




WATER, SANITATION AND HYGIENE SITUATION IN HEALTH CARE FACILITIES IN TANZANIA MAINLAND AND WAY FORWARD

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EXECUTIVE SUMMARY

Background and rationale

Improved Water, Sanitation and Hygiene (WASH) in healthcare facilities (HCFs) is important as it ensures quality and safe care needed by humans and minimizes the risk of infection to patients and their caretakers, healthcare workers and the communities around. Infectious disease risks facing HCFs are costly economically as they pose a great financial burden to the government, health sector, health care system and individual and their families. Absence of safe water and acceptable conditions of sanitation and hygiene in the majority of HCF settings in the developing countries continue to be blamed for its contribution to perpetuating infections that increase morbidities, hospitalization and mortalities among both the adults and young children.

Aim of the study

UNICEF is supporting the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC)'s wider plans targeting to improve the quality of care in HCFs through the assessment of the availability, quality and coverage of water supply, sanitation infrastructure, and hand-washing facilities as well as the hygienic practices in HCFs and thereafter generating evidence-based policy options for actions geared towards improving maternal, newborn and child health (MCH) conditions by effectively preventing and controlling WASH infections. On this background, UNICEF supported the National Institute for Medical Research (NIMR) to conduct a study to asses WASH status in healthcare facilities (HCF) in 7 districts.

Methodology

The study adopted a cross-sectional survey design and was implemented in seven districts marked as UNICEF Program Districts. These districts are located in different regions in the mainland part of Tanzania and they include Temeke Municipal Council, Makete DC, Njombe DC, Iringa DC, Mufindi DC, Mbeya DC and Mbarali DC. It was aimed at gathering a combination of qualitative and quantitative information to allow a realistic translation of the data that would lead to more realistic inference drawing and policy option suggestions. Furthermore, biological samples from touch surfaces and air-capture were also collected in HCF.

Key findings

Source of water and piped connectivity in healthcare facilities

Although the government of the United Republic of Tanzania aimed to provide access to more than 75% of its people with access to safe water by 2015, only 58 out of 96 of surveyed health facilities (60.4%) are not connected with piped water supply. It was revealed from the survey that, only few hospitals (16.7%) are not connected with piped water supply. However, it was alarming that, more than 50% of health centres and dispensaries lacked connectivity with piped water supply.

Water availability and access in healthcare facilities

Of the health facilities visited, 44 out of 96 (46%) reported inadequacies in water supply. Thirty two of the visited health facilities (34%) they reported irregular supply and that, they experienced water shortages for at least one day in a week whereas 12 healthcare facilities (12.5%) obtain water only seasonally.

Availability of handwashing stations with soap/alcohol based hand rubs within the facility

44% of consultation rooms and 42% of delivery rooms in the surveyed HCF didn't have functional hand washing facilities and some had been replaced by plastic water containers without drainage. Soap for hand washing was present in 51% of consultation rooms and 79% of delivery rooms. As for antiseptic hand rub only 9% and 12% of the health facilities surveyed had antiseptic hand rubs present at hand washing points in consultation room and delivery rooms respectively.

Running water availability in bathing facilities in HCFs

All hospitals (district hospitals and regular hospitals) had running water systems in their bathing facilities. However, only 43 % of health centers and 50% of dispensaries had running water supplies in bathing areas. This means we had as much as half of the dispensaries and still a significant number of health centers where patients and workers would have no running water but depending solely on buckets or some other containers for their supplies.

Availability and status of toilets in healthcare facilities

All of the 96 visited health care facilities had toilets but with differing designs and qualities; these are Traditional Pit Latrines 10%, Improved Pit Latrine 19%, Ventilated Improved Pit (VIP) Latrines 11%, Pourflush Latrines 23% and Flush toilets (water closet) 37%. The large majority of the toilet facilities visited (91.07%) were functional at the time of visit. Two thirds of the facilites (66.07%) were accessible to clients. Facilities with latrines that were not accessible to clients included 43.24% of dispensaries, 13.33% health centers, and in one hospital.

Repair and maintenance of WASH infrastructures in healthcare facilities

There observed differing designs of the plumbing systems in HCFs which presents a challenge to the operation of water supply system and maintenance. Equipment utilizing plumbing connections includes handwashing stations in service areas, water supply in the operating theatre and dental units, laboratory water systems, laboratory sinks, bathrooms and toilets. Typical plumbing concerns for the visited health facilities include the general lack of maintenance and repairing of toilets, toilet sinks and pans, hand washing sink and shower; maintaining piping systems throughout the facility for water, keeping drain systems and waste-water lines open and operating properly.

Auxiliary workers awareness and training on infection prevention and control

It was found that only 26% of auxiliary workers in the studied districts had received training and orientation on Infection Prevention and Control (IPC). There were smaller proportions of auxiliary workers in dispensaries and health centers that had received training on IPC 24% and 23%, respectively as compared with district hospitals and designated district hospitals 35% and 100%.

Hygiene education and awareness in Health Care Facilities

Only 33.5% of the respondents were informed of the essential hygiene behaviors upon arrival at the health care facility. Further results show that government owned healthcare facilities provide more hygiene education to clients than private and faith-based HCFs, all combined.

Microbial quality of water in health care facilities

The findings revealed that, water samples from health facilities in all district councils surveyed were contaminated with *E. coli* and other microbes. Total coliform (TC) in water samples were found to range from 0.15 - 110 MPN/mL in Temeke DC, 0.23 - 4.6 MPN/mL in Mbarali, 0.036 - 2.4 MPN/mL in Mufindi & Njombe and 0.15 -2.4 MPN/mL in Iringa & Makete. The MPN values show that, Temeke DC water samples are most contaminated followed by Mbeya and Mbarali.

Microbial quality of air in health care facilities

The findings on air exposure method established that, hospitals had high microbial count (CFU/m^3) in postnatal wards but Health centers and Dispensaries had high Microbial count (CFU/m^3) in Labour rooms. In this study, Temeke and Mbarali DCs were found to have the highest Microbial count. Meanwhile, the Iringa DC showed the lowest Microbial count**.** These results point out that the air in almost all Health facilities was generally contaminated and a clear presence of various microorganisms was observed.

Microbial contamination in hand washes from staff, patients and visitors in health care facilities

A higher degree of microbial count (CFU/mL) of HFs Staff and Clients hands was observed. 94.4% of the hand washes from staff and clients had microbes.

Healthcare waste management in healthcare facilities

Healthcare waste management practices were assessed among the HCWs in the surveyed HCFs. The study identified issues that impede a proper infectious waste management. Gaps and deficiencies were observed related to segregation, collection, storage and disposal of healthcare wastes, hence proving to be hazardous to the patients as well as the visitors.

Health care facilities WASH policy and guidelines

Our findings show limited understanding on policy and guidelines on WASH at healthcare facilities at the regional and district levels.

Recommendations

Conditions of water supply, sanitation services and hygienic practices in the studied health care facilities are alarmingly inadequate. These observations reflect on a much broader picture of the situation of WASH in healthcare facilities around the country. The WASH conditions observed and the implication to hygiene and health safety in the healthcare environment calls for urgent action by the government, development partners and health facilities managers. We recommend the following key actions to be undertaken in response to the needs revealed by the current study.

1) The government of the United Republic of Tanzania involving MoHCDGEC, MoWI and PoRALG should develop National policies, guidelines, standards and tools to improve WASH in HCFs. The policies, guidelines and tools are critical for:
    i) assessment to identify gaps
    ii) implementation
    iii) monitoring and evaluation
2) The government of the United Republic of Tanzania the reform of the WASH in health care facilities, generate strategic sub-sector investment plans and build a stronger evidence base to support the sector's planning process.
3) MoHCDGEC in collaboration with MoWI and PoRALG should provide essential environmental health standards for WASH in HCFs.
4) The MoHCDGEC should foster the integration of WASH into the existing National Infection Prevention and Control Standards for Hospitals in Tanzania (2012).
5) The MoHCDGEC should foster stronger integration of WASH in Health Care Facilities to accelerate progress on maternal and newborn health accompanied by improved monitoring of WASH in health care facilities providing MNH services as part of routine national-level monitoring through standard WASH instruments.
6) National efforts to reduce maternal and newborn mortality and morbidity should adequately reflect on WASH improvement as a pre-requisite for ensuring the quality, effectiveness, and use of health care services.
7) Further implementation research is needed to identify effective interventions to improve WASH at home and in health care facilities, and to impact on MNH in different health system contexts.

ACRONYMS

GIZ	Gesellschaft für Internationale Zusammenarbeit
GLAAS	Global Analysis and Assessment of Sanitation and Drinking-Water
HCF	Health Care Facilities
HCW	Health Care Workers
IPC	Infection Prevention and Control
MDGs	Millennium Development Goals
MOHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
NIMR	National Institute for Medical Research
SIMAVI	Steun Inzake Medische Aangelegenheden Voor Inheemschen
UNICEF	United Nations Children's Fund
WASH	Water, Sanitation and Hygiene
WATSAN	Water and Sanitation Network
WHO	World Health Organization

DEFINITION OF WASH PARAMETERS IN HEALTH CARE FACILITIES

Availability of improved drinking water supplies in Healthcare Facilities

The '**improved drinking water sources in HCFs'** includes sources that, by nature of their construction or through active intervention, are protected from outside contamination, particularly from fecal matter. It comprises a plumbing system to a yard or interior space of a healthcare facility. Other improved drinking water sources include public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs and rainwater collection.

Current water service scale for general purpose with referee to health care facility water requirements and access implication

Water availability in Health Care Facilities					
Presence of a water source or water supply in or near the facility for use for drinking, personal hygiene, medical activities, cleaning, laundry and cooking. Does not consider safety, continuity or quantity.					
Water access level per patient	**Distance from source**	**Collection time**	**Needs met**		**Level of health concern**
No access (quantity collected often below 5L per capita per day	More than 100m	30 minutes or more	i. ii.	Consumption – is not assured Hygiene – not possible at HCF	Very high
Basic access (average quantity unlikely to exceed 20L per capita per day	Between 10m and 100m	5 to 30 minutes	i. ii.	Consumption – can be assured Hygiene – handwashing and basic food hygiene possible; laundry/bathing difficult to assure	High
Intermediate access (average quantity about 50L per capita per day	Water delivered through one tap on plot (within 10m) or inside facility	About 5 minutes	i. ii.	Consumption –assured Hygiene – all basic personal and food hygiene assured, laundry and bathing also assured	Low
Optimal access (average quantity 100L per capita per day	Water supplied continuously through a plumbing system with multiple taps in all areas	Less than one minutes (water flows on turning on the tap)	i. ii.	Consumption – all needs met Hygiene – all needs met	Very low

Modified from WHO (2003) and WHO/UNICEF (2015)

Access to improved sanitation facilities in healthcare facilities

Improved sanitation facilities is defined as one that hygienically separates human excreta from human contact (UNICEF/WHO - http://www.wssinfo.org/definitions-methods/). The MoHCDGEC in Tanzania described the details of an improved sanitation facilities as those having basic requirements including durable and tightly constructed pit, washable floor, and sound superstructure with roof and lockable door (MoHSW, 2012). Presence of adequate sanitation

services in healthcare facilities is essential to ensure convenient staff and clients work and stay as well as meeting the hospital hygienic standards.

Sanitation service levels with referee to health care facility sanitation requirement and access implication

Sanitation in Health Care Facilities				
Presence of functional and accessible latrines or toilets within the facility and also presence of latrines or toilets that are friendly to groups with special needs (e.g. for small children, elderly and the disabled).				
Latrine/toilet access level per patient	**Number of toilets/latrines in OPD per 40 patients per day**	**Type of latrine**	**Sanitation needs met**	**Level of health concern**
No access (no latrine/toilet		-	None	Very high
Limited access (locked latrine facility – one needs a key to access it)		Any type	No	High
Intermediate access	2	Improved (Direct/offset to pit) without water seal	Moderate	Low
Optimal access (Readily accessible to patients, HCW and visitors)	4	Improved (pour flush/WC) – water based	Yes	Very low

Modified from WHO (2003) and WHO/UNICEF (2015)

Hygiene practices and facilities

The Millennium Development Goals did not take into account hygienic practices among indicators, however the importance of hygienic practices and the enabling environment to facilitate them is at the center of the WASH initiative. The good news is that the post 2015 development goals have now incorporated this essential element of health (*http://www.wssinfo.org/fileadmin/user_upload/resources/JMP-WASH-Post-2015-Brochure.pdf*). The proposed post 2015 JMP framework broadly defines hygiene broadly as the conditions and practices that help maintain health and prevent spread of disease including handwashing, menstrual hygiene management and food hygiene.

Hygiene service level broadly defined at health care facility level Hygiene facilities and practices				
Availability of handwashing stations with soap or alcohol based hand rubs within the facility.				
Handwashing facility access level	**Availability of soap**	**Availability of alcohol based hand rubs**	**Needs met**	**Level of health concern**
No access	Absent	Absent	None	Very high
Limited access	Bar soap	Irregular supply	Moderate to lower	High
Basic access	Powder/reconstituted liquid soap/detergent	Available in critical sections	Satisfactory	Low
Optimal access	Liquid soap in dispenser	Regularly available in all	Good	Very low

handwashing stations

*Modified from WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation (http://www.wssinfo.org/). **Note:** The new core indicator; 'percentage of population with handwashing facilities with soap and water at home' is being proposed for post 2015 JMP evaluation which refers to the presence of a device to contain, transport or regulate the flow of water to facilitate handwashing. Broadly at community level.*

The definitions referred above represent the description of Water Sanitation and Hygiene services at community levels, particularly focusing at a household as a unit of measurements. This has largely been the focus of global development programs under the MDG era. Part of the reason being there has not been much international attention on WASH in HCFs during the time period. The authors of this report recognize the need to focus the definition to HCFs but the subject is out of the scope of the current report.

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Contents

1.0 INTRODUCTION

1.1 GLOBAL SITUATION OF WATER, SANITATION AND HYGIENE (WASH) IN COMMUNITIES

In much of the world, community water systems do not exist. Approximately 780 million people do not have access to an improved drinking water source (WHO/UNICEF, 2012). The World Health Organization and UNICEF recently estimated 2.4 to 2.6 billion individual's lack access to any type of improved sanitation facility (WHO/UNICEF, 2015).

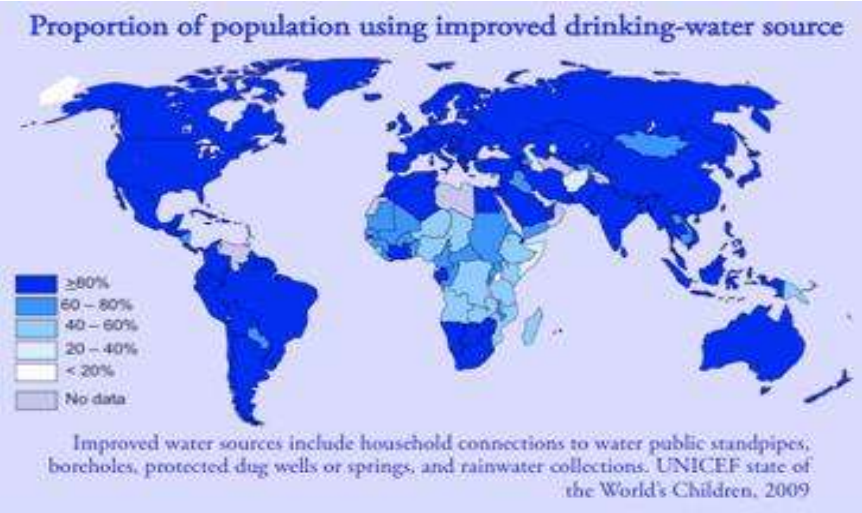

Figure 1**:** Proportion of the population using improved drinking water source. Source: UNICEF 2009

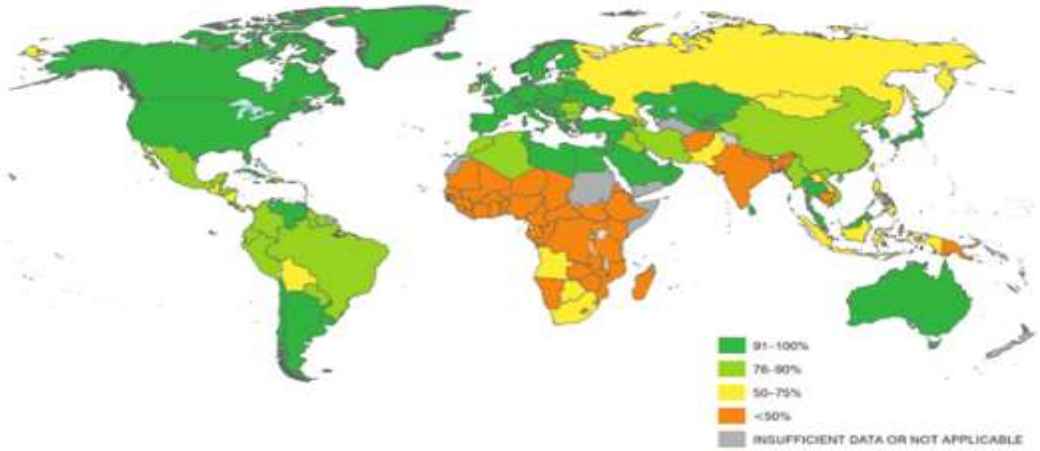

Figure 2: Proportion of the population using improved sanitation facilities in 2015. Source: WHO/UNICEF 2015

Water covers 70% of our planet, however, freshwater, the stuff we drink, bathe in, irrigate our farm fields with, and is incredibly rare. Only 3% of the world's water is fresh water, and two-thirds of that is tucked away in frozen glaciers or otherwise unavailable for human use. Investment in water

supply is prerequisite to have the global population equitably have access to the available water resources. Currently, some 1.1 billion people worldwide lack access to water, and a total of 2.7 billion find water scarce for at least one month of the year. Inadequate sanitation is also a problem for 2.4 billion people; they are exposed to diseases, such as cholera and typhoid fever, and other water-borne illnesses. Two million people, mostly children, die each year from diarrheal diseases alone. Many of the water systems that keep ecosystems thriving and feed a growing human population are being stressed. The available water resource from rivers, lakes and aquifers are either dwindling or becoming too polluted to use. More than half the world's wetlands have disappeared.

Climate change is altering patterns of weather and water around the world, causing shortages and droughts in some areas and floods in others. The world's demand for water is postulated to surge in the next few decades. Rapidly growing populations will drive increased consumption by people, farms and companies. More people will move to cities, further straining supplies. An emerging middle class could clamor for more water-intensive food production and electricity generation. Using an ensemble of climate models and socioeconomic scenarios, water stress has been estimated to be a serious problem in 2020, 2030, and 2040. Two-thirds of the world's population may face serious water shortages.

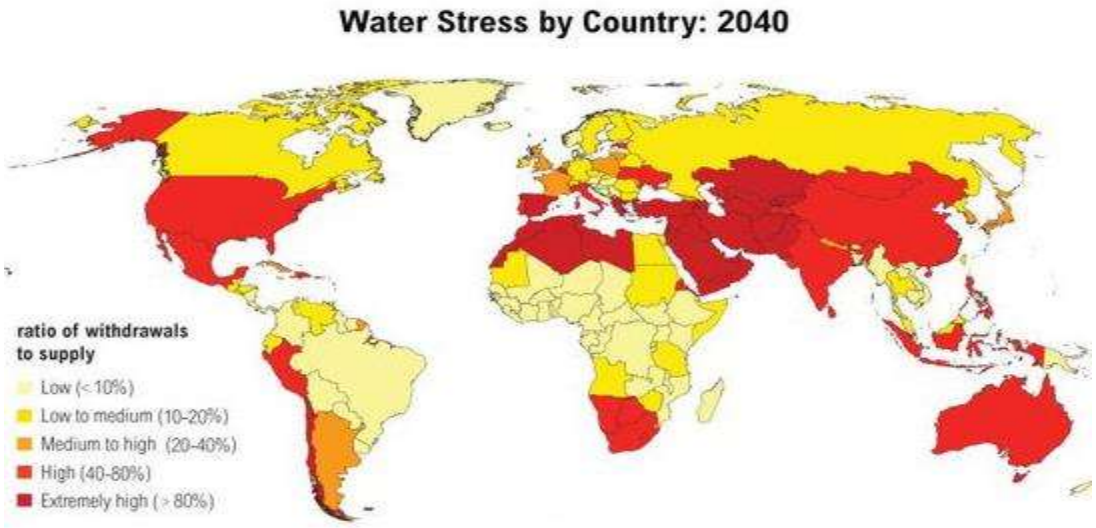

Figure 3: Water stress by country in 2040

1.2 GLOBAL SITUATION OF WASH IN HEALTH CARE FACILITIES

Availability and quality water supply, improved sanitation and hygiene in health care facilities are fundamental for the provision of quality, people-centered care. Water, sanitation and hygiene (WASH) services are well acknowledged to reduce health care associated infections, increase trust and uptake of service, increase efficiency and decrease cost of service delivery and improve staff morale (Jarvis, 1994; Boyce and Pittet, 2002; Curtis and Cairncross, 2003; WHO, 2009; WHO/UNICEF, 2015). Health experts have for a long time advocated that, improvement in global

health depend on basic WASH services in health care facilities (Jarvis, 1994; Curtis and Cairncross, 2003). WASH services in health care facilities include point of use improved water source accessible to all users at all times, adequate, functioning and accessible toilet facilities, separated by gender, for staff, patients and visitors, functioning handwashing stations near all toilets and points of care and safe health care waste management including segregation, collection, transport, treatment and disposal (Boyce and Pittet, 2002; WHO/UNICEF, 2015).

Recently, the first global assessment on the status of provision of WASH services in health care facilities (HCFs) in 54 countries has revealed that, majority of countries are facing the problem of low access to WASH, inadequate WASH services and the current levels of WASH services are far less than the recommended coverage (WHO/UNICEF, 2015). Out of 66,101 HCFs assessed; 38% of them were not providing users with access to water from improved sources; 19% HCFs not providing improved sanitation; whereas 35% not having water and soap for hand washing (WHO/UNICEF, 2015). WHO/UNICEF further reported that, despite the low observed coverage of WASH services, the situation is even worse when reliability and safety of supplies is taken into account. Disparities between and within countries have also been observed whereby in the same country one may find a district with worse conditions than other districts thus making them have low coverage up to 2 or 3 factor below the national coverage (WHO/UNICEF, 2015). Despite the importance of primary health care centers, WASH situations in the centres are even worse compared to hospitals. In most cases primary health care facilities such as dispensaries and health centers are the entry points for most health care including maternal, newborn care and other infectious diseases, yet these facilities are not equipped for proper infection prevention and control (IPC). National plans and policies play an important role in improving WASH services in HCFs. Despite having an unacceptable WASH situation in HCFs, the 2015 WHO/UNICEF assessment found that only 25% of the observed countries had a fully implemented plan for WASH in HCFs. National plans and policies play an important role in improving WASH services in HCFs.

1.3 THE IMPACT OF THE ENVIRONMENT ON INFECTIONS IN HEALTHCARE FACILITIES

Healthcare-acquired infections (HCAI), or nosocomial infections, are one of the leading causes of death globally, killing more people than HIV/AIDS, breast cancer, or road accidents (Weinstein, 1998). Some of the key factors that have led to increasing nosocomial infection rates in healthcare settings include:

i. low handwashing rates by staff between patient contacts,
ii. sicker and more immunocompromised patients in hospitals,
iii. infrastructure repairs and renovations to aging healthcare facilities and new construction on existing campuses creating risk of airborne fungal diseases caused by dust and spores released during demolition and construction, and
iv. increasing antimicrobial use in health facilities and long-term care facilities creating a large reservoir of resistant microbial strains (Weinstein, 1998).

