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Multidrug Resistant Organism Surveillance Project: Assessing patient and healthcare providers' attitudes; knowledge or beliefs regarding multidrug resistant organism infection, surveillance and infections control practices at CHUK, Kigali.

A post graduate research dissertation submitted to the college of Medicine and health sciences, school of medicine and pharmacy in full fulfillment of the requirements for the award of a Masters of medicine in internal medicine of University of Rwanda.

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DECLARATION

I, KABWA YUMA Agneau, declare that this work entitled "**Multidrug Resistant Organism Surveillance Project: Assessing patient and healthcare providers' attitudes; knowledge or beliefs regarding multidrug resistant organism infection, surveillance and infections control practices at CHUK, Kigali"** is my own work except where otherwise acknowledged. This thesis has not been submitted for another degree award, it is a requirement by the college of Medicine and health Science in partial fulfillment of the academic requirements for award of Master's degree of Medicine, University of Rwanda.

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DEDICATION

To my God for giving me health and capacity during the whole course of my study

To my husband MBUYU Christopher and my son Don MBUYU, for their support, and most of all, for your love without which the completion of this work would not have been possible

To my niece Kabwe Yuma Ornella

To the memory of my parents

To my beloved family

To all my friends

I gratefully dedicate this work

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ABSTRACT

Background:

Nosocomial infections caused by multi-drug resistant organisms (MDRO) contribute significantly to mortality and prolonged length of stay among hospitalized patients. A significant proportion of MDRO infections are transmitted between patients via healthcare workers typically in setting of poor hand hygiene practices. Methicillin resistant staph aureus (MRSA) and extended-spectrum beta-lactamase producing (ESBL) organisms are recognized as some of the principal pathogens that are easily transmitted in healthcare settings.

OBJECTIVES:

This study aimed to assess patient and healthcare providers' attitudes, knowledge and/or beliefs around MDRO surveillance and infection control practices at CHUK, Kigali.

METHODOLOGY:

Questionnaires were administered to both healthcare providers as well as patients hospitalized on various departments or units (Pediatrics, Gynecology-Obstetrics, Intensive Care Unit, Emergency Department, Ear, Nose and Throat, Internal Medicine and Surgery) at CHUK hospital. Healthcare providers self-administered their own questionnaires while patient respondents were guided on how to fill them by study investigators. Simple descriptive statistics were used to report study findings for each surveyed category (patients or healthcare providers). Chi square test was used to compare response frequencies between patients and healthcare providers with statistical significance set at $p<0.05$.

RESULTS:

Overall, 250 healthcare providers and 245 patients completed the survey. The study found that while 128/250 (51.2%) of health care workers (HCWs) had limited knowledge about MDROs, there was a significantly limited knowledge about them among surveyed patients ($P<0.05$). While 236 HCWs (94.4%) agree with the use of soap and water as being appropriate for hand hygiene, only 174 (69.6%) HCWs reported that they routinely wash their hands after handling patients. Overall, majority of patients (64.9%) were not satisfied with HCWs hand hygiene practices.

Regarding surveillance procedures, 71 patients (29%) reported discomfort with accepting rectal swabs as a modality for screening for colonization with ESBL producing organisms and 74% of HCWs still believe that beta-lactam antibiotics (penicillins and cephalosporins) can be used for their treatment.

CONCLUSION

This study showed limited knowledge by both patients and healthcare providers regarding nosocomial infections caused by MRSA and ESBL producing organisms. These knowledge gaps about MDROs and their surveillance are concerning and should inform future efforts to educate patients and their providers about this public health problem.

