ASSESSMENT OF THE LEVEL OF IMPLEMENTATION OF INFECTION PREVENTION AND CONTROL PRACTICES IN DISTRICT AND REGIONAL HOSPITALS IN DAR ES SALAAM, TANZANIA

Mohd Abdulrahman Bakar, BSc.EH

MSc (Microbiology & Immunology) Dissertation
Muhimbili University of Health and Allied Sciences
October, 2024

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

SCHOOL OF DIAGNOSTIC MEDICINE

DEPARTMENT OF MICROBIOLOGY AND IMMUNOLOGY

ASSESSMENT OF THE LEVEL OF IMPLEMENTATION OF INFECTION PREVENTION AND CONTROL PRACTICES IN DISTRICT AND REGIONAL HOSPITALS IN DAR ES SALAAM, TANZANIA

By

Mohd Abdulrahman Bakar

A Dissertation Submitted in (Partial) Fulfilment of the Requirements for the Degree of Master of Science in (Microbiology and Immunology) of

the Muhimbili University of Health and Allied Sciences

October, 2024

CERTIFICATION

These undersigned certify that they have read and hereby recommend for acceptance by the Muhimbili University of Health and Allied Sciences as a dissertation entitled "Assessment of the Level of Implementation of Infection Prevention and Control Practices in District and Regional Hospitals in Dar es Salaam, Tanzania'', in partial fulfilment of the requirements for Masters of Science (Microbiology and Immunology) of Muhimbili University of Health and Allied Sciences.

……..

Dr. Frank Msafiri

(Supervisor)

Date:……..

……

Lilian Nkinda

Co-Supervisor

Date:…….

DECLARATION AND COPYRIGHT

I, Mohd Abdulrahman Bakar, declare that this dissertation is my original work and that it has not been presented to any other University for similar or any other degree award.

Signature:…… **Date**:……..…….

This dissertation is copyright-protected under the Berne Convention, the Copyright Act 1999, and the international and national enactments, on that behalf, of intellectual property. It may not be produced by any means, in full or in part, except in short extracts in fair dealing, for research or private study, critical scholarly review, or discourse with an acknowledgment, without the written permission of the Director of Postgraduate Studies, on behalf both the author and the Muhimbili University of Health and Allied Sciences.

ACKNOWLEDGEMENT

First and foremost, I would like to thank my Almighty God for gifting me the opportunity, strength, knowledge, and skills to pursue and complete this research study. Without His blessings, this accomplishment would not have been possible.

Followed by my research supervisors, Dr Frank Msafiri and Ms. Lilian Nkinda for their assistance and dedicated support at every step throughout the process. Their guidance helped me throughout my research dissertation. They were better advisors and mentors for my master's study.

Also, I would like to thank the other academic members of the Microbiology and Immunology Department for their support and encouragement throughout my residency program.

Furthermore, I would like to express my sincere appreciation to the Muhimbili University of Health and Allied Sciences Institute review board (MUHAS-IRB) for granting me the ethical clearance to conduct this research, administration of all regional referral hospitals and district hospitals in Dar es Salaam Region for their permission and assistance during data collection.

I am grateful to the Ministry of Health and Muhimbili College of Health and Allied Sciences (MUCOHAS) for allowing me to pursue a master's degree and financing my university costs, including this research.

Finally, I must express special thanks to my family and colleagues for their good cooperation, advice, and encouragement, throughout my master’s Program

I am asking our almighty GOD to reward them abundantly.

DEDICATION

This dissertation is dedicated to my family for their patience and support throughout my studies.

Also, the Ministry of Health (MOH), which is responsible for regulating the quality, safety, and efficacy of healthcare delivery system

ABSTRACT

Introduction: Infection prevention and control (IPC) is imperative for the prevention of healthcare associated infection (HCAI) and multi drug resistant bacteria. However, IPC implementation is suboptimal in developing countries. To improve optimization of IPC measures, and resources, World Health Organization (WHO) has developed the Infection Prevention and Control Assessment Framework (IPCAF) as a self-assessment tool for the level of IPC implementation at healthcare facility.

Objectives: This study aimed to assess the level of implementation of IPC activities in district and regional hospitals in Dar es Salaam, using the WHO IPCAF

Materials and Methods: A cross-sectional study was done to collect data between April and July, 2024. This assessment recruited three regional referral hospitals, five district hospitals and one health centre in Dar es Salaam. Only high-volume hospitals were purposively selected. Implementation of IPC was assessed using the WHO IPCAF tool. IPC focal person, hospital pharmacist, matron/patron (clinical nurse manager), laboratory manager, environmental health officer and human resource manager or health secretary were interviewed to provide data regarding IPC implementation. Scores were calculated based on each IPC core component (CC) and on the summation of all eight core components. The total scores were used to categorize the hospitals into four distinct IPC levels– Inadequate, Basic, Intermediate, and Advanced**.**

Results: The overall median IPCAF level was 417 (IQR 478.6-408.75). About 89% of the surveyed facilities had intermediate IPC and the remaining 11% fell into basic IPC level. All facilities had well-elaborated IPC guidelines, good environment, materials and equipment. Surveillance and monitoring were found to be areas with big gaps in all study facilities. Underperformance of these indicators fuel AMR and HCAIs. All hospitals had inadequate staffing levels, indicating patient workload. No facility-maintained bed occupancy of one patient per bed in all units. Bed standing in corridor outside the ward was not found in RRH, however, it was found in 33.33% of hospitals at district level.

Conclusion and recommendations: Majority (89%) of the facilities had intermediate IPC level. IPC gaps observed in the accessed facilities, underscore the requirement of quality improvement programs and feedback.

TABLE OF CONTENTS

ASSESSMENT OF THE LEVEL OF IMPLEMENTATION OF INFECTION PREVENTION AND CONTROL PRACTICES IN DISTRICT AND REGIONAL HOSPITALS IN DAR ES SALAAM, TANZANIA i

DECLARATION AND COPYRIGHT iv

ACKNOWLEDGEMENT vi

DEDICATION vii

ABSTRACT viii

LIST OF TABLES xi

LIST OF FIGURE xi

LIST OF ABBREVIATIONS xii

DEFINITION OF TERMS xiii

CHAPTER ONE 1

1.0 INTRODUCTION 1

1.1 Background 1

1.2 Problem statement 2

1.3 Rationale of the study 3

1.4 Research questions 3

1.5 Objectives 3

1.5.1 Broad objectives 3

1.5.2 Specific objectives 3

1.6 Conceptual framework 4

1.7 Literature review 5

1.7.1 Overview of Infection Prevention and Control 5

1.72 Situation analysis of the compliance of WHO IPC core components 6

1.7.2.1 IPC Program 6

1.7.2.2 IPC guidelines 6

1.7.2.3 IPC education 7

1.7.2.4 HCAI surveillance 7

1.7.2.5 Multimodal strategies 7

1.7.2.6 IPC monitoring and feedback 7

1.7.2.7 Workload, staffing and bed occupancy 8

1.7.2.8 Built environment, materials, and equipment for IPC 8

1.7.3 Roles of IPC in preventing healthcare-associated infections 8

1.7.4 Roles of IPC in preventing emergency and spread of antimicrobial resistance 9
1.7.5 IPC implementation in sub-Saharan Africa 10
1.7.6 Tools for assessment of IPC 11
CHAPTER TWO 13
2.0 METHODOLOGIES 13
2.1 Study design, area and setting. 13
2.2 Sample size and sampling technique 13
Nine public health facilities were selected using a purposive sampling technique to conduct an assessment of the level of IPC implementation in district and regional hospitals in Dar es Salaam. 13
2.3 Variables 13
2.4 Data collection tool 13
2.5 Study procedures 14
2.6 Data analysis 14
2.8 Ethical consideration 15
2.9 Dissemination plan 15
CHAPTER THREE 16
3.0 RESULTS 16
CHAPTER FOUR 25
4.0 DISCUSSION, STRENGTH AND LIMITATION OF THE STUDY 25
4.1 Discussion 25
4.2 Strengths of the study 27
4.3 Limitation of the study 28
CHAPTER FIVE 29
5.0 CONCLUSION AND RECOMMENDATION 29
5.1 Conclusion 29
5.2 Recommendations 29
REFERENCES 30
APPENDICES 36
Appendix 1 Data collection tool 36
7.2 (A) Appendix 2 Informed consent form (English version) 56
7.2 (B) Fomu ya idhini (Toleo la Kiswahili) 60

LIST OF TABLES

Table 1 Distribution of IPCAF score by core component 19
Table 2 Hospital basis IPCAF core components score 21
Table 3 Key gaps and findings of IPCAF assessment in selected hospitals of Dar es Salaam 23

LIST OF FIGURE

Figure 1: Conceptual framework narrating assessment of IPC implementation at healthcare facility 4
Figure 2: IPCAF score of assessed hospitals in Dar es Salaam 17

LIST OF ABBREVIATIONS

AMR	Antimicrobial resistance
COVID-19	Coronavirus disease-19
CC	Core component
HCAIs	Healthcare associated infections
IPC	Infection prevention and control
IPCAF	Infection prevention and control assessment framework
LMICs	Lower- and middle-income countries
MDROs	Multidrug resistant organisms
MRSA	Methicillin resistance staphylococcus aureus
RRF	Regional referral hospital
SARS-Cov2	Severe acute respiratory syndrome coronavirus-2
SSIs	Surgical Site Infections
SD	Standard deviation
WHO	World Health Organisation

DEFINITION OF TERMS

Antimicrobial resistance: Natural phenomenon of genetic changes/mutation in microorganisms that resulting to resist against antimicrobials designed to kill them or inhibit their growth

Coronavirus disease-19: An infectious disease due to SARS-CoV2 virus. The disease emerged in 2019, first occurred in China and become endemic worldwide

Healthcare associated infections: Infection occurring to patient or healthcare provider during healthcare delivery in healthcare facility, which was not present or incubating at the time of admission. In some instances, these infections may happen after discharge.

Infection prevention and control: Is a multidisciplinary, evidence-based approach intended to prevent and control infections to patients and healthcare workers during healthcare delivery in hospitals or other healthcare facilities

Infection prevention and control assessment framework: It is a reference tool that guide the implementation of the World Health Organization guidelines on core components of IPC programs at health care facility

Methicillin resistant *Staphylococcus aureus*: Is defined as strain of Staphylococcus aureus that has become resistant to methicillin/cefoxitin

Multidrug resistant organism: Microorganism that has become resistant to at least one agent from three or more classes of antimicrobial

Severe acute respiratory syndrome coronavirus-2: Is defined as viral respiratory illness caused by SARS-Cov-2

Surgical site infection: Infection that occurs within 30 days post-surgery or up to a year if the implant remains in the site after surgical procedures

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Implementation of infection prevention and control (IPC) is the cornerstone for the prevention of healthcare-associated infections (HCAIs) as well as antimicrobial resistance (AMR)[1]. Unfortunately, IPC implementation is suboptimal in developing countries[2]. According to the World Health Organization (WHO), an estimated 10-30% of all hospital admissions result in HCAIs[3]. HCAIs and the spread of antimicrobial resistance strains have contributed to great economic loss as well as morbidity and mortality burdens. Globally, the morbidity rate due to HCAIs is more than 1.4 million patients annually with mortality of over 10% [4].

To track IPC implementation progress in Tanzania, the Ministry of health conducts annual assessment supportive supervision across healthcare facilities in different regions. For example, in the year 2010, 2011, 2012, 2014, and 2017 a total of 34, 35, 36, 50 and 180 healthcare facilities were assessed respectively[5]. Unfortunately, in the year 2013, 2015, and 2016 the assessment was not conducted due to lack of fund [5]. This indicate that IIPC assessment in our country still faces challenges especially due to inconsistence fund to support the implementation. The recent pandemics of emerging infectious diseases have emphasised the urgency of improving IPC in healthcare settings. About 44% of the previous SARS-CoV-2 infections early in the outbreak were hospital-acquired [6]. Moreover, a systematic review study reported high burdens of HCAIs in Africa with the pooled prevalence of about 12.8%[7]. About 8-30% of surgical procedures in low and middle-income-countries (LMICs) result in surgical site infections (SSIs) [8]. In Dar es Salaam, Tanzania, the prevalence of SSI among tertiary healthcare facilities had risen at an alarming rate. One of the study conducted at MNH found that 22% of patients attending open urological surgery develop SSIs[9]. This rate of infection was reported to be higher among catheterized patients compared to non-catheterized patients. Other factors contributing to SSI include old age, diabetic mellitus, taking long time during the procedure as well as lack of prophylactic antibiotics, pre-and post-surgery[10]. Postnatal infections among women giving births at Amana and Temeke regional referral hospitals are also of significant concern, about 6.7% of women and 6.2% of newborns develop postnatal infections from day 0 to day 7 following

delivery at Amana and Temeke regional referral hospitals[11]. The infection rate is higher among cesarean childbirth than with normal vaginal delivery[11]. To improve IPC standards and best healthcare delivery, the WHO developed an evidence-based tool for assessing compliance with IPC. The tool is known as the infection prevention and control assessment framework (IPCAF).

IPCAF is an organized structured tool that can be used as a reference checklist to assess the current status of the IPC program and activities within a healthcare facility, evaluate the progress of the IPC program over time, and help foster improvement. It can be used for self-assessment at the healthcare facility and in cooperation with external assessors to reach sound arguments on IPC measures. IPCAF covers almost all necessary IPC gaps required to control HCAIs and improve the quality of healthcare services.