Further, Weinstein (1998) found that at least one-third of nosocomial infections are preventable. A strong body of research shows that the built environment in particular influences the incidence of

infection in hospitals and that, by careful consideration of environmental transmission routes; air, surface and water in the design and operation of healthcare facilities, hospital-acquired infections can be reduced dramatically.

1.4 THE IMPACT OF WASH IMPROVEMENT IN HEALTH CARE FACILITIES

The World Health Organization (WHO) has continued advocating adoption of simple measures such as improving coverage of hygienic toilets, installing low-cost handwashing stations and water treatment at HCFs to improve quality of care, increase uptake of services and also encourage community members to change WASH practices at home (WHO, 2008; 2009; WHO/UNICEF, 2015). In the Millennium Development goals (MDGs) goal 4, target 5 aims at reducing by two-thirds the death rate for children under-five while goal 5, target 6 aims at reducing maternal mortality by three-quarters. These MDGs combine the safe environment needed for health care with the responsibility of health care providers not to make the environment more dangerous from the waste generated and contaminations from patients and HCWs (Boyce & Pittet, 2002; WHO, 2008; 2009; 2013; 2014).

While most infections are not directly transmitted to patients from environmental surfaces, these surfaces come in contact with the hands of caregivers frequently. As discussed earlier, low handwashing compliance is a problem in healthcare facilities. Hence, regular cleaning and disinfection of environmental surfaces as appropriate is critical to controlling surface contact transmission of infections. Environmental surfaces that are likely to get contaminated by pathogens can be divided into two groups—those with frequent hand contact (such as surfaces of medical equipment and high-touch housekeeping surfaces such as doorknobs, bedrails, light switches, wall areas around the toilet in the patient room, and edges of privacy curtains) and those with minimal hand contact (e.g., floors and ceilings). The number and type of organisms present on the surface depends upon (Collins, 1988):

i. the number of people present in the environment,
ii. amount of moisture,
iii. amount of activity,
iv. presence of material capable of supporting bacterial growth,
v. rate at which organisms suspended in the air are removed (ventilation), and
vi. type of surface and orientation (horizontal or vertical).

High-contact surfaces in patient-care areas need to be cleaned and disinfected more frequently than minimal contact surfaces. Typically, the infection-control specialists in the organization use a risk assessment approach to identify high-touch surfaces and then coordinate an appropriate cleaning and disinfecting strategy and schedule with the housekeeping staff.

1.5 WASH IN HEALTH CARE FACILITIES IN TANZANIA

A 2014 study by Benova and coworkers in Tanzania found that 44% of facilities conducting deliveries had basic WASH services. It was further shown that, only 24% of those facilities had

WASH services in the delivery room (Benova et al., 2014). WaterAid reports that, Nearly, half a million babies die in their first month of life each year because they are born into unhygienic conditions. The report further reveals that nearly 20% (1 in 5) die during their first month of life in the developing world due to WASH related problems. That is to say washing them in clean water and cared for in a clean environment by people who had washed their hands could have prevented their deaths. (http://www.wateraid.org/us/news/news/one-in-five-newborn-deaths-in-developing-world-could-be-prevented-with-wash retrieved on September 21, 2015).

Despite shortage of water supply in most health facilities, a study done in Tanga found out that there is a potential for rain water harvest and bore holes which has not been fully taped and utilized to cover a the deficit of water in health care facilities (GIZ, 2014).Results from this study further identified that most flush systems of the toilets, showers and sinks are not functioning, no sanitary facilities properly designed for people with special needs. Furthermore a study found that there are no or little maintenance of the existing facilities due to lack of qualified personnel, lack of funds and inadequate spare parts.

Steun Inzake Medische Aangelegenheden Voor Inheemschen (SIMAVI) reported that 342 primary health facilities in Dodoma, 50% had no water at all, only 33% had access to tap water, and the rest had boreholes of different depths.

Dispensaries and health centers are frequently the first point of care, especially for those in rural areas in Tanzania. They are also critical in responding to disease outbreaks, such as cholera. Without WASH services, the ability of HCWs to carry out proper infection prevention and control measures and demonstrate to communities' safe WASH practices is hindered. This is strange since both of the latter activities are so important for effectively controlling and stopping the outbreaks of infections. The lack of knowledge, skills, and WASH infrastructure for the services needed do constrain the ability of the existing health system to provide the basic and routine needed health services, and these include, among others, services related to hygienic child delivery, hence generally lowering the credibility of the existing health system and actually the government's ability to support prevention and control of infections.

It is well accepted that one of the most effective things that people can do for themselves in their everyday lives to prevent or reduce the risks of contracting an infectious or parasitic disease is to practice good hand hygiene. The hands are particularly important since they are the last line of defense in the chain of transmission of gastrointestinal (GI) pathogens, either directly from hand-to-mouth, or indirectly by handling of food or water. Although respiratory tract (RT) infections such as colds and influenza are transmitted via contaminated aerosol particles of mucous, the hands can also play a part; where hands become contaminated with respiratory viruses, infection can be transferred by rubbing the conjunctiva of the eyes, or the nasal mucosa. The hands can also play a part in the transmission of skin, wound, eye and other infections. The available scientific data suggest that the efficacy of the handwashing process itself has a significant impact on the risk of disease transmission. The efficacy of handwashing depends on a number of factors including:

i. The use of soap or other materials to facilitate detachment of microbes etc. from the skin surface,
ii. The extent of the friction applied to the hands (the duration and technique of hand rubbing),
iii. Sufficient amount of safe water (treated/disinfected water) to rinse the hands.

1.6 AVAILABILITY OF PLANS AND GUIDELINES

WHO/UNICEF suggests that national policies are an important element of improving WASH in healthcare facilities. This lack of data is a barrier towards better understanding and addressing WASH needs in health care facilities. Despite the fact that most countries with available data on provision of water and national plans doing better in water services in Healthcare facilities it is a pity to learn that Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) 2014 results indicates less than one third of countries have a plan for drinking- water or sanitation in health care facilities and schools that is being fully implemented, funded and regularly reviewed.

The situation of WASH in health facilities in Tanzania is no different from the rest of the developing countries, a study conducted in Tanga region by GIZ found that there were no guidelines for provision of WASH services in HCFs in all facilities visited. It is in this light make it necessary for the assessment of water sanitation and hygiene situation in healthcare facilities for mainland Tanzania

2.0 RESEARCH OBJECTIVES

The aim of this study is to support the Ministry of Health and Social Welfare's wider plans to improve quality of care in health facilities through an assessment of availability, quality and coverage of water supply, sanitation infrastructure, hand washing facilities and hygienic practices in HCFs with a view to generate evidence-based recommendations for policy and actions geared towards improving MCH conditions prevention and control of WASH related infection.

2.1 KEY RESEARCH QUESTIONS

i. **Water quality:** How safe is water used for drinking, cooking, personal hygiene, medical activities, cleaning and laundry services in a health facility?
ii. **Water quantity:** How sufficient is the available water for infection control activities?
iii. **Handwashing stations:** What is the coverage of functional handwashing stations with water, soap/antiseptics where health-care is provided (wards, consulting rooms, delivery rooms, operating theatres, etc.)?
iv. **Water access and facilities:** How sufficient and what is the coverage of appropriate and functional water collection points in areas of service delivery?
v. **Excreta disposal:** How sufficient, adequate, accessible, appropriate and safe toilets/latrines are available for staff, patients and carers?

vi. **Wastewater disposal:** How are wastewaters from handwashing, bathing, cleaning, or laundering is disposed rapidly and safely in the health-care setting?

vii. **Storm water management:** What is the health facility doing to ensure that storm water does not carry potentially infectious material away as well as enter any areas where health-care is delivered?

viii. **Cleaning and disinfecting:** How can the health-care facility ensure that it always has sufficient materials (detergent, mops, buckets, chlorine) and staff to routinely clean and disinfect environmental surfaces?

ix. **Health-care waste management:** How is the facility ensuring safe segregation, collection, transport, treatment and disposal of health-care waste?

x. **Infection prevention and control:** How is the facility ensuring that staff has sufficient and adequate personal protection knowledge and skills and equipment for the tasks they are carrying out (e.g. disposable gloves, single use plastic aprons, single use face masks, overalls, eye glasses, boots, thick gloves, and gowns)?

xi. **Clinical handwashing:** How is the facility ensuring that staff carry out clinical handwashing before and after every shift, directly before and after every patient contact (even if wearing gloves), directly after handling infectious materials, and when entering and leaving high risk areas such as delivery rooms, surgeries, isolation areas etc.?

xii. **Disease vector control:** How is the facility ensuring that patients, staff and carers are protected from disease vectors?

xiii. **Hygiene promotion:** How is the facility ensuring that patients and carers are informed of essential hygiene behaviors on arrival at the health facility?

3.0 METHODOLOGY

3.1 SURVEY DESIGN

This was a cross sectional study design conducted at HCFs level in 7 UNICEF programme districts with three components. Firstly, direct observation of safe water supply, sanitation infrastructure, hand washing facilities and hygienic practices in HCFs, secondly collection and analysis of microbiological state of environmental media samples from interior healthcare facility environments, followed by administration of an anonymous questionnaire to test HCWs knowledge on infection prevention in health care.

3.2 STUDY SETTING

MoHCDGEC decision makers and WASH coordinators; PMORALG decision makers and LGA coordinators; hospitals, health centres and dispensaries in the seven UNICEF program districts: Temeke Municipal Council, Makete DC, Njombe DC, Iringa DC, Mufindi DC, Mbeya DC and Mbarali DC.

3.3 STUDY POPULATION

The target population for assessment of the existing situation on the availability, quality and coverage of safe water supply, sanitation infrastructure, hand washing equipment and hygienic practices were the MoHCDGEC and PMOLARG officials, RHMT/CHMTs members, healthcare facilities, healthcare facility managers, healthcare staff and healthcare facility users. This population was selected based on the assessment setting the groundwork for an ongoing system of supportive supervision interventions and assessment of health care waste management (HCWM) in healthcare facilities as part of the Ministry of Health and Social Welfare's work on infection prevention and control in HFs in Tanzania.

3.4 SAMPLING AND SAMPLE SIZE

The study involved seven Tanzania mainland districts namely: Temeke Municipal Council, Makete DC, Njombe DC, Iringa DC, Mufindi DC, Mbeya DC and Mbarali DC, all of which were districts councils under the support of UNICEF WASH programs. The study sampled at least 15 healthcare facilities including all levels of HCFs within the districts namely dispensaries, health centers, and hospitals. Dispensaries that did not have delivery services as part of (Reproductive and Child Health Services) were excluded. At least 1 district (or designated district hospital), 1 regular hospital, 4 health centers, and 9 dispensaries were selected randomly from list of facilities within a council. Regular hospitals mostly represented privately run hospitals. This means, sampled health facilities found in the 7 program districts provided for representation of both public and private hospitals, albeit with variations in their numbers depending on their availability. Inclusion also considered referral and regional hospitals found in the study areas. All selected points for the study were geo-referenced. The mapping also included other points such as schools, churches, mosques, water pumps, wells, public water collection points.

3.5 STUDY APPROACHES

Triangulation of methods combining quantitative and qualitative approaches was employed for data collection and analysis. An *in-depth assessment* was carried out by using a facility *walk-through checklist approach* comprising health facility environmental observations; water supply and connectivity observations; observations of hygienic practices by healthcare workers; swabbing of fomite, tap water and other surfaces; and *structured interviews* with healthcare workers, administrators and service users. The qualitative approach was intended to help capturing of the information on knowledge, attitude and practices of health facility managers, healthcare workers and service users on the existing situation of the availability, quality and coverage of safe water supply, sanitation infrastructure, hand washing facilities and hygienic practices in HFs. Laboratory analysis for water quality in HCFs, swabs from touch surfaces and hand washes was carried out. The *walk-through checklist* observational survey and the semi-structured questionnaires were useful for the quantitative analysis and in order to get real and timely snapshot of the situation.

3.6 DATA COLLECTION METHODS

Data collection included adoption of qualitative and quantitative techniques. To highlight them, the methods used included individual interviews with key informants (i.e. key informant interviews),

observations, group interviews (either focus group discussions – FGDs or 2-4 persons in groups), and desk review of the official documents.

3.6.1 Health Facility WASH Needs Assessment Tool and Document Capture

This tool was targeted to collect information on healthcare organization, systems and operations, human resources, WASH infrastructure, infection prevention and control and healthcare practices. Health facility questionnaire (all healthcare units were assessed) was used for data collection which included:

WASH data

a. **Water quality**: Water for handwashing and personal hygiene, drinking water, water for cooking, water for medical activities, cleaning and laundry. HCF water was collected and tested for microbiological and physicochemical quality.

b. **Water quantity**: Assessment was done to determine sufficiency of water available at the health-care facility at all times for infection control, medical activities, cleaning, laundry, personal hygiene, drinking and food preparation purposes.

c. **Water facilities and access to water:** Assessment was done to determine sufficiency of water-collection points and water-use facilities in the healthcare facility and to judge as to whether it allowed convenient access to water for medical activities, infection control activities, drinking, personal hygiene, food preparation, laundry and cleaning. Microbial contaminants in drinking water were also assessed.

d. **Excreta disposal**: This assessed as to whether sufficient numbers of sanitary, accessible, appropriate and safe toilets are provided for patients, staff, people with disabilities and carers.

e. **Wastewater disposal and site drainage**: This assessed how healthcare facility wastewater was disposed.

f. **Operational and maintenance of WASH facilities and services in HCFs**: This assessed whether there was O&M plan, guidelines and activities carried out.

g. **Health-care waste disposal**: Structured observation was carried out to determine how healthcare waste was segregated, collected, transported, treated and disposed of. In addition, assessment on the healthcare color code waste segregation policy in HCFs, training of health workers on safe management of health care waste, waste segregation colored bins, and final treatment and disposal was done. Furthermore, assessment for the existence of functional healthcare waste incinerator and other disposal options, assignment of HCW supervisors and trained incinerator operators was also conducted.

h. **Hand washing and Infection Prevention and Control (IPC) promotion and activities**

   Assessment was done to evaluate sufficiency of functional hand washing facilities that are available in the health-care setting and correct behavior for IPC (including hygiene promotion and IPC training).

3.6.2 WASH infrastructure and supplies observations (digitally recorded)

i. Hand washing facilities in different sections of the health facility
ii. Latrine types available in different sections of the health facility
iii. Water connectivity and storage tanks available
iv. Safe drinking water system available
v. Water supply/available in the latrine
vi. Cleanliness of latrine
vii. Availability of soap at hand washing facilities and in the latrine
viii. Use of protective/barrier clothing
ix. Availability & storage of cleaning resources
x. Existence of and adherence to a documented daily/routine cleaning roster/mechanism for toilets, sinks, water drawing points, etc.
xi. Also whether there is a functioning mechanism for maintenance of the same when broken e.g. funds and arrangements for replenishing of disinfectants, repair of broken pipes, etc.

3.6.3 The state of WASH and Infection Prevention and Control (IPC)

The study utilized a novel microbiology-based approach to assess potential pathogen load at important hand-touch sites in health facilities including the labour room and maternity ward, children ward, medical, isolation wards and cleaning facilities, which was compared with visual inspection of clinical environments. Hand washes from health workers, cleaners, outpatients, inpatients and visitors were collected. Latrine swabs from the drop-hole and sanitation platform also collected. Swab samples from health facilities were stored at 2-8°C for a maximum of 4 hours before being cultured at 37°C, aerobic conditions using a variety of agar mediums. Examination was done at 24 and 48 hours. Species identification was done by using Gram staining and standard biochemical tests.

3.6.4 Desk review

Review was done to assess the extent to which WASH diseases have prevailed and their consequences in mortality in selected study HCF catchment areas and districts, interventions or initiatives in place to mitigate the challenges, success stories (if any) and community participation, among other important issues as per the study objectives. Review supported with some informal interviews were done to establish the way and extent to which WASH activities have been budgeted for and eventually funded, by whom (source of funding by looking at the role played by local and central government authorities, development partners and local communities if any); main causes of the observed WASH diseases, existence of discernible plans for controlling WASH problems and the way such plans were organized to involve which stakeholders.

3.6.5 Key informant interviews

These were conducted using an interview guide (the key informant interview – KII Guide) that has been prepared in advance, the aim being to obtain experience and views of the respondents regarding the real world phenomena as happening in their natural sense in different geographical and demographic settings. The KIIs were conducted by the social scientists with sufficient skills for handling in-depth interviews in the field and performing transcription and interpretation of what transpired out (Weinreich, 2006). The data needed from these participants are addressable by setting clear questions asked in logical manner with reference to almost all the objectives listed

above as regards to what has been happening in the area of WASH, from the planning through implementation stages and how the morbidity and mortality situation reported in relation to WASH problems were connected to issues of stakeholders commitment to address them at different levels.

3.6.5.1 Group interviews

Several WASH stakeholders were approached at different levels – i.e. national and district levels and this was accomplished during the planning and dissemination of results workshop stages. Participants in these interviews included representatives from the MoHCDGEC headquarters, regional and district officials (RHMT, CHMT and Local Government Authority members), as well as HCWs at selected HCFs. Among the key questions covered through interviews with such officers were their views regarding chances for establishing avenues for effective collaboration between WASH stakeholders and local government authorities, communities on the provision and maintenance of safe water supply system, sanitation infrastructure, hand washing equipment and hygienic products in HCF, based on their knowledge and experiences; budget allocated for WASH problem solving plans and actual interventions and chances or need for such budgets to increase given the existence of competing needs for resources in other health sector areas, etc. However, flexibility was allowed to interview the officers individually if it became impossible to mobilize two-four of them into a group for collective interviews. This provided a room for seeing the degree to which the information obtained from the responding officers was comparable or differed and the implication of this on setting priorities for WASH strategic plans and budgeting.

3.6.5.2 Structured interviews

For quantitative data, questionnaire was used to assess the capacity of HCFs to provide WASH services. The questionnaire target was to make the investigators assess, among other things, the number and skills of the existing human resources, infrastructural conditions and essential supplies. Questions were also asked for the respondents to share their experiences and views regarding the observed situation of safe water availability/supply, sanitation infrastructure, hand washing equipment, and hygienic practices in HCFs and the determining factors; and whether there was any avenue for establishing an effective collaboration between WASH stakeholders including local government authorities and community members when it comes to financing and maintenance of safe water supply system, sanitation infrastructure, hand washing equipment and hygienic products in HCFs.

3.7 TRAINING OF THE RESEARCH TEAM AND PRETESTING

Before data collection, the identified research team was trained on the use of data collection tools and techniques pertaining to this study. Such tools pre-tested in at health facilities at Morogoro Municipality study setting a closely similar picture of the nature of the data expected to be collected was eventually sought. After pre-testing (taken to include in what others call a pilot phase of the research tools), the data collection tools were refined by improving them to ensure that they were ready for use in the actual data collection process. Close and supportive supervision was ensured throughout data collection and later on in the analysis stages to ensure data quality. The English version of Questionnaire was translated into Swahili language. It was back translated to English

and checked for conceptual equivalence. The catalogue & questionnaire were pretested in Morogoro Municipal Council.

3.8 OPERATIONAL DEFINITIONS

Based on World Health Organization (WHO) guidelines the following operational definitions were used:

1. **Handwashing**: Washing hands with plain or antimicrobial soap and water.
2. **Antiseptic agent**: An antimicrobial substance that inactivates microorganisms or inhibits their growth on living tissues. Eg: alcohol, chlorhexidine, iodine etc.
3. **Compliance with hand washing**: defined as either washing hands or wrists with water and plain soap or rubbing with an antiseptic solution before and after patient care.
4. **Non Compliance**: Any deviation from the above mentioned definition of compliance and departure from the room after patient care without handwashing.
5. **Health care worker**: A Nurse or doctor involved with patient care.

4.0 RESULTS AND DISCUSSION

4.1 GENERAL HCF INFORMATION

A total of 97 healthcare facilities were enrolled in the study, among which assessment was completed in 96 facilities. The assessment could not be completed in one of the facilities (run by faith based activities) due to limitation of facility staff time to participate. The facilities involved included district hospitals, regular hospitals, health centers, and dispensaries. Ninety six oral interviews with facility in charges, 141 interviews with auxiliary workers, 212 interviews with *exit* clients, 86 observation checklists, and interviews with facility heads of units were administered (table 4).

Figure 4: Healthcare facilities where assessment was conducted by district and type

Facility type	***Iringa***	***Makete***	***Mbarali***	***Mbeya***	***Mufindi***	***Njombe***	***Temeke***	***Total***
District Hosp.	1	1	1	1	1	0	1	6 (6.3 %)
Regular Hosp.	*0*	*1*	*1*	*0*	*0*	*0*	*3*	*5 (5.2 %)*
Health Centre	*2*	*4*	*4*	*3*	*3*	*1*	*2*	*19 (19.8 %)*
Dispensary	*12*	*8*	*8*	*9*	*11*	*14*	*4*	*66 (68.8 %)*
Total	*15*	*14*	*14*	*13*	*15*	*15*	*10*	*96 (100%)*

Eighteen (18) interviews were carried out at regional and district levels in all study locations. Interviews included Regional Medical Officers (RMOs), Regional Health Officers (RHOs), Regional Water Engineers (RWEs), District Medical Officers (DMOs), District Health Officers (DHOs) and District Water Engineers (DWEs). At national level, a total of 20 key informants were interviewed including key actors dealing with WASH programmes at sector ministries of water and health. In addition key development partners dealing with WASH programmes were also involved in in-depth interviews.

4.2 AVAILABILITY AND ACCESSIBILITY TO CLEAN AND SAFE WATER SUPPLIES

Of the healthcare facilities visited 81% were receiving water from improved sources namely; community piped water (40%), tube well with mechanical pump (15%), tube wells with hand pumps (7%), shallow wells with hand pump (10%), and protected spring (9%), though not necessarily within the HCFs premises. On the other hand HCFs receiving water from unimproved water sources found were rivers (13%) and shallow wells (6%). Specifically, healthcare facilities that depended on un-improved water sources for their daily consumption were Mbarali (36%), Mbeya (31%), Makete (28%), Njombe (13%), Iringa (13%), and Mufindi (7%). The highest connectivity to water supplies was 62% in Mbeya DC and the lowest was 7% in Njombe DC. Only 41% of the facilities had pipeline connection into facility buildings (mainly community tap water and tube wells with mechanized pumps); the remaining facilities received water at outside stand pipes, fetching from nearby sources, or being supplied by water vendors. Even among those that received community piped water connections only 40% were connected with pipeline connection into their buildings.

Figure 5: Water sources as observed in some HCFs, a stand pipe outside of a facility with plumbing (left) and an open but lined well used by another facility (right).

Figure and 7 Summarizes the distribution of water sources among healthcare facility types/levels where the largest proportion of general hospitals obtained water from privately owned tube wells with mechanical pumps and much less from public water supply systems, while the rest of facilities had their largest proportions being supplied from community tap water sources. On the other hand, district (or designated) hospitals had the largest coverage of community tap water supplies among facilities. Although the government of the United Republic of Tanzania aimed to provide access to more than 75% of its people with access to safe water by 2015, only 38 out of 96 of surveyed health facilities (39.6%) are connected with piped water supply.

