastic bags to dispose of infectious waste. The most common means of infectious waste disposal were contracting out off-site (18%) or incineration within the facility premise (40%).The most common means of non-infectious waste disposal were either burning in open pits (37%) or incineration within the facility premises (51%).

Results from the walkthrough checklist found all the 7 facilities to have a designated waste disposal area, although in 2 facilities these were not fenced off. In one facility it was found that waste was thrown onto the ground away from the disposal pits.

On the other hand, 3 out of 7 facilities were found not to have an infectious waste pit while one facility had an uncovered infectious waste pit. 2 of the 7 facilities reported needing to transfer waste to another site for disposal; one facility transferred placentas, while another transferred safety boxes. Qualitative interviews revealed placentas and other infectious wastes at one of the facilities to be transported by the hospital ambulance, which was a major concern.

Human resources and training

Results from the facility questionnaire (n=37) revealed that all facilities had someone in charge of cleaning the maternity unit, including the beds and mattresses, and to sterilize equipment etc. In addition, all facilities with a theatre had at least one person involved in water and sanitation maintenance within the facility premises. On the other hand, among

facilities without a theatre, only 13% had someone in charge of water maintenance, and only 20% reported having at least one person involved in sanitation maintenance within the facility premises.

Across all the seven facilities where qualitative interviews were conducted, staff complained about shortages of orderlies. In line with the qualitative findings, results from the facility questionnaire (n=37) revealed that, only 54% of facilities had an orderly present in the maternity unit the morning before and night shift prior to the survey. However, all facilities with a theatre had at least one orderly in the previous morning shift. At some facilities, facility managers complained about having only one orderly, who was a female. Concerns were raised not only in relation to the fact that it was challenging when this person was sick and there was no one to clean, but also the fact that because she was a woman it limited her from doing some of the more physically strenuous tasks e.g. cutting tree trunks etc. This further highlights the fact that orderlies' tasks are not limited to cleaning duties but they are expected to perform other duties in addition.

In line with above findings, the facility questionnaire (n=37) reported 30% of facilities without a theatre to clean the delivery room less than once a day, while 35% reported cleaning the maternity toilets less than once a day.

Some facilities reported having no one responsible for cleaning the environment outside the facility, which required them to find other coping mechanisms. At one facility visited, there was an arrangement for all the staff to clean the grounds outside the facility together once a week; this took the staff away from their care provision tasks. At another facility, there was an agreement with community members to clean the facility grounds once a month under the guidance of community leaders.

The shortage of orderlies was further aggravated by the fact that most orderlies reported in qualitative interviews that they performed healthcare-related tasks such as delivering women, attending women coming for antenatal care, wound dressing and prescribing medications. This is particularly concerning given the orderlies' lack of formal medical training. Performing these tasks significantly reduced their time spent on cleaning activities. The research team observed orderlies conducting deliveries at some facilities, with or without assistance of care provider.

> *"Other tasks that I do apart from cleaning are delivering women, dressing wounds, giving injections, caring for the newborn, and distributing food. We just work from experience without any training."* (ORDERLY)

At one facility orderlies reported being allocated clinical shifts in maternity wards on their own i.e. without presence of skilled birth attendant. This finding was in line with findings from the facility questionnaire, which revealed that, in 12% of facilities without a theatre visited there was no skilled birth attendant during the morning and night shift prior to the survey completion.

"*We are allocated shifts on our own with no any nurse present. I deliver women, I give injections, I prescribe medicines, we also examine pregnant women. I have not received any training.*" (ORDERLY)

The majority of orderlies who reported performing clinical tasks reported not having received official training in relation to the clinical tasks performed. Most reported

receiving some kind of instruction from skilled healthcare providers, who advised them on how to perform various tasks. On the other hand, care providers appreciated the help received from the orderlies and most recommended that they also receive IPC training so that they can perform those duties better.

"YES, cleaners [orderlies] *should be taken as part of the health work force. They should be taught some medical skills as they do assist us with some activities. Some don't know how to protect themselves but if trained they will know how to protect themselves from getting infections when doing such clinical work."* (CARE PROVIDER)

"We help each other, we do help them to dispose of waste if there are too many filled buckets. They also help us in care provision when necessary, for example to deliver women. You know all is needed is just the skills, and we are very few so they do help us." (CARE PROVIDER)

At one facility however, the facility in-charge reported being concerned by these practices, and strongly felt this was responsible for the observed poor performance of orderlies and hence poor status of cleanliness in maternity units.