Implementation level, and gaps in IPC standards, have not been addressed in our district and regional healthcare facilities, in Dar es Salaam and therefore underscore the need for research. District and regional hospitals in Dar es Salaam serve a huge number of patients, both outpatients and inpatients, hence compliance to IPC should be assessed and improved to control the possible outbreak of HCAIs and spread of AMR strains.

1.2 Problem statement

Tanzania is one of the Sub-Saharan countries experiencing a high prevalence of HCAIs. More than 20% of hospitalized patients in our setting acquire HCAIs, with surgical ward being the most affected area[10]. In Tanzania, SSI is among the main cause of morbidity and mortality with the morbidity rate ranging from 10% to 26%[10]. Patients attending high volume hospitals are at risk of acquiring HCAIs. Dar es Salaam is the highest populated region of Tanzania with congested impatiens and outpatients, hence prone for potential HCAIs and AMR. About 8.5% of admitted patients at regional referral hospitals in Dar es Salaam are carriers of Methicillin Resistant *Staphylococcus aureus* (MRSA)[12]. Theses MRSA carriers are therefore potentials for HCAIs and MRSA spreads if IPC is not in place. In addition, the recent emergent infectious diseases exposed IPC gaps, and therefore necessitate for research. Monitoring of IPC practices and feedback, inadequate surveillance of HCAIs, surveillance and isolation of patients with MRSA

and AMR, high-patient workload, inadequate compliance to standard bed occupancy are the predominant gaps in our healthcare settings

1.3 Rationale of the study

This study has provided data on the extent of IPC implementation activities among district and regional hospitals in Dar es Salaam. The study demonstrated achievements in IPC implementation progress, however, several IPC gaps were noted at the assessed facilities. The study demonstrated that, HCAIs surveillance, IPC education and training, inadequate AMR surveillance and isolation of patients with MRSA and AMR, overcrowding in hospital wards especial in maternity and pediatric wards, in adequate compliance to standard bed occupancy and bed spacing are the priority areas that call for improvement. Improvement for these IPC gaps will help to tackle the problem of HCAIs and the spread of AMR strains among District and Regional hospital level in Dar es Salaam that is among a top priority on National Health Agenda

1.4 Research questions

1. What is the level of implementation of IPC activities at district and regional hospitals in Dar es Salaam?
2. What are the IPC gaps contributing to HCAIs and AMR in our healthcare settings and hinder the best level of IPC adherence?

1.5 Objectives

1.5.1 Broad objectives

To assess the level of implementation of infection prevention and control measures at Regional and District Hospitals in Dar es Salaam

1.5.2 Specific objectives

1. To identify the level of implementation of IPC measures at district and regional hospitals in Dar es Salaam using WHO IPCAF tool

2. To identify IPC gaps at district and regional hospitals in Dar es Salaam using WHO IPCAF tool with respect to the eight WHO IPC core components

1.6 Conceptual framework

The study variables that are independent and outcome variables are shown in the figure 1 below. The independent variable is the implementation of IPC CCs that are going to be measured in the study. The outcome variable is the IPC scores. IPC score is dependent up on the implementation of IPC CCs. The overall score of IPC CCs will determine the level of IPC implementation as inadequate, basic, intermediate or advanced.

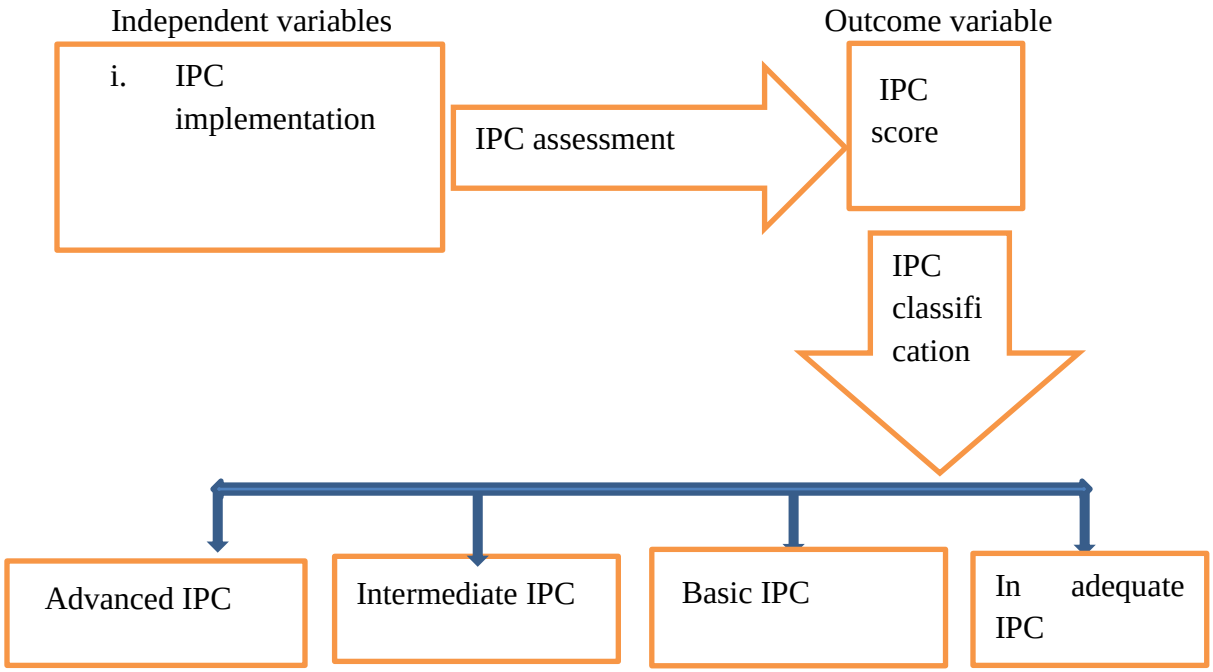


Figure 1: Conceptual framework narrating assessment of IPC implementation at healthcare facility

1.7 Literature review

1.7.1 Overview of Infection Prevention and Control

IPC is multidisciplinary measures and activities intended to prevent and control infections to patients and healthcare workers during healthcare delivery. HCAI is an infection that happens during patient care at a healthcare facility, which was not previously present or incubating before admission. In some cases, HCAIs can appear after hospital discharge[13]. HCAIs are usually transmitted due to poor sterilization of medical equipment, inadequate antiseptic measures, poor hand hygiene, environmental contamination, lack of enough sanitary facilities, and improper use of personal protective equipment (PPE) among others[14,15]. Pathogens such as vancomycin-resistant enterococci (VRE), MRSA, *Acinetobacter baumannii*, *Clostridium difficile*, and *Pseudomonas aeruginosa*, can persist in the environment for an extended period and therefore increase their potential to HCAIs[15]. IPC measures are categorized into two approaches, which are standard precautions and transmission-based- precautions (TBPs).

Standard precautions are measures and activities that must be applied at all times for all patients in all situations to achieve a basic level of IPC[16]. These measures apply to all patients and healthcare workers on handling blood (including dried blood) and all other body fluids (except sweat), non-intact skin, and mucous membranes. Standard precautions encompass all measures related to water, sanitation, and hygiene (WASH)[16]

TBPs are the measures used in addition to standard precautions to prevent the possible spread of infection from patients known or suspected to be infected with epidemiologically important or highly transmissible pathogens[17]. TBPs apply all the standard measures to prevent air born, droplets and contact transmissible infections. The measures include isolation of patients having highly transmissible infections, screening of patients or people visiting hospital during outbreak as well as prevention of ventilator associated pneumonia[17]. Despite over two decades on the implementation of IPC activities in Tanzania, adherence to IPC standards is still not optimal, and significantly differs by level of facility as well as among facilities of the same level. Prevalence of HCAI in our healthcare settings is still high and therefore, necessitates research to address the gaps and failure in implementing best IPC practices.

Another part of IPC is risk recognition. Risk recognition is the detection and identification of the potential for the spread of HCAIs for effective prevention. It helps to set priorities for the most risk areas with significant potential for infections. The ranks of risk recognition are ordered in that manner; eliminating the risk> isolating the hazard> reducing the risk through engineering control> reducing the exposure to hazard using administrative control> using PPEs. Lack of risk assessment and prioritization of IPC activities based on the local epidemiology remain the gaps in our facilities.

1.72 Situation analysis of the compliance of WHO IPC core components

The eight WHO IPC core components are evidence-based strategies to reduce and prevent the current and the future threats due to HCAIs and AMR and strengthen IPC practices at healthcare facility and National level.

1.7.2.1 IPC Program

IPC programs are composed of a dedicated trained team of professionals, clearly defined objectives, and action plans based on local epidemiology and priorities according to risk assessment, for the prevention of HCAIs and AMR[13]. According to a report by Tripartite Antimicrobial Resistance Country Self-Assessment Survey /TrACSS (2020-2021), about 11% of the surveyed countries worldwide have IPC programs, but 54% of those having IPC programs had not adequately implemented[18]. The limited budget for IPC, and lack of expertise to conduct monitoring, were the identified gaps[18]. In Dar es Salaam, Tanzania, we lack current data on the proportion of healthcare facilities with IPC programs and identified gaps.

1.7.2.2 IPC guidelines

Tanzania has its National IPC guidelines that align with WHO standards. In 2018, the Ministry of Health revised the guidelines to incorporate the WHO's new scientific developments. Despite the improvement of Tanzania National IPC guidelines, several standards in the guidelines have not yet translated into implementation in our healthcare facilities[4]. Studies conducted among referral hospitals in Tanzania showed that 100% of the facilities had National IPC guidelines, but had limitations in translating them into practice[19]. Lack of data regarding the implementation status of the standards and gaps in our healthcare setting, remain unclear

1.7.2.3 IPC education

IPC education is critical in HCAI prevention and should be offered to new employees and regularly to existing staff of all levels [13]. Continuous education and training of healthcare workers, patients, and visitors have proven positive impacts on IPC adherence[20]. Until 2021, the Ministry of Health had trained around 2544 healthcare workers, however, gaps between knowledge and IPC practices still exist [21].

1.7.2.4 HCAI surveillance

HCAI surveillance is based on standard definitions and adopted according to available resources and local epidemiology. Currently, SSI is the only HCAI in which the Ministry of Health Tanzania, has developed surveillance tools, and some facilities have adopted its implementation, but most of the facilities do not analyze and utilize it as per WHO recommendations[19]. Lack of surveillance and isolation of patients with MDR, lack of surveillance for HCAIs, and evaluating the implementation of the program are some of the gaps in this area

1.7.2.5 Multimodal strategies

Multimodal strategies are organizational culture change oriented to improve IPC for quality healthcare delivery and enhanced patient safety climate. Successful implementation requires the involvement of champions/role models in various classes/departments and needs to be linked with national quality aims/or health facility accreditation bodies. In Tanzania, the models used are frequent training, mentorships, supervision, posters, job aids, and standard operating procedures, however, the concept of multimodal strategies is new in our healthcare facilities[19].

1.7.2.6 IPC monitoring and feedback

IPC monitoring is the periodic evaluation of IPC practices/indicators with timely feedback for improvements oriented toward the reeducation of HCAIs and AMR. Monitoring is critical to track progress toward improvement and detect gaps toward achievement of objectives. Results from the assessment study revealed the lowest score, indicating the existence of huge gaps for this IPC core component[19]. Lack of well-defined monitoring plan with clear goals, targets and activities as well identifying action plan to address gaps could be associated with under performance of this core component and failure in achieving optimal standards.

1.7.2.7 Workload, staffing and bed occupancy

Standards for bed occupancy should be one patient per bed with >1 meter spacing between patient beds. Ward design regarding bed capacity should be adhered to standards, as overcrowding can lead to disease transmission[13].

In exception when bed capacity is exceeded, management should act to ensure appropriate staffing level according to patient workload and adequate bed spacing (http://www.who.int/hrh/resources/wisn_user_manual/en/). As in many other SSA countries, no referral public health facility in Tanzania had achieved standard workload, staffing, and bed occupancy[19]. Evaluation and possible interventions on the impact of inpatient overcrowding in our healthcare setting are thus paramount.

1.7.2.8 Built environment, materials, and equipment for IPC

This encompasses water sanitation and hygiene (WASH). Facility management should ensure an adequate hygienic environment and the availability of IPC materials and equipment at the point of care[22]. WASH guidelines have been incorporated into our national IPC guidelines and supervision of environmental health sanitation is in place[22], however, implementation at facility level had not attained the required level[19] Regular assessment of hand hygiene and monitoring as per the WHO hand hygiene checklist are still the gaps in our facilities.

1.7.3 Roles of IPC in preventing healthcare-associated infections

Patients and healthcare workers are at risk of HCAIs due medical interventions such as surgery, intubation, antibiotic use, as well as exposure to microorganisms from other patients, medical staffs and contaminated hospital environment. Fortunately, most of HCAIs are preventable through evidence-based IPC measures[23]. Thus, the roles of IPC are include all measures and activities to prevent hospital related infection; these include WASH, isolation of infectious patients, protective isolation, antiseptic and sterilization, decontamination of hospital environment, antimicrobial stewardship, surgical preoperative antibiotic prophylaxis, proper disposal of hospital wastes, vaccination of HCWs, screening of MRSA carriers and other multidrug resistant

organisms (MDROs), surveillance of HCAIs, screening and partial exclusion of staffs as well as engineering design[23,24] Several studies that assessed the impact of hand hygiene promotion on HCAIs (from 1977-2008) reported significant reduction on HCAIs. One of the studies reported significant reduction rate of HCAIs from 37.2% to 15.1% per 100 patient-days pre-intervention and post-intervention respectively[25]. Evidence shows that adherence to hand hygiene practices is a key measure in reducing of MDR pathogens contaminating healthcare workers' hands and preventing transmission to patients[26]. Hence, without proper hand hygiene practices, microbial colonization, and transmission to patients may occur [27].