ACCRONYMS

CHUK : Centre Hospitalier and Universitaire de Kigali
AMROs : Antimicrobial Resistant Organisms
MRSA : Methicillin Resistant Staphylococcus Aureus
ESBL : Extended-Spectrum Beta-lactamase
ESBL-EC : Extended-spectrum Beta-lactamase Escherichia coli
LTCFs : Long-term Care Facilities
HCWs : Healthcare Workers
HCPs : Health care providers
ENT : Ear-nose-throat
ICU : Intensive care Unit
SSTI : Skin and Soft Tissue Infection
CNS : Central Nervous System
ABHR : Alcohol-based hand rubs
MDROs : Multi-drug resistant organisms

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CHAP I. INTRODUCTION

I.1 Background and literature review

Antimicrobial resistant bacteria have become more widespread worldwide[1,2]. Indeed, Antimicrobial resistance (AMR) is one of the greatest global health concerns of the modern age and the prevalence is rising day by day thereby making the treatment of common infectious diseases complicated and require the use of complex antibiotics ([3,4, 5, 6, 7]) that increase mortality rates and length of hospital stay with associated increase of medical costs ([5]).

Over 1.4 million people worldwide suffer from infections acquired in the hospital ([8]). 5-10 % of patients acquire one or more infections in developed countries and in developing countries as high as 44% of patients acquire them[8]. At least 2 million are infected and 23.000 die each year in the United States from MDROs [9]

The use and overuse of antibiotics in both human and animal populations, transmission of antimicrobial resistant organisms in the community and healthcare settings constitute the key divers for emergence and spread of antimicrobial resistance[10, 9]Certain environments make patients more prone to acquire resistant organism including long-term care facilities (LTCFS) which represent a complex group of ever evolving healthcare systems as it is a unique environment favoring the transmission of infection to residents,[11] and the healthcare workers (HCWs) are positioned at the apex of antimicrobial resistance phenomenon by their poor infection prevention practices [12,13].

Nevertheless, methicillin resistant staphylococcus aureus (MRSA) and gram-negative bacteria producing extended-spectrum beta-lactamases (ESBLs) are the most common bacteria causing healthcare associated infections (HAIs) and approximately 722.000 individuals are infected and 75.000 will die from an HAI each year in U.S hospitals [9]. Indeed, these organisms are prevalent also in Rwanda and Uganda[7,14] and they are resistant to major antimicrobial classes[1,7].

ESBL organisms produce enzymes called beta-lactamases which disrupt the structure and thereby, action of certain antibiotics making them ineffective[4,3]. They can colonize or infect persons, and persons colonized or infected serve as major reservoir in LTCFs as well as hospitals[12,15] .

The mode of transmission of MDROs is from patient to patient via unwashed hands of healthcare workers. After contact with colonized or infected patients, infected or colonized body sites of the personnel themselves, devices, items or environmental surfaces may be contaminated with these MDROS[9, 13]

The risk factors for colonization, infection and transmission of MDROs in LTCFs and hospitals are age, antibiotic use, medical device use, length of stay, elderly and disabling residents, presence of decubitus ulcers, contaminated ultrasonography gel, healthcare workers 'colonized hands, immune-suppression, invasive procedures, long term dialysis, family members with MDROs, previous antibiotic resistant, frequency of antibiotic resistance in the community [4,10,16].

Prevention of spread and control of $MDRO_S$ in healthcare setting is a critical[9], urgent and essential patient safety issue because the number of antibiotics available to heat these infections is severely limited especially in resource poor countries, and there is associated increased healthcare costs, patient mortality [16] and unfortunately, the development of new antibiotics targeting these organisms specifically is not forth coming in the near future[1].

Several infection control measures have been advocated including chlorexidine body washing, contact precaution for known carriers of MDROs, rapid detection of carriers at admission and putting carriers in single room[2,8] and these constitute the basic approach to prevent and control the spread of MDROS [4].