"Staffs do not know their responsibilities. We have health orderlies. Their performance is not satisfactory. Sometimes they are given jobs which are not theirs and they forget their primary role." (IN-CHARGE)

It was also a common finding from the qualitative interviews across all the facilities visited (n=7) that the majority of the staff hired and posted to facilities for cleaning and hygiene maintenance had received no training in relation to their job description. This was reported by care-providers as being a huge challenge. Not only that the newly hired staff did not have enough knowledge about how to clean the various areas within the facility but also there were major concerns regarding cross-contamination and poor maintenance of the facility environment.

Not surprisingly, results from the swab samples taken from various hand-touch sites e.g. beds, lockers etc. and from cleaning equipment in the maternity units revealed significant levels of microorganisms (above results). Qualitative interviews further revealed poor monitoring systems, with supervisors rarely checking on orderlies' work.

Availability of policies and guidelines

Overall, results from the facility questionnaire (n=37) revealed that only 20% of facilities currently providing maternity services in Zanzibar had policy documents available (policies, guidelines and/or posters) on sewage disposal. 37% of facilities had policies or posters about cleaning surfaces and 32% has policies or posters on the decontamination of areas contaminated with body fluids. This proportion was higher, about half, for facilities with a theatre. The facility questionnaire showed that the 5 facilities that were not equipped to assist deliveries performed particularly weakly with regards to availability of policy documents compared to those that were equipped to perform deliveries.

In contrast with the above findings, most respondents from the qualitative interviews from the 7 facilities visited, including orderlies, mentioned policies/protocols related to WASH and solid waste disposal as being readily available policies. Moreover, most respondents could correctly explain the processes/procedures for implementing the

commonly available WASH and solid waste disposal guidelines and protocols, particularly in relation to proper waste management.

Summary

We found a general low level of cleanliness for delivery beds and toilets, in particularly patients' toilets. The qualitative interviews and the facility questionnaires reveal very lows levels of training for orderlies on water and sanitation maintenance. A shortage of staff for water and toilet maintenance as well as a shortage of orderlies was evidenced from both the facility questionnaire and the qualitative interviews. Shortage of orderlies was further aggravated by the fact most of them as well reported performing clinical tasks.

Most facilities relied on the District Health Management Team for water and toilet maintenance; however, there were consistent complaints about the timing of DHMT response after facilities reported broken infrastructures. It is also important to note that there is no individual national guideline for sanitation, and that it is just covered by the national IPC guidelines.

3: Cord care

In addition to the key findings relating to hand hygiene and environmental hygiene, the needs assessment also identified important issues surrounding postnatal care, in particular around cord care. Clean birth and particularly postnatal care practices have been shown to be effective in reducing neonatal mortality from sepsis and tetanus[17].

The facility questionnaire found that over half of facilities (65%) in Zanzibar have access to the necessary equipment for clean cord care: i.e. disposable or sterile cord clamps and disposable or sterile blades. Provision of sterile blades was higher than the provision of sterile cord clamps: 90% of facilities had available and sterile blades, while 68% of facilities had available and sterile cord clamps. 30% of facilities reported having no cord clamps. The findings from the facility questionnaire were largely consistent with the findings from the walkthrough data. The walkthrough data found a higher provision of clean cord cut equipment: all facilities had access to either reusable or disposable cord cutting and cord clamping equipment, which was decontaminated (if reusable) and stored safely. Similarly, with the facility questionnaire, access to cord clamps is low. Facilities appear to overcome this by creating their own from materials which are available to them. 5 out of 7 facilities reported creating self-made cord clamps from the rim of sterile gloves and strings.