PPEs have a significant reduction of airborne infection in hospital settings. Heneghan et al. estimated that daily infections with COVID-19 in HCWs during the early pandemic were as greater as 9.1% per day in the United Kingdom between March 21 and April 15, 2020. These high rates of infections among HCWs in the early pandemic were due to a shortage of PPEs during the first wave of the disease. This infection rate subsequently declined following the universal masking implementation[28]. Generally, all studies done to assess the effectiveness of IPC reported significant reductions in infection rates. In Tanzania, studies have done to assess epidemiology of HCAIs, factors affecting compliance to IPC as well as hand hygiene compliance on the reduction of microbial hand contamination among other studies [7,29,30] At our regional and district hospitals in Dar es Salaam, we have limited information regarding the evidence-based achievements of each IPC CC implemented on the reduction of HCAIs. Hence studies are needed to provide evidence-based progress for the implemented IPC measures on the reduction of HCAIs at regional and district hospitals in Dar es Salaam

1.7.4 Roles of IPC in preventing emergency and spread of antimicrobial resistance

The prevention of emergency and spread of AMR pathogens is one of the urgent global and public health concerns worldwide [31] Factors associated with the spread of AMR pathogens in hospital settings include environmental contamination with MDROs, transmission during healthcare delivery, misuses of antibiotics, low dose exposures of microorganisms with disinfectants due to inadequate sterilization and transmission between patients among others[32]. Provision of clean water, basic sanitation, and hygiene has brought positive impacts in stopping the spread of AMR

pathogens[32]. Triage and identification of patients, contact precautions, patient isolation, cleaning and disinfection of environment, items, and equipment, surveillance of AMR bacteria, monitoring of IPC practices, IPC education and training have been defined as the key approaches toward the prevention of AMR. Maina et al. reported that water, sanitation, and hygiene (WASH) are the key foundation for prevention of AMR. Hospitals with inadequate WASH are associated with an increased risk of AMR [33]. IPC provides a practical solution for the reduction of MDROs colonization on environmental surfaces and HCWs and reduces the risk of transmission[34]. Implementation of the standard practice and screening program that targets the reduction of transmission of specific pathogens followed by decolonization has successfully reduced the spread of MDROs[35]. The study reported that proper hand hygiene(HH) is the most cost-effective approach in reducing the spread of MDROs [36]. Several studies done from 1989 to 2016 from different countries reported that the combination of the five strategies of IPC, i.e. decolonization, environmental cleaning, antimicrobial stewardship program (ASP), source control, and standard care i.e., HH and contact precautions have brought positive impact on the reduction of AMR pathogens[37]. In Africa and Tanzania, studies have been conducted to review the national antimicrobial stewardship activities. According to the studies, IPC is given little attention in many healthcare facilities despite the evidence that it is the most critical area in preventing MDROs[38]. Little is known about antimicrobial resistance pathogens in our hospital setting at both regional and district levels in Dar es Salaam due to the scarcity of microbiological data, inadequate surveillance on tracking HCAIs and antibiotic resistance patterns. The need to strength surveillance of HCAIs and AMR patterns in hospital settings is thus of paramount

1.7.5 IPC implementation in sub-Saharan Africa

Globally, the reductions in the prevalence of HCAIs have been successful for over two decades; however, a varying prevalence of the disease burden remains in Sub-Saharan Africa (SSA)[39]. The prevalence of HCAI varies across the SSA and within a country, suggesting unequal compliance with IPC. SSA experiencing a high rate of HCAIs due to a lack of resources to adequately dispose of infectious waste, inadequate infrastructure for safe patient care, inadequate knowledge of the IPC policies, and knowledge of effective screening and triage practices to minimize potential transmission of infectious diseases to the health facility[40]. SSA had adopted

the implementation of the two branches of IPC measures. These are the standard precautions and transmission-based precautions. Unfortunately, these standard precautions and transmission-based precautions are not effectively implemented in most of SSA[41].

Over two decades, Tanzania has implemented the standard-based management and recognition (SBM-R) approach to identify and guide measures that improve IPC practices and prevent HCAIs at facilities. The SBM-R approach involves; identifying desired standards for a defined service delivery or specific content area, implementing those standards systematically, and identifying, gaps between actual and desired performance as well as designing a comprehensive action plan for addressing the gaps, monitoring the process for improving process and rewarding the achievements of standards[42]

Report on the trends for compliance of IPC in Tanzania, from 2010 to 2017 reported successful improvement in adherence with standards, showing the maximum average scores of 53% in 2014.[5] Development of action plans, training, and regular assessment for IPC compliance remain as the main gaps in IPC implementation among healthcare facilities in Tanzania. In addition, a report from the WHO Joint External Evaluation (JEE) in 2016 demonstrated improved capacity (level 3 of 5) in implementing IHR (2005)[43]. But, antimicrobial resistance detection**,** surveillance of infections caused by antimicrobial-resistant pathogens, and antimicrobial stewardship activities were indicators with underperformance scores, portraying significant gaps[43]. Another follow-up assessment done with the support of The USAID Medicines, Technologies, and Pharmaceutical Services (MTaPS) for six MTaPS-supported hospitals demonstrated improved adherence to IPC in the year 2020, through 2021, to 2022, however, inconsistency was noted in some facilities where the score was dropped back in the year 2022[44].

1.7.6 Tools for assessment of IPC

IPCAF tool: This is an evidence-based tool that assesses the compliance of WHO infection prevention and control core components. The IPCAF provides a baseline assessment of the IPC activities and ongoing evaluations to see improvement and foster improvement. The tool comprised of eight sections reflecting the WHO CCs of the IPC program. Each section of IPC CCs contains a column of close-ended questionnaires regarding IPC activities/standards, a column of

answers regarding the IPC implementation, and a column for scoring. The total scoring for each CC is 100 units, giving a total of 800 units for all eight CCs[45]

Tanzania uses the national IPC standard-based management and recognition tool[46]. Tanzania National IPC Standards comprised with 66 standards that guide the delivery of all services provided in the health care settings. The 66 standards are listed according to the functional area and are comprised of four columns which are: -

Performance standards: they are the "desired standards", i.e., they identify what is anticipated from healthcare providers, or an operating area, or the whole facility

Verification criteria: Give detailed procedures on the implementation of the standards, availability of equipment for IPC as well as settings and operations of the specific area of service provision

The scoring column/Y, N, N/A: This column has been designed for scoring and defines whether a verification criterion has been attained (Y), not reached (N), or is not applicable (N/A).

Comments: This column provides room for remarks on the assessment results that explain the reason for failure to meet or fulfill the target standard[45]. This tool is useful as it can apply to any healthcare facility, it is simple but very comprehensive, it identifies gaps and guides the interventions, and it is standardized and quantifiable to assess the implementation level.

CHAPTER TWO

2.0 METHODOLOGIES

2.1 Study design, area and setting.

A cross-sectional exploratory study was conducted in nine healthcare facilities in Dar es Salaam, Tanzania, from April to July, 2024. Among them, three were regional referral hospitals (RRH) which are Mwananyamala (MRRH) Amana (ARRH), and Temeke (TRRH), five hospitals at the district level which are; Mbagala Rangi Tatu Hospital (MBH), Mnazi Mmoja hospital (MJH), Sinza hospital (SZH), Vijibweni hospital (VJH), Kivule hospital (KVH) and one health centre which is Buguruni (BGHc). These healthcare facilities were purposively selected due to high patient load, delivering services for the majority of the Dar es Salaam population.

2.2 Sample size and sampling technique

Nine public health facilities were selected using a purposive sampling technique to conduct an assessment of the level of IPC implementation in district and regional hospitals in Dar es Salaam.

2.3 Variables

Dependent variable

IPC score

Independent variable

IPC implementation

2.4 Data collection tool

An IPCAF tool (Appendix 1) was used as a reference checklist for assessing the existing IPC activities in selected hospitals. IPCAF is a systematically constructed, close-ended questionnaire with a scoring system. It is an evidence-based tool established by the World Health Organization to assess IPC activities and explore existing strengths and weaknesses at healthcare facilities. It encompasses eight sections identifying the eight WHO IPC core components (CC). These eight CCs are

1. IPC program
2. IPC guidelines
3. IPC education and training
4. HAI surveillance
5. Multi-modal strategies for implementation of IPC interventions
6. Monitoring/audit of IPC practices and feedback
7. Workload, staffing, and bed occupancy
8. Built environment, materials, and equipment for IPC at the facility level

Each CC is built up with questions relevant to the respective component that provide possible scores. The result of the score for each CC ranges from 0 to 100. The overall IPCAF score is calculated by the summation of the score of all eight CCs. Based on the total score obtained, the relevant facility was categorized into one of four IPC implementation levels. Interpretation of the IPCAF score was based on WHO classification as; 0-200 = inadequate IPC, 201-400 = basic IPC, 401-600 = intermediate IPC, and 601-800 = advanced IPC.

2.5 Study procedures

We interviewed key IPC personnel including; the IPC focal person, hospital pharmacist, matron/patron, laboratory manager, environmental health officer and human resource manager or health secretory to obtain data of IPC implementation. Key IPC personnel were. To ensure the validity of the information, observation was conducted to verify the implementation of those reported IPC indicators.

2.6 Data analysis

Data entry and analysis were computed through Microsoft Excel. Descriptive analysis for each CC was summarized into a median score with an interquartile range (Table 1). The overall median IPCAF score for participating hospitals was also calculated and summarized into the median score with an interquartile range. IPC gaps for each CC were summarized into frequency and proportion.

2.8 Ethical consideration

Ethical approval was sought from Muhimbili University of Health and Allied Sciences Institutional Review board (MUHAS IRB). Ethical Approval (MUHAS-REC-04-2024-2148) with Ref No DA.282/298/01.C/2148 was given. Ethical consent and permission for data access was obtained from hospital administration for respective hospital. Consent form for data collection was signed by IPC focal person of the responsible health facility.

2.9 Dissemination plan

The findings of this study were presented to the Department of Microbiology and Immunology, and the report will be available at the MUHAS library. The study findings will also be published in a peer-reviewed medical journal.

CHAPTER THREE

3.0 RESULTS

i. Demographic information

All 9 healthcare facilities were public healthcare facilities with three regional referral hospitals, five district hospitals, and one health center. About 33.33% of the hospitals have key departments and providing all five core-specialized healthcare services, 55.55% were hospitals at district level having the capacity of providing all five basic care services including Medical, Pediatric and Child Health, Obstetrics and Gynecology, Dental, and Surgical services, one facility was a health center

ii. Distribution of IPCAF score

The median IPCAF level was 417 (IQR: 478.6-408.75), indicating an intermediate IPCAF adherence. In general, higher scores were observed in RRHs than district health facilities. This is because most of the IPC interventions by ministry of health are directed toward higher facilities than lower facilities. The higher facilities also had more resources and IPC experts than lower facility level. Of all RRHs, the highest score recorded at TRRH (Fig 1). The highest score at TRRH was largely contributed due monitoring of implementation of some of IPC indicators including hand hygiene monitoring. Monitoring of IPC standards is a key for successful IPC implementation. In overall, about 89% of the facilities scored intermediate IPCAF level, and the other 11% scored basic IPC classification (Fig 2). For the side of district hospitals, Sinza scored the highest, while the lowest score was recorded at Mbagala Rangi Tatu Hospital. Basic and intermediate IPC level is common in many healthcare facilities of low and middle income countries due to in adequate resources, experts and physical infrastructure, materials, and equipment for optimum IPC practices.

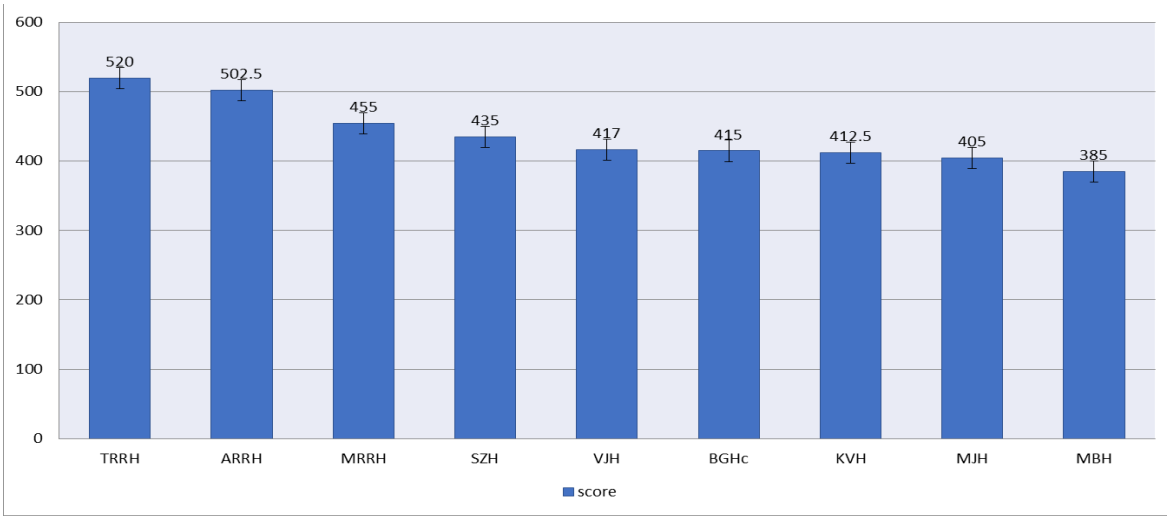


Figure 2: IPCAF score of assessed hospitals in Dar es Salaam

TRRH: Temeke Regional Referral Hospital, ARRH: Amana Regional Referral Hospital, MRRH: Mwananyamala Regional Referral Hospital, SZH: Sinza Hospital, VJH: Vijibweni Hospital, BGHc: Buguruni Health Centre, KVH: Kivule Hospital, MJH: Mnazimmoja Hospital, MBH: Mbagala Hospital.