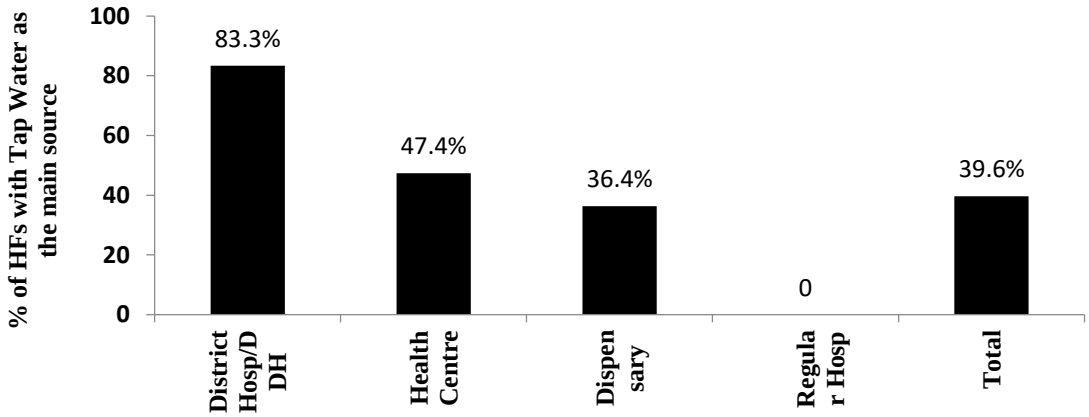

Figure 6: Distribution of healthcare facilities connectivity to community tap water supplies by facility types

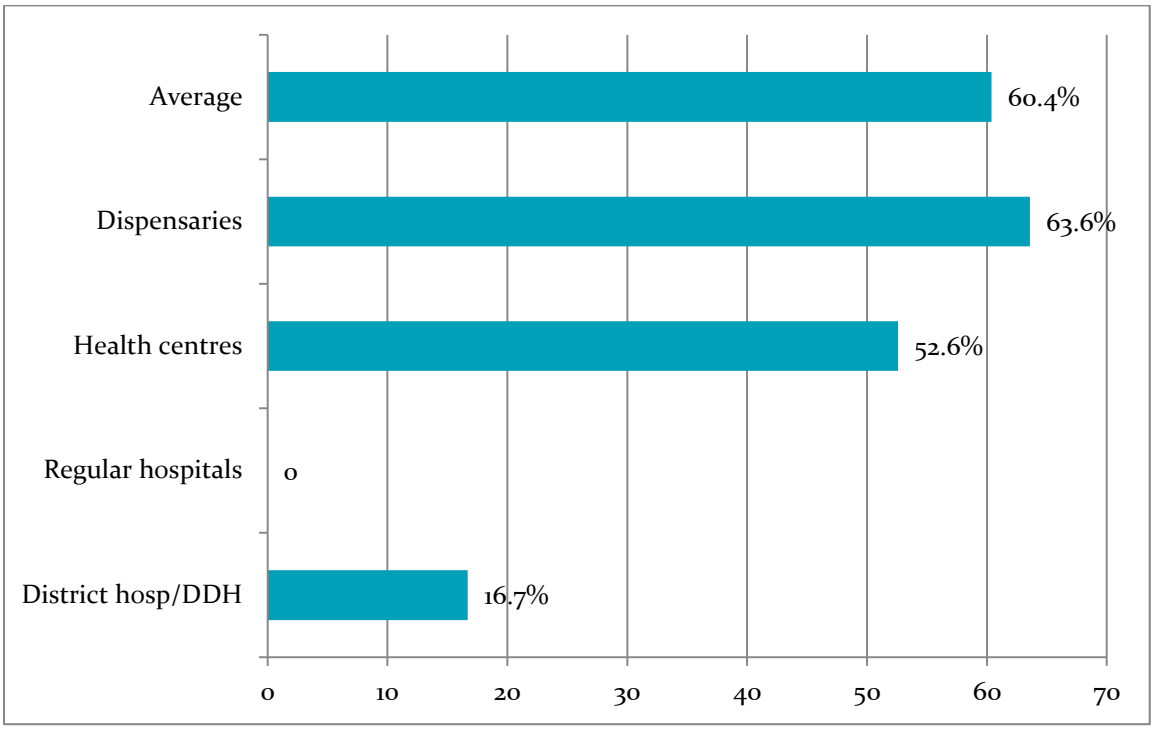

Figure 7: Distribution of healthcare facilities lacking connectivity to community tap water supplies by facility types

It was revealed from the survey that, only few hospitals (16.7%) are not connected with piped water supply. However, it was alarming that, more than 50% of health centres and dispensaries lacked connectivity with piped water supply (Figure 8).

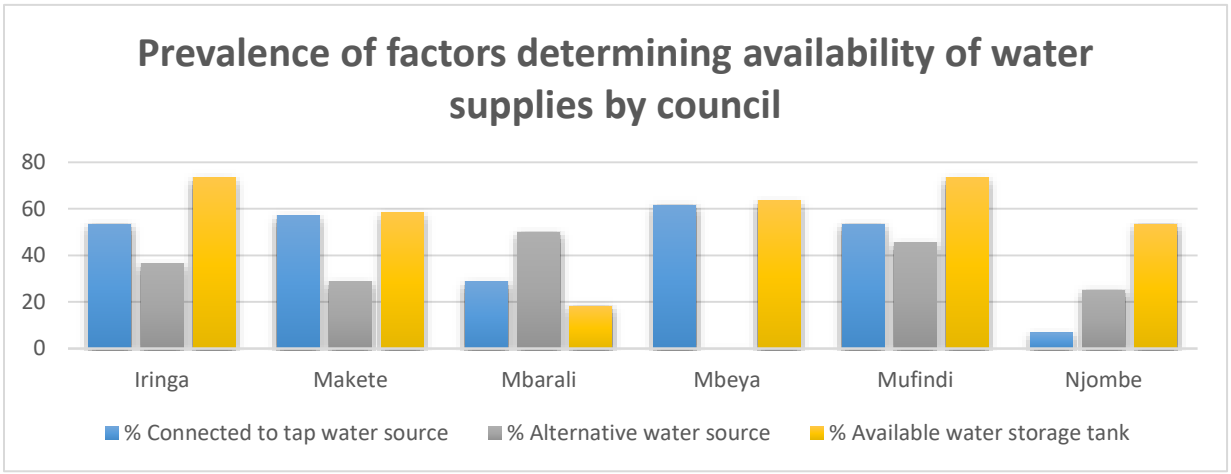

Figure 8: Distribution of indicators for water supply availability in healthcare facilities by council

Low coverage of piped connection to healthcare facility building is a concern as "not being connected" to water mains jeopardizes not only accessibility to water supplies but also adequacy and safety of water being supplied. Hauling water to the facility inside during service hours is tedious and require extra human power and time to get such that it becomes more difficult for ensure that there will be water available and adequate quantities for hygiene and care. Water that is being hauled requires use of containers thus increasing chances of contamination through the contact with containers and handling by works. Our observation on the placement of auxiliary workers (who would be in the front line in water hauling) are often involved in multiple tasks including cleaning, assisting in patient services, and in collecting water or ensuring that other services such as utility are provided. Small sets of factors (indicators) have been identified which when examined together helps in making inferences on the state of water supplies at a particular or in a group of healthcare facilities. Below we present indicators that collectively describe availability, accessibility, reliability, and safety/quality of water supplies.

4.3 AVAILABILITY OF WATER SUPPLIES IN HEALTHCARE FACILITIES

Key indicators describing availability of water in healthcare facilities were identified as connectivity to community water source (community tap water was regarded as one), presence of functional alternative water source (in case of shortages from the main source), and presence of water storage tank of adequate capacity. Having these factors in place ensures that water will remain available even when one or the other system fails.

It was observed that 58% of the healthcare facilities had water storage arrangement at least at a central location. Iringa rural and Mufindi Councils had the highest coverage in terms of storage tanks for HCFs (73%) whereas Mbarali DC had the least proportion of facilities (18%) with storage tanks. In terms of alternative water sources, only 30% of the facilities had alternative water sources to provide water in cases of emergency. Mbarali was the council with most healthcare facilities with alternative water sources (50%) followed closely by Mufindi Council (45%) where as in Mbeya DC there was not any facility with access to alternative water sources. Connectivity to community tap water supplies was highest in Mbeya DC. Crudely averaging the prevalence of indicator for availability of clean and safe water supplies identifies Mufindi DC as the one with highest score in terms of availability

4.4 ACCESSIBILITY TO CLEAN AND SAFE WATER SUPPLIES

Three indicators were used to assess accessibility to water for use in service areas namely, facility pipeline connection to water supply sources, pipeline distribution of water indoors (at least to consultation room), and presence of hand washing point at consultation rooms. Sixty percent (60%) of the facilities had hand washing points at consultation rooms (representing service areas where water is required), whereas 20% had indoor plumbing supply connection in consultation rooms. Facilities that had plumbing water supply connection at consultation rooms were about half the number of facilities with piped water connection to facility building. These results are suggestive

of the fact that water supplies is poorly distributed inside healthcare facilities even where healthcare facilities are provided with pipeline water connections despite the fact that pipeline connectivity to water supplies is generally low. Taking the three factors into consideration we observed that Makete district council had the highest proportion of facilities with better accessibility to water supplies particularly because of having high coverage of connectivity to tap water. In healthcare facilities that were connected to tap water systems, many hand washing points were not supplied by interior plumbing system, even where water was available. It was common to see broken sinks either leaking, broken, or otherwise closed by the outside stop cork or find water storage buckets for hand washing in front of the non-functioning but otherwise appropriate hand washing basins. In one district hospital we observed all hand wash basins in service areas visited except for in charge room (labor room, pediatric ward, and postnatal wards) were closed instead water was being provided at improvised buckets. In-depth discussions with facility in charges identified absence of maintenance plan and lack of budgetary allocations for among the main contributing factors.

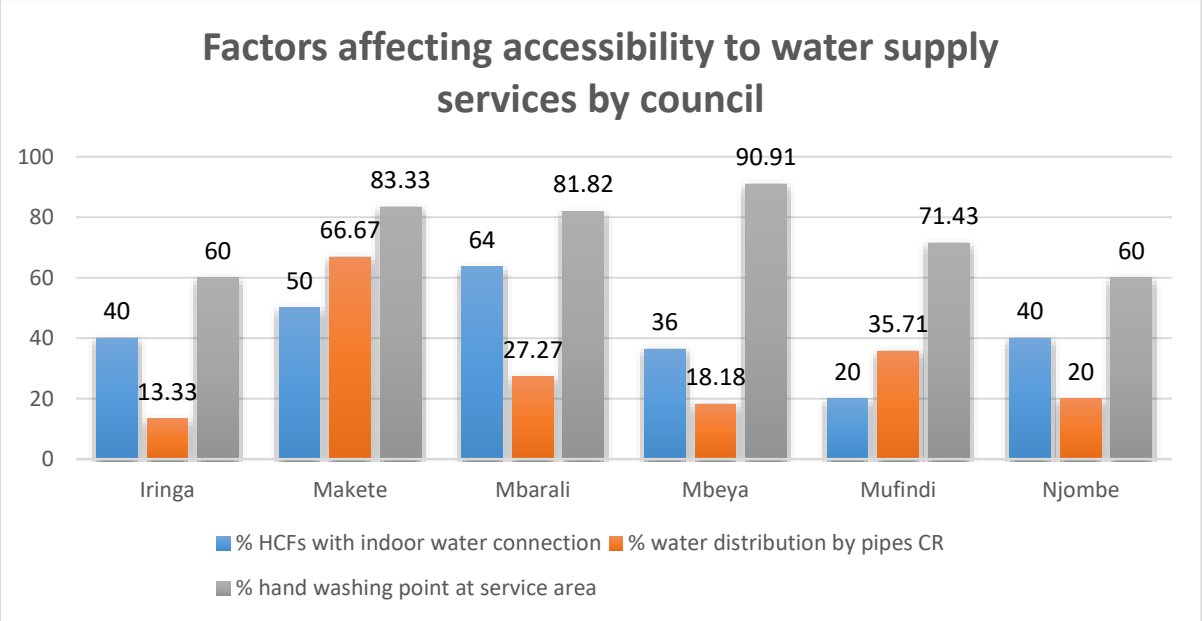

Figure 9: Determinants of accessibility to water supplies at point of service

When the clients were asked about their experiences in terms of having access to water for use while in the HCFs, a quarter of the clients reported of having accessed water while in facility in any district. Mbarali and Temeke had the highest proportion of clients reporting access to water (26% each), with Njombe, Mufindi, and Mbeya having less than 10% of their clients accessing water supplies when needed. These are lesser proportions than those connected to water sources, which may imply that water is either not distributed, not made available, or no access is being provided for use by clients and others. Faith based facilities were reported to have more piped water 71.7 % followed by government owned HCFs 44.5 % (P value = 0.0039).

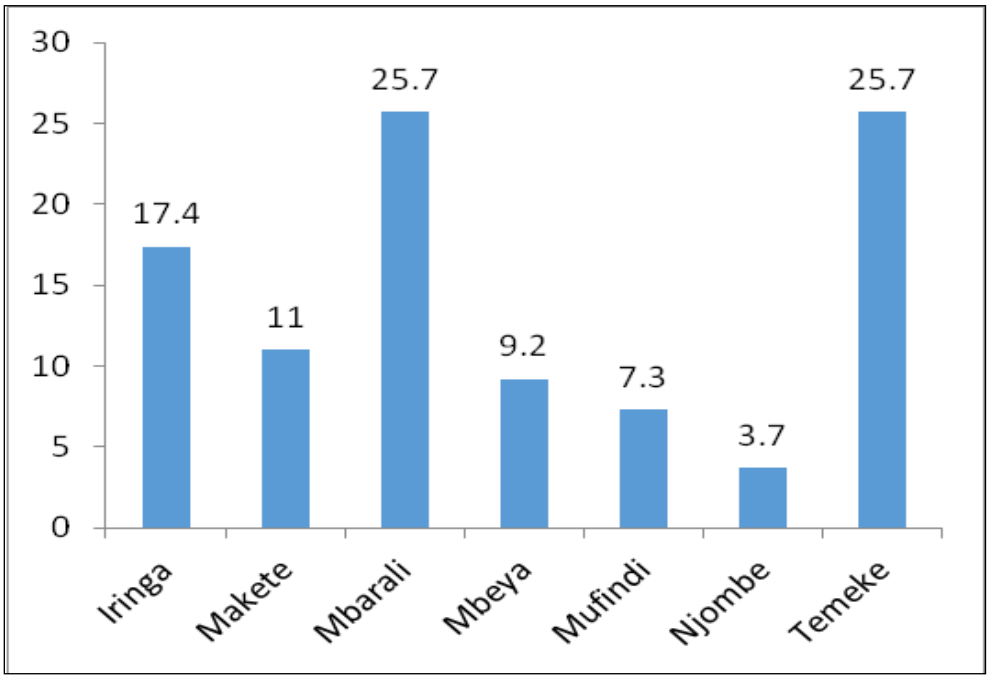

Figure 10: Reported accessibility to water at healthcare facilities by councils

4.5 RELIABILITY OF WATER SUPPLY SERVICES IN HEALTHCARE FACILITIES

Based on current experience in water supply availability and shortages we identified three factors namely; regularity of water supply in daily basis (whether water is generally available every day in the facility), duration of water shortages (whether water shortages stay beyond few hours or more but not usually exceeding a day [24hrs duration]), and having no experience of recent water shortages (whether they did not have any water shortages in the period of 10days preceding the assessment). Reliable water supplies would be the one with water flowing in most days, having shortages sustaining for hours only, and whose users have not recent memory of water shortages.

Figure 11: Rain water harvesting and storage tank at a dispensary. Rain water harvesting system was provided supplementary to internment piped water supplied at a standpipe.

Of the facilities visited, 54% of HFs reported that they receive water in most days, these include facilities that obtain water from non-piped supply sources. Makete and Mbarali councils reported the highest proportion (64% each) of facilities where water was available on daily basis, whereas Mbeya DC had the least proportion (31%) receiving water daily. One third of the facilities (33.33%) obtain water in some days in a week and 12.5% obtain water only seasonally.

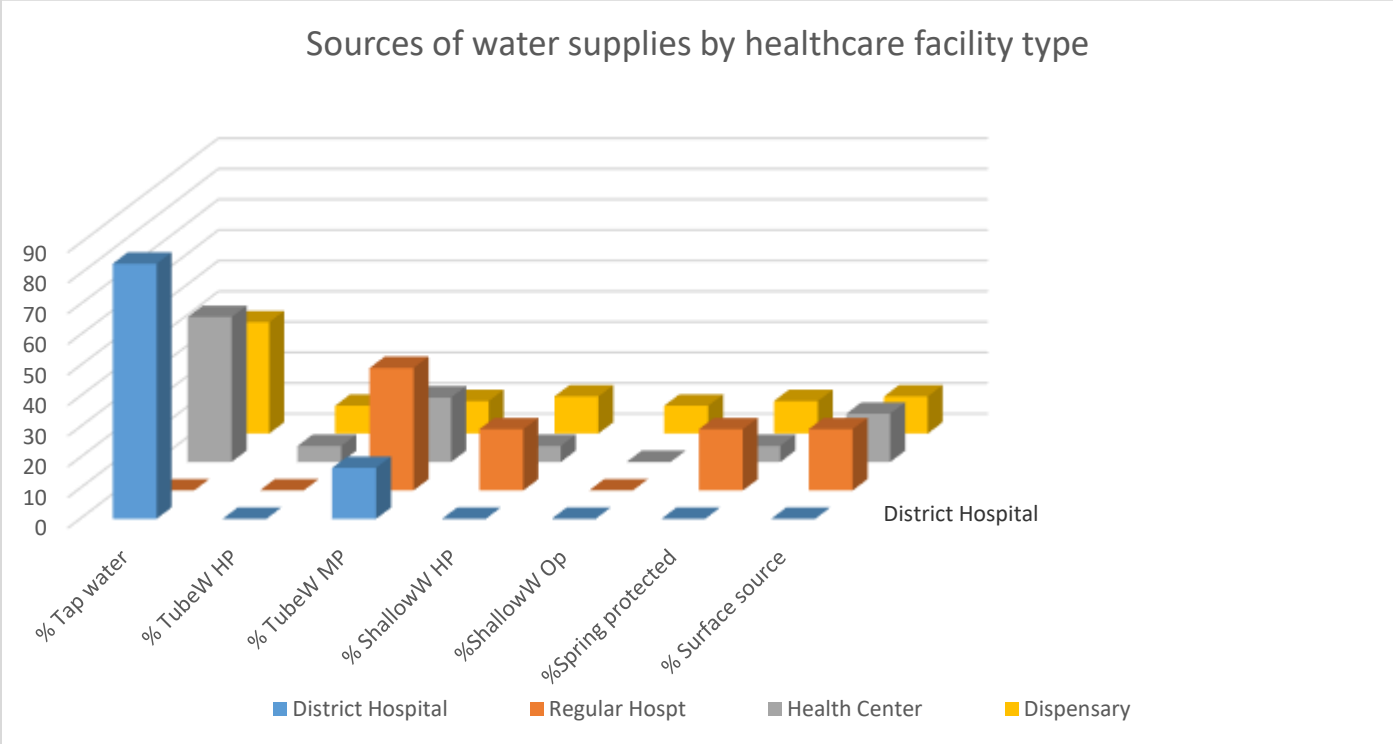

Figure 12: Distribution of water sources in healthcare facilities by facility types

Iringa and Mbarali councils had the highest proportion of facilities where water availability was affected by seasonality 27% and 22% respectively. Mbarali DC was also the council with the largest proportion of facilities receiving water from unimproved sources (36%). Thirty four percent (34%) of the facilities experienced water shortage for at least one day in a week where as 16.67% got water for only 2 days or less in a week. Mbeya DC had the highest proportion of facilities receiving water for 2 days or less in a week (37%) followed by Iringa and Makete 27% and 22% respectively. Composite measure of reliability will be determined for easy comparison.

4.6 QUALITY AND SAFETY OF WATER SUPPLY IN HEALTHCARE FACILITIES

Based on 9 point criteria (outlined below) we determined the state of water safety at healthcare facility level. One out of five regular hospitals, 16% of health centers (n = 19), and 21% of dispensaries (n = 66) received water from unimproved sources. None of the district (or designated) hospitals got water from sources categorized as unimproved. Reports from in-charge of the

facilities show that only 23% of healthcare facilities received water that was treated at source. Njombe, Makete, and Mbeya councils had the high proportion of water supplies that were treated from sources 33%, 31%, and 28% respectively, whereas Mufindi and Iringa councils had the least number of facilities 13% each, followed by Mbarali DC 22%. About half of the district hospitals (50%) and health centers (48%) received water that was treated at sources, yet only 13% of dispensaries and 20% of regular hospitals were receiving water that was treated from source. We observed that 37% of healthcare facilities had leakages on pipelines and distribution systems that presented risk of water contamination. Mbeya DC had the highest proportion of facilities whose water distribution pipelines were leaking with Mbarali DC having the least proportion of facilities with leaking pipelines.

Nine points criteria for water safety:

1. The facility has plumbing connection and not an outside stand pipe only
2. The facility has storage reservoir within its boundaries
3. There is not any leakage on water storage tanks
4. Facility taps are not shared with other users (households/institutions) apart from the HCF
5. There have not been any discontinuity of water supply for the last 10 days
6. Areas around water tank or taps not dirty
7. There are no leaks in the facility pipes
8. Facility water come from one reliable source not more
9. There are no pools of stagnant water or waste water around the facility

Having all the water safety indicators pulled together, we categorized water supply services into low (tolerable risk level) and high risk (substantial risk level) categories. Among the facilities supplied with piped water 58.7% fell into high risk category based on the criteria. Njombe region had the highest proportion (50%) of facilities whose water supply system was categorized to low risk group among the regions. Mbeya region had only 14.29% of its facilities water system categorized to low risk which is lowest between the regions. Detailed categorization into 4 levels of low, medium, high, and very high showed that majority (58.33%) of faith based healthcare facilities had their water systems ranked as low risk, private owned facilities ranged from having medium to high risk range whereas government facilities were the only group with facilities in all categories with 9.38% belonging to very high risk category. All districts and the designated district hospitals had their water supply systems categorized as presenting low risk (100%). Regular hospitals fell into medium risk categories (100%), health centers had 33% of facilities categorized both as low risk, 59% medium risk, and 8.3% of facilities high risk category. Dispensaries were the only group of facilities with water supplies rated to the very high risk category, with 10% and 20% of facilities water systems respectively rated into high and very high risk categories. Hence dispensaries presented the only group of facilities whose water safety is ranked with highest level of risk among healthcare facility types.

The exit clients were asked to give their opinion as to whether water available at the heath care facility was safe to drink; only 32 % (n=68) of the clients opined that water was safe. The most

clients reported (56 %), (n=21)) were from Makete district followed and the least proportion reported in Njombe council 18 % (n=17). Comparing opinions of clients by type of HCF, clients from faith based HCFs were more satisfied with the safety of drinking water than government and private owned ones.

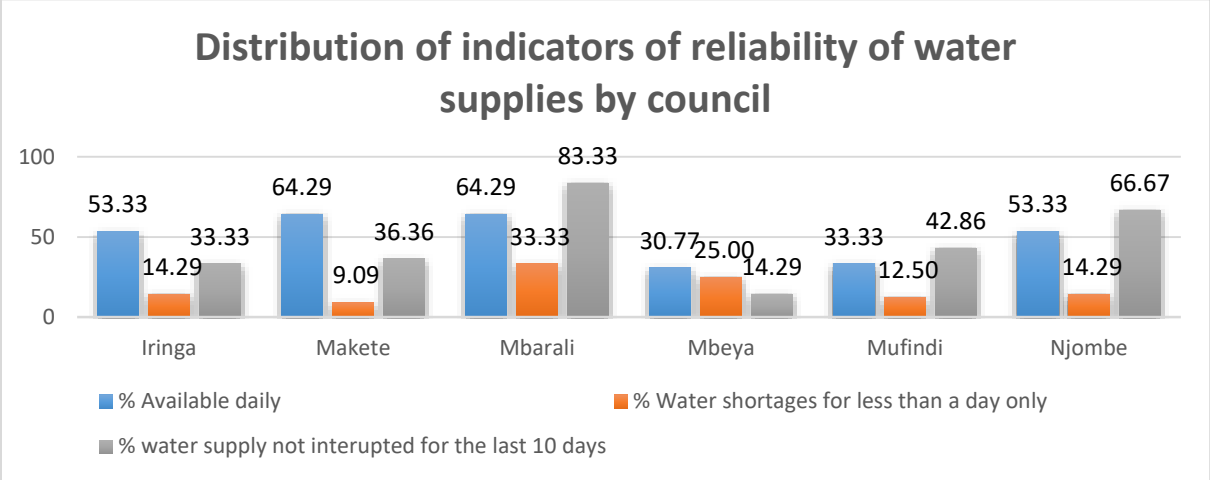

Figure 6: Distribution of indicators or reliability of water supplies by council

In event whereby pregnant women feeling to find unlikely WASH attractive environment at health care facility levels, a number of them may avoid attending their antenatal visits as scheduled as it has been noted in one study in Tanzania (Mubyazi 2010; Unpublished).