ESBLs

Extend-spectrum beta-lactamases (ESBLs) are among beta-lactamase plasmid mediated enzymes that hydrolyze beta- lactam antibiotics , enzymes that produced by some bacteria[17, 18 ,21]. There were described in the 1980s and first reported in UK in 2000s [19,6,11], in Germany in 1983 and in 1985 in France[19] . In North America, ESBLs were first reported in 1988 and the prevalence among patients in US hospitals ranges from 0-25% with the average of 3%[4], and in Asian and Australian sites, the prevalence of ESBL varies country to country and from species by species (for E.Coli 5% of resistance in Korea, 23.3% in Indonesia, and for Klebsiellaspp, 48.8% in Korea and 20 - 40% in Japan, China and Southeast Asia; in Africa and the Middle East national

surveillance data are lucking[4], and the true prevalence is not known or is under estimated because of difficulties encountered in their detection [20]. The distribution and prevalence of ESBLs in worldwide is increasing and in many part of the world 10-40% of strains of E.coli and Klebsiella pneumonia express ESBLs [22,4]. While it may be associated with colonization rather true infection [20], ESBL infections may cause serious or life threatening infections[17,4,21] with high mortality rate ranging from 42- 100% [4].

For ESBL producing organisms, they are transmitted (a) orally by contaminated hands and reside in the intestine, (b) into the urinary tract by poor hygiene after bowel movement or by a urinary catheter and may establish reservoirs in the gallbladder, or (c) through wound contamination[5]. Common ESBL species are Klebsiellapneumoniae, Escherichia coli, Proteus mirabilis, Enterobacter cloacae, Non typhoidal Salmonella[5].

There are more than 1600 beta-lactamase types among gram negative bacilli according to Bush Medeiros Jacoby and Ambler Scheme, including TEM-1, TEM-2, TEM-6, TEM-12, TEM-71 types ESBLs, SHV-1, HSV-5, HSV-12 types ESBLs, and others OXA type, CTX-M type, PER-type) [18,19]and there are classified as class A: TEM-1,2, SHV1, KPC; class B: MBLs; class C: AMPc; or class D: OXA[4,22]. Typical sites of infection are urinary tract infection, bacteremia, skin and soft tissues, pneumonia, intra abdominal infections, others [23] and symptoms depend of involved sites.

Rapid detection of ESBLs is a challenge for most clinical microbiology laboratory and their identification has important clinical implications in antibiotic treatment and infection control [17]. Laboratory detection of ESBLs is done by multiple means including double disk approximation test by using Muller- Hinton Agar plate, E-test using antibiotic biodisks, Vitek automated susceptibility system[19,4], and multiplex PCR assays which provide valuable information for ESBL epidemiological investigation[17.

Carbapenems including Imipenem, Meropenem, Doripenem and Ertapenem have the most consistent activity against ESBL [6] and are the first choice for medical treatment of serious infections caused by ESBL producing organisms. Cephamycins and cefoxitin are less used in treatment of ESBLs. Amoxicillin-clavulanic acid and piperacillin-tazobactam are occasionally

suitable alternatives to carbapenems in case of bloodstream infection due to ESBL-EC[20]. The third generation cephalosporins are less recommended [6] .However, Cefepime, a fourth generation cephalosporins appears to have a higher intrinsic activity against many ESBL producers[6].

HCWs hand hygiene practice by using water and soap or alcohol-based hand cleaner before and after touching any patient or any surface constitutes the most important way to prevent the spread of germs. Protective clothing; private room; disposable or dedicated personnel items care such as thermometers, stethoscopes or their disinfection if they are shared with other patients; monitoring the presence of spread of ESBL and educating caregivers are other measures of prevention [9] .

MRSA

Methicillin-resistant Staphylococcus aureus (MRSA) is strain of Staphylococcus aureus bacteria that is resistant to a large group of beta- lactams antibiotics and constitutes the most common cause of healthcare-associated infections [24]. It was first identified in 1960s in England, and first reported in U.S in mid 1980s [26, 25]. The incidence of gram-positive organisms has risen in United States (U.S)[25]and the resistance quickly developed, increasing from 2.4% in 1979 to 29% in 1991[25] and the current prevalence of MRSA in hospitals and other facilities ranges from < 10% to 65%[25]. Asia is among the regions with highest prevalence rates of healthcare and community associated MRSA in the world with estimated proportion from 28% to more than 70% in Korea[25]. MRSA poses a viable threat in many African countries with the gradually rise of prevalence during the first years of the new millennium, the greatest increase was observed in Tunisia from 12-18% before 2005 to 41-46% after wards. In Botswana, the prevalence varied between 23-44% from 2000 to 2007, but in South Africa the prevalence of MRSA decreased from 36% in 2006 to 24% during 2007-2001. Nevertheless, Morocco was the only country where the prevalence of MRSA seems to be stabilized during 2003-2008 [27].