Self-made cord clamp from rim of sterile glove

Self-made cord ties in disinfectant

As well as collecting information about the equipment for cord cutting, the facility questionnaire also asked about care providers' behaviour around cord cutting. It was found that 55% of facilities report using sterile or disposable cord clamps most of the time or always, and using disposable blades most of the times or always. Of concern was the finding that 73% of facilities report not performing cord preparation before cord cutting. Whereas, 24% were found to clean the cord before cutting using a method that was *not* tap water, distilled water, Benzalkonium chloride, Cetrimide, Sterile water, Chlorhexidine gluconate solution without alcohol, Betadine, Chlorhexidine gluconate solution containing alcohol or alcohol.

As mentioned above, virtually all facilities report using routinely both disposable cord clamps and blades compared to re-usable ones. However, the findings suggest the

[17] Blencowe, H. et al (2011) "Clean birth and postnatal care practices to reduce neonatal deaths from sepsis and tetanus: a systematic review and Delphi estimation of mortality effect" 11 (3): S11

constant availability of cord clamps is an issue. Re-usable cord clamps may be an alternative, however, in the light of the findings on sterilization equipment, this may not be a viable option.

With exception of two facilities, all re-usable equipment is sterilized within the facility. All facilities have at least one form of sterilisation or disinfection device. Dry heat sterilisers and autoclaves are the most common means of sterilisation available. However, in 13% of facilities that have sterilization devices available, none of them are functional. In 10% of facilities that have sterilization devices available, half are non-functional. This suggests that there are gaps in equipment maintenance. In addition, 20% of facilities rely only on High Level Chemical Disinfection (HLD); none of these are facilities with a theatre. HLD is a suboptimal option to sterilization; indeed, HLD results in all forms of microbial life being destroyed except bacterial spores.

Conclusions

Infrastructure, supplies and equipment

The needs assessment identified poor infrastructure maintenance for waste disposal as a priority area, in particular with regards to disposal of infectious waste. The assessment identified a number of challenges related to toilets and sinks. Over 60% of facilities revealed not having a sufficient number of toilets in the maternity. In addition, there are major infrastructural challenges to effective hand hygiene. The results from both the walkthrough checklist and the facility questionnaire suggested that the provision and accessibility of hand washing stations in many facilities is poor.

Related to this is the availability of running water. The facility questionnaire revealed that in 20% of PHCU/PHCU+ water supply is interrupted at least once a week. When running water interrupts, the most common alternative is stored water. Of the water samples from a variety of sources, water from water storage containers was the most unsanitary. The quality and availability of drinking water, particularly for clients, was also poor.

The walkthrough checklist revealed a positive association between the provision of cleaning equipment and microbiological cleanliness throughout facilities. Those facilities with access to more cleaning equipment scored better than those with access to less equipment.

Human resources

The qualitative data revealed that health orderlies were found to be performing clinical duties. This is likely to be related to low staffing levels. Indeed, in 12% of PHCU/PHCU+, there was no skilled birth attendants during the morning and night shift prior to the survey. Staffing shortages and the high caseloads were frequently mentioned as a reason for poor IPC, however, this needs further investigation before conclusions are made. Similarly, both the facility questionnaires and the qualitative interviews revealed very lows levels of training for health orderlies. In 12% of PHCU/PHCU+, there were no skilled birth attendants working during the morning and night shift prior to the survey. Staffing shortages and high caseloads were frequently mentioned as a reason for poor IPC, however this issue needs further investigation before conclusions are drawn.

Policies, practices and monitoring

Staff training on infection prevention in the past year was reported widely across the facilities. There is however, a mismatch between the training levels and the reported practices. Poor knowledge around the key moments of hand hygiene, poor practices around waste disposal, cord care, and the consistent hygiene failures reported from the microbiological data revealed potential areas for improvement via training.

Technical recommendations

Two key cross-cutting issues – hand hygiene and environmental cleaning – were identified as potential strategic priorities for change. These are pivotal areas in the transmission pathways between healthcare provision and nosocomial infections.

Appendices

1. Facility questionnaire
2. Facility questionnaire indices
3. Facility questionnaire results
4. Walk through checklist
5. Walk through indices
6. Walkthrough microbiology swab collection guide
7. Walkthrough microbiology water collection guide
8. Walkthrough photography guide
9. Walkthrough checklist results
10. Walkthrough microbiology results
11. Sanitary Inspection Form
12. 12a-12e Qualitative tools – English versions
13. Research protocol
14. Letter of ethical approval

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