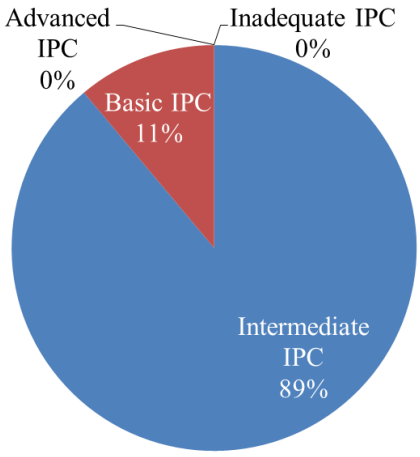


Figure 2: Proportion of IPCAF score of assessed hospitals: Most facilities scored intermediate adherence level, and the remaining few fall into basic IPC implementation. Limited budget, expert, materials, infrastructures, knowledge and inadequate commitment to IPC implementation were the factors hindering the achievements of advanced IPC level. There is a need to improve the scope of implementation, quality and long-term plan to sustain the existing IPC and achieve adherence level as recommended by the World Health Organization.

iii. Component-based analysis

IPC program

The median score for IPC programs was 70 (IQR: 70-65). This score suggests that, most indicators of IPC program were implemented, but not at optimal level as recommended by the WHO. In adequate budget and administrative support to implement IPC standards was a challenge to achieve optimal level of the IPC program. All facilities had an IPC program supported by a team of IPC professionals, an annual action plan and budget for IPC objectives. Executive meeting level, executive rounds, morbidity and mortality meetings oriented to discuss IPC improvement and failure was cited only in 33.33% of assessed facilities. Only 2 hospitals out of 9 had microbiological laboratory support for providing results reliably (timely with sufficient quality).

IPC guidelines

IPC guidelines scored the highest among all eight CC, with overall median of 75 (IQR: 77.5-75). This score is within the range of WHO recommendation. Hand hygiene guidelines, waste management guidelines, standard precaution, transmission-based precaution, disinfection and sterilization, prevention of catheter-associated sepsis, injection safety, prevention of ventilator-associated pneumonia, prevention of CAUTIs, prevention of transmission of MDR, antibiotic stewardship, prevention of SSIs and outbreak management and preparedness guidelines were found in all facilities. All the available guidelines were consistent with national or /international guidelines, but, healthcare workers protection and safety are not included in the national IPC guidelines. Expertise for adopting IPC guidelines was available in all assessed healthcare facilities, but only 2 hospitals (22.2%) out of 9 had regular monitoring systems for implementing the guidelines.

IPC education and training

The highest score for IPC education and training was 65 and the lowest score was 30. The median score was 40(IQR: 55-35). This score suggests that, most standards of this core component are not implemented, leaving a big IPC gap. About 22.22% of the surveyed facilities had no expert for

IPC training at their facility. All facilities claimed inadequate budget to conduct regular IPC training. All hospitals have training for new cleaner employees but no regular training is offered afterward. No hospitals cited a plan for specific IPC training for patients or their family members.

HCAI surveillance

HCAI surveillance recorded the second lowest score with an overall median score of 30(IQR: 50-22.5). Most of the IPC indicators in this core component were not implemented as per the WHO recommendation, underscoring the need to improve scope and quality of implementation. None of the hospitals had incorporated a surveillance system as a component of the IPC program. All hospitals had no skilled professionals trained in epidemiology to carry out surveillance. Only two hospitals reported regular analysis for antimicrobial resistance patterns. None of the facilities cited prioritization to determine HCAIs for surveillance or surveillance for device-associated infections or colonization/infection caused by MDR. Only 3 hospitals (33.33%) conducted surveillance for SSI and provide feedback on surveillance data.

Table 1 Distribution of IPCAF score by core component

IPC Core component	**Median (IQR)**
IPC Program	70 (70, 65)
IPC Guidelines	75(77.5, 75)
IPC Education	40(55, 35)
HCAIs surveillance	30(50, 22.5)
Multimodal strategies for the implementation of IPC	60(67.5, 55)
Monitoring of IPC and feedback	25(31.25, 25)
Workload, bed occupancy, and staffing	55(60, 40)
Build environment, materials, and equipment	77.5(80, 75)

Multi-modal strategies

Implementation of multimodal strategies for IPC activities was found in all facilities, with a reported median score of 55 (IQR: 67.5-55), indicating basic implementation. Most of the IPC

personnel were not enough aware of this core components suggesting special training to improve conceptualization and scope of implementation. Majority of facilities (77.8%) do not monitor compliance with IPC indicators. None of the hospitals' managers showed visible support for safety climate and culture change. Posters and reminders or other awareness-raising tools for IPC intervention were found in all facilities.

Monitoring and audit of IPC practices and feedback

IPC monitoring recorded the lowest score of all CCs. The lowest score was 25 and highest score was 40. The median score was 25 (IQR: 31-25). We need to design standard monitoring tool that can be used to monitor IPC implementation including those international standard tool such as the WHO hand hygiene assessment tool. Majority of IPC indicators were not monitored, hindering the quality and optimal implementation of IPC standards. Few indicators that were monitored are waste management and sterilization of medical equipment. No hospital reported monitoring of antimicrobial consumption. No hospital had a defined plan for monitoring IPC intervention with defined goals and targets. WHO hand hygiene self-assessment survey, was reported in two, hospitals of which one hospital had annual reporting of monitoring data

Table 2 IPCAF core by facilities

IPC Core components	Facility names and scores								
	ARRH	BGH	KVH	MBH	MJH	MRRH	SZH	TRRH	VJBH
IPC program (CC1)	70	70	65	65	65	70	70	70	65
IPC guidelines (CC2)	80	75	75	75	72.5	75	75	80	75
IPC education and training (CC3)	60	40	30	30	50	40	40	65	30
HCAI surveillance (CC4)	65	22.5	22.5	22.5	30	40	32.5	60	22.5
Multimodal strategies (CC5)	70	55	55	60	65	65	55	70	55
Monitoring of IPC and feedback (CC6)	35	25	25	25	20	27.5	25	40	25
Workload, and staffing (CC7)	45	45	60	25	35	60	60	55	60
Built environment, materials, and equipment (CC8)	77.5	77.5	80	72.5	67.5	77.5	77.5	80	85

TRRH: Temeke Regional Referral Hospital, ARRH: Amana Regional Referral Hospital, MRRH: Mwananyamala Regional Referral Hospital, SZH: Sinza Hospital, KVH: Kivule Hospital, VJH: Vijibweni Hospital, BGHc: Buguruni Health Center, MJH: Mnazimmoja Hospital, MBH: Mbagala Hospital,

CC score descriptions	
51-74	Intermediate score
75-100	Advanced score
26-50	Basic score
0-25	Inadequate score

Workload, staffing, and bed occupancy

This IPC core component reported a median score of 55(IQR: 60-40). The score fall at intermediate adherence level, indicating the requirement of increasing scope and quality of implementation. All facilities reported assessment of their staffing level in accordance with national agreement. All facilities maintained the WHO/national agreed ratio of healthcare workers to patients in more than 50% of their total units. Only 2 hospitals (22.2%) had bed occupancy kept to one patient per bed for all departments. No hospital had maintained international/national standards for bed spacing (> 1 m) between patient beds for all units. Assessment system to respond when bed capacity is exceeded was found in 3 hospitals (33.33%), however despite the response system in place, it is not ideally implemented due to a high patient load.

Built environment, materials, and equipment for IPC

This core component reported the second-highest score with a median score of 77.5 (IQR: 80-75). The maximum score was 85 and the minimum score was 67.5. This score generally indicates optimal implementation, however only few standards were still exist as gaps Availability of sufficient water services was found in all healthcare facilities, but reliable safe drinking water stations were found only in 1 hospital (11.11%). All facilities had functional mechanical or natural ventilation in patient-care areas. Hand hygiene stations were found in all hospitals but some stations lack with reliably supplies of soap or alcohol-based hand. No single-use towels were present at any hand hygiene station for all hospitals. Single rooms for cohorting were not available, but rooms for cohorting patients with similar infections were found in all hospitals. Reliable continuous and sufficient of PPE was reported by all healthcare facilities. All waste generation points had available color-coded waste collection containers in all assessed facilities. All hospitals had either functional incinerator on or off-site and were operated by licensed personnel. Sufficient reliable disinfected and sterilized medical equipment for daily use was available in all facilities

IPC gap-based analysis

Many significant gaps were observed in the assessed facilities. Some of these gaps were observed in all facilities, whilst others were reported in some of the facilities. In general, RRHs cited fewer IPC gaps than district hospitals; however, in some of the IPC CCs, RRHs recorded more significant gaps than district hospitals.

Table 3 Key IPC gaps identified during the assessment

IPC Core Components	IPC Gaps	No. of facilities with gaps	Proportion (%)
IPC Program	Senior facility leadership is not included in the IPC committee	9	100.0
	In adequate capacity of microbiology laboratory to deliver sufficient quality results	7	77.8
IPC guideline	Lack of regular monitoring of implementation of IPC guidelines	8	22.2
IPC education	Lack of IPC training for patients and their family members	9	100.0
	No regular evaluation for the effectiveness IPC training	9	100.0
	No ongoing development/education for IPC staffs by regular attending conference courses	6	66.7
	Lack of ongoing IPC education for cleaners.	9	100.0
Surveillance of HCAIs	Surveillance is not addressed as a defined component in the planned IPC program	9	100.0
	Lack of trained professional in basic epidemiology and surveillance for carrying out surveillance of HCAIs	9	100.0
	No prioritization to determine HCAIs for surveillance	9	100.0
	No surveillance of SSI	6	66.7
	Surveillance is not done for device associated infection	9	100.0
	Lack of surveillance of infection/colonization caused by MDR	9	100.0
	Lack of isolation of patients infected with MDR		
	No feedback of surveillance data	6	66.7
Multimodal strategies for implementation of IPC	No safety climate and culture change, managers/leaders showing and act as a champion promoting IPC quality	9	100.0
	No monitoring of compliance and timely feedback of monitoring results to healthcare workers and key players	7	77.8
Monitoring/Audit of PC	No well-defined monitoring plan with clear goals, targets and activities	9	100.0
	Hand hygiene compliance using WHO hand hygiene observation tool is not regularly monitored	7	77.8

activities and feedback	No monitoring of antimicrobial consumption using PPS	9	100.0
	No monitoring of intravascular catheter insertion and/or care	9	100.0
	No monitoring of cleaning of ward environment	9	100.0
	No assessment of safety cultural factors using survey such as HSOPSC, SAQ or others	9	100.0
Workload, bed occupancy and staffing level	In adequate staffing.	9	100.0
	Lack of maintenance of bed occupancy kept to one patient per bed.	7	77.8
	No adequate spacing of > 1 m between patient beds.	9	100.0
	No system to assess and respond when adequate bed capacity is exceeded	9	100
Build environment, materials and equipment for IPC	No reliable safe drinking water station present and accessible at all times	8	88.9
	Hand hygiene stations present but some supplies are not reliably available	7	77.8
	No record of floors and surfaces being cleaned	5	55.6
	Record of floors and surfaces being cleaned exist but not completed and signed daily or outdated	2	22.2
	Pit for disposal of non-infectious waste available but over field or irregular municipal pick-up of solid waste	6	66.7

CHAPTER FOUR

4.0 DISCUSSION, STRENGTH AND LIMITATION OF THE STUDY

4.1 Discussion

Majority (89%) of the facilities had intermediate IPC and the remaining 11% scored basic IPC. No facility scored inadequate or advanced IPC. This finding is slightly different form previous study that demonstrated that 50%, 33.34% and 16.67% of referral hospitals in Tanzania had basic, intermediate and advanced IPC level respectively[19]. This finding is different from our study mostly because of differences in the level of assessed healthcare facilities. Higher healthcare facilities generally demonstrate higher IPC compliance than lower facility level largely due to resources and experts. Intermediate IPC level is generally cited across many facilities in lower middle-income countries due to limited resources and experts. Another study in Turkey reported, 73.5%, and 23.5%, of Turkish healthcare facilities meet advanced and intermediate IPC level respectively[47]. In our assessment, surveillance and monitoring were found to be areas with big gaps in all study facilities. Underperformance in these indicators fuel AMR and HCAIs. The gaps described this study emphasize the need to develop strategies to improve IPC adherence in our setting. There was observed a significant degree of heterogeneity of IPC score among the facilities. Temeke RRH scored the highest IPCAF score which is consistent with a recently conducted study[19]. While the highest score was recorded in some IPC CCs (IPC guidelines, build environment, material, and equipment and IPC program) which were often found to be in place, not all were sufficiently implemented, portraying the requirement for improvement.