4.7 HYGIENE INFRASTRUCTURE IN HEALTHCARE FACILITIES

The design of the plumbing systems in HCFs presents a challenge to the operation of water supply system and maintenance. While some of these challenges are similar to those in households, others are unique to the health care environment. Typical plumbing concerns for the visited health facilities include repairing toilet, sink and shower; maintaining piping systems throughout the facility for water, keeping drain systems and waste-water lines open and operating properly.

Figure 14: Inadequacy of hand washing infrastructure in HCFs owing to non-adherence to standard provisions and poor operational maintenance. Inappropriate hand washing infrastructure is also associated with poor drainage of contaminated waste water.

4.7.1 Hand washing facilities and water supplies for hygiene

Water supplies were distributed by pipelines at consultation and delivery rooms in 29% and 24% healthcare facilities respectively. Consultation rooms of 73% of facilities had hand washing points available, compared to 75% in delivery rooms. There were no marked variability in terms of distribution of hand washing facilities between the two departments among the study districts. Of the hand washing points present at facilities 49% in consultation rooms were hand washing basin with water tap type whereas only 35% of the hand washing facilities in delivery rooms were handwashing basin with water tap type but the difference was not statistically significant. Many of the handwashing basins with water tap type facilities were not functional and some had been replaced by plastic water containers without drainage.

On interviews, 11% of the clients reported that they could not wash hands after visiting toilets within facilities because there was no water for hand washing. Healthcare facilities in Mbarali District Council had the highest proportion of its clients (39%) reporting to have experienced water shortage for hand washing. It was observed that water available at hand washing point at

consultation room in 56% of facilities and 58% of the facility delivery rooms. Soap for hand washing was present in 51% of consultation rooms and 79% of delivery rooms.

As for antiseptic hand rub only 9% and 12% of the facilities had antiseptic hand rubs present at hand washing points in consultation room and delivery rooms respectively. Hand antiseptics uses were also unevenly distributed between districts where some districts like Njombe and Mufindi did not have hand rub antiseptics in the two service departments. There was also an interesting administrative decision in terms of apportioning the antiseptic between consultation rooms and delivery rooms where in Mbeya district most of the antiseptics were found at consultation rooms with almost none being provided at the delivery rooms where as in Makete district all the antiseptic hand rubs being used were in delivery rooms only.

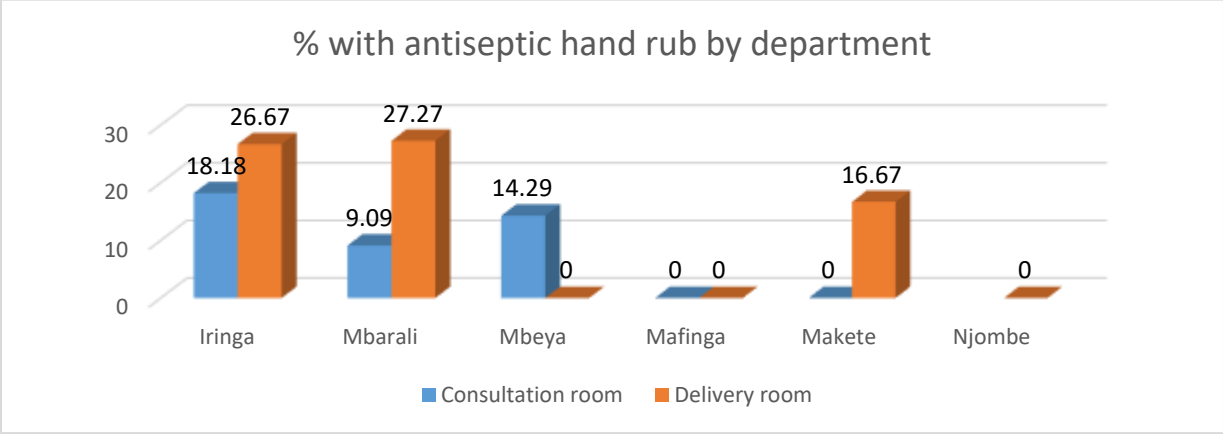

Figure 15: Distribution of antiseptic hand rub in consultation and delivery rooms by council

Four types of soap that were being used in various healthcare facility departments were identified as liquid soap (whole commercial form or diluted), reconstituted liquid from detergent powder, soap bars, and detergent powder. Reconstituted detergent powder was the most common used soap form in delivery room, but there was 10% of facilities that uses bar soap for hand washing.

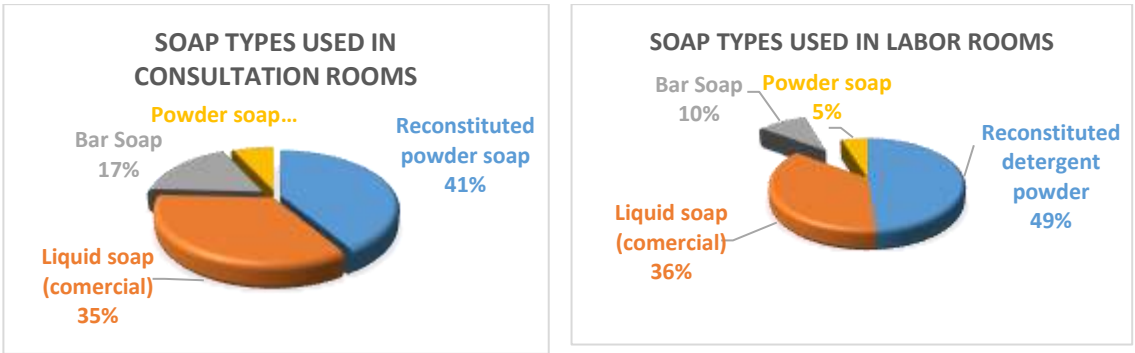

Figure 16: Types and forms of soap used for hand washing in delivery rooms

There was variation in terms of type of soaps used in consultation and delivery rooms between districts. Iringa, Mufindi and Njombe district Councils used mostly bar soaps in consultation rooms, where as Mufindi District Councils used by far the most bar soaps of all the districts at the delivery rooms. Mbarali and Mbeya District Councils were using comercial liquid soap for hand wasing both at consultation and as well as delivery areas.

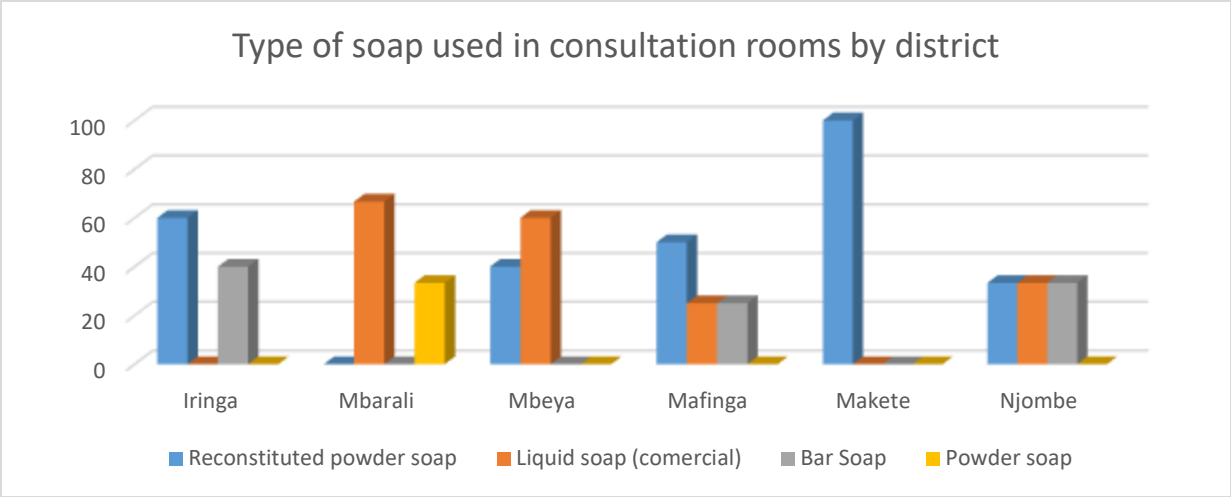

Figure 17: Types of soap used in consultation and labor rooms by districts

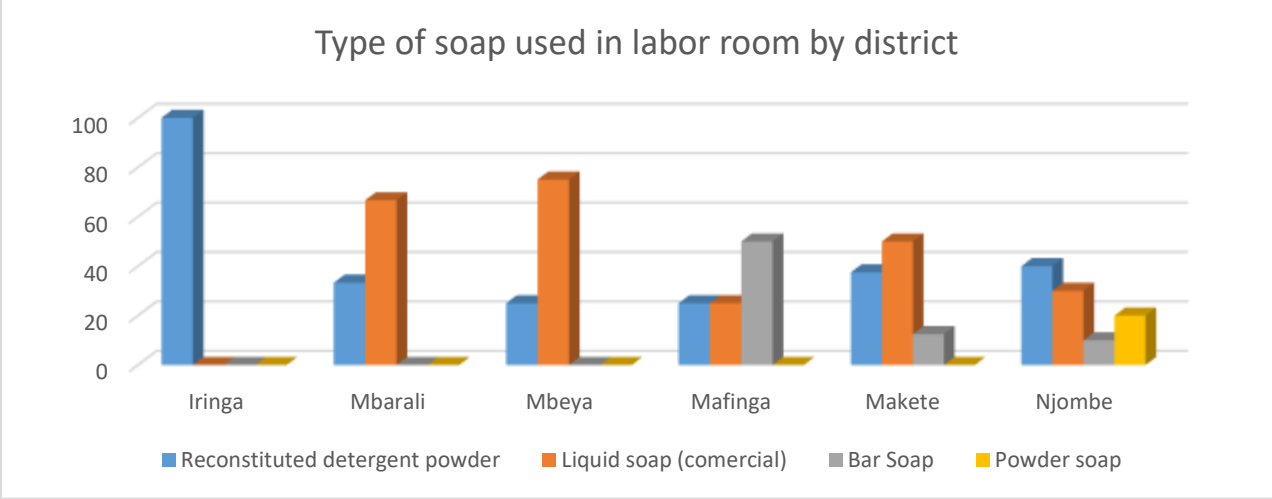

Figure 18: Types of soap used in consultation and labor rooms by districts

4.7.2 BATHING FACILITIES

It was observed that among the HCFs assessed only 25% of delivery rooms and 8% of consultation rooms had bathing facilities. Delivery rooms and postnatal wards had the highest

percentage (25%) of bathing facilities relative to other departments. Mbarali and Mbeya districts had the highest proportions (18%) of facilities with bathing facilities in the consultation rooms while Njombe and Iringa did not have bathing facilities in the consultation rooms on one hand. On the other hand, Makete had the highest proportions (41.7%) of facilities with bathing facilities in the delivery rooms (see

Figure 19).

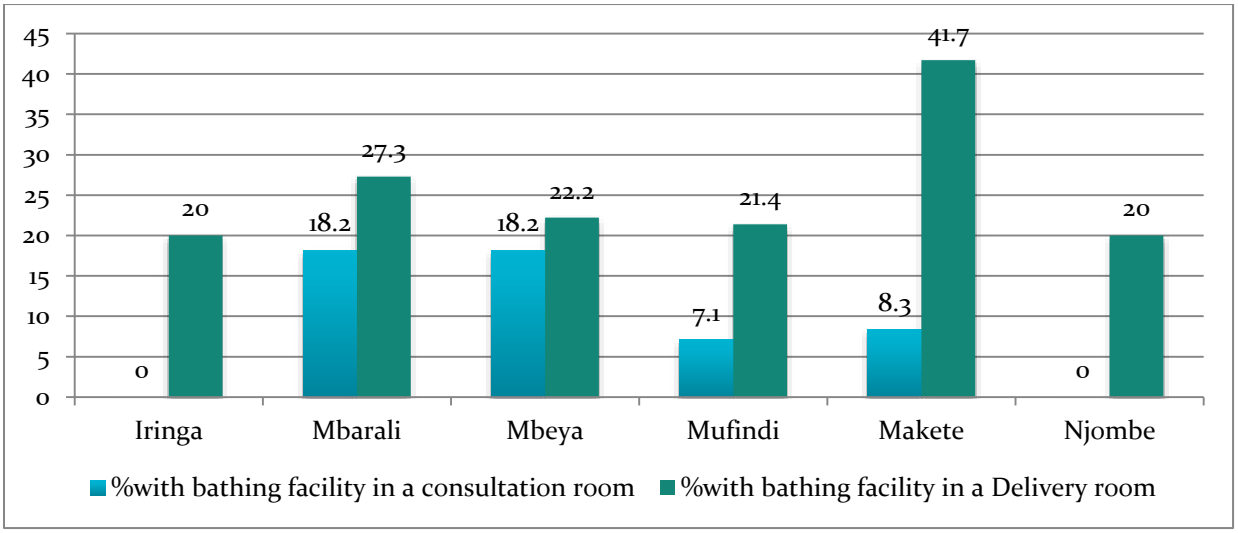

Figure 19: Facilities with bathing facilities in consultation rooms and delivery rooms by councils

Comparing availability of bathing facilities by ownership in the consultation rooms, we found higher proportions of private healthcare facilities with bathing facilities compared to government facilities. In delivery rooms, there were larger proportions of bathing facilities in faith based facilities compared to government facilities. Whichever department, the government owned facilities had the least proportion of bathing facilities.

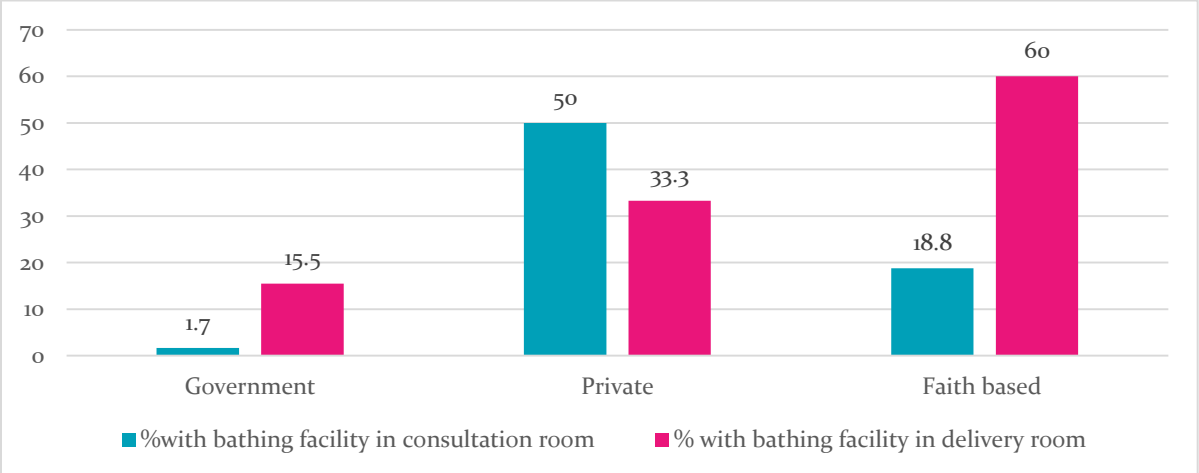

Figure 20: Percentages of facilities with bathing facilities in consultation rooms and delivery rooms by ownership of the facility

When comparing availability of bathing facilities by level of facility, it was found that only dispensaries and health centers had bathing facilities on the consultation rooms though in a very small proportions, 06.9% and 12.5% for respectively. However, about 50% of the district hospitals, 81% of regular hospitals, 43% of health centers, and 18% dispensaries had bathing facilities for use in labor rooms.

4.7.3 Bath water systems

Facilities with bathing facilities were assessed to find out if they had running water systems or were using buckets/containers. Our results show that, in the consultation rooms in the districts of Mufindi and Makete all of them had running water systems while in Mbarali and Mbeya had 50% each for their bathing facilities having running water systems. Iringa and Njombe facilities were found to have no running water in the bathrooms. Furthermore, in the delivery rooms, Makete had the highest proportion, where 80% of its bathing facilities had running water systems. Njombe council did not have any of its visited facilities with running water in the bathing facilities in delivery rooms. Proportions with no running water systems were using buckets or some other movable containers.

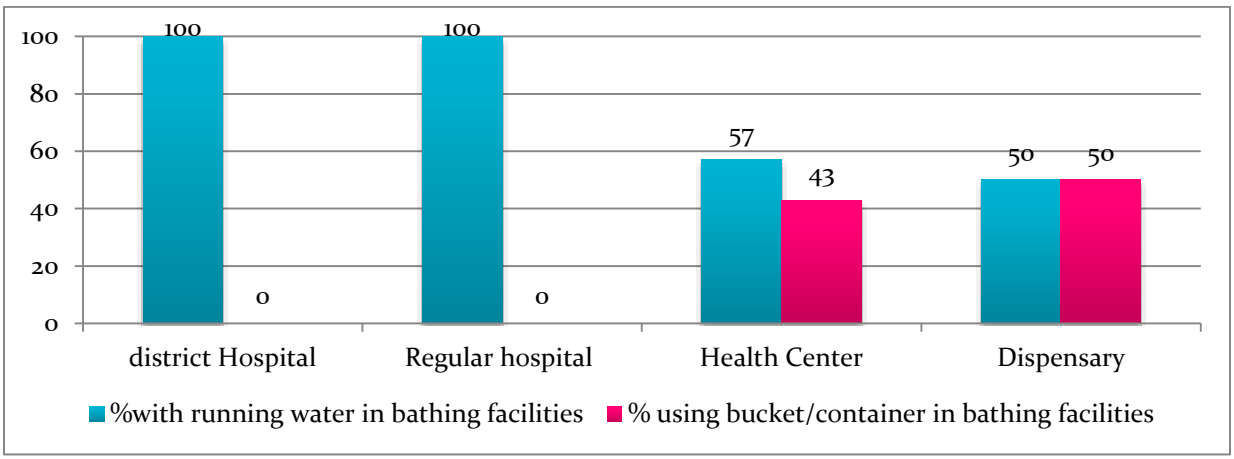

Figure 21: Facilities with running water systems for bathing facilities by level of healthcare facility

All hospitals (district hospitals and regular hospitals) had running water systems in their bathing facilities. However, only 43 % of health centers and 50% of dispensaries had running water supplies in bathing areas. This means we had as much as half of the dispensaries and still a significant number of health centers where patients and workers would have no running water but depending solely on buckets or some other containers for their supplies. The lack of water systems in dispensaries and health centers is a major risk factor for mothers who deliver in those facilities who would definitely be faced with difficulties in obtaining water, a level of scarcity due to limited supplies, and increased risk of using contaminated water or having water contaminated in the

process of hauling. These concerns go beyond the mothers to affect the newborns being delivered in those HCFs.

4.7.4 Cleanliness of bathing facilities

Cleanliness of bathroom facilities was assessed by observing presence of standing water, dirty walls, soiled floor, foul smells, and flies. Majority of bathrooms were considered to not be of adequate cleanliness where about 80% of the bathrooms in delivery rooms and near 95% in consultation rooms were found to have visible contaminants at various degrees. Majority of the bathroom facilities in consultation rooms and reception areas were observed to be not clean compared to those in labor rooms. Nevertheless, the proportion of relatively clean bathroom facilities in delivery rooms is still alarmingly high. Both the provision and good state of maintenance (cleanness) of the bathroom facilities are critical for control of infection among new mothers and neonates. As the Ministry of Health and social welfare is making efforts to provide delivery services to all levels of healthcare facilities, it is also paramount important to ensure that these facilities are provided with appropriate hygiene amenities and that the amenities are kept clean.

4.7.5 State of repair for the bathrooms

In terms of ventilation and lighting, we observed that only about 08% of bathrooms in consultation rooms and 24% in delivery rooms did not have adequate natural ventilation. About 05% of the bathrooms in delivery rooms were provided with mechanical ventilation equipment with none such at the consultation rooms and reception areas. Of the all facilities studied, 22% had natural lighting in delivery wards compared to 08% at consultation room areas. Twenty one percent of the bathrooms in delivery rooms were provided with light bulbs for night and day illumination as opposed to 05% in consultation room areas. All bathrooms (100%) in consultation and 79% of bathrooms in delivery wards had intact ceilings. Having good roofs and ceilings ensures that bathrooms are safe and can be used in all seasons.

4.8 Awareness and training on infection prevention and control (IPC)

A total of 141 auxiliary workers were interviewed to assess their knowledge, training and the situation of WASH in the facilities where they work. The mean age of workers auxiliary workers interviewed was 33 years. Most of the auxiliary workers were females 89% (126), while males were only 11% (15) (Table 3).

Table 3: General characteristic of auxiliary workers interviewed in healthcare facilities

Variable	Total
Number of respondents	141
Number respondents (females)	126
Number respondents (males)	15

Average number of years worked in the facility	04
Type of cadres	Medical attendants 50% (71) Nurse attendants 29% (41) Cleaners 15% (21) Other cadres 05% (08)

4.8.1 Training of auxiliary workers on infection prevention and control (IPC)

It was found that 26% of auxiliary workers (n = 141) in the studied districts had received training and orientation on Infection Prevention and Control (IPC). There were a smaller proportions of auxiliary workers in dispensaries and health centers that had received training on IPC making a total of 24% and 23%, respectively compared to district hospitals and designated district hospitals whereby 35% and 100% received training respectively. However, none of the auxiliary workers from enrolled regular hospitals (n = 4) reported to have received any training.

Comparing the coverage of training among auxiliary workers among councils, Iringa District and Mbarali district Councils had higher proportions of workers trained compared to other councils whereas Mbeya and Njombe districts had the least proportions (see Figure 22)

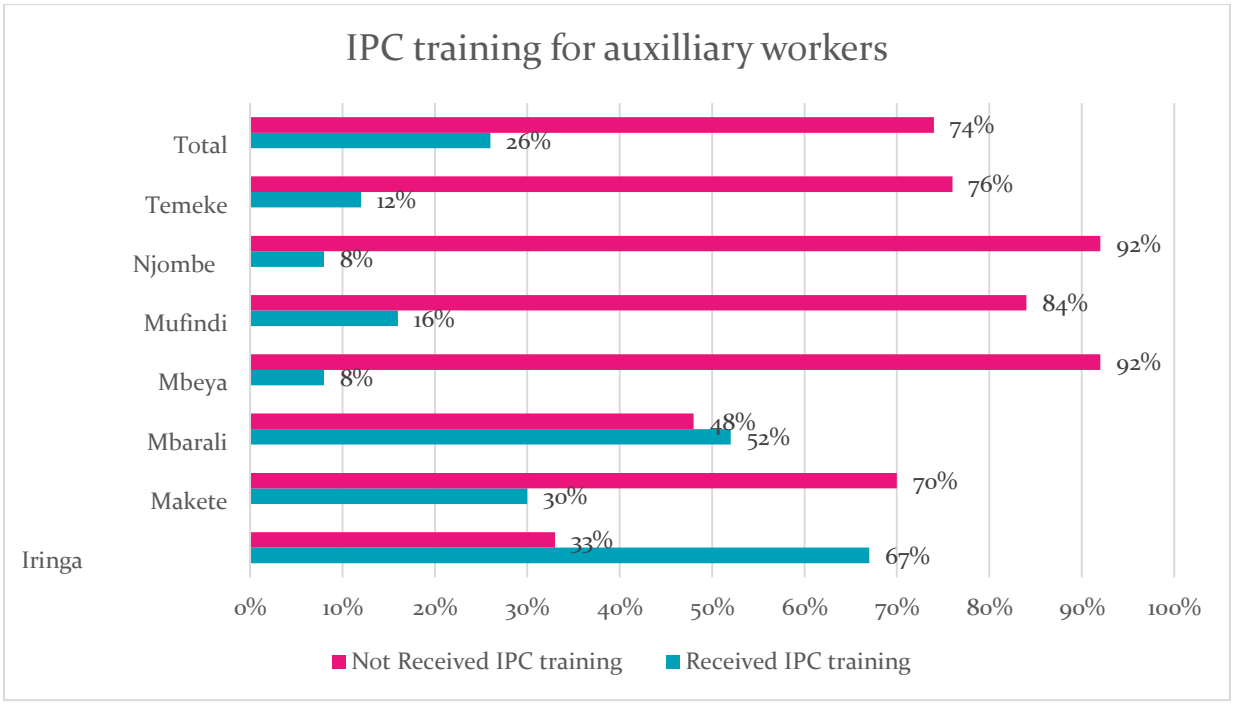

Figure 22: Training of auxiliary workers

These percentages though apparently substantially different appear not to be of statistical significance. Nevertheless they provide systematic view of the level of awareness among the workers between districts. Workers awareness on the infection risk and preventive measures is

paramount not only to safeguards workers health but also to limit infection transmission within the healthcare facilities.