MRSA is responsible for several difficult to treat infections in humans and over the past several decades, MRSA strains have developed resistance to many antimicrobial classes including Aminoglycosides, Beta-lactams, Cephalosporins, Fluoroquinolones, Macrolides, Carbapenems and has become responsible for several difficult to treat infections in humans over the past several decades [25].

MRSA rates may be higher in LTCFs if they are associated with hospitals that have higher rates[23,25]. Transmission occurs through direct or indirect contact with a reservoir [25] and three main components for transmission are a source of the infecting microorganism, a vulnerable host, and a way to transmit the microorganism to the host[28,20] and their sites of colonization are anterior nares, axillae, nose, upper extremities, urinary tract and perineum, and colonization can be persistent, intermittent or result in a clinical infection [13].

MRSA infection may present as skin and soft tissue infections (SSTI), bacteremia and endocarditis, pneumonia, bone and joint infection, central nervous infection (CNS), other systems [21,13]. The symptoms depend of site of infection [1, 20, 23].

To identify MRSA, cotton swabs are used to collect sample from an open skin rash or skin sore, throat, nostrils and groins, other bodily fluids may be tested including blood, urine, sputum, pus from a abscess, then several tests may beused to isolate and identify the organism including: tube coagulase test, slide coagulase test, latex agglutination test, DNase and heat-stable nuclease test, commercial biochemical tests, molecular test, Agar dilution, Etast methods, breakpoint methods, Agar screening method, and disc diffusion test[26]

Vancomycin is the first choice for treatment of MRSA[24]. In serious infections, Rifampicin can be used adjunctively with Vancomycin[24]. Clindamycin is a good drug for bone or joint MRSA infection [23]. Daptomycin, Quinupristin-Dalfopristin (Synercid), Linezolid (Zyvox), Telavancin and Ceftaroline, are salvage drugs for MRSA infection but routine use is discouraged to prevent development of resistance [19].

Nasal decolonization with Mupirocin and skin decolonization with Chlorhexidine in particular cases may be indicated to eradicate MRSA[24] . Education of patients and caregivers, regular hand hygiene, environmental cleaning agents, periodic laboratory surveillance by bacterial wound cultured for detection of MRSA infection if there is known case of MRSA infections constitute the infection control measures [24,23].

Healthcare workers, patients and Infection control practices.

Several studies have been conducted on healthcare providers' knowledge, attitudes and practices around multi-drug resistant organisms preventive measures: A study done in 2016 in the U.S and Canada about hand hygiene, 90% HCWs agreed with hand hygiene using ABHR and 50% said that it will be good for them to clean their hands as recommended if the ABHR was closer to the patients[28].

Other studies conducted in 2010 at Mashhad hospital assessed knowledge and attitude of nursing staff around hospital infection control. 67.9% of nursing staff were rated as having average knowledge about infection control, 90.4% had good positive attitude towards the perceived threats of nosocomial infections, 35.2% agreed with perceived benefits of infection control[29]. In a study conducted in 2013, in Georgia, 42.4% of nurse staff lack time as a barrier to implementing infection prevention practices, 32.8% reported work load, 20% reported no-adherence in one or more practice[12].In an exploratory cross-sectional and descriptive study in Seton Hall University conducted in 2012, registered nurses demonstrated sufficient knowledge and adherence to recommended guidelines of infection control practices and positive attitudes [15].