Regarding the IPCAF score for each CC, considerable differences existed between referral and district hospitals, as well as hospitals at the same level.

IPC program was present in all healthcare facilities, but defined objectives and annual activity plans were dependent up on available resources and not based on the local epidemiology. Involving senior facility leadership in the IPC team was a gap in all assessed facilities. Literatures argue that, facility leader is important member of IPC and have to clearly designate staff who are committed for IPC interventions and not just letting IPC team to chance to plan and implement IPC

interventions without oversight and guidance. Administrators are also responsible to oversee the leader of the IPC program and take an active role in helping to define and support the program's priorities and plans [48]. This study also noted that a deficit in budget allocations is a common challenge hindering the effective implementation of IPC program. IPC program with a committed team of professionals and leadership is crucial for effective IPC implementation[49]

All facilities had IPC guidelines, however, implementation of most guidelines including antibiotic stewardship guidelines were not optimal. No facility conducted point prevalence survey for monitoring of appropriate consumption of antibiotics. Regular monitoring of implementation of guidelines were also not implemented almost in 78% of the facilities.

IPC education and training was parent in all facilities but recorded low score, and most of indicators were not effectively implemented. No facility had all her healthcare workers (HCWs) trained in IPC, but had at least some HCWs trained in IPC. Most facility reported no regular IPC training or evaluation of effectiveness of IPC education. Inadequate knowledge of the IPC roles, principles as well as un-optimal use may fail to prevent HCAIs or may result escalation of transmission of infection during outbreak or daily care delivery[50]. Moreover, inconsistency in the provision or content of IPC education among healthcare workers can lead to misperception, risky practice, and lack of confidence among clinicians. Hence, knowledge and skills in IPC measures for all healthcare workers is the most critical key element in achieving safety practices during healthcare delivery, and need to be addressed among the top priorities during planning of IPC objectives.

HCAI surveillance was not found to be included in the planning of IPC annual action plan in all facilities. Most facilities had inadequate microbiology laboratory capacity and lack experts trained in basic epidemiology to support HCAIs surveillance. HCAI surveillance in healthcare facility is critically needed to help the estimation of burden and incidence of HCAIs so that appropriate IPC measures can be taken[51]

Multimodal strategies were perceived as new concept in many healthcare facilities. Most of the indicators were comparatively not known and were not implemented. Larger proportion of the

hospitals achieved a low score for this component, indicating little awareness on the need to have a multi-disciplinary team and approaches to implement IPC strategies.

IPC monitoring scored the lowest. All facilities lack a well-defined monitoring plan with proper goals, targets, and activities. Most of the facilities not provided regular feedback reports on IPC performance audits to the upper administration or frontline HCWs, and thus hindering institutional investment in IPC measures.

Workload, bed occupancy and staffing was found with significant IPC gaps with potential to HCAIs and AMR. All facilities demonstrated understaffing and overcrowding, with potential significant risk factors for HCAIs, as demonstrated in other studies[52]. Overcrowding and inadequate staffing in these hospitals revealed the requirement of the urgent improvement in IPC practices that require high-level administration support and planning. The policymakers should prioritize and fill up vacancies and foster the recruitment process to acquire standard patient to staff ratio. The Ministry of health should also identify plan to cope up with the persistent overcrowding in hospitals with the aim to attain standard bed occupancy.

Build environment, materials and equipment assesses the hospital infrastructure, materials, and equipment for optimum IPC practices. The study revealed that the hospitals' water, electricity, light, and ventilation system was generally good in all facilities. Only one facility which was a health center found to have insufficient number of functional toilets.

4.2 Strengths of the study

The study provided the opportunity to conceptualize the IPCAF tool at large, to assess the present IPC situation and identify critical gaps towards improvement of IPC implementation district and regional referral hospitals. These findings can be used by all IPC stakeholders and policymakers in adopting with IPC behaviors and to increase investment and prioritization of IPC to ensure the safety of healthcare workers in healthcare facilities

4.3 Limitation of the study

The study was carried out in selected public health facilities, which lack representativeness of private hospitals. Incorporating private hospitals that offer the corresponding healthcare services could have revealed greater heterogeneity in existing IPC level. Furthermore, some few indicators were based on self-report by a designated IPC person, for example, attending IPC education, IPC feedback to frontline healthcare workers etc. The assessments could be made more robust with objective data to support their determinations.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

By describing the current status of IPC activities in our district and regional referral hospitals, this study provides a useful framework for clinicians and policymakers to assess the current scenario and design strategic improvement plans. This study demonstrates clear areas that require improvement. The data suggests that the areas in most need of improvement are regular IPC education and training for all healthcare workers, monitoring of IPC activities and feedback and HCAI Surveillance as they are the central core components for most other CCs. For establishing an effective IPC implementation and improvement, system, there should be a close monitoring and feedback of IPC. The predominant IPC gaps among assessed hospitals are improper ward designing according to international standard as well as inadequate staffing level. Almost al RRH are highly congested with patients even exceeding the bed capacity and overloading the health staffs compromising the delivery of quality healthcare services.

5.2 Recommendations

We recommend the Ministry of health to strengthen IPC education, but also hospital management have to consider regular IPC education as mandatory for all HCWs. Cleaners, who are a core part of IPC stakeholders that maintaining hospital hygiene, as well as administrative staff should never left behind for IPC education as many studies found that they receive IPC training even less frequently than healthcare workers as similarly reported in our study. Also, the Ministry of health has to strengthen HCAIs surveillance and timely feedback oriented for assessment and improvement of IPC in the facilities. Furthermore, IPC Monitoring and Evaluation need to be strengthened at facility level, through the use of standard monitoring tools. More importantly, policymakers should prioritize and fill up vacancies to acquire international/national standard patient to staff ratio. Lastly, the Ministry of health should also identify and implement best plan to cope up with the persistent overcrowding of inpatients so as to attain international/national standard ward designing and bed occupancy.

REFERENCES

1. Qijia A, Verma M, Yang L, Legido-quigley H. The Lancet Regional Health - Western Pacific An analysis of national action plans on antimicrobial resistance in Southeast Asia using a governance framework approach. Lancet Reg Heal - West Pacific [Internet]. 2021;7:100084. Available from: https://doi.org/10.1016/j.lanwpc.2020.100084
2. Das A, Garg R, Kumar ES, Singh D, Ojha B, Kharchandy HL, et al. Implementation of infection prevention and control practices in an upcoming COVID-19 hospital in India: An opportunity not missed. PLoS One. 2022 May 1;17(5 May).
3. Nejad SB, Allegranzi B, Syed SB, Pittet D. Health-care-associated infection in Africa : a systematic review. 2011;(March):757–65.
4. Hokororo J, Mohsmed H, Ngowi R, German C, Bahegwa R, Msigwa Y, Nassoro O, Marandu L, Kiremeji M, Lutkam D, Habtu M LE and EE. Evaluation of Infection Prevention and Control Compliance in Six Referral Hospitals in Tanzania using National and World Health Organization Standard Checklists. Prev Med Epidemiol Public Heal. 2021;2(3).
5. J H, E E, R N, C G, R B, Y M, et al. Report of Trend for Compliance of Infection Prevention and Control Standards in Tanzania from 2010 to 2017 in Tanzania Mainland. Microbiol Infect Dis. 2021;5(3):1–10.
6. Harun MGD, Anwar MMU, Sumon SA, Hassan MZ, Haque T, Mah-E-Muneer S, et al. Infection prevention and control in tertiary care hospitals of Bangladesh: results from WHO infection prevention and control assessment framework (IPCAF). Antimicrob Resist Infect Control [Internet]. 2022;11(1):1–13. Available from: https://doi.org/10.1186/s13756-022-01161-4
7. Abubakar U, Amir O, Baño JR. Healthcare - associated infections in Africa : a systematic review and meta - analysis of point prevalence studies. J Pharm Policy Pract [Internet]. 2022;5:1–16. Available from: https://doi.org/10.1186/s40545-022-00500-5
8. Mehtar S, Wanyoro A, Ogunsola F, Ameh EA, Nthumba P, Kilpatrick C, et al.

Implementation of surgical site infection surveillance in low- and middle-income countries a position statement for the international society for infectious diseases: a position statement for the international society for infectious diseases. Int J Infect Dis [Internet]. 2020;100:123–31. Available from: https://doi.org/10.1016/j.ijid.2020.07.021

9. Kibwana UO, Manyahi J, Sensa V, Yongolo SC, Lyamuya E. Predictors of Surgical Site Infections among Patients Undergoing Open Urological Surgery at a Tertiary Hospital, Tanzania: A Cross Sectional Study. East African Heal Res J. 2022;6(1):113–8.

10. Mawalla B, Mshana SE, Chalya PL, Imirzalioglu C, Mahalu W. Predictors of surgical site infections among patients undergoing major surgery at Bugando Medical Centre in Northwestern Tanzania. BMC Surg. 2011;11.

11. Woodd SL, Kabanywanyi AM, Rehman AM, Campbell OMR, Kagambo A, Martiasi W, et al. Postnatal infection surveillance by telephone in Dar es Salaam, Tanzania: An observational cohort study. PLoS One [Internet]. 2021;16(7 July):1–15. Available from: http://dx.doi.org/10.1371/journal.pone.0254131

12. Joachim A, Moyo SJ, Nkinda L, Majigo M, Mbaga E, Mbembati N, et al. Prevalence of methicillin-resistant Staphylococcus aureus carriage on admission among patients attending regional hospitals in Dar es Salaam, Tanzania. BMC Res Notes. 2017;10(1):1–7.

13. Guidelines on Core Components of Infection Prevention and Control Programmes at the National and Acute Health Care Facility Level.

14. Suleyman G, Alangaden G, Bardossy AC. The Role of Environmental Contamination in the Transmission of Nosocomial Pathogens and Healthcare-Associated Infections. Curr Infect Dis Rep. 2018;20(6).

15. Chemaly RF, Ghantoji SS, Simmons S, Dale C, Rodriguez M, Gubb J, et al. The role of the healthcare environment in the spread of multidrug-resistant organisms: Update on current best practices for containment. Ther Adv Infect Dis. 2014;2(4):79–90.

16. WHO. Standard precautions for the prevention and control of infections Key elements at a glance Risk assessment. 2022;1–5. Available from: https://www.who.int/publications-detail-redirect/WHO-UHL-IHS-IPC-2022.1

17. WHO. Transmission-based precautions for the prevention and control of infections. 2022;1–4. Available from: https://apps.who.int/iris/handle/10665/259462

18. WHO. Global report on infection prevention and control. Who. 2022. 1–182 p.

19. Hokororo J, Mohamed H, Ngowi R, German C, Bahegwa R, Msigwa Y, et al. Evaluation of Infection Prevention and Control Compliance in Six Referral Hospitals in Tanzania using National and World Health Organization Standard Checklists. Vol. 2, Preventive Medicine, Epidemiology and Public Health. 2021.

20. Manchanda V, Suman U, Singh N. Implementing Infection Prevention and Control Programs When Resources Are Limited. Curr Treat Options Infect Dis. 2018;10(1):28–39.

21. Kilonzo SB, Gunda DW, Mpondo BCT, Bakshi FA, Jaka H. Hepatitis B Virus Infection in Tanzania: Current Status and Challenges. J Trop Med. 2018;2018.

22. MoHCDGEC. the National Guidelines for Water, Sanitation and Hygiene in Health Care Facilities. United Repub Tanzania Minist Minist Heal Community Dev Gender, Elder Child. 2015;(October):1–121.

23. Lee MH, Lee GA, Lee SH, Park YH. Effectiveness and core components of infection prevention and control programmes in long-term care facilities: a systematic review. J Hosp Infect [Internet]. 2019;102(4):377–93. Available from: https://doi.org/10.1016/j.jhin.2019.02.008

24. Barrera-Cancedda AE, Riman KA, Shinnick JE, Buttenheim AM. Implementation strategies for infection prevention and control promotion for nurses in Sub-Saharan Africa: A systematic review. Implement Sci. 2019;14(1).

25. Salama MF, Jamal WY, Mousa H Al, Al-AbdulGhani KA, Rotimi VO. The effect of hand hygiene compliance on hospital-acquired infections in an ICU setting in a Kuwaiti teaching hospital. J Infect Public Health [Internet]. 2013;6(1):27–34. Available from: http://dx.doi.org/10.1016/j.jiph.2012.09.014

26. Wiedenmayer K, Msamba VS, Chilunda F, Kiologwe JC, Seni J. Impact of hand hygiene intervention: A comparative study in health care facilities in Dodoma region, Tanzania

using WHO methodology. Antimicrob Resist Infect Control. 2020;9(1):1–9.

27. Pittet D, Allegranzi B, Sax H, Dharan S, Pessoa-Silva CL, Donaldson L, et al. Evidence-based model for hand transmission during patient care and the role of improved practices. Lancet Infect Dis. 2006;6(10):641–52.