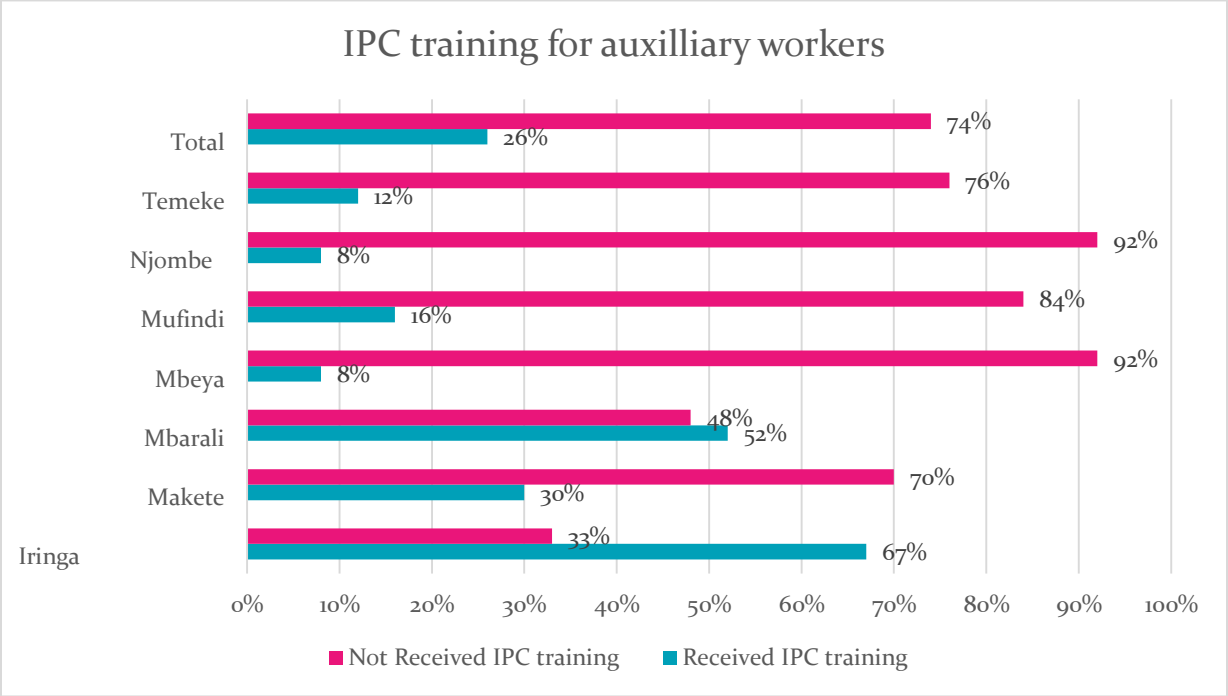

Figure 23: Number of auxiliary workers received IPC training across councils

Those who said they were not trained or oriented on IPC said that they perform tasks basing on own experience were (45%), oriented by in charge of facility (27%) and oriented by duty supervisor (28%).

4.8.2 Hygiene education and awareness to clients

Interviews were conducted involving 212 clients attending various healthcare facilities (Table 2). Majority of client that responded were female 170 (80.2%). The vast proportion of females' respondents was due to combined emphasis on delivery units and the larger number of female care takers than males at OPDs rather than differences in acceptance and refusal to take part in the study. Of the 212 clients, 88 (41.5%) had at some point been admitted at the respective healthcare facilities. The highest proportion of respondents ever admitted was from healthcare facilities in Makete District (62.5 %).

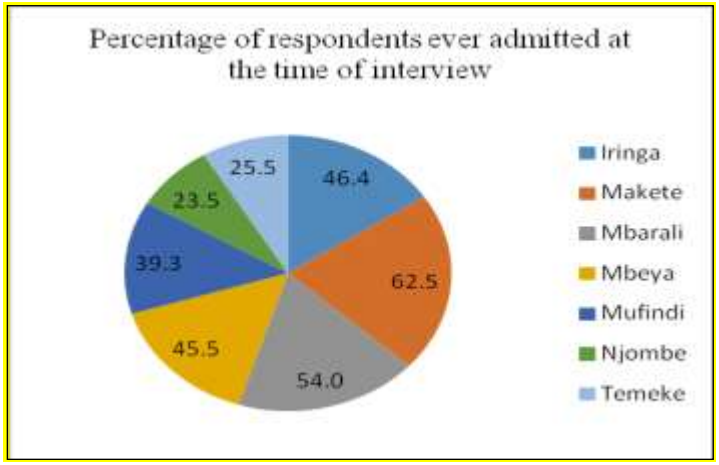

Figure 24: Proportion of respondents that had ever been admitted at the healthcare facilities

Concerning raising awareness and providing education to clients, it was observed that sanitary facilities, healthcare waste management, and hand washing facilities in the healthcare facilities were not properly utilized. Hygienic use of toilets and latrines were particularly concerning as in many cases there were reports of clients not leaving the latrines clean after use. This was a reason for facilities to restrict access to sanitary facilities. Education and awareness on toilet hygiene among clients goes hand in hand with proper hand washing practices, use of waste management tools, and general hygiene while in healthcare facilities as well as in communities.

Only 33.5% of the respondents were informed of the essential hygiene behaviors upon arrival at the health care facility. Further results show that government owned healthcare facilities provide more hygiene education to clients than private and faith-based healthcare facilities, all combined. Similarly, clients reported to have seen WASH posters more in government healthcare facilities than in private and faith based facilities.

4.9 Infection control practices in health care facilities

The state of infection control was ascertained by observations on the integrity and state of maintenance of indoor surfaces (floors, walls, and table tops), equipment and materials (mostly linen cleanliness), and check for availability of cleaning agents and cleaning aides using the criteria outlined here under;

Eleven points criteria for assessing the state of indoor maintenance as related to facility infection control

1. Floor is washable,
2. Floor is clean (no visible dirty)
3. Floor is intact (no cracks)
4. Walls are clean (no visible dirty)
5. Walls are intact (no cracks)

6. Housekeeping is generally good (observe the arrangement of things)
7. No standing water on the floor/sink
8. There was no visible stains on linen
9. Mop and bucket present for each room
10. Cleaning agents are present
11. Daily cleaning schedule (up-to-date) present and displayed.

The results are presented from consultation rooms and delivery rooms which are the primary focus of this report. Floors were washable in 98% of consultation rooms and 96% of delivery rooms although only 52% of consultation rooms and 57% of delivery rooms had their floor clean. Notwithstanding the above fact, some of the few facilities without intact floor were in very bad condition. Between 50%- 70% of the walls in consultation and delivery rooms were intact and clean. However, there were no cleaning agents on site and up-to-date daily cleaning schedules present and/or displayed in all the visited consultation rooms and delivery rooms. In many of the facilities (from dispensaries to district hospitals) surface cleaning including mopping in service rooms is done only once or twice a week; for some (like in a dispensary in Mbarali district) it was not possible to clean every day because they only received water once a week while others had planned to do mopping once or twice week in convenience bases (a hospital facility in Makete district).

In terms of the state of maintenance as it relates to IPC, we observed that between 20% to 30% of floors and 35% to 40% of walls in the HCFs had cracks, not properly finished, or otherwise not intact. Brocken walls and floors make it difficult to clean and harbors microbes that may be transmitted to other places. Other important factors observed included service room being difficult to maintain due to poor housekeeping (about 90%) and, same mops being used to clean dirtier and cleaner rooms presenting an important risk of cross infection in over 95% of facilities.

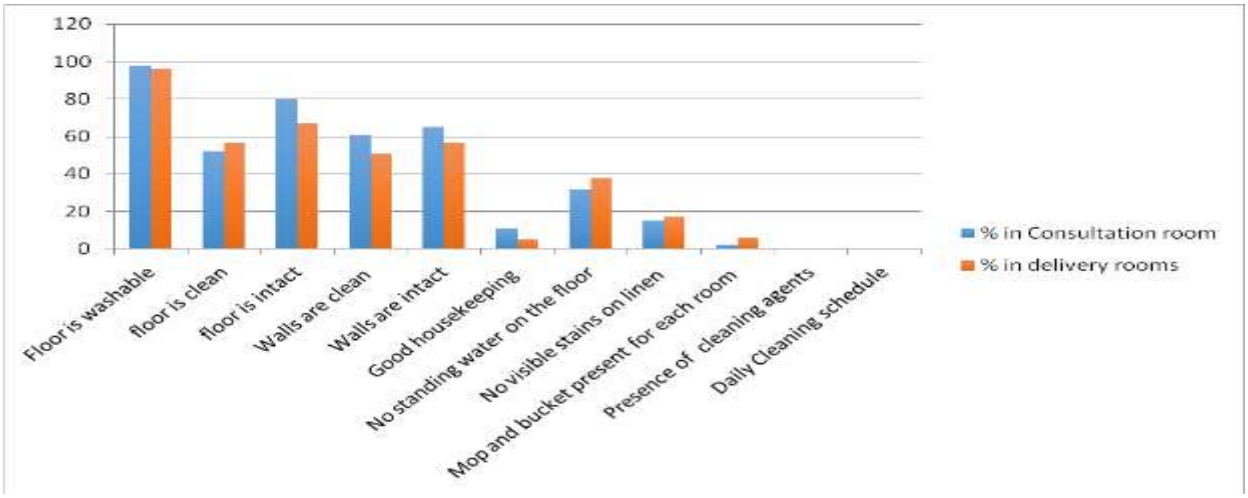

Figure 25: State of cleanliness and physical features affecting IPC in healthcare facilities

4.10 Auxiliary workers practices and opinions on the IPC in healthcare facilities

4.10.1 Hand washing practices

When asked if they wash hands when performing their duties, all auxiliary workers interviewed (100%) reported that they wash hands at some time in the process of executing their duties. The most common occasions reported were before and after finishing duties (78%). A smaller but significant proportion of respondents reported to be washing hands only after finishing cleaning activities or when they feel that their hands have gotten dirty (17%) as shown in Figure 26.

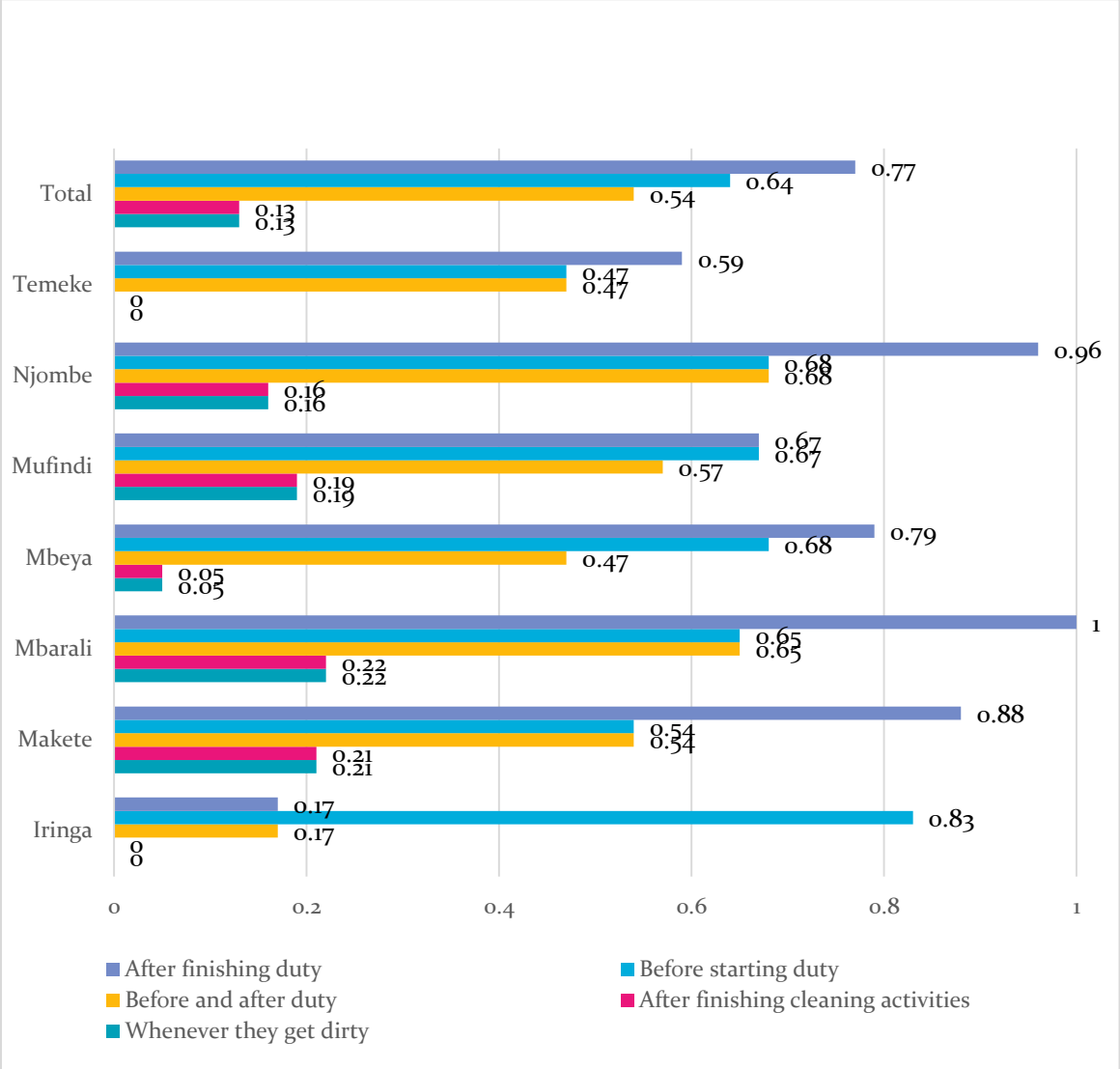

Figure 26: Times for washing hands are reported by auxiliary workers

Regarding adequacy of hand washing facilities 55% (n = 77) of auxiliary workers reported that the facilities were adequate in their respective facilities. If we compare reported adequacy of hand

washing across studied districts, more of the auxiliary workers from Temeke Municipal Council 71% (N=12) reported to have adequate facilities for hand washing whereas Mufindi District Council had the least percentage of workers reporting satisfactory number of hand washing facilities (38% (N=21)). Taking the proportions as the mean response on the adequacy of the hand washing facilities, one way analysis of variance (ANOVA) was used to compare the difference between the districts. No significant difference was obtained (ANOVA, unadjusted p-value 0.4938).

When we compared number of auxiliary workers reported adequacy of hand washing with regards to type of ownership of private and public facilities, faith based health workers reported more adequacy (89%), compared to public facilities (42%). There was a significance difference between public facilities and private (Test of Proportions, p-value= 0.0015), public facilities and faith based (p-value <0.001), however, was there was no significant difference observed between private and faith based facilities (Test of Proportions, p= 0.3582). When asked of barriers that hinder auxiliary workers in hand washing; lack of water, limited water availability, lack of soap, lack of time and no reason were mentioned. Lack of water for hand washing was the limiting factor mentioned by about 40% of respondents in Mufindi DC, but it was not the major hindrance for workers in Mbeya and Temeke districts (Figure 27). In the overall 1 in 5 of the auxiliary workers could not wash their hands properly because there was no water for hand washing at their work place.

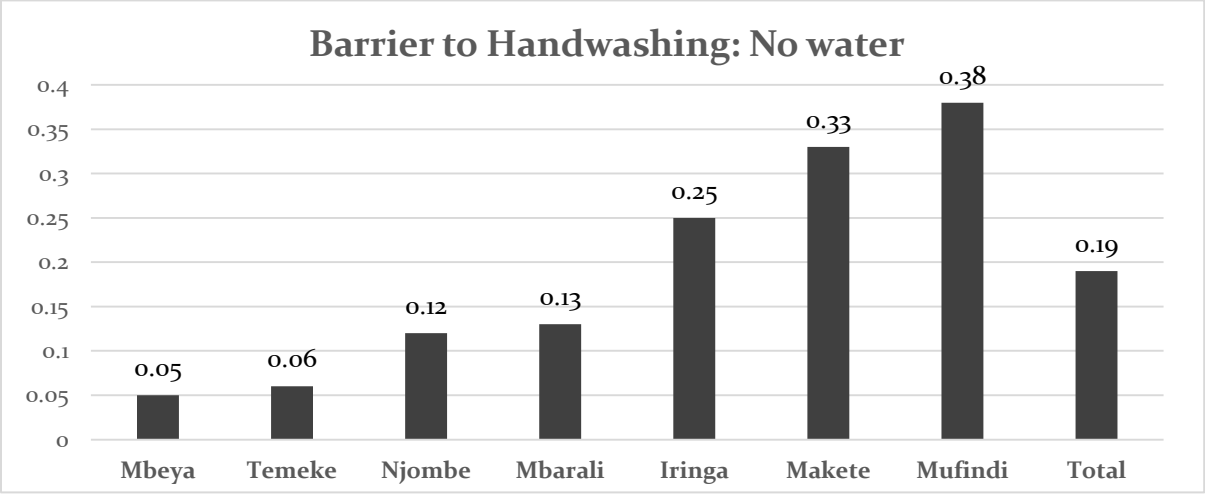

Figure 27: Absence of water for hand washing identified as a barrier to hand washing in healthcare facilities by district

4.10.2 Auxiliary workers personal hygiene and protective devices

Regarding availability of cloak rooms for personal cleanliness by auxiliary workers, 83% (N=141) reported to have no cloak rooms (or changing rooms) at work. Comparing availability of such facilities at different levels of service delivery, we found that 73% of auxiliary workers from district

hospitals, 50% from regular hospitals, and 87% of health centers and dispensaries did not have changing rooms in their working stations. With no changing rooms in place, auxiliary workers to change clothes or do proper cleaning when need to. Furthermore, the auxiliary workers, who are in the forefront of handling waste products and potentially infectious materials are forced to return home without adequate cleaning or bathing and/or not to change clothes. Absence of facilities for workers personal hygiene extends the work related health risks to workers families and the public at large.

4.10.3 Auxiliary workers opinion on the risk of acquiring infection

When asked if they were at risk of acquiring hospital infections 86% of auxiliary workers were concerned that they were in a danger of acquiring such infections. This agreement was consistent across healthcare facility levels, types, and between regions (ANOVA, for between region percentages gave an uncorrected p-value=0.0882). Thecommon infections of concern to auxiliary workers were were diarrhhoea, tubeclosis, and HIV-AIDS. When asked if they were provided by protective equipment (PPE), 41% of auxiliary workers said they were not provided by PPES all the time and threfore they performed duties for substantial times without protective equipment. Of the auxilliary workers 20% were not provided were any protective equipment. Auxiliary workers at disensaries reporterd to have the most stock outs (48%) of equipment compared to those from health centres (40%), regular hospitas (25%) and distirict hospitals (26%).

4.10.4 Sanitary facilities in health facilities

Majority (71% of the facilities had latrines at consultation area or customers reception; this included all (100%) hospitals, 93.75% of health centers, and 63.79% of the dispensaries visited. Of the sanitation facilities 55% were water based (flush toilets) or semi-water based (pour flush toilets) with varying design aspects see Figure . The large majority of the toilet facilities visited (91.07%) were functional at the time of visit. About two thirds of the facilites (66.07%) were accessible to clients. Facilities with latrines that were not accessible to clients included 43.24% of dispensaries, 13.33% health centers, and one out of two hospitals. It was observed that, 50% of the toilet facilities had separate compatments for male and female users. Both district hospitals, 56.67% of health centers, and 51.35% of dispensaries did not have separate sanitary convinience for males and females. There was more government owned facilities without separate latrines for different sex (56.10) compared to those owned by faith based organizations (27.27) ($Pr(Z > z) = 0.0438$).

Figure 28: sanitation infrastructure in healthcare facilities with clear concerns for cleanliness and maintenance. Facilities with unimproved forms or even none latrines were also found during the study.

4.10.5 Types of toilets/latrines observed in the surveyed health facilities

All hospitals had water based pour flush latrines at consultation or reception areas. Conversely, water based and semi-water based latrines constituted 80% and 43% of toilet facilities at consultation or reception areas for health centers and dispensaries respectively. Onsite dry latrines constituted 46.35% and 9.09% of government and faith based facilities respectively; none of the privately owned healthcare facilities visited had an onsite sanitary facility at their consultation rooms or reception.

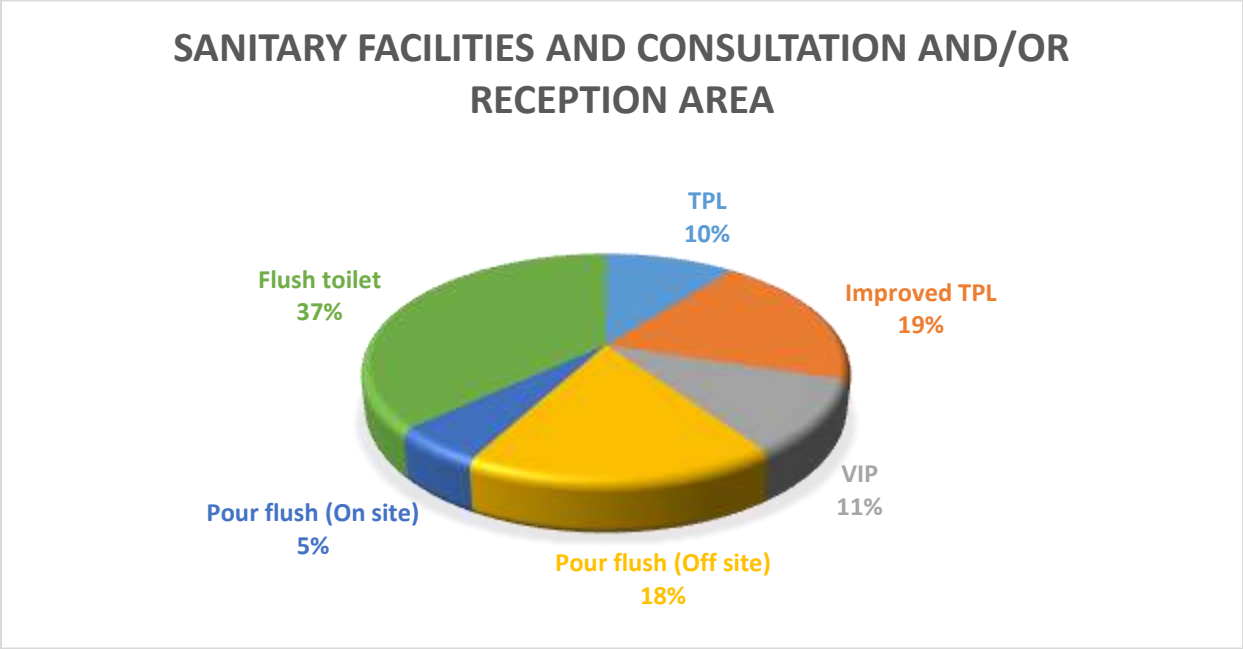

Figure 29: Distribution of sanitary facilities in consultation and/or reception areas

4.10.6 Cleanliness of toilets/latrines in the surveyed health facilities

Visual assesment of toilet cleanliness revealed that only 36% of toilets were found to be suficiently clean for normal uses. Besides visual cleanliness, 50% of the toilets/latrines did not produce any foul smell, and 75% of the facilities did not have flies coming from or surrounding them. Larger proportion (70.73%) of toilets were not sufficiently clean among government owned facilities compared to faith based facilities (45.45%) although the difference was not statistically significant $Pr(Z > z) = 0.0617$. Significantly larger proportion (56.10%) of the government owned facilities had their latrines producing faul smell compared to those owned by faith based owned facilities (27.27%), $Pr(Z > z) = 0.0438$. Government owned facilities had a substantial number of latrines that produced flies (34/1%) albeit flies production or surrounding was not obsrved in any of the faith based, nor privately owned facilities.