On the other hand, in 2016, across sectional study done among medical, dental, nursing students in the university of Aden and Nasher health institute, it was observed that 95% washed hands before and after food intake, 85% used soap and water, 8% used only water, 84% washed hands after handling patients; and overall 90% of participant showed appropriate attitude. A study assessing infection control knowledge showed that 98% are aware of hand hygiene practice; 51.5% thought the main route of spreading cross contamination the hand of HCW when not clean; 26% said it air circulation, 51% said it is hospital environment, 21% thought the germs were already present on patients[8].

1.2 Problem statement

The project provides useful information on the patients and healthcare providers knowledge around infectious control surveillance, attitudes and practices on nosocomial infections prevention precisely (MRSA and ESBL producing organisms infections) in different departments of CHUK, so it would serve as justification to reinforce patients education around MRSA and ESBL producing organisms infections, preventive measures of transmission and healthcare

provider training on precaution measures for prevention of MRSA and ESBLs producing organisms transmission and treatment.

1.3 Research questions

A. What are patients and healthcare providers' knowledge or beliefs regarding multidrug resistant organisms?
B. What are patients and healthcare provider's attitudes around multidrug resistant organisms?
C. What are patients and healthcare provider's infection control practices around preventing multidrug resistant organism transmission?

1.4 Hypothesis

There is limited knowledge about drug resistant organism infections, their severity and their mode of transmission among patients and healthcare providers in CHUK?

1.5 Objectives

1.5.1 General objectives

- To assess patients and healthcare provider's attitudes, knowledge or beliefs around multi drugs resistant surveillance and infection control practices.

1.5.2 Specific objectives

To evaluate by questionnaires:

- Patients and healthcare providers knowledge or beliefs around infections control and surveillance on MRSA and ESBL organisms.
- Patients and healthcare providers attitudes on MRSA and ESBL organisms and transmission, and
- Patients and healthcare providers' infection control practices

CHAP. II. METHODOLOGY

2.1. Study design

A cross sectional design utilizing questionnaires

2.2 Study population and Site

Admitted patients from: Surgery, Internal Medicine, Emergency and gynecology-obstetric departments and healthcare providers from Intensive Care Unit, Emergency department, Ear, Nose, Throat service, Internal Medicine, Surgery, Gynecology-obstetric and Pediatrics departments were questioned about their knowledge on MDR bacteria, as well as attitudes around infection control practices.

2.3 Inclusion criteria:

- ✓ Patients admitted from 1st December 2016 to 31st January 2017 in (Emergency , Surgery, Internal Medicine, Gynecology-Obstetrics departments) and who were able to consent.

- ✓ Healthcare providers present in service during the period from 1st December to 31st December from Intensive Care Unit, Emergency , ENT , Gynecology-Obstetric, Surgery, Pediatrics, Internal Medicine

2.4 Exclusion criteria:

- ✓ Patients who were not consented or couldn't give consent according to his/her health condition and Patients who were absent during the time of data collection.
- ✓ Healthcares workers who were absent during the period of study and who declined to consent.

2.5. Sample size

The study sampled 245 patients and 250 Health providers during the period of the study.

2.6 Ethical consideration

Following internal review by faculty at School of Medicine and Pharmacy, permission to carry out this study was obtained from the Research Committee of the college of Medicine and health Sciences, Institutional Board (IRB). The purpose of the project was explained to the patients and healthcare providers and a consent form was signed by each patients or healthcare providers before inclusion in the study. The nature of the study and its benefits to all healthcare system was explained in clear language, Patients and healthcare providers were free to participate to the study and to withdraw at any time, data were held confidential.

2.7. Plans for utilization and dissemination of results

A research report will be submitted to the University of Rwanda as a partial fulfillment of the masters degree in Internal Medicine, This work will also be submitted to the College of Medicine and health Sciences Institutional review board at the University of Rwanda as recognition for having hosted the study. It will be presented as an oral presentation at the University research day. Finally, findings of this research may be submitted to an international journal for publication.