28. Soleman SR, Lyu Z, Okada T, Sassa MH, Fujii Y. Ef fi cacy of personal protective equipment to prevent environmental infection of COVID-19 among healthcare workers : a systematic review. 2023;1–12.

29. Bahegwa RP, Hussein AK, Kishimba R, Hokororo J, German C, Ngowi R, et al. Infection Prevention in Practice Factors affecting compliance with infection prevention and control standard precautions among healthcare workers in Songwe region , Tanzania. Infect Prev Pract [Internet]. 2022;4(4):100236. Available from: https://doi.org/10.1016/j.infpip.2022.100236

30. Rayson D, Basinda N, Pius RA, Seni J. Comparison of hand hygiene compliance self-assessment and microbiological hand contamination among healthcare workers in Mwanza region, Tanzania. Infect Prev Pract [Internet]. 2021;3(4):100181. Available from: https://doi.org/10.1016/j.infpip.2021.100181

31. Kaiser RA, Taing L, Bhatia H. Antimicrobial Resistance and Environmental Health: A Water Stewardship Framework for Global and National Action. Antibiotics. 2022;11(1):1–26.

32. Salam MA, Al-Amin MY, Salam MT, Pawar JS, Akhter N, Rabaan AA, et al. Antimicrobial Resistance: A Growing Serious Threat for Global Public Health. Healthc. 2023;11(13):1–20.

33. Maina M, Tosas-Auguet O, McKnight J, Zosi M, Kimemia G, Mwaniki P, et al. Evaluating the foundations that help avert antimicrobial resistance: Performance of essential water sanitation and hygiene functions in hospitals and requirements for action in Kenya. PLoS One. 2019;14(10):1–19.

34. Wong VWY, Huang Y, Wei WI, Wong SYS, Kwok KO. Approaches to multidrug-resistant organism prevention and control in long-term care facilities for older people: a systematic

review and meta-analysis. Antimicrob Resist Infect Control [Internet]. 2022;11(1):1–14. Available from: https://doi.org/10.1186/s13756-021-01044-0

35. Beattie M. A Guide to Infection Control in the Hospital. Vol. 6, Australian Infection Control. 2001. 102 p.

36. Wang Y, Yuan Y, Lin L, Tan X, Tan Y. Determining the ideal prevention strategy for multidrug-resistance organisms in resource-limited countries: A cost-effectiveness analysis study. Epidemiol Infect. 2020;

37. Teerawattanapong N, Kengkla K, Dilokthornsakul P, Saokaew S, Apisarnthanarak A, Chaiyakunapruk N. Prevention and control of multidrug-resistant Gram-negative bacteria in adult intensive care units: A systematic review and network meta-analysis. Clin Infect Dis. 2017;64(Suppl 2):S51–60.

38. Kamere N, Garwe ST, Akinwotu OO, Tuck C, Krockow EM, Yadav S, et al. Scoping Review of National Antimicrobial Stewardship Activities in Eight African Countries and Adaptable Recommendations. 2022;1–17.

39. WHO Regional Office for Africa; Health situation analysis of the African Region Country Profiles [Internet]. 2022. Available from: http://apps.who.int/bookorders.

40. Rothe C, Schlaich C, Thompson S. Healthcare-associated infections in sub-Saharan Africa. J Hosp Infect [Internet]. 2013;85(4):257–67. Available from: http://dx.doi.org/10.1016/j.jhin.2013.09.008

41. Ridde V. Need for more and better implementation science in global health. BMJ Glob Heal. 2016;1(2):1–3.

42. Prevention NI, Standards C, Hospitals FOR. THE UNITED REPUBLIC OF TANZANIA NATIONAL INFECTION PREVENTION AND CONTROL STANDARDS FOR. 2020;

43. Date R. Mission Report ／ 出張報告書. 2016;(February):3–5.

44. Brief T. USAID MEDICINES , TECHNOLOGIES , AND PHARMACEUTICAL SERVICES (MTAPS) PROGRAM Improving Infection Prevention and Control in Tanzania Stakeholder Engagement. 2023;41(101221):1–8.

45. Health MOF, Development C. THE UNITED REPUBLIC OF TANZANIA.

46. Improving FOR, Prevention I. THE UNITED REPUBLIC OF TANZANIA. 2021;

47. Azak E, Sertcelik A, Ersoz G, Celebi G, Eser F, Batirel A, et al. Evaluation of the implementation of WHO infection prevention and control core components in Turkish health care facilities: results from a WHO infection prevention and control assessment framework (IPCAF)—based survey. Antimicrob Resist Infect Control. 2023;12(1).

48. Maragakis LL. Infection Prevention and Control .

49. Jeong Y, Joo H, Bahk H, Koo H, Lee H, Kim K. A nationwide survey on the implementation of infection prevention and control components in 1442 hospitals in the Republic of Korea: comparison to the WHO Infection Prevention and Control Assessment Framework (IPCAF). Antimicrob Resist Infect Control. 2022;11(1):1–9.

50. Yago M. R et al. Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-. Ann Oncol. 2020;(January):19–21.

51. WHO. Worldwide country situation analysis : Worldwide country situation analysis : World Heal Organ 20 Ave Appia, 1211 Geneva 27, Switz. 2015;(April):1–50.

52. Mitchell BG, Gardner A, Stone PW, Hall L, Pogorzelska-Maziarz M. Hospital Staffing and Health Care–Associated Infections: A Systematic Review of the Literature. Jt Comm J Qual Patient Saf. 2018;44(10):613–22.

APPENDICES

Appendix 1 Data collection tool

i. Social demographics

Interviewee code/Name _____

Date (dd/mm/yyyy) ____/___/_____

1. Phone number _____
2. Position: _____
3. Name of Hospital: _____
4. Region_____
5. Level of hospital

   Regional ☐ District ☐

ii. WHO IPCAF tool

CORE COMPONENT 1: Infection Prevention and Control (IPC) Program			
S/N	Question	Answer	Scores
1	Do you have an IPC program?	☐ No	0
		☐ Yes without clearly defined objectives	5
		☐ Yes with clearly defined objectives and annual activity plan	10
2	Is the IPC programme supported by an IPC team comprising of IPC professionals	☐ No	0
		☐ Not a team, only an IPC focal person	5
		☐ Yes	10
3	Does the IPC team have at least one full-time IPC professional or equivalent (nurse or doctor working 100% in IPC) available?	☐ No IPC professional available	0
		☐ No, only a apart-time IPC professional available	2.5
		☐ Yes, one per > 250 beds	5
		☐ Yes, one per ≤ 250 beds	10
4	Does the IPC team or focal person have dedicated time for IPC activities?	☐ No	0
		☐ Yes	10
5	Does the IPC team include both doctors and nurses?	☐ No	0
		☐ Yes	10
6	Do you have an IPC committee actively supporting the IPC team?	☐ No	0
		☐ Yes	10
7	Are any of the following professional groups represented /included in the IPC committee?		

Senior facility leadership (for example, administrative director, chief executive officer [CEO], medical director		☐ No	0
		☐ Yes	5
Senior clinical staff (for example, physician, nurse)		☐ No	0
		☐ Yes	2.5
Facility management (for example, biosafety, waste, and those tasked with addressing water, sanitation, and hygiene [WASH]		☐ No	0
		☐ Yes	2.5
8	Do you have clearly defined IPC objectives (that is, in specific critical areas)?	☐ No	0
		☐ Yes, IPC objectives only	2.5
		☐ Yes, IPC objectives and measurable outcome indicators (that is, adequate measures for improvement)	5
		☐ Yes, IPC objectives, measurable outcome indicators and set future targets	10
9	Does the senior facility leadership show clear commitment and support for the IPC programme:		
	By an allocated budget specifically for the IPC programme (that is, covering IPC activities, including salaries)?	☐ No	0
		☐ Yes	5
	By demonstrable support for IPC objectives and indicators within the facility (for example, at executive level meetings, executive rounds, participation in morbidity and mortality meetings)?	☐ No	0
		☐ Yes	5
10		☐ No	0

	Does your facility have microbiological laboratory support (either present on or off site) for routine day-to-day use?	☐ Yes, but not delivering results reliably (timely and of sufficient quality)	5
		☐ Yes, and delivering results reliably (timely and of sufficient quality)	10
Subtotal scores			**100**

CORE COMPONENT 2: Infection Prevention and Control (IPC) Guidelines			
S/N	Question	Answer	Scores
1	Does your facility have the expertise (in IPC and/or infectious diseases) for developing or adapting guidelines?	☐ No	0
		☐ Yes	7.5
2	Does your facility have guidelines available for:		
Standard precautions?		☐ No	0
		☐ Yes	2.5
Hand hygiene?		☐ No	0
		☐ Yes	2.5
Transmission-based precautions		☐ No	0
		☐ Yes	2.5
Outbreak management and preparedness?		☐ No	0
		☐ Yes	2.5
Prevention of surgical site infection?		☐ No	0
		☐ Yes	2.5
Prevention of vascular catheter-associated bloodstream infections?		☐ No	0

		☐ Yes	2.5
Prevention of hospital-acquired pneumonia ([HAP]; all types of HAP, including (but not exclusively) ventilator-associated pneumonia)?		☐ No	0
		☐ Yes	2.5
Prevention of catheter-associated urinary tract infections?		☐ No	0
		☐ Yes	2.5
Prevention of transmission of multidrug-resistant (MDR) pathogens?		☐ No	0
		☐ Yes	2.5
Disinfection and sterilization?		☐ No	0
		☐ Yes	2.5
Health care worker protection and safety?		☐ No	0
		☐ Yes	2.5
Injection safety?		☐ No	0
		☐ Yes	2.5
Waste management?		☐ No	0
		☐ Yes	2.5
Antibiotic stewardship?		☐ No	0
		☐ Yes	2.5
3	Are the guidelines in your facility consistent with national/international guidelines (if they exist)?	☐	0
		☐ Yes	10
4	Is implementation of the guidelines adapted according to the local needs and resources while maintaining key IPC standards?	☐	0
		☐ Yes	10
5	Are frontline health care workers involved in both planning and executing the implementation of IPC guidelines in addition to IPC personnel?	☐	0
		☐ Yes	10

6	Are relevant stakeholders (for example, lead doctors and nurses, hospital managers, quality management) involved in the development and adaptation of the IPC guidelines in addition to IPC personnel?	☐	0
		☐ Yes	10
7	Do health care workers receive specific training related to new or updated IPC guidelines introduced in the facility?	☐	0
		☐ Yes	10
8	Do you regularly monitor the implementation of at least some of the IPC guidelines in your facility?	☐	0
		☐ Yes	10
Subtotal			**100**

CORE COMPONENT 3: Infection Prevention and Control (IPC) Education			
S/N	Question	Answer	Scores
1	Are there personnel with the IPC expertise (in IPC and/or infectious diseases) to lead IPC training?	☐ No	0
		☐ Yes	10
2	Are there additional non-IPC personnel with adequate skills to serve as trainers and mentors (for example, link nurses or doctors, champions)?	☐ No	0
		☐ Yes	10
3	How frequently do health care workers receive training regarding IPC in your facility?	☐ Never or rarely	0
		☐ New employee orientation *only* for health care workers	5
		☐ New employee orientation and regular (at least annually) IPC training for health care workers offered but not mandatory	10
		☐ New employee orientation and regular (at least annually) mandatory IPC training for all health care workers	15
4		☐ Never or rarely	0

	How frequently do cleaners and other personnel directly involved in patient care receive training regarding IPC in your facility?	☐ New employee orientation *only* for other personnel	5
		☐ New employee orientation and regular (at least annually) training for other personnel offered but not mandatory	10
		☐ New employee orientation and regular (at least annually) mandatory IPC training for other personnel	15
5	Does administrative and managerial staff receive general training regarding IPC in your facility?	☐ No	0
		☐ Yes	10

CORE COMPONENT 3: Infection Prevention and Control (IPC) Education			
S/N	Question	Answer	Scores
6	How are health care workers and other personnel trained?	☐ No training available	0
		☐ Using written information and/or oral instruction and/or e-learning *only*	5
		☐ Includes *additional* interactive training sessions (for example, simulation and/or bedside training)	10
7	Are there periodic evaluations of the effectiveness of training programmes (for example, hand hygiene audits, other checks on knowledge)?	☐ No	0
		☐ Yes, but not regularly	5
		☐ Yes, regularly (at least annually)	10
8	Is IPC training integrated in the clinical practice and training of other specialties (for example, training of surgeons involves aspects of IPC)?	☐ No	0
		☐ Yes, in some disciplines	5

		☐ Yes, in all disciplines	10
9	Is there specific IPC training for patients or family members to minimize the potential for health care-associated infections (for example, immunosuppressed patients, patients with invasive Devices, patients with multidrug-resistant infections)?	☐ No	0
		☐ Yes	5
10	Is ongoing development/education offered for IPC staff (for example, by regularly attending conferences, courses)?	☐ No	0
		☐ Yes	10
Subtotal			**100**

CORE COMPONENT 4: Health Care Associated Infections (HAIs) surveillance			
S/N	Question	Answer	Scores
Organization of surveillance			
1	Is surveillance a defined component of your IPC programme?	☐ No	0
		☐ Yes	5
2	Do you have personnel responsible for surveillance activities?	☐ No	0
		☐ Yes	5
3	Have the professionals responsible for surveillance activities been trained in basic epidemiology, surveillance and IPC (that is, capacity to oversee surveillance methods, data management and interpretation)?	☐ No	0
		☐ Yes	5
4	Do you have informatics/IT support to conduct your surveillance (for example, equipment, mobile technologies, electronic health records)?	☐ No	0
		☐ Yes	5