4.10.7 Toilet/latrine states of repair

Concerning the state of repair for toilet/latrine infrastructure, 50% of toilet building at consultation/reception rooms of healthcare facilities were considered to be in good state of repair, 80% had washable floor leaving 1 out of 5 facilities with floors not washable. Eighty eight percent of the facility latrines had doors that were lockable and ensured privacy and two thirds (66.07%) of the latrines had intact roof. Averaging the proportions for the three indicators of latrine maitenance (cleanliness) we realized that Iringa District had the lowest proportion of facilities that were properly maintained and kept clean while Mbarali district was the district with largest proportion of latrines being well maintained (See Figure 3030).

When we combined the four indicators of state of maintanance and repair of the infrastructures we found that Mbarali district had once again overall largest proportion (84.09%) of facilities with latrines in good state of repair among the districts followed by Mufindi, Mbeya and Njombe, while Iringa and Makete district had the least proportion of toilets/latrines in good state of structural repairs.

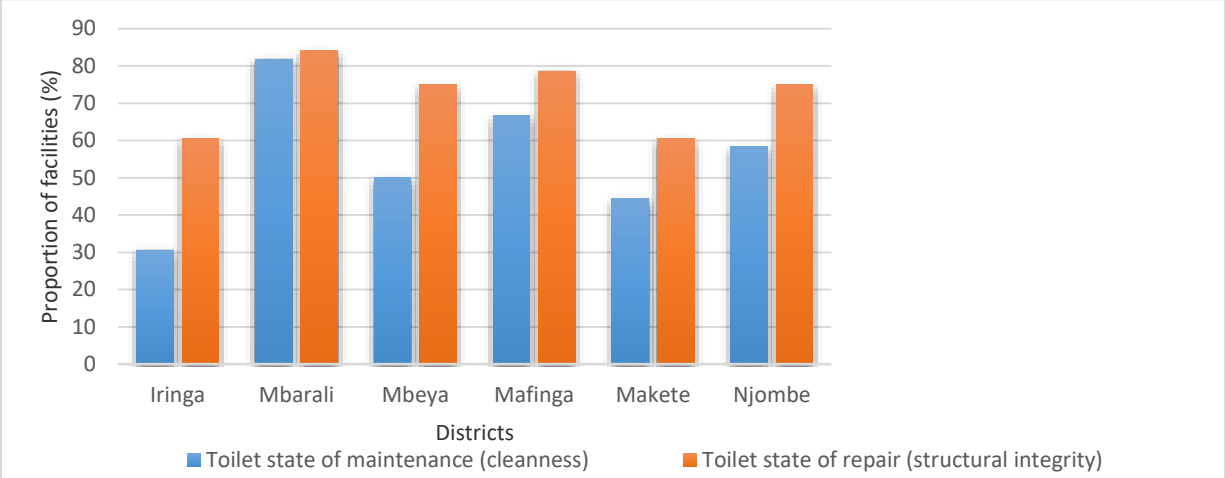

Figure 30: Proportion of facilities with toilets in good state of maintenance and repair by districts

The clients were asked in order to allude on their experiences with the use of toilets/latrines in healthcare facilities. A large majority of the respondents (93%) (, n=212) had used toilet facilities at some time during their visit or stay at a respective healthcare facility. A quarter (25.2 % (n=33) of the respondents reported not to find enough water at the toilet. Many respondents reporting not to find enough water were from government facilities (63.6 %). As for the anal cleansing materials the respondents reported to use water only for anal (83%) cleansing in the toilets/latrines. More than half of the respondents (55.7%) reported that the hygiene of healthcare facilities were very satisfactory or satisfactory.

4.11 Surveillance for infectious agents in health care facilities

Contamination of healthcare equipment, medicines, and water supplies with healthcare pathogens is a well-recognized cause of common-source outbreaks of healthcare acquired infections (HCAIs). Nosocomial transmission pathogens are shed into the healthcare environment probably by workers, patients, visitors etc. Several important pathogens including *Clostridium difficile*, methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Aspergillus* species and norovirus, have the ability to survive in the dry-surface environment, which may then become a source for transmission.

In the present microbial analysis of water samples from hand washing facilities, taps and storage containers in health facilities were analyzed for total coliform and *E. coli* count for 24 and 48 hours

duration. The absence of both signs (gas and acid production) in all cultures gave MPN values of less than two and for the positives the MPN values were recorded as guided by McCrady table. The findings revealed that, water samples from health facilities in all district councils surveyed were contaminated with *E. coli* and other microbe (Figure 31).

4.11.1 Microbial quality of water in healthcare facilities

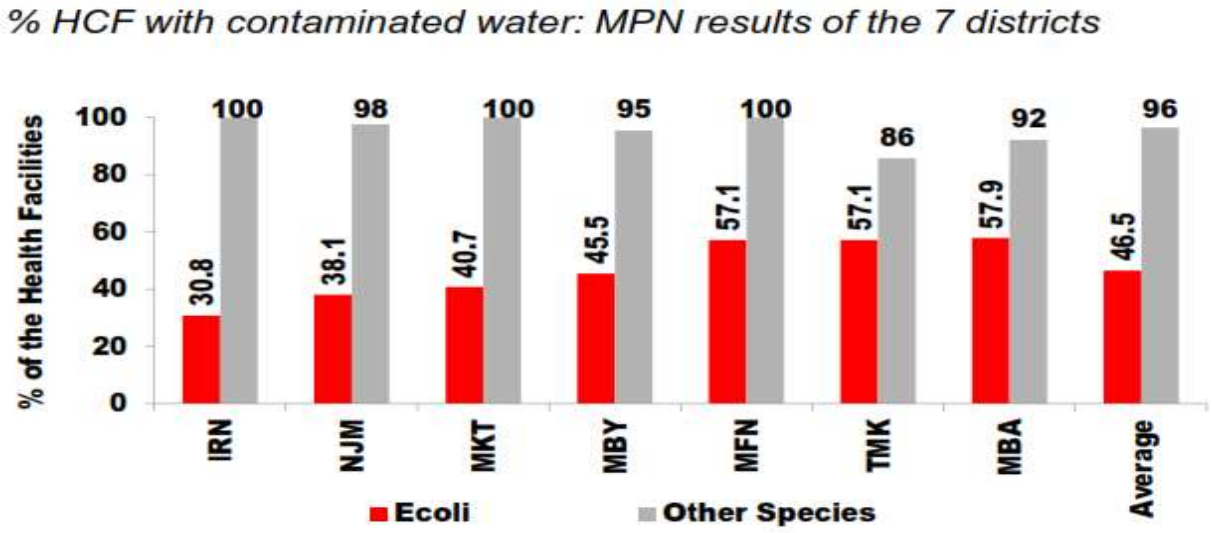

Figure 31: A graph showing MPN results of the 7 UNICEF programme districts

These results are consistent with those reported by Ahmed *et al*., 2013 on qualitative analysis of drinking water through the MPN method. In a confirmatory test to all positive MPN tubes, *E. coli* colonies were detected and these appeared bluish black by transmitted light and had a greenish metallic sheen by reflected light (Figure 32). This observation has been also reported by Ahmed *et al*., 2013 whereby, the indicator bacterium *E. coli* was observed in water samples. In this study, other bacteria were observed to be many ranging from 86% - 100%.

On the cultural characteristics of the few that were able to grow, were discovered to have three different bacterial colonies attributes. One group showed swarming kind of growth on a culture media. Another group produced greenish pigment (after 48 hours of incubation). The last group contained strains which had mucoid type of colonies. All reacted negatively with Gram stain.

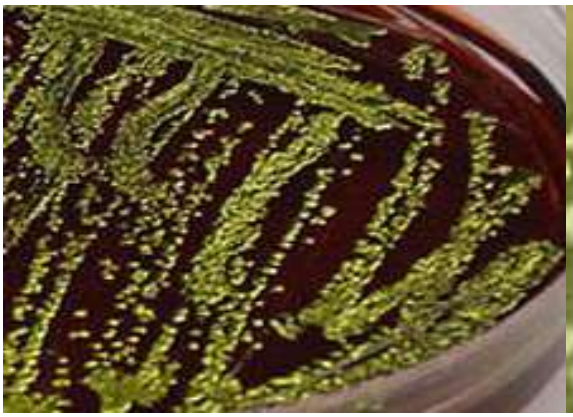

Figure 32: Greenish metallic sheen: *E. coli* colonies by reflected light on Eosin Methylene blue agar plate.

Figure 33**:** Green pigmented colonies on Nutrient agar plate

*Figure 34**:** Mucoid colonies on Nutrient agar plate*

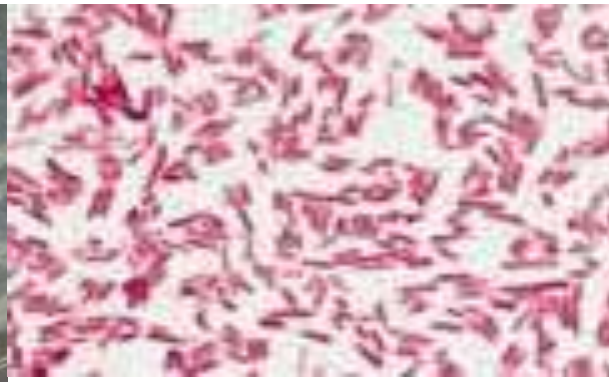

Figure 35**:** A Gram negative reaction (1000X) of one pure isolates

The biochemical tests identified them as *Proteus* spp, *Pseudomonas* spp and *Klebsiella* spp as shown in table 4.

Table 4: Biochemical tests findings:

Identified microorganism	**Methyl red**	**Urease**	**Citrate**	**Voges-Proskauer**	**Indole**
Pseudomonas spp	+	+	-	-	-
Klebsiella spp	+	-		+	+
Proteus spp	-	-	-	-	+

Total coliform (TC) in water samples were found to range from 0.15 - 110 MPN/mL in Temeke DC, 0.23 - 4.6 MPN/mL in Mbarali, 0.036 - 2.4 MPN/mL in Mufindi & Njombe and 0.15 -2.4 MPN/mL in Iringa & Makete (Table 5). The MPN values show that, Temeke DC water samples are most contaminated followed by Mbeya and Mbarali.

Table 5: Total coliforms and fecal coliform values

District	**Total Coliforms (TC) MPN/mL**	**Feacal coliforms (FC) MPN/mL**
Temeke DC	0.15 - 110	0.036 - 0.93
Mbarali & Mbeya	0.23 - 4.6	0.074 - 2.4
Iringa & Makete	0.15 - 2.4	0.036 - 0.93
Mufindi & Njombe	0.036 - 2.4	0.23 - 4.6

These findings agree with Antony and Renuga (2012) but also with Ahmed *et al*., 2013. These earlier researches reported the coliforms and other pathogenic bacterial species as members of the *Enterobacteriaceae* family. This particular study has also observed the so called other bacteria to belong to *Enterobacteriaceae* family by being Gram negative by the Gram reaction and identified by the biochemical tests as *Proteus* spp, *Pseudomonas* spp and *Klebsiella* spp.

According to the World Health Organization (WHO);s Guidelines for Drinking-water Quality, 4th Edition and Water and Wastewater Quality Monitoring Guidelines for Water Utilities (2014), water samples should not contain any coliform organisms or should not be detectable in 100 ml of any two consecutive samples and no sample should contain *E. coli* in 100ml. These current findings support results of a previous study done by Antony and Renuga. 2012 which reported that, all water samples from the study sites were contaminated with high amount of bacterial population than Indian acceptable limit. Based on Indian standards (BIS, 1981), throughout the year, 95% of samples should not contain any coliform organisms or should not be detectable in 100 ml of any two consecutive samples and no sample contains *E. coli* in 100ml. The desirable limit of coliform in water is 10 MPN/100ml. On the other hand, Kassenga, 2007 reported that, other sources of water

in Tanzania such as shallow wells, dug wells, and open ditches are considered to be unsafe for drinking purposes.

4.11.2 Microbial quality of air in healthcare facilities

The findings on air exposure method established that, hospitals had high microbial count (CFU/m^3) in postnatal wards but Health centers and Dispensaries had high Microbial count (CFU/m^3) in labor rooms.

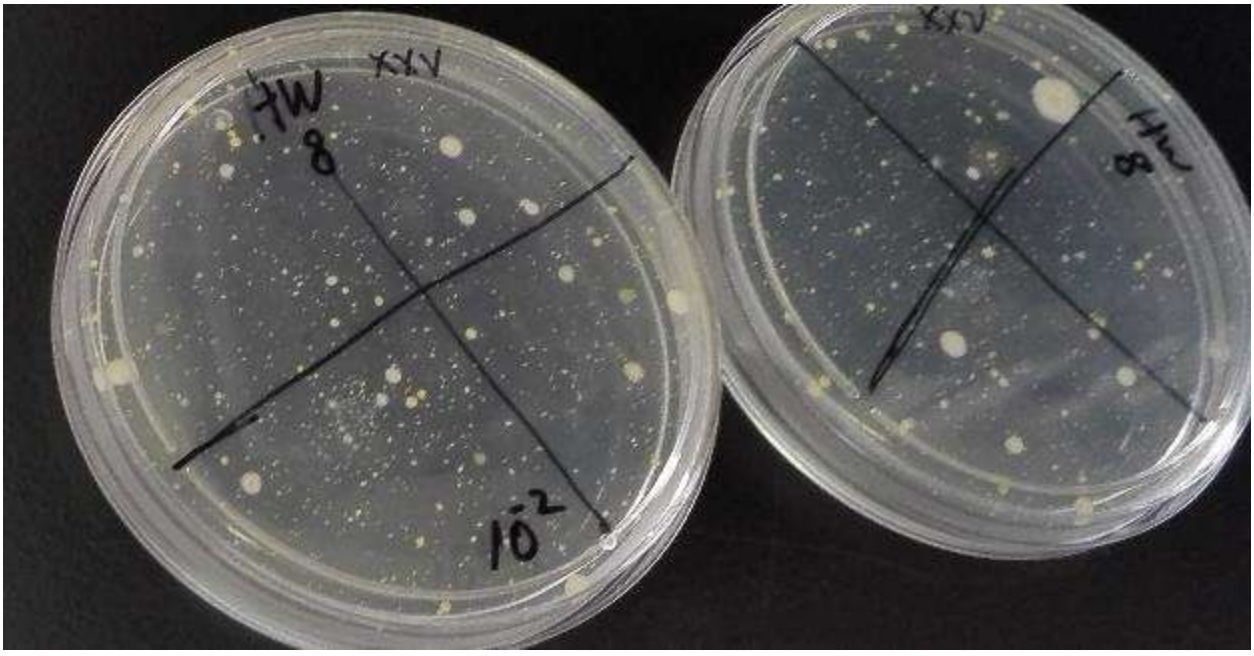

Figure 36: A photograph of plates showing different microbial strains

In this study, Temeke and Mbarali DCs were found to have the highest Microbial count. Whilst, Iringa DC had the lowest Microbial count**.** These results point out that the air in almost all Health facilities was generally contaminated and a clear presence of various microorganisms was observed (Figures 35 & 36). However, a quantitative explanation of the results describing the air quality in Health facilities investigated is difficult due to the lack of established standard and indicative values. Generally information on appropriate significant level of inside air contamination with microorganisms is lacking in Tanzania. Airborne transmission is one of the routes of spreading diseases responsible for a number of Nosocomial infections (Claudete *et al*., 2006). Although the airborne microorganism levels reported in this study should not be directly interpreted as inhalation exposure because they were obtained from randomly exposed plates, but these results can be useful to assess airborne microorganism levels generated under various health facilities situations.

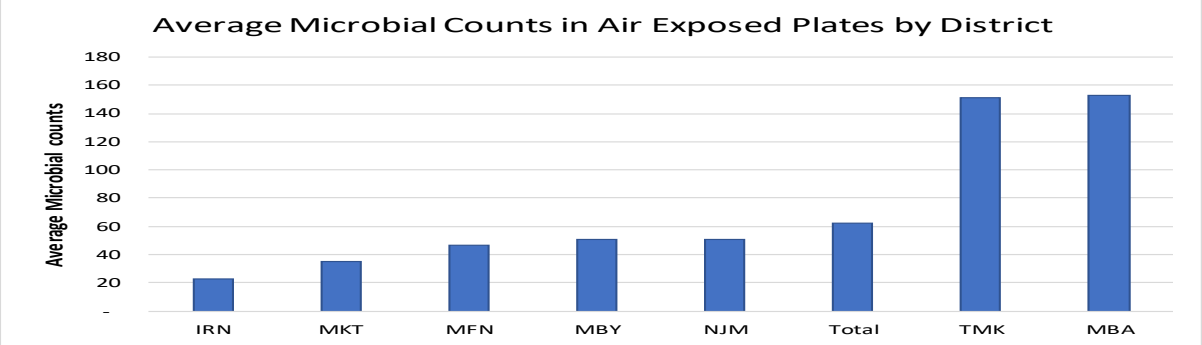

Figure 37**:** A graph showing air exposure colony count by district

Previous reports have also revealed that, outside hospital's air is somewhat accountable for a number of inside air microorganisms. This study agrees with this as most of examined infrastructures' are not pleasant. Other Researchers from other parts of the world have gone further signifying that, some interior causes of airborne microorganisms in hospital environment include utensils/apparatus engaged for clean-up, aeration structures (like fans and air conditioners) but also the personnel activities (Douwes *et al.*, 2003; Luksamijarakul 2012).

A higher degree of microbial count (CFU/mL) of HFs Staff and Clients hands was observed. 94.4% of the hand washes from staff and clients had microbes. Only 5.6% (n=3) were found without microbes, these were 2 Duty staff (Iringa and Njombe) and 1 client (Iringa). A study of Pittet *et al*., 2006 reported that, the hands of healthcare workers (HCWs) are the most common vehicle for the transmission of micro-organisms from patient to patient and within the healthcare environment. Another report denoted that, contaminated hands play a key role in transferring fecal particles from one host to another. A person who practices inadequate hand hygiene after defecation can transfer pathogens to other persons through direct interpersonal contact, contact with inanimate objects and surfaces, and food preparation (Pickering *et al*., 2010).

Figure 38**:** Microbial population from hand rinses of duty Staff by districts

Figure 39**:** Microbial population from hand rinses of Clients by districts

But also, it is known from a previous report that, the density of bacteria which may limit colonization with more pathogenic microorganisms on normal human skin ranges from 10^2 to 10^3 cfu/cm^2. Beyond this limit signifies hygienically problem (Mackowiak 1982). This truth has been observed in this study as the results indicated are beyond these levels. Another observation of this study was that, client hand rinse samples had more CFU/mL compared to CFU/mL Staff samples (figure 9). Such a declaration was also reported by Pickering *et al*., 2010.

4.12 Healthcare waste management in healthcare facilities

Health care waste management (HCWM) has been and continues to be an essential aspect in the prevention of infections among health workers, enhancing public health and protection of the environment. Since 2004, the Ministry of Health and Social Welfare (MoHCDGEC) in collaboration with various stakeholders has been very active in implementing activities that are geared towards improving the quality of infection prevention and control for reducing potential negative impacts of health care waste to humans and the environment. The unsafe disposal of health-care waste (for example, contaminated syringes and needles) poses public health risks (Manyele, and Mujuni, 2010). Contaminated needles and syringes represent a particular threat as the failure to dispose of them safely may lead to dangerous recycling and repackaging which lead to unsafe reuse. During incineration more toxic forms of some of these substances can be created. The three most important constituents of the emissions, in terms of health effects, are particulates, heavy metals and combustion products of man-made chemicals; the latter two can be adsorbed onto the smaller particulates making them especially hazardous. In Tanzania, most hospitals had low incineration capacity, with few of them having fire brick incinerators (Manyele and Anicetus, 2006). Again Waste segregation practices are generally deficient in most health facilities, which may result into injuries such as needle stick injury to healthcare workers (Kayumba and Anicetus, 2012), In some cases those injuries incidences have resulted into acquiring of infections by healthcare works employees during health delivery services (Kassile *at el.*, 2014).

4.12.1 Healthcare waste management practices and infection prevention measures

Healthcare waste management practices and infection prevention measures was assessed among health care workers in the surveyed health facilities. The study identified issues that impede a proper infectious waste management and infection prevention and control (IPC) practices. Gaps and deficiencies were observed related to segregation, collection, storage and disposal of healthcare wastes and laxity in applying IPC principles, hence posing health risks to the patients, healthcare workers, the environment and the community at large. Poor safety, insufficient budget, lack of trainings, weak monitoring and supervision, and poor coordination has eventually resulted in improper waste management in the surveyed health facilities. The study findings indicated that, majority of the healthcare facilities under the study had no recommended methods for waste treatment and disposal. Almost 98% of the study population (HCF), relies on open burning and burnt structures which pose a high health risks to the nearby residing community. Of the overall HCF, only Temeke District hospital was found to have a better way of treating and disposing healthcare waste. Majority indicated to be aware of the importance of Infection prevention but practically not put in action due to lack of reference guidelines and training to majority of the healthcare workers. This could be due to more effort being devoted to Regional and Referal hospital leaving the districts HCF not backed up.

4.12.2 Availability of standard HCWM equipment

The study findings results concerning availability of standard HCWM equipment in the visited health facilities across the study area. As evident in the **figure below**, availability of standard health care waste equipment was poor in most of the regions visited, that is, most of the health facilities in the regions lacked essential standard HCWM equipment. These included waste bin, bin liners, and transportation facilities, thus posing a great challenge for proper management of waste for improving quality of services in health care facilities in the country. Furthermore, most (84%) of the facilities lacked plans for HCWM. Moreover, in most of the facilities (about 70%), waste containers were not labelled as required, suggesting lack of best practices for HCWM within the concerned facilities. equally; this malpractice presents a potential risk for environmental pollution.