2.8. Data recording and Analysis

Data were obtained from healthcare providers and patients by questionnaires (Survey). Questionnaires were distributed to healthcare providers in seven services of hospitalization (Gynecology-obstetric, surgery, emergency department, ear nose throat , pediatrics, Intensive care unit , Internal medicine) after explanation about how to fill it and then it will be send back to the investigator. The investigator fills questionnaires for patients after more explanations around the purpose of the study. Descriptive statistical analysis of collected data has been performed using SPSS.

CHAP. III. RESULTS

III.1. Socio demographics characteristics of respondents

Table 1:Socio demographics characteristics of respondents

Characteristics		Patients	%	Healthcare providers	%
Gender	Female	125	51,0	139	55.6
	Male	120	49.0	111	44.4
Professional	Nurse	8	3.3	141	56.4
	Prof nurse	3	1.2		
	Others(students, businessmen, farmers, teachers)	234	95.5		
	Doc IV students			32	12.8
	Medical officer			77	30.8
CHUK department	Medical	75	30.6	53	21.2
	Surgery	89	36.3	45	18
	Gynecology-obstetric	45	18.4	57	22.8
	Emergency	36	14.7	30	12
	Pediatric			29	11.6
	ICU			27	10.8
	ENT			9	3.6
Education	Primary	108	44.1		
	Secondary	60	24.5		
	College	12	4.9		
	None	65	26.5		
Provinces	Kigali	117	47.8		
	East	53	21.6		
	West	31	12.7		
	North	24	9.8		
	South	20	8.2		
Age	< 25	54	22.0		
	25-45	134	54.7		
	>45	57	23.3		

A convenience sample of 245 patients from four departments of CHUKs completed the survey, the females were 125 (51. 0%) and males 120 (49.0%), there were more patients from Kigali 117 (47.8%) than provinces, the age of more patients were ranged between 25-45 years, 134 (54.7%) with primary education level for 108 patients (41.1%), more than half patients had other occupations than nurses and 250 healthcare providers from seven services of hospitalization

completed the survey, the females were 139 females (56.6%) and males 111 (44.4%), there were more nurses 141/250 (56.4%)

III.2. DESCRIPTIVE ANALYSIS OF THE PATIENTS

3.2.1. Patients Knowledge- assignment of level of knowledge

For the 12 questions in the questionnaire, level of knowledge was assigned as follows: if ≤7 appropriate responses = limited level of knowledge, if 8-9 appropriate responses = average level of knowledge and if >9 appropriate responses = sufficient level of knowledge.

Table 2: Knowledge of patients about MRSA and ESBL producing Organism infections, route of transmission and the severity at CHUK

Characteristics	Frequency [N=246]	
	Disagree	Agree
Knowledge of MRSA/ESBL		
Hearing about MRSA/ESBL	204 [83.3%]	41[16.7%]
Discussion between HCW and patient	226 [92.2%]	19 [7.8%]
cause severe sickness	209 [85.3%]	36 [14.7%]
cause death	209 [85.3%]	36 [14.7%]
Cause harmless	241 [98.4%]	4 [1.6%]
Route of transmission of MRSA and ESBL		
Air circulation	214 [88.8%]	27 [11.2%]
HCW hands	208 [86.3%]	33 [13.7%]
Hospital devices	210 [87.1%]	31 [12.9%]
Hospital visitors	216 [89.6%]	25 [10.4%]
Bad luck	233 [96.7%]	8 [3.3%]
Whit craft	233 [96.7%]	8 [3.3%]
Bad procedures	211 [87.6%]	30 [9.4%]

This table demonstrates that most of the patients had limited level of knowledge regarding nosocomial infections caused by MRSA and ESBL producing organisms, 204 (83.3%) never heard about it, 226 (92.2%) denied any discussion around it with healthcare providers, 209 (85.3%) of patients ignore how severe are the infections caused by MRSA and ESBL producing organisms, about death 209 (85.3%)?. More than half of patients didn't know the main routes of transmission of MRSA and ESBL producing organisms, 208 (86.3%) for hand hygiene route, 210 (87.1%) for hospital devices, 211 (87.6%) for procedures, but more patients didn't agree that it is bad luck 233 (96.7%) or witchcraft 211(87.6%) that cause MRSA and ESBL producing organism infections.