Priorities for surveillance - defined according to the scope of care			
5	Do you go through a prioritization exercise to determine the HAIs to be targeted for surveillance according to the local context (that is, identifying infections that are major causes of morbidity and mortality in the facility)?	☐ No	0
		☐ Yes	5
6	In your facility is surveillance conducted for:		
	Surgical site infections?	☐ No	0
		☐ Yes	2.5
	Device-associated infections (for example, catheter-associated urinary tract infections, central line-associated bloodstream infections, peripheral-line associated bloodstream infections, ventilator associated pneumonia)?	☐ No	0
		☐ Yes	2.5
	Clinically-defined infections (for example, definitions based only on clinical signs or symptoms in the absence of microbiological testing)?	☐ No	0
		☐ Yes	2.5
	Colonization or infections caused by multidrug-resistant pathogens according to your local epidemiological situation?	☐ No	0
		☐ Yes	2.5

CORE COMPONENT 4: Health Care Associated Infections (HAIs) surveillance			
S/N	Question	Answer	Scores
	Local priority epidemic-prone infections (for example, norovirus, influenza, tuberculosis [TB], severe acute respiratory syndrome [SARS], Ebola, Lassa fever)?	☐ No	0
		☐ Yes	2.5
	Infections in vulnerable populations (for example, neonates, intensive care unit, immunocompromised, burn patients)?	☐ No	0
		☐ Yes	2.5
	Infections that may affect health care workers in clinical, laboratory, or other settings (for example, hepatitis B or C, human immunodeficiency virus [HIV], influenza)?	☐ No	0
		☐ Yes	2.5

7	Do you regularly evaluate if your surveillance is in line with the current needs and priorities of your facility?	☐ No	0
		☐ Yes	5
8	Do you use reliable surveillance case definitions (defined numerator and denominator according to international definitions [e.g. CDC NHSN/ECDC] or if adapted, through an evidence-based adaptation process and expert consultation?	☐ No	0
		☐ Yes	5
9	Do you use standardized data collection methods (for example, active prospective surveillance) according to international surveillance protocols (for example, CDC NHSN/ECDC) or if adapted, through an evidence-based adaptation process and expert consultation?	☐ No	0
		☐ Yes	5
10	Do you have processes in place to regularly review data quality (for example, assessment of case report forms, review of microbiology results, denominator determination, etc.)?	☐ No	0
		☐ Yes	5
11	Do you have adequate microbiology and laboratory capacity to support surveillance?	☐ No	0
		☐ Yes, can differentiate gram-positive/negative strains but cannot identify pathogens	2.5
		☐ Yes, can reliably identify pathogens (for example, isolate identification) in a timely manner	5
		☐ Yes, can reliably identify pathogens and antimicrobial drug resistance patterns (that is, susceptibilities) in a timely manner	10

CORE COMPONENT 4: Health Care Associated Infections (HAIs) surveillance			
S/N	Question	Answer	Scores
Information analysis and dissemination/data use, linkage, and governance			
12	Are surveillance data used to make tailored unit/facility-based plans for the improvement of IPC practices?	☐ No	0
		☐ Yes	5
		☐ No	0

13	Do you analyze antimicrobial drug resistance on a regular basis (for example, quarterly/half-yearly/annually)?	☐ Yes	5
14	Do you regularly (for example, quarterly/half-yearly/annually) feedback up-to-date surveillance information to:		
	Frontline health care workers (doctors/nurses)?	☐ No	0
		☐ Yes	2.5
	Clinical leaders/heads of department	☐ No	0
		☐ Yes	2.5
	IPC committee	☐ No	0
		☐ Yes	2.5
	Non-clinical management/administration (chief executive officer/chief financial officer)?	☐ No	0
		☐ Yes	2.5
15	How do you feedback up-to-date surveillance information? (at least annually)	☐ No feedback	0
		☐ By written/oral information *only*	2.5
		☐ By presentation and interactive problem-orientated solution finding	7.5
Subtotal			**100**

CORE COMPONENT 5: Multimodal strategies for implementation of infection prevention and control (IPC) interventions			
S/N	Question	Answer	Score
1		☐ No	0

	Do you use multimodal strategies to implement IPC interventions?	☐ Yes	15
2	Do your multimodal strategies include any or all of the following elements: Choose one answer (the most accurate) per element	**System change**	0
		☐ Element not included in multimodal strategies	0
		☐ Interventions to ensure the necessary infrastructure and continuous availability of supplies are in place	5
		☐ Interventions to ensure the necessary infrastructure and continuous availability of supplies are in place and addressing ergonomics and accessibility, such as the best placement of central venous catheter set and tray	10
		Education and training	
		☐ Element not included in multimodal strategies	0
		☐ Written information and/or oral instruction and/or e-learning *only*	5
		☐ *Additional* interactive training sessions (includes simulation and/or bedside training)	10
		Monitoring and feedback	
		☐ Element not included in multimodal strategies	0
		☐ Monitoring compliance with process or outcome indicators (for example, audits of hand hygiene or catheter practices)	5
		☐ Monitoring compliance and providing timely feedback of monitoring results to health care workers and key players	10
		Communications and reminders	
		☐ Element not included in multimodal strategies	0
		☐ Reminders, posters, or other advocacy/awareness-raising tools to promote the intervention	5
		☐ *Additional* methods/initiatives to improve team communication across units and disciplines (for example, by establishing regular case conferences and feedback rounds)	10

		Safety climate and culture change	
		☐ Element not included in multimodal strategies	0
		☐ Managers/leaders show visible support and act as champions and role models, promoting an adaptive approach and strengthening a culture that supports IPC, patient safety and quality	5
		☐ *Additionally*, teams and individuals are empowered so that they perceive ownership of the intervention (for example, by participatory feedback rounds)	10
3	Is a multidisciplinary team used to implement IPC multimodal strategies?	☐ No	0
		☐ Yes	15
4	Do you regularly link to colleagues from quality improvement and patient safety to develop and promote IPC multimodal strategies?	☐ No	0
		☐ Yes	10
5	Do these strategies include bundles19 or checklists?	☐ No	0
		☐ Yes	10
Subtotal			**100**

CORE COMPONENT 6: Monitoring/audit of IPC practices and feedback			
S/N	Question	Answer	Score
1	Do you have trained personnel responsible for monitoring/audit of IPC practices and feedback?	☐ No	0
		☐ Yes	10
2	Do you have a well-defined monitoring plan with clear goals, targets and activities (including tools to collect data in a systematic way)?	☐ No	0
		☐ Yes	10
3	Which processes and indicators do you monitor in your facility? Tick all that apply	☐ None	0
		☐ Hand hygiene compliance (using the WHO hand hygiene observation tool or equivalent)	5
		☐ Intravascular catheter insertion and/or care	5
		☐ Wound dressing change	5
		☐ Transmission-based precautions and isolation to prevent the spread of multidrug resistant organisms (MDRO)	5
		☐ Cleaning of the ward environment	5
		☐ Disinfection and sterilization of medical equipment/instruments	5
		☐ Consumption/usage of alcohol-based hand rub or soap	5
		☐ Consumption/usage of antimicrobial agents	5
		☐ Waste management	5
4	How frequently is the *WHO Hand Hygiene Self-Assessment Framework Survey* undertaken? Choose one answer	☐ Never	0
		☐ Periodically, but no regular schedule	2.5
		☐ At least annually	5

CORE COMPONENT 6: Monitoring/audit of IPC practices and feedback			
S/N	Question	Answer	Score
5	Do you feedback auditing reports (for example, feedback on hand hygiene compliance data or other processes) on the state of the IPC activities/performance? Tick all that apply	☐ No reporting	0
		☐ Yes, within the IPC team	2.5
		☐ Yes, to department leaders and managers in the areas being audited	2.5
		☐ Yes, to frontline health care workers	2.5
		☐ Yes, to the IPC committee or quality of care committees or equivalent	2.5
		☐ Yes, to hospital management and senior administration	2.5
6	Is the reporting of monitoring data undertaken regularly (at least annually)?	☐ No	0
		☐ Yes	10
7	Are monitoring and feedback of IPC processes and indicators performed in a "blame-free" institutional culture aimed at improvement and behavioral change	☐ No	0
		☐ Yes	5
8	Do you assess safety cultural factors in your facility (for example, by using other surveys such as HSOPSC, SAQ, PSCHO, HSC22)	☐ No	0
		☐ Yes	5
Subtotal			**100**

CORE COMPONENT 7: Workload, bed occupancy and staffing			
Staffing			
	Question	Answer	Scores
1	Are appropriate staffing levels assessed in your facility according to patient workload using national standards or a standard staffing needs assessment tool such as the	☐ No	0
		☐ Yes	5

	WHO Workload indicators of staffing need method?		
2	Is an agreed (that is, WHO or national) ratio of health care workers to patients maintained across your facility? Choose one answer	☐ No	0
		☐ Yes, for staff in less than 50% of units	5
		☐ Yes, for staff in more than 50% of units	10
		☐ Yes, for all health care workers in the facility	15
3	Is a system in place in your facility to act on the results of the staffing needs assessments when staffing levels are deemed to be too low?	☐ No	0
		☐ Yes	10
Bed occupancy			
4	Is the design of wards in your facility in accordance with international standards regarding bed capacity? Choose one answer	☐ No	0
		☐ Yes, but *only* in certain departments	5
		☐ Yes, for all departments (including emergency department and pediatrics)	15
5	Is bed occupancy in your facility kept to one patient per bed? Choose one answer	☐ No	0
		☐ Yes, but *only* in certain departments	5
		☐ Yes, for all units (including emergency departments and pediatrics)	15
6	Are patients in your facility placed in beds standing in the corridor outside of the room (including beds in the emergency department)? Choose one answer	☐ Yes, more frequently than twice a week	0
		☐ Yes, less frequently than twice a week	5
		☐ No	15

CORE COMPONENT 7: Workload, bed occupancy and staffing			
	Question	Answer	Scores
7	Is adequate spacing of > 1 meter between patient beds ensured in your facility? Choose one answer	☐ No	0
		☐ Yes, but *only* in certain departments	5
		☐ Yes, for all departments (including emergency department and pediatrics)	15
8	Is a system in place in your facility to assess and respond when adequate bed capacity is exceeded? Choose one answer	☐ No	0
		☐ Yes, this is the responsibility of the head of department	5
		☐ Yes, this is the responsibility of the hospital administration/ management	10
Subtotal			**/100**

CORE COMPONENT 8: Build environment, materials and equipment for IPC at the facility level			
	Question	Answer	Scores
Water			
1	Are water services available at all times and of sufficient quantity for all uses (for example, hand washing, drinking, personal hygiene, medical activities, sterilization, decontamination, cleaning and laundry)? Choose one answer	☐ No, available on average < 5 days per week	0
		☐ Yes, available on average ≥ 5 days per week or every day but not of sufficient quantity	5
		☐ Yes, every day and of sufficient quantity	7.5
2	Is a reliable safe drinking water station present and accessible for staff, patients and families at all times and in all locations/wards? Choose one answer	☐ No, not available	0
		☐ Sometimes, or only in some places or not available for all users	2.5
		☐ Yes, accessible at all times and for all wards/groups	7.5
Hand hygiene and sanitation facilities			
3	Are functioning hand hygiene stations (that is, alcohol-based hand rub solution or soap and water and clean single-use towels) available at all points of care? Choose one answer	☐ No, not present	0
		☐ Yes, stations present, but supplies are not reliably available	2.5
		☐ Yes, with reliably available supplies	7.5
4	In your facility, are ≥ 4 toilets or improved latrines28 available for outpatient settings or ≥ 1 per 20 users for inpatient settings? Choose one answer	☐ Less than required number of toilets or latrines available and functioning	0
		☐ Sufficient number present but not all functioning	2.5
		☐ Sufficient number present and functioning	7.5
Power supply, ventilation and cleaning			
5	In your health care facility, is sufficient energy/power supply available at day and night for all uses (for example, pumping and	☐ No	0
		☐ Yes, sometimes or only in some of the mentioned areas	2.5

	boiling water, sterilization and decontamination, incineration or alternative treatment technologies, electronic medical devices, general lighting of areas where health care procedures are performed to ensure safe provision of health care and lighting of toilet facilities and showers)? Choose one answer	☐ Yes, always and in all mentioned areas	5

CORE COMPONENT 8: Build environment, materials and equipment for IPC at the facility level			
	Question	Answer	Score
Power supply, ventilation and cleaning			
6	Is functioning environmental ventilation (natural or mechanical) available in patient care areas?	☐ No	0
		☐ Yes	5
7	For floors and horizontal work surfaces, is there an accessible record of cleaning, signed by the cleaners each day? Choose one answer	☐ No record of floors and surfaces being cleaned	0
		☐ Record exists, but is not completed and signed daily or is outdated	2.5
		☐ Yes, record completed and signed daily	5
Hand hygiene and sanitation facilities			
8	Are appropriate and well-maintained materials for cleaning (for example, detergent, mops, buckets, etc.) available? Choose one answer	☐ No materials available	0
		☐ Yes, available but not well maintained	2.5
		☐ Yes, available and well-maintained	5
Patient placement and personal protective equipment (PPE) in health care settings			
9	Do you have single patient rooms or rooms for cohorting patients with similar pathogens if the number of isolation rooms is insufficient (for example, TB, measles, cholera, Ebola, SARS)? Choose one answer	☐ No	0
		☐ No single rooms but rather rooms suitable for patient cohorting available	2.5
		☐ Yes, single rooms are available	7.5
10	Is PPE32 available at all times and in sufficient quantity for all uses for all health care workers? Choose one answer	☐ No	0
		☐ Yes, but not continuously available in sufficient quantities	2.5