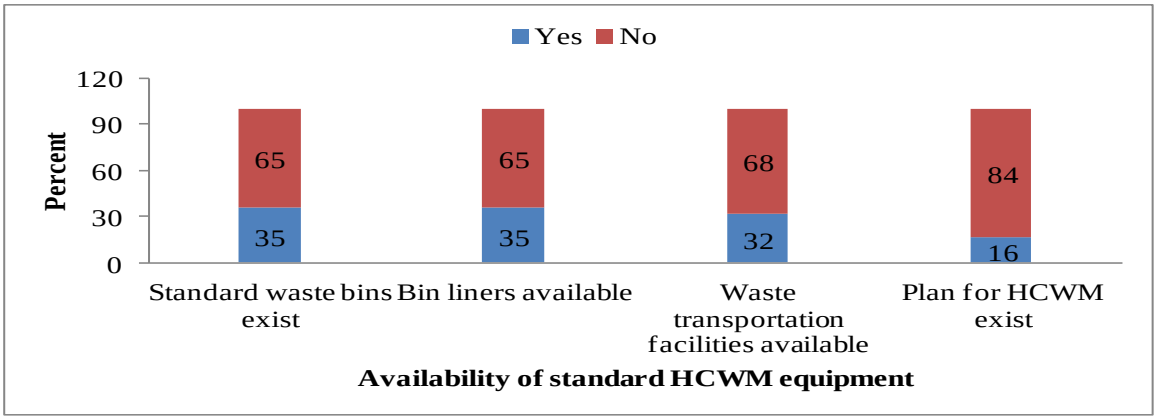

Figure 40: Availability of standard HCWM equipment

Other challenges include limited training opportunities, unavailability of national guidelines for IPC and HCW, weak communication with supportive stakeholders, unavailability of supplies from Medical Stores Department, lack of suitable personal protective equipment, and standard health care waste storage containers, bin liners, and incinerators. Segregation protocols were also not adhered to by the Majority of healthcare facilities.

Figure 41: Scenarios on health care waste management in health facilities

4.13 POLICY AND GUIDELINES ON WASH AT HEALTHCARE FACILITIES

4.13.1 Knowledge on policy and guidelines on WASH at healthcare facilities

Our findings show limited understanding on policy and guidelines on WASH at healthcare facilities at the regional and district levels. The most commonly mentioned policy and guideline was that of Infection Prevention and Control (IPC) at health facilities that was mentioned mainly by health officers at district level. However, at the national, level there was adequate understanding of WASH policy and guidelines at health facilities though informants indicated to have the documents as soft copies, and given limited resources such copies were not produced and distributed to regional and district levels where WASH activities are currently being carried out. The most common mentioned WASH guidelines regarding health facilities were construction of buildings stipulating the ratio, location of toilets, number of toilets and number of people in relation to use of toilets. The guides are developed by the Ministry of Works in consultation with Ministry of Health Social Welfare and Ministry of Water including National Water Policy of 2002 (NAWAPO), specifically guide construction of health facilities but not specific on WASH amenities alone.

> *"There is general guideline for construction of health facilities at all levels including WASH amenities. For example every consultation room must have a wash room, wards must have enough wash rooms depending on the number of people, wash room should consider people with physical challenges- disabled people"* KII, National Level

There was increasing attention especially at the sector ministerial levels to include WASH components at health facilities in the planning including Big Results Now (BRN) Strategy and the National Sanitation Campaign, Phase II, which started implementation in July 2015, unlike for Phase I which concentrated on households and primary schools. However, the

> *"Implementation of wash is guided by Water Sector Development Programme it has component of sanitation and hygiene. And from this we have created what we call, National Sanitation Campaign that deals with improvement of environmental sanitation (toilets, hand wash facilities and water provision in areas we intend to put sanitation facilities) these are inseparable, water is a core, we are guided by water sector development programme policy we are in the process of creating national hygiene and sanitation policy so that to spear head the implementation of national sanitation campaign. In national sanitation campaign we also entail to improve sanitation in health facilities as well"* KII, National Level

Another example of policy guideline for WASH at health facilities developed by the Ministry of Health and Social Welfare in collaboration to development partners in 2014 is the National Catalogue for Health Care Waste Management Equipment and Disposal Methods.

The general conclusion from this section is the fact that there were limited policy guidelines that were in place to guide implementation of WASH intervention at health facilities, but interest and attempts are underway to develop such guidelines. If such guidelines are available, they are in soft copies at national level, and dissemination has not tricked down to regional and district levels.

4.13.2 Effectiveness of collaboration among key actors implementing WASH programmes

It emerged that there existed collaboration involving key stakeholders implementing WASH interventions at regional and district level though in some other districts such collaboration was not effective. Informants at regional and district levels acknowledged that with the introduction of WASH intervention in the education sector; School Water, Sanitation and Hygiene (SWASH) in the studied district collaboration of key sectors was strengthened. These sectors are water, health and education through co-ordination of District Planning Department.

Our findings show that the success of strengthened effective collaboration in implementing SWASH project in the studied districts included the following elements:

i) Joint planning
ii) Joint implementation of SWASH activities
iii) Joint monitoring and evaluation of activities
iv) Transparency in the use of financial resources at all stages of implementation of project

v) Good and effective leadership in bringing the actors together and in resolving problems when they arise.

Good examples of show case on effective collaboration in the implementation of SWASH project are Mbarali District Council and Njombe District Council. Another avenue which strengthened collaboration among key stakeholders is the National Sanitation Campaign – a sector wide approach implemented in the studied districts.

> *"Key to the success in implementing SWASH in this area is team work. We move as one during planning, implementation and evaluation. Transparence is there in all stages and if there is a problem is resolved during regular quarterly meetings. Effective leadership is central to see that key actors work together*" Key Informant Interviewer, Njombe Region.

It appears that key sectors should meet on quarterly basis through District Water and Sanitation Team (DWST) to discuss WASH activities in the studied districts. However, in emerged that in absence of project initiatives such as SWASH and National Sanitation Campaign such meetings could not be convened on quarterly basis main reasons being lack of quorum, other competing activities and lack of funding. Rarely such teams discussed WASH activities in the health facilities.

Key challenges identified that impede effective collaboration at regional and district level were lack of funding to implement WASH activities, lack of transparency in the use of resources, delays in procurement in implementing SWASH activities. Political interference especially in dividing and separating District Councils was also mentioned and a case in example in Mufindi Town Council which has been separated from Mufindi District Council in July 2015 of which most of staff with experience in implementing SWASH work in Mufindi Town Council which is not UNICEF supported SWASH site.

Another key challenge identified is political interference of use of SWASH funds to finance construction of laboratories in secondary schools thus deviating from initial plan of improving WASH in primary and secondary schools. In Mufindi District Council, for example it was revealed that in 2013/2014 more than 200 million shillings meant to improve WASH in in schools were diverted and used for other activities including construction of secondary school laboratories.

At the national level, key WASH actors from sector ministries of health and water and those of NGOs admitted to have a certain level of collaboration with departments that deals with WASH. It was revealed that key actors on WASH including health sector, education and water sector, these three sectors through departments that deal with WASH issue meet in a quarterly basis together with development partners to discuss WASH issues. Other key actors were PMORALG and education sectors. Such collaboration at national level was generally considered good, of which the Ministry of Water was a convener of such meetings. It was further revealed that in a situation of planning and implementation of WASH initiatives such as National Sanitation Campaign such meetings became were more frequent.

> *"We have four key ministries that work jointly, PMORALG, Ministry of Health, Ministry of Education and Culture and Ministry of Water. The Ministry of Water is the custodian of*

WASH resources, all the money and equipment are coming through this ministry, we also report to this ministry. We have also partners, we have strong collaboration, first of all, they fund us, second they are committed to work on WASH, we also have leaders, who are positive in supporting WASH programs which make collaboration effective, *leaders like, Director of Preventive Services, Chief Medical Officer, and Permanent Secretary"* KII National Level

However, such collaboration was not binding and if one key actor failed to participate in the WASH meetings, there was no organ above that could question and make the key actors accountable. This was a key weakness identified at the national, regional and district level. It also emerged that some actors were implementing WASH activities in selected districts and modality of selection of districts was not clear and in some cases there was no joint effective planning, implementation and monitoring of WASH activities involving all actors as WASH programme is a cross cutting issues.

It can be concluded that experience of implementation of SWASH and National Sanitation Campaign strengthened collaboration of key sectors in addressing WASH issues at education sector and at the household level. This experience is an asset and vital if interventions to address WASH will be implemented at the health facilities especially where implementation was a success story.

4.13.3 Priority level of WASH interventions in healthcare facilities

It appeared that WASH Interventions at healthcare facilities was not a priority currently in relation to planning and budget allocation in the studied districts. Less than 1% of budget in the health department was planned and allocated funding on WASH activities at the health facilities for the financial year 2014. Other than funds from UNICEF and National Sanitation Campaign there was very limited or not at all allocation of district budget in addressing SWASH problems at schools and household level.

Key reasons identified for the anomaly above are:

i) Lack of awareness in improving WASH infrastructure at health facilities from national to district level
ii) ii) Limited and inadequate funding especially from own sources of studied districts
iii) iii) Budget ceiling limitation is already guided by Central Government on resource use there is no enough budget for WASH on health facilities iv) Investment in WASH infrastructure at health facilities especially construction of Water projects in health facilities is huge and needs huge budgets of which district councils cannot afford.

"It is not that WASH is not a priority at health facilities – the main problem is scarcity of water in this district bearing in mind that water projects need huge resources which cannot be accommodated by council health budget. For example, district own collection in 2014 was less than 1 billion Tshs, the amount which cannot even pay for salaries of teachers

and health workers. While supplying water in hospital or health center in this district you need billions on shillings" Key Informants Interview, Njombe Region

It also emerged that communities are more sensitized to mobilize resources to address WASH problems at schools than at health facilities. One way to improve and sustain WASH interventions at health facilities is to mobilize communities to contribute in the construction and maintenance of WASH infrastructure in health facilities so as to build community ownership of such facilities. Community Owned Water Supply Organizations (COWSOs) were identified as important grassroots initiative organizations to mobilize resources and maintain WASH infrastructure at the health facilities.

It seemed that politicians were more interested in tangible buildings which could be seen physically by the electorate to win their votes and confidence other than non-tangible things such as improving sanitation in health facilities. This explains why there are many new dispensaries with no running water and poor sanitation of which such dispensaries lack also minimum standards of health workers. It appears that there is limited awareness of proper use of toilets at health facilities. Some of health public health facility toilets were locked due to abuse by users. This necessitated the keys to be kept by a personnel and this key is only made available on request by users.

'*You get the key at the secretary's office if you need to use a toilet. It is surprising that you have to request a key to use the toilets at health facility though use of toilet is a basic need. The problem is widespread not only in health facilities but in many offices and public sector even at council level offices'* KII Iringa Region

At the national level, all key informants at WASH sector ministries as well as development partners and NGOs agreed that interventions on WASH at health facilities for planning and budget allocation was currently not a priority. It emerged that the Ministry of Health and Social Welfare receive funding from the central government, including basket funding. In health sector for example the big challenge is priority setting, with meagre budget there should be a carefully planning and priority setting to incorporate WASH programmes adequately.

It was noted that, in the health sector WASH interventions is not their priority; as much of the budget goes to medical/ treatment in terms of buying of drugs rather than prevention.

"For example in health sector, the priority is on medical devices, or rather treatment like buying of medicines and the alike, WASH is not a core function in health and this is a big challenge, even though in health sector water, hygiene and sanitation are crucial." KII National Level.

Yet another key informant at national level further argues;

"For example budget in the basket fund is treatment services, in WASH the budget allocated is very minimal, and they just allocate cleanness equipment only, such as brush, gumboots and slashes. In the past three years, the budget for sanitation and hygiene was cancelled, what was given priority was medicines and diagnostic equipment. WASH component was not an issue, although we advocate at least 60% of health budget should

be on sanitation. We go back to priority setting and ignorance on how we finance the health sector "KII National Level

Another key informant from one of sector ministries lamented;

"Noted at the national level that priority is on curative and not preventive services. For example in health sector supportive services, clinical and managerial services are given priority such DMO, nurses, and building all these are managerial , people are being attended, they get medicine off they go, but supportive service like electricity and water are not given priority; that is typically lack of priority and ignorance , they do not know that toilet is part of health facility, part of house and part of school, even in some councils when they plan, issue of environmental health is given limited priority. Even if you go today at national hospital, Muhimbili there are no adequate toilets. Absence and adequacy of number of toilets is another issue, when you go to health facilities in regions, waiting place where patients queue, there is no single toilet" KII National Level

However, our findings show a growing voice and eagerness to advocate for increased awareness to allocate resources to address WASH problems especially after success implementation of SWASH in the education sector. The main challenge however is availability of resources.

4.13.4 Monitoring and supervision and maintenance of WASH services at healthcare facilities

Monitoring and supervision of WASH infrastructure at health facilities is done by Council Health Management Teams (CHMTs) through supervision checklist matrix which also includes WASH areas. However, effective supervision was sometimes affected by availability of transport given large geographical size of studied districts. Other identified mechanism for monitoring and maintenance of WASH infrastructure at the facilities is Community Owned Water Supply Organizations (COWSOs). Such organizations repair WASH infrastructure by using resources they collect in the providing of water at the areas. It appeared that if maintenance and construction costs are high then COWSOs will report to Ward C Meetings which will later report to Council for inclusion in the district water plan. One challenge identified is the fact amount of money collected by COWSOs is little necessity need of additional support from central government and other partners.

Findings from national level show that since there is no clear policy for WASH in health facilities, even the monitoring and supervision was not specifically for WASH. At the Ministry of Water, Department of Policy and Planning coordinates all monitoring and evaluation activities using indicators to evaluate quality of water. Physical and bacteriological indicators are used and the evaluation for water quality is done by chemist and laboratory technicians. Usually the supervision team is comprises of people with different professions.

"When we go for supervision we do not have anything special for health facilities, we may go to the health facility as one of our beneficiaries, if for example we visit a place for

supervision we can visit one of the institution in the area, this could be a school or health facility. However, rarely we conduct joint supervision involving water and health departments unless there is implementation of WASH initiative such as SWASH and National Sanitation Campaign" KII National Level

Responses from development partners, (Non-Governmental Organizations) regarding the issue of monitoring and supervision WASH services revealed minimal level of monitoring and supervision and even if they do supervision it is not proper because health inspectors who have been assigned the job are not doing their job.

It was further revealed that partners currently do not have indicators, and the monitoring tools are not updated. It was further revealed that evaluation is expected to be done once a year from district level using data from lower levels but it is not done as it is supposed to be done. Monitoring and evaluation at national level is done is being done mainly in project implementation areas in collaboration between partners and sector Ministries of water and health. At Ministry of Health and Social Welfare level supportive supervision on WASH is done mainly at referral, regional and at district hospitals.

"We do monitoring at different levels, under National Sanitation Campaign Phase II we do supervision at schools, households, and transport hubs and recently we have also started in health facilities, especially a regional and referral hospitals which we visit twice a year. This is done through supportive supervision and we assess the provision of wash facilities using a check list" KII National Level

It was noted that with availability of funding for National Sanitation Campaign in which they have included health facilities to start with they have added regional and referral hospitals since July 2015.

5.0 CONCLUSIONS

This first comprehensive baseline survey on water, sanitation and hygiene (WASH) in health care facilities in Tanzania has found the situation 'alarming' as concluded below.

5.1 WASH INFRASTRUCTURE, SUPPLIES AND EQUIPMENT

The study has identified inadequacies in WASH infrastructure in terms of provision, design, construction, and maintenance.

5.1.1 Water supply infrastructure and service adequacy

Water supplies were inadequate both for general (quantity wise) and specific uses (in terms of quantity and required qualities) such as for drinking or specific medical uses. At least 60% of the surveyed health facilities were not connected to community tap water supply sources with concerns on accessibility of supplies; one out of 5 the facilities obtained water from unimproved sources. Only 30% of handwashing points were connected to water mains. Water supplies were found to be

mainly intermittent in facilities categorized or connected to be serviced by tap water as 40% of the HCFs experience water supply interruption for at least two days a week.

5.1.2 Hand hygiene infrastructure and service adequacy

The state of infrastructure for hand washing was regarded as inadequate as an essential hygiene element in healthcare services both in terms of quantity and type of facilities. One in four healthcare service room did not have hand washing point at all. About half of the hand washing facilities among those provided in consultation rooms and two out of three in delivery rooms were rudimental (locally assembled; not meeting material standards, not placed at convenient height, not connected to drainage systems). Only moderate proportion of hand washing points (51% - 79%) were provided with soap: Hand washing points were some of the most poorly maintained facilities compounding their provisional inadequacy.

5.1.3 Sanitation infrastructure and service adequacy

Sanitation services are inadequate and deficient in standards necessary to maintain the cleanliness, comfort, prevent the spread of infection, and to be a positive agent for change among facility staff, clients, and community. About 30% of HCFs mainly dispensaries and health centers did not have functional latrines for outpatient services users. Among the latrine facilities available 10% were of traditional (virtually unimproved) form and 40% onsite direct to pit type. Two out of three latrines were not sufficiently clean.

5.1.4 Safety of Water supply service

Safety of the water being supplied and used in healthcare facilities remains a matter of critical concern as basic water safety requirements in facilities have not being adhered to. About 60% of HCFs mainly composed of dispensaries and health centers had water supply systems categorized as high risk based on 9 points criteria. The surveyed healthcare facilities were not treating water and facilities management not aware of treatment being done at source. Neither were there records of use of regular nor incidental monitoring of quality of water (from within or outside the facilities) were found virtually at the study facilities.

5.2 SANITATION AND HYGIENE KNOWLEDGE AND PRACTICES IN HEALTH CARE FACILITIES

The study has identified the existence in most of the health facilities of inadequate knowledge, practice, infrastructure design, construction of handwashing facilities and supplies as follows:

5.2.1 Hand hygiene

i. Inadequate knowledge on proper hand hygiene techniques and procedures
ii. Inadequate hygiene infrastructure and supplies, including reliable running water, soap, antiseptic etc.

5.2.2 Healthcare environmental hygiene

i. Cleaning schedule not up to date and not adhered to in most of the health facilities.
ii. Inadequate training on proper cleaning techniques and procedures for Medical Attendants and other responsible supporting staff.
iii. Inadequate cleaning equipment and supplies
iv. Inadequate supportive supervision on hygiene in healthcare facilities.

5.2.3 Healthcare environmental sanitation

i. Inadequate waste management (deficiencies in segregation, transportation and disposal)
ii. Most of health facilities have unsanitary latrine/toilet facilities for patients
iii. Inadequate training on proper environmental sanitation techniques and procedures for Medical Attendants and other responsible supporting staff.
iv. Responsibilities regarding sanitation in health facilities are often not well defined, neither within the HCF itself nor within the LGA, MoHCDGEC and MoWI organizational structures
v. Inadequate supportive supervision on sanitation in healthcare facilities.

5.3 EXISTENCE OF INFECTIOUS MICROORGANISMS IN WATER SAMPLES, AIR AND TOUCH SURFACES IN HEALTH CARE FACILITIES

Microbiological analysis of water samples have confirmed the physical observations indicating contaminated of water supplies in HCFs. Water used in the facilities are largely contaminated posing risk of transmitting infection hence unsuitable for drinking or other clean applications within the HCFs. Over 95% of samples were contaminated with bacteria, half of which were contained e. coli. A number of known nosocomial agents (*E. coli*, *Proteus* spp, *Pseudomonas* spp and *Klebsiella* spp) were also isolated in facility contact surfaces including items in delivery.

5.4 WATER, SANITATION, AND HYGIENE FOR MATERNAL AND NEWBORN HEALTH

We found a number of risk factors for transmission of infection prevailing in and around delivery facilities from, inadequate hand washing facilities, poor state of indoor hygiene of labor facilities, absence of clean bathrooms and toilet facilities, and inadequacy of water supplies for delivery rooms. Results from physical inspection have been complemented with microbiological samples of air swabs from touch surfaces, hand washes, and air exposures all showing high degrees of microbial contamination. Conditions of delivery services are alarming and there is now sufficient evidence that warrant greater attention from stakeholders.

5.5 HEALTH CARE WASTE MANAGEMENT (HCWM)

Healthcare waste management practices namely segregation, collection, storage and disposal of healthcare wastes were found inadequately practiced in the visited health care facilities.

5.6 CHALLENGES FACING MEDICAL ATTENDANTS/AUXILIARY WORKERS IN HEALTHCARE FACILITIES

The cleanliness of healthcare facilities is an important component in the provision of clean safe care. Cleaning of healthcare facilities is essential in maintaining an environment with a low pathogenic burden which is critical in avoiding complications during the care and improvement of patients. Health and safety concerns require specialized training for cleaning services at healthcare facilities. Cleaning serves the healthcare industry the dual functions of:

(i) Surface cleanliness, and
(ii) Infection prevention and control.

As such, healthcare settings require intensive and frequent cleaning with a wide range of products. Medical Attendants/Auxiliary workers, including those performing such duties ascleaning, sterilizing, and laundering or cloth washing form the lowest healthcare cadre and the lowest paid among workers. Other challenges facing Medical Attendants/Auxiliary workers are:

i. Currently in Tanzania, neither are there education requirements nor necessary certifications for Medical Attendants/Auxiliary workers.
ii. The invisibility of the cleaning function among the core healthcare activities
iii. Lack of respect for cleaners,
iv. Misconception that cleaning is undemanding, and assumptions that cleaning is particularly easy.
v. Inadequate training on cleaning skills, methods and personal safety
vi. Inadequate cleaning equipment and supplies
vii. Inadequate protective equipment and safety
viii. High frequency of cleaning creates big workload as compared to other cadres
ix. Low payment
x. Unclear career path

5.7 WASH GOVERNANCE AND REGULATORY ENVIRONMENT IN HEALTHCARE FACILITIES

Healthcare facilities in the surveyed areas in Tanzania suffer from a lack of adequate WASH infrastructure and poor IPC practices. Common problems include inadequacies in water supply and storage, poorly maintained infrastructure (leaking water tanks, defective incinerators, leaking water systems and blocked latrines), lack of personal protective equipment for staff, improper management of healthcare waste resulting in visibly dirty facilities and poor handwashing practices. Evidence from this study attributes the observed WASH problems to inadequate governance and regulatory environment in HCFs as:

i. Lack of WASH policy and guidelines in HCFs in Tanzania.
ii. Lack of minimum standards on WASH in HCFs.
iii. Most of the HCFs use different WASH technologies (poor to improved), but neither any guideline nor plan for operational and maintenance was found.

6.0 RECOMMENDATIONS

6.1 SECTOR POLICY AND PLANNING

6.1.1 The government of the United Republic of Tanzania should work to forge a framework involving MoHCDGEC, MoWI and PoRALG for the reform of the WASH in health care facilities, generate strategic sub-sector investment plans and build a stronger evidence base to support the sector's planning process.

Such a framework should lay down clear guidelines on management of WASH facilities including planning, budgeting, and financing for both provision as well as maintenance of WASH services as a priority services in healthcare delivery.

6.1.2 MoHCDGEC in collaboration with MoWI and PoRALG should provide essential environmental health standards for WASH in Health Care facilities to cover the following:

1. Water availability and access
2. Water quality
3. Water quantity
4. Water facilities design, plumbing system, construction and management
5. Excreta disposal facilities, toilet/latrine design, construction, maintenance and cleanliness
6. Wastewater disposal facilities, design, construction, maintenance and management
7. Health care waste disposal facilities, design, construction, maintenance and management

6.1.3 There should be separate provisions for WASH in delivery services that specifies on requirements for safeguarding the maternal and child health needs while at delivery and care environment as part of the standards.

6.1.3 The MOHCDGEC should establish mechanism to facilitate sustainable monitoring of WASH services in order to comply with appropriate standards along with other components of hospital cares.

6.2 WASH AND HEALTHCARE INFECTION CONTROL PRACTICES

The MoHCDGEC should foster the integration of WASH into the existing National Infection Prevention and Control Standards for Hospitals in Tanzania (2012). WASH should also be integrated in the existing Infection Prevention and Control (IPC) frameworks and guidelines, these are the:

1. *Tanzania Quality Improvement Framework, September 2004*
2. *National Infection Prevention and Control Guidelines for Health Care Services in Tanzania, November 2004*
3. *National Infection Prevention and Control Pocket Guide for Health Care Services in Tanzania, February 2007*
4. *Mwongozo wa Taifa wa kukinga Maambukizo katika Utoaji wa Huduma za Afya: Kiongozi cha Mfukoni wa Watoa Huduma za Afya Tanzania, April 2007*
5. *Implementation Guideline for 5S-CQI-TQM Approaches in Tanzania, May 2009*

6. *Quality Improvement: Infection Prevention and Control Orientation, Guide for Participants, July 2008*
7. *National Supportive Supervision Guidelines for Health Care Services, September 2010*
8. *National Infection Prevention and Control Standards for Hospitals in Tanzania, June 2012*

6.3 IMPROVING WATER, SANITATION, AND HYGIENE FOR MATERNAL, NEWBORN AND PATIENTS HEALTH

6.3.1 The MoHCDGEC should foster stronger integration of WASH in Health Care Facilities to accelerate progress on maternal and newborn health accompanied by improved monitoring of WASH in health care facilities providing MNH services as part of routine national-level monitoring through standard WASH instruments.