III.2.2. Attitudes of patients regarding preventive measures against transmission of MRSA and ESBL producing organism infections at CHUK

Table 3: Prevention characteristic of Hand hygiene

Characteristics	Frequency	
	Disagree	Agree
One patient to another	17 [6.9%]	228 [93.1%]
HCW to patient	19 [7.8%]	226 [92.2%]
Patients to HCW	21 [8.6%]	224 [91.4%]
Caretakers to patient	18 [7.3%]	227 [92.7%]
Patient to caretakers	17 [6.9%]	228 [93.1%]

The above table shows that more than half of the patients agree with the appropriate attitudes for infection control

3.2 .3 Patients Practices

Table 4: Knowledge of patients regarding infection control practices of healthcare workers at CHUK

Characteristics	Frequency	
	Disagree	Agree
Wearing gloves/washing hands before touching patient by HCP	11 [4.5%]	234 [95.5%]
Satisfaction with hand hygiene procedures by nurses	86 [35.1%]	159 [64.9%]
Satisfaction with hand hygiene procedures by physicians	96 [39.2%]	149 [60.8%]
Feeling stigmatized if isolated in case of MRSA or ESBL infection HCP	191 [78.0%]	54 [22.0%]
Feeling stigmatized if doctors/nurses wear gloves before touching you	233 [95.1%]	12 [4.9%]
Washing hands before and after food intake	13 [5.3%]	232 [94.7%]
Washing with alcohol are acceptable as procedures in the hospital	122 [49.8%]	123 [50.2%]
Washing with soap and water is acceptable as procedures in the hospital	22 [9.0%]	223 [91.0%]
Washing with water alone is acceptable as procedures in the hospital	219 [89.4%]	26 [10.6%]
Screening of MRSA and ESBL		
Nasal swab	23 [9.4%]	222 [90.4%]
Axillar swab	30 [12.2%]	215[87.8%]
Rectal swab	71 [29%]	174 [71%]

More than half patients prefer hand hygiene using water and soap 223 (91.0%), half of them were not satisfied with hand hygiene performed by healthcare providers 159 (64.9%) for nurses and 149(60.8%) for physicians.

Regarding preferable ways which can be used for assessing colonization and transmission of MRSA and ESBL producing organisms 215 (87.8%) patients prefer nasal swab, 222 (90.6%) prefer axillar swab and 174 (71.0%) prefer rectal swab.

III.2.4. BIVARIATE ANALYSIS OF THE PATIENTS

III.2.4.1. Practice risk behaviors

In the following part, we analyzed relationship between Practice risk behaviors and different independent variables. P values with Chi^2 have been calculated to each of variables in order to demonstrate the significance of the relation.

Table 5: Association between practice behaviors and socio demographics characteristics

Socio-demographic characteristic	Practice level		P-Value	Chi^2
	good infection control practice	**Bad infection control practice**		
Gender				
Female	40 [32%]	85 [68%]	0.116	2.45
Male	50 [41.7%]	70 [58.3%]		
CHUK wards				
Medical	35 [46.7%]	40 [53.3%]	0.001	25.6
Surgery	15 [16.9%]	74 [83.1%]		
Gynecology-Obstetric	25 [55.6%]	20 [44.4%]		
Emergency	15 [41.7%]	21 [58.3%]		
Province				
East	15 [28.3%]	38 [71.7%]	0.071	8.61
West	9 [29.0%]	22 [71.0%]		
North	5 [20.8%]	19 [79.2%]		
South	9 [45.0%]	11 [55.0%]		
Kigali	52 [44.4%]	65 [55.6%]		
Education				
Primary	41 [39.0%]	67 [62.0%]	0.525	2.23
Secondary	22 [36.7%]	38 [63.3%]		
College	2 [16.7%]	10 [83.3%]		
None	25 [38.5%]	40 [61.5%]		
Occupation				
Prof Nurse	2 [66.7%]	1 [33.3%]	0.202	3.21
Staff Nurse	1 [12.5%]	7 [87.5%]		
Other	87 [37.2%]	147 [62.8%]		
Age				
< 25 years old	16 [29.6%]	38 [70.4%]	0.373	1.97
25-45 years old	54 [40.3%]	80 [59.7%]		
> 45 years old	20 [35.1%]	37 [64.9%]		