		☐ Yes, continuously available in sufficient quantities	7.5
Medical waste management and sewage			
11	Do you have functional waste collection containers for non-infectious (general) waste, infectious waste and, sharps waste in close proximity to all waste generation points? Choose one answer	☐ No bins or separate sharps disposal	0
		☐ Separate bins present but lids missing or more than 3/4 full; only two bins (instead of three); or bins at some but not all waste generation points	2.5
		☐ Yes	5

CORE COMPONENT 8: Build environment, materials and equipment for IPC at the facility level			
12	Is a functional burial pit/fenced waste dump or municipal pick-up available for disposal of non-infectious (non-hazardous/ general waste)? Choose one answer	☐ No pit or other disposal method used	0
		☐ Pit in facility but insufficient dimensions; pits/dumps overfilled or not fenced/locked; or irregular municipal waste pick up	2.5
		☐ Yes	5
13	Is an incinerator or alternative treatment technology for the treatment of infectious and sharp waste (for example, an autoclave) present (either present on or off site and operated by a licensed waste management service), functional and of a sufficient capacity? Choose one answer	☐ No, none present	0
		☐ Present, but not functional	1
		☐ Yes	5
14	Is a wastewater treatment system (for example, septic tank followed by drainage pit) present (either on or off site) and functioning reliably? Choose one answer	☐ No, not present	0
		☐ Yes, but not functioning reliably	2.5
		☐ Yes and functioning reliably	5
Decontamination and sterilization			
15	Does your health care facility provide a dedicated decontamination area and/or sterile supply department (either present on or off site and operated by a licensed decontamination management service) for the decontamination and sterilization of medical devices and other items/equipment?	☐ No, not present	0
		☐ Yes, but not functioning reliably	2.5
		☐ Yes and functioning reliably	5

	Choose one answer		
16	Do you reliably have sterile and disinfected equipment ready for use? Choose one answer	☐ No, available on average < five days per week	0
		☐ Yes, available on average ≥ five days per week or every day, but not of sufficient quantity	2.5
		☐ Yes, available every day and of sufficient quantity	7.5
17	Are disposable items available when necessary? (for example, injection safety devices, examination gloves)	☐ No, not available	0
		☐ Yes, but *only* sometimes available	2.5
		☐ Yes, continuously available	5
Subtotal			**/100**

7.2 (A) Appendix 2 Informed consent form (English version)

Assessment of the Level of Implementation of Infection Prevention and Control Practices in District and Regional Hospitals in Dar es Salaam, Tanzania

The researcher

A postgraduate student form Muhimbili University of Health and Allied Sciences **(MUHAS)**

Purposes of the study

Healthcare associated infection is a significant public health problem responsible for increased burden of morbidity, mortality and unnecessary hospital costs. Fortunately, healthcare associated infections are preventable through effective implementation of infection prevention and control. On the other hand, poor implementation of infection prevention and control is associated with unnecessary morbidity due increased rate of healthcare associated infections

Therefore, the aim of this study is to assess the level of implementation of infection prevention and control in district and regional hospitals in Dar es Salaam. The results of this study will help

to determine adherence level of IPC measures, identify IPC gaps in our hospitals and recommend the improvement measures

Who will be in the study?

The selected district and regional hospitals in Dar es Salaam with their respective IPC focal persons will be given opportunity to participate. Participating in this study is a self-volunteering and therefore you are free to leave the study at any time.

What participation involves

Participants will be interviewed to provide information on the IPC measures and standards at their hospitals as described in the World Health organization IPCAF tool. When necessary, observation will be made to ensure validity of the provided information.

What will happen to the sample?

Implementation of IPC measure will be scored in accordance with the WHO IPCAF tool. The total score will be evaluated to rank the level of IPC implementation at your hospital based on the WHO IPCAF tool. You will be asked to participate in this study which will takes 8 weeks.

Benefits of the study

Participation in this study is voluntary; however, an increment of fifty thousand shillings will be given to participant who will participate fully in this study. More importantly, it is reasonable to expect the following benefits from this research

Objective assessment of IPC level at your healthcare facility

Understand the level of implementation of IPC measures at you facility in accordance with WHO IPCAF

Recognize IPC gaps at your healthcare facility

Potential risks of the study

This study involves the following risks.

Time consuming

Wrong perception from you college for your collaboration.

Interference with your working environment and schedule

Other unpredictable risks

Provide baseline information to improve IPC measures at your facility

Improve public health safety and economy since healthcare associated infections are preventable through effective IPC implementation. Others may also benefit in the future from the information we find in this study.

Freedom to participate in the study

Participation in this study is completely voluntary. Being participant in this study is your decision. If you decided to refuse from participation, it will not affect your rights of healthcare services, social status or any aspect of your life. In addition, you are free to leave from the study at time you decided

Confidentiality

The information provided will be confidential. Name and address of interviewees will be not mentioned; instead code number will be used to make sure that they can't be traced by any unauthorized body. The data can be accessed by member of Muhimbili University of Health and Allied Sciences (MUHAS) and Ministry of health. The results on the level of implementation of IPC at district and regional hospitals in Dar es Salaam will be accessible by the general public because the research will be published.

Informed consent for participant

I have read and understand the consent form and the attached information for the study on the assessment of the level of implementation of infection prevention and control practice in district and regional hospitals in Dar es Salaam, Tanzania. I am satisfied with information provided and understand the study involves.

I agree to participate in this study

Name of participant…….
Signature/thumb print…….Date…….

I certify that the above information was provided and explained verbally and that I understand the nature and the purpose of the study

For any question regarding the study, you can contact:

Muhimbili University of Health and Allied Sciences (MUHAS)
Directorate of research, publications and innovation
P.O. Box 65001 Dar es Salaam
Tel: +255 22 2152489, Tel: +255 22 2150302-6
(Ext. 1016 Director, Ext. 1038 OMS)
Fax: +255-22-2152489
E-Mail: drp@muhas.ac.tz
OR
Dr. Frank Msafiri
Research supervisor 1
Tel: +255768944937, +255713588613
Email: fmsafiri82@gmail.com
OR

Ms. Lilian Nkinda
Research supervisor 2
Tel: +255622458903

Email: lilynkinda@gmail.com
OR

Mr. Mohamed Bakar
Principal investigator
Tel: +255776673375: Email prai2suza@gmail.com

7.2 (B) Fomu ya idhini (Toleo la Kiswahili)

Kichwa cha habari

Tathmini ya kiwango cha utekelezaji wa hatua za kuzuia na kudhibiti magonjwa yanayoweza kuambmukizwa wakati wa kutoa huduma za matibabu katika vituo vya afya ngazi ya wilaya na mkoa kwa Mkoa wa Dar es Salaam, Tanzania

Mtafiti

Mwanafunzi wa shahada ya uzamili kutoka katika Chuo kikuu cha Afya na Sayansi Shirikishi Muhimbili

Madhumuni ya utafiti huu

Maambukizi ya magonjwa yatokanayo na utoaji wa huduma za afya katika vituo vya kutolea huduma za afya ni tatizo kubwa la afya ya jamii ambalo limepelekea ongezeka la magonjwa ya kuambukiza, vifo pamoja na gharama za matibabu zisizo za lazima. Kwa bahati mzuri magonjwa mengi amabayo mtu anaweza kuambukizwa wakati wa utoaji wa huduma za afya hospitali yanaweza kuzuilika kupitia utekelezaji sahihi wa hatua za kuzuia na kudhibiti magonjwa yanayoweza kuambmukizwa wakati wa utoaji wa huduma za afya (IPC). Kwa hivyo, lengo la utafiti huu ni kutathmini kiwango cha utekelezaji wa hatua za kuzuia na kudhibiti magonjwa yanayoweza kutokea wakati wa utoaji wa huduma za afya katika vituo vya kutolea huduma za afya ngazi ya wilaya na mkoa kwa mkoa wa Dar es Salaam. Matokeo ya utafiti huu ni kutoa taarifa ya tathmini ya utekelezaji wa hatua hizo, kufafanua mapungufu katika utekelezaji wake kwa hospitali husika na kupendekeza hatua za kuimarisha utekelezaji wa hatua hizo.

Watakaoshirki kwenye utafiti huu

Hospitali za wilaya na mkoa zilizochaguliwa katika mkoa wa Dar es Salaam. Msimamizi wa IPC katika hospitali husika atasailiwa kwa lengo la kufafanua utekelezaji wa IPC katika hospitali hio.

Yaliomo ndani ya kushiriki kwenye utafiti huu

Kama utaamua kushiriki unaombwa kwa hiari yako kutoa taarifa ya hatua za utekelezaji wa mbinu za kuzuia na kudhibiti magonjwa yanaweza kutokea wakati wa utoaji wa huduma za afya katika hospitali yako kama ilivyofafanuliwa katika fomu ya mfumo wa tathmini ya utekelezaji wa mbinu za kuzuia na kudhibiti magonjwa yanayoweza kuambukizwa wakati wa utoaji huduma za afya wa Shirika la Afya Dunianiani (WHO IPCAF). Kwa kila hatua inayotekelezwa kuzuia maambukizi katika hospitali yako itapewa alama kama ilivyo ainishwa kwenye WHO IPCAF. Alama zote zitajumlishwa pamoja na kutafsiriwa kwa kuainishwa ngazi ya utekelezaji wa (IPC) kulingana na muongozo wa WHO IPCAF.

Madhara unayoweza kuyapata kwa kushiriki utafiti huu

Kutoa muda wako kwa kushiriki utafiti huu

Mtazamo hasi kutoka kwa wenzako kwa kushiriki wako.

Mwingiliano katika mazingira yako ya kazi

Athari nyengine zisizo tarajiwa

Faida za kushirki kwenye utafiti huu

Mshiriki atakaeshiriki kikamilifu kwenye utafiti huu atapewa motisha ya shilingi elfu hamsini za kitanzania (50,000/=). Zaidi ya hapo, inategemewa kutakuwepo na faida zifuatazo.

Kujua kiwango cha utekelezaji wa IPC katika hospitali yako kulingana na tathmini ya WHO IPCAF

Kufahamau mapungufu katika utekelezaji wa IPC katika hospitali yako

Kupata taarifa za awali kuhusu namna ya uboreshaji wa IPC katika hospitali yako

Kuboresha afya ya jamii kupitia kuzuia magonjwa yanaweza kuambukizwa hospitali wakati wa utoaji huduma za afya

Siri

Taarifa za utekelezaji wa IPC katika hospitali yako zinaweza kupatikana katika Chuo kikuu cha Afya na Sayansi Shirikishi Muhimbili (MUHAS) na Wizara ya Afya. Kwa hivyo, majina na anuani za washirki hazitotajwa, badala yake zitatumika alama kuhakikisha kwamba haziwezi kutambulika na mtu asiyeidhinishwa kwa namna yoyte kwa lengo la kutunza siri. Hata hivyo, matokeo ya utekelezaji wa IPC yataweza kupatikana na jamii kwa sababu utafiti huu utachapishwa.

Uhuru wa kushiriki kwenye utafiti huu

Kushiriki katika utafiti huu ni hiari yako binafsi. Kama ukiamua kutokushiriki katika utafiti huu, hakuna haki yako yoyote utakayonyimwa, ikiwemo haki ya kupata huduma za afya, heshima na utu wako, au kuathiri kipengele chochote katika maisha yako. Hat hivyo motisha ya shilingi elfu hamsini itatolewa kwa washiriki watakao sailiwa na kutoa ushirikiano kikamilifu katika utafiti huu.

Idhini ya kushiriki kwenye utafiti huu

Nimesoma na kuelewa fomu ya idhini na malengo ya utafiti huu. Nimeridhika na maelezo yaliotolewa kuhusu yale yaliomo kwenye utafiti huu Niko tayari kushiriki kwenye utafiti huu

Jina la mshiriki: ……..
Sahihi/alama ya kidole_____Tarehe

Kwa mawasiliano au tatizo lolote kuhusu utafiti huu tuwasiliane kupitia namba au anuani zifuatazo

Chuo kikuu cha Afya na Sayansi Shirikishi Muhimbili
Kurugenzi ya utafiti, machapisho na uvumbuzi

S. l. P 65001 Dar es Salaam

Simu: +255 22 2152489, Simu: +255 22 2150302-6

(Ext. 1016 Director, Ext. 1038 OMS)

Fax: +255-22-2152489

Barua pepe: drp@muhas.ac.tz

Au

Dr. Frank Msafiri

Msimamizi wa utafiti 1

Simu: +255768944937, +255713588613

Barua pepe: fmasifiri82@gmail.com

Au

Ms. Lilian Nkinda

Msimamizi wa utafiti 2

Simu: +255622458903

Barua pepe: lilynkinda@gmail.com

Au

Mr Mohamed Bakar

Mtafiti

Simu: 0776673375

Barua pepe: prai2suza@gmail.com