6.3.2 National efforts to reduce maternal and newborn mortality and morbidity should adequately reflect on WASH improvement as a pre-requisite for ensuring the quality, effectiveness, and use of health care services.

6.3.3 Further implementation research is needed to identify effective interventions to improve WASH at home and in health care facilities, and to impact on MNH in different health system contexts.

6.4 TRAINING OF CLEANERS FOR EFFECTIVE CLEANING IN HEALTH CARE FACILITIES

6.4.1 Health and safety concerns require specialized training for cleaning services at healthcare facilities. The MoHCDGEC should establish Cleaners Cadre in the staffing level for health care facilities.

6.4.2 The MoHCDGEC should develop and implement a training program on health care facilities cleaning designed to increase professionalism and demonstrate a commitment to effective cleaning to support infection prevention and control. Specifically, the program should be focused on training and certifying frontline health care cleaning professionals. This cleaning training programme will encourage safe work practices, and development of skills related to cleaning effectively and efficiently. Graduates of the program should be able to:

i. Carry out general and specialized cleaning duties.
ii. Use cleaning equipment and products effectively.
iii. Maintain safety of themselves, others, and the environment when performing cleaning services.
iv. Communicate within the boundaries of their role.
v. Apply biosafety and security procedures.
vi. Apply infection control and contamination prevention procedures, under supervision
vii. Understand common problem areas as identified by healthcare professionals that need special attention and regular cleaning

6.5 IMPROVING HEALTH CARE WASTE MANAGEMENT

1. The Ministry in collaboration with RHMTs should facilitate development of a Healthcare Waste Management Plan in all district hospitals
2. The MoHCDGEC should circulate the National specifications /Catalogue for Healthcare waste equipment and Disposal options to all healthcare facilities in order for the facilities to follow-up the standards.
3. The CHMTs shall maintain regular supervision for healthcare waste management activities to ensure availability and usage of healthcare waste management equipment and facility disposal options.
4. RHMTs and CHMTs shall ensure regular availability of Safety Box, bin liners and standards waste bins in all health facilities
5. CHMTs shall ensure allocation of adequate resources for the support of Healthcare waste management activities. CHMTs should plan for the provision of Placenta pit at every point where deliveries services are expected.
6. Regular training and onsite strengthening sessions are essential to enhance conformity with IPC and HCWM standards.

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8.0 ANNEXES

ANNEX 1: PROTOCOL: HEALTHCARE FACILITIES WASH SAMPLES COLLECTION AND ANALYSIS

1. STUDY PARAMETERS

A. Parameter 1: Water quality
Microbial and physicochemical assessment of quality of water used for drinking, cooking, personal hygiene, medical activities, cleaning and laundry services.

B. Parameter 2: Microbes in toilet/latrine footrest and door handles
Microbial isolation from toilets/latrines footrest and door handle swabs.

C. Parameter 3: Microbes in touch surfaces
Microbial isolation from swabs in sampled touch surfaces from paediatric and labor wards and labor room.

D. Parameter 4: Hand washes from hands of healthcare workers, patients and visitors
Microbial isolation from toilets/latrines footrest and door handle swabs.

E. Parameter 5: Antibiotic susceptibility assessment of isolated microorganisms
Assessment of microbial susceptibility to antimicrobial agents currently in use.

2. STUDY SAMPLES

i. **Water samples** will be collected in the sterile plastic bottles (100 ml) and will be kept in a cool box with ice blocks during delivery.

ii. **Swab samples** will be collected using sterile transport swabs and thereafter kept in Stuart Transport medium.

3. SAMPLE NUMBER ESTIMATION

Two to three samples will be taken from each sampling location in hospitals and health centres making approximate number of samples to be as follows: 2 wards 19, delivery room 11, toilets 18, water supply 8 samples, hand washes 7 = total 63 samples.

In dispensaries, samples will be collected from delivery room 11, toilets 12, water supply 8, hand washes 7 = total 38 samples.

Taking triplicate samples for each with quality control/quality assurance samples will give a total of 200 samples for hospital and health centers, and 100 samples for a dispensary. In the overall the following total number of samples is expected to be collected from HCFs in all villages combined.

Figure 42: Estimated number of culture samples for different HCF levels

S/N	Facility type	Number per district	Total samples per district	Overall total samples (7 districts)
1.	Hospital	1	200	1400
2.	Health Center	2	400	2800
3.	Dispensary	6	600	4200
4.	Total	9	1200	8400

4. COLLECTION OF ENVIRONMENTAL SWAB SAMPLES

i. Hands should be washed before sample collection.
ii. All samples should be collected aseptically. *Gloves,clean lab coat, hair net and if necessary face maskmust be worn.*
iii. Prior to sampling, the outside of the sample container must be labeled with the appropriate information including sample name, date, time and sampling site.

a. ***Collection ofwater samples*** **-** A 100 ml sample in a sterilized plastic bottle is required for this analysis (sterilized bottles are provided by the laboratory on request).

Sampling techniques

1. **Taps**. When sampling from a tap, open fully and let water run to waste for 2-3 minutes or for a time sufficient to permit clearing of the service line. Reduce the flow to permit filling the bottle without splashing. If tap cleanliness is questionable apply a solution of Sodium Hypochlorite (100mg/L) or flame the faucet before sampling. Let water run for an additional 2-3 minutes after treatment. If sampling from a hot/cold tap, run hot water for 2 minutes then cold water for 2-3 minutes and collect samples as above.
2. **Reservoirs** (eg: Tanks, Swimming Pools, Cooling Towers, etc) Hold the closed bottle near its base and plunge it below the surface. Remove the top and turn the bottle until its neck points slightly upward and mouth is directed toward the current. If there is no current,

create one by pushing the bottle forward away from the hand. Replace cap before pulling the sample out.

Specific locations and items from which microbial swab or water samples will be taken as summarized in the two figures below.

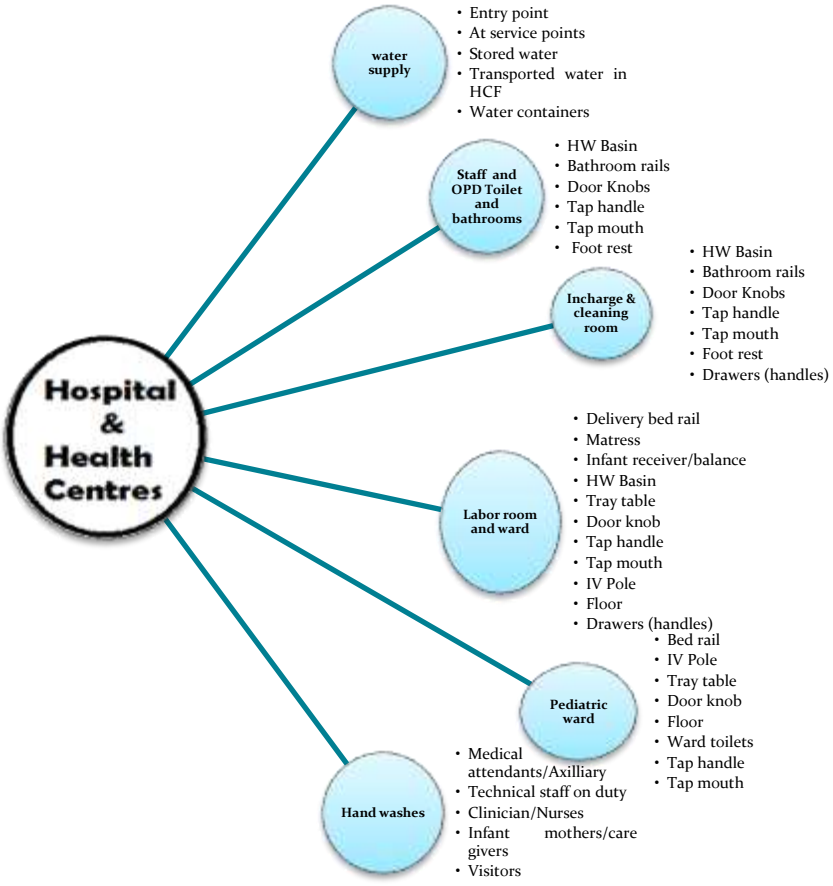


Figure 7: Microbiological sample areas for Hospital and health centers

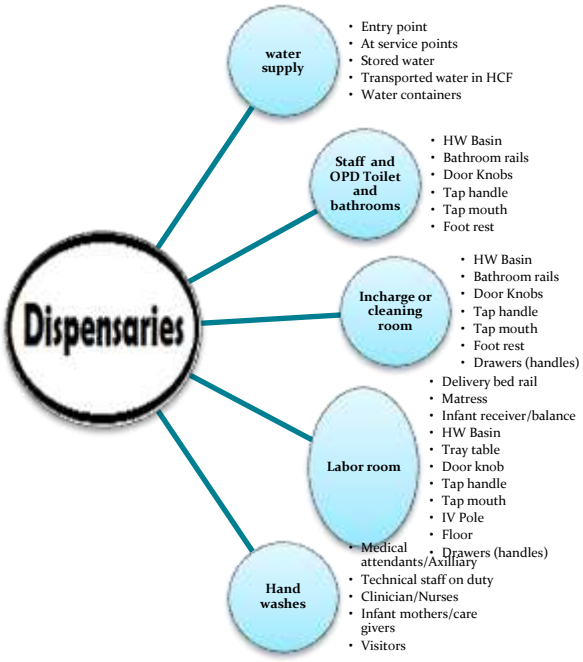


Figure 8: Microbiology sample areas for Dispensaries

5. ISOLATION OF MICROORGANISMS

5.1 Culture-dependent

5.1.1 Isolation of Extended Spectrum Beta-lactamase (ESBL) producing bacteria

Brilliance ESBL Agar plates will be inoculated with water samples (by spread plate technique) or swab samples (by streak plate technique). The inoculated medium will be incubated for 24 hours at 37ºC. Negative plates will be re-incubated for an additional 24 hours. Blue or pink colonies are presumptive positive for E. coli ESBLs and green colonies for KESC group ESBLs (i.e. *Klebsiella*spp; *Enterobacter*spp; *Serratiamarscescens* and *Citrobacter*spp). Proteus, Morganella and Providencia produce tan colonies with a brown halo.

5.1.2 Membrane filter method

- Sample dilution (1:10, 1:100 & 1:1000)
- Sample filtration
- Filters placement on Medium
- Incubation
- Colonies counting
- Computing of Bacterial concentrationn.

5.2 Culture-independent

5.2.1 Culture-independent DNA (Deoxyribonucleic acid) extraction:

From each sampling site, two total genomic DNAs (gDNAs) of environmental samples will be isolated by adding 1 g of sterile glass beads, 0.8 g of sample and 0.8 ml of extraction buffer (2% Triton X100, 1% SDS, 100 mMNaCl, and 10 mMTris-pH 8, 1 mM EDTA-pH 8) into a sterile 2-ml eppendorf tube (Hong *et al*., 2009). The mixture will be dismembrenated (Sartorius Mikro dimembrator U) for 1.5 min, then 60 µl of 20% sodium dodecyl sulfate (SDS) will be added and mixed on the vortex and incubated at 65ºC for 1 h. This will be followed by addition of 600 µl phenol/chloroform/isoamylalcohol (25: 24: 1) and incubation at 65ºC for 20 min. After gently vortexing for 10 seconds, the mixture will be centrifuged (15000 g) for 10 min. The upper aqueous layer will then be transferred into a new sterile tube and extracted with chloroform: isoamyl alcohol (24: 1). Then, 50 µl sodium acetate (3 M) and 1000 µl ethanol (96%) will be added. The DNA will be precipitated overnight at -20ºC and collected by centrifugation (10 min at 15000 g). The DNA pellet will then be washed with 250 µl ethanol (70%). The pellet will then be air dried for about 20 min, dissolved in 50 µl TE buffer and stored at -20ºC.

5.2.2 Estimation of DNA concentration:

The quantity of DNA will be estimated by spectrophotrometric measurement of absorbance at 260 nm following a standard protocol (Sambrook*et al*., 1989). The concentration of DNA obtained in this study ranged from 50 ng - 100 ng.

5.2.3 Polymerase chain reaction (PCR) of a partial 16S rRNA gene and ITS:

For the polymerase chain reaction (PCR), a set of bacteria primers Primer: 27F Sequence: (5'-AGA GTT TGA TCM TGG CTC AG-3') & Primer: 1492R Sequence (5'- CGG TTA CCT TGT TAC GAC TT -3') will be used. Fungal primers to be used are ITSI: Sequence: (5'-TCC TCC GCT TAT TGATAT GC-3') and ITS 4: Sequence: (5'-TCC TCC GCT TAT TGATAT GC-3').Total PCR reaction mixture volume will be 50 µl composed of 1µl (50 - 100 ng) of each genomic DNA template, a PCR bead and 1 pmol/µl of each primer. The cycling conditions in a Veriti AB PCR machine will be: initial denaturation at 95ºC for 4 min, 30 cycles of 95ºC for 45 s, 68ºC for 45 s, and 72ºC for 1 min, and a final extension of 5 min at 72ºC. The PCR products will be separated by gel electrophoresis in 1.5% agarose gels which will be stained with ethidium bromide (0.5 µg/ml).

5.2.4 Purification of the PCR products:

Before the sequencing, all PCR products will first be purified to remove excess salts and other impurities using the QIAGEN Kit (QIAGEN: Sweden) following the manufactures protocol.

5.2.5 Partial 16S rRNA gene & ITS sequencing and cloning:

After purification the PCR products will be sent to a commercial facility at Inqaba Biotechnical Industries in South Africa for sequencing and cloning for the environmental samples. The sequencing will be done by the Big Dye chain termination method using an ABI 3730 Genetic analyzer. Each sample will be sequenced twice, using either forward primer or reverse primer.

5.2.6 Nucleotide sequence analysis:

The sequences obtained will be edited using Bio edit program and matched with previously published sequences available in National Centre for Biotechnology Information (NCBI) using Basic Local Alignment Search Tool (BLAST) (Altschul*et al*., 1997). Multiple sequence analysis will be carried out using CLUSTALX (Thompson *et al*., 1997) and Tamura *et al*., 2011.

5.2.7 Antibiotic susceptibility testing

Isolated ESBL producing bacteria will be subjected to antibiotic susceptibility testing (AST) to test for resistance to Aztreonam (monobactam), Amoxicillin/Clavulanate (Penicillin combination), Ciprofloxacin (the second-generation quinolone antibiotics) and Cefotaxime (**third generation cephalosporin**), as well as susceptibility to the carbapenemsimipenem and meropenem by disc diffusion. These antibiotics will be used because they cover several classes of β-lactam antibiotics hence serving as a *screening step to detect bacteria that could be potential ESBL species*. Apart from these, isolates will also be tested for resistance to Cefepime, which is a **fourth generation cephalosporin**.

5.2.8 Isolation of Methicillin resistant Staphylococcus aureus (MRSA) and Susceptibility testing

Water and swabs samples taken from hospitals, HC and Dispensaries will be inoculated onto Brilliance MRSA 2 Agar and then incubated for 18–20 hours at 37ºC. Denim blue colonies are presumptive positive for MRSA. Identifications as MRSA will be confirmed by Molecular biology methods. Isolated MRSA will be subjected to susceptibility testing by disk diffusion method using Cefoxitin. Mueller Hinton agar supplemented with NaCl (2%) will be used; incubation is at 33-35 ºC for 24 hours.

5.2.9 Isolation of Group B Sreptococcus (GBS) i.e. Streptococcus agalactiae

Water and swab samples will be inoculated onto *Brilliance* GBS agar and will be incubated at 35-37 ºC for 18-24 hours. GBS will grow as pink-coloured colonies on the medium. Molecular biology methods will be used to confirm speciation.Brilliance GBS Agar contains a combination of antibacterial compounds to inhibit the growth of a wide variety of organisms commonly associated with human carriage. Any non-target organisms (i.e. non-GBS) that are not inhibited grow as either blue or purple colonies. Susceptibility testing of the isolated GBS will be done by disk diffusion method using Penicillin, Clindamycin, Vancomycin, Erythromycin, and Streptomycin antibiotics. Fluconazole, Itraconazole and Voriconazole will be used for the fungi susceptibility testing.

5.2.10 Isolation of Pseudomonas aeruginosa

Water and swab samples will be inoculated onto Nutrient agar and will be incubated at 37 ºC for 24 hours. **Pseudomonas *aeruginosa***colonieswill grow as green-coloured colonies on the medium. Susceptibility testing of the isolated *Pseudomonas aeruginosa* was done by disk diffusion method using Amikacin, Tobramycin, and Azithromycin, Cefepime, Ceftazidime, Ticarcillin-clavulanate, Ciprofloxacin, Cotrimoxazole (trimethoprim-sulfamethoxazole), Meropenem and Azithromycin. Molecular biology methods will be used to confirm speciation

6. Microbiological detection techniques

Three detection techniques was used in order to satisfy three levels of objectives namely quantification of microbial contamination, a factor that is to be related with hygiene levels, testing sensitivity of selected antimicrobial agents with specific culture based confirmation of microbial groups, as well as specific identification and description composition of wide range of bacterial and fungal forms found in hospital environment using molecular approach. The order in which different sample types will be analyzed is summarized here under:

S/N	Analysis technique employed	Sample source	Target number of samples	Description
1.	Culture- dependent	Sample from all identified locations	8400	Samples from location as described in the general sampling plan.
2.	sensitivity testing on selected pure isolates	Samples from labor room, labor ward, and neonatal/pediatric Wards	20	Subculture from samples that will produce identifiable colonies of nosocomial agents.
3.	Culture- independent	Water and toilet samples	21	1 sample from each HCF level (3 per district) for each district.

7. Sensitivity test

Three bacterial species (*Staphylococcus aureus, Streptococcus* spp and *Pseudomonas aureginosa*) based on their importance as known agents of nosocomial infection or presenting treatment challenges to infected individuals are targeted for the sensitivity test.

8. Quality control/quality assurance

Different levels of controls will be put to ensure that the microbial measurements and analysis adheres to the highest standards of practices and that they lead to good levels of accuracy and precision of the results. The following will be done on quality control;

1. Provision of concise and clear laboratory and field protocols
2. Selection of credible and experienced team of scientists and laboratory/field technicians
3. Preparation and processing of field and laboratory blank samples.

Blank samples

At least four blank samples for each type of measurements (i.e. 3 samples for culture at least 1 water sample and 2 swab samples, and 1 blank sample for genomic test) of should be taken to the field in each district, treated and analyzed as the rest of the samples. Blank samples should be prepared and labeled in advance.

Three blank samples should be prepared and stored within the laboratory and to be processed as other samples.

A total of 8 samples will be processed for every region or in every new laboratory.

Annex 2: Persons Contacted at National, Regional and District Levels

Regional and District Levels

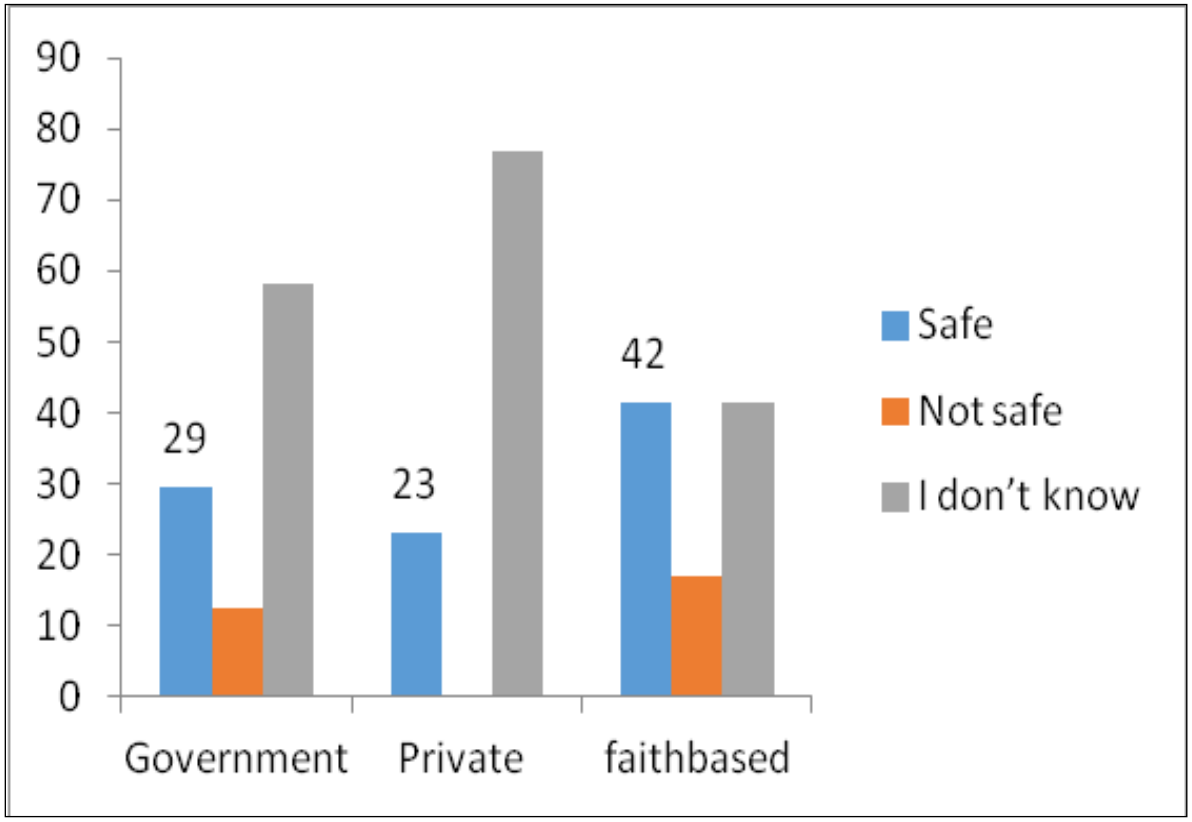
1. Regional Medical Officer (RMO)- Mbeya
2. Regional Health Officer (RHO)- Mbeya
3. Regional Water Engineer (RWE)- Mbeya
4. Regional Medical Officer- (RMO)- Njombe
5. Regional Health Officer (RHO)- Iringa
6. Regional Water Engineer (Njombe)
7. Regional Health Officer (RHO)- Njombe
8. District Water Engineer (DWE)- Mbeya DC
9. District Health Officer (DHO)- Mbarali DC

10. Ag. District Medical Officer (DMO)- Mbarali DC
11. District Water Engineer (DWE)- Mbarali DC
12. District Health Officer (DHO)- Makete DC
13. Ag. District Water Engineer (DWE)- Makete DC
14. Ag. District Water Engineer (DWE)- Njombe DC
15. Ag. District Health Officer (DHO)- Njombe DC
16. District Health Officer (DHO)- Mufindi DC
17. Ag. District Water Engineer (DWE)- Mufindi DC
18. District Water Engineer (DWE)- Temeke MC

National Level- Key WASH Officials

19. Ministry of Health and Social Welfare- (MoHCDGEC). Three officials
20. Ministry of Water (MoW). Two officials
21. SNV
22. JHPIEGO
23. United Nations Children Fund (UNICEF)
24. Plan International
25. Water AID

Annex 3: Opionion of clients (service users) on water safety



Annex 4: pecentage of facilities with running water in the bathing facilities by districts.