There was no statistically significant difference regarding knowledge on infection control practices in sex, education level, age, occupation. However, CHUK departments were highly associated to practice behaviors with statistically significant difference (p: 0.001)

III.2.4.2. Attitude on risk behaviors

In the following part, we analyzed relationship between attitude and risk behaviors and different independent variables. P values with Chi^2 have been calculated to each of variables in order to demonstrate the significance of the relation.

Table 6: Analysis of factors influencing attitudes on infection control for MRSA and ESBL producing organisms

Socio-demographic characteristic	Prevention level		P-Value	Chi^2
	Appropriate attitude	**Non appropriate attitude**		
Sex				
Female	7 [5.6%]	118 [94.4%]	0.547	0.36
Male	9 [7.5%]	111 [92.5%]		
CHUK ward				
Medical	5 [6.7%]	70 [93.3%]	0.032	8.74
Surgery	2 [2.2%]	87 [97.8%]		
Gynecology-Obstetric	3 [6.7%]	42 [93.3%]		
Emergency	6 [16.7%]	30 [83.3%]		
Province				
East	6 [11.3%]	47 [88.7%]	0.278	5.08
West	2 [6.5%]	29 [93.5%]		
North	0 [0%]	24 [100%]		
South	0 [0%]	20 [100%]		
Kigali	8 [6.8%]	109 [93.2%]		
Education				
Primary	7 [6.5%]	101 [93.5%]	0.993	0.08
Secondary	4 [6.7%]	56 [93.3%]		
College	1 [8.3%]	11 [91.7%]		
None	4 [6.2%]	61 [93.8%]		
Occupation				
Prof Nurse	0 [0%]	3 [100%]	0,711	0.68
Staff Nurse	1 [12.5%]	7 [87.5%]		
Other	15 [6.4%]	219 [93.6%]		
Age				
< 25 years old	2 [3.7%]	52 [96.3%]	0.321	2.27
25-45 years old	8 [6.0%]	126 [94.0%]		
> 45 years old	6 [10.5%]	51 [89.5%]		

CHUK departments were highly related to prevention level attitudes behaviors with p=0.032

Table 7: Bivariate analysis of factors influencing knowledge about MRSA and ESBL producing organisms and their route of transmission among patients in CHUK (N=245)

Socio-demographic characteristic	Main route of transmission		P-Value	Chi^2
	Knowledge about route of transmission	Not knowledge about route of transmission		
Gender				
Female	20 [16.0%]	105 [84.0%]	0.555	0.35
Male	16 [13.3%]	104 [86.7%]		
CHUK ward				
Medical	9 [12.0%]	66 [88.0%]	0.001	12.3
Surgery	22 [24.7%]	67 [75.3%]		
Gynecology-Obstetric	3 [6.7%]	42 [93.3%]		
Emergency	2 [5.6%]	34 [94.4%]		
Province				
East	8 [15.1%]	45 [84.9%]	0.172	6.38
West	6 [19.4%]	25 [80.6%]		
North	0 [0%]	24 [100%]		
South	5 [25.0%]	15 [75.0%]		
Kigali	17 [14.5%]	100 [85.5%]		
Education				
Primary	12 [11.1]	96 [88.9%]	0.001	23.97
Secondary	17 [28.3%]	43 [71.7%]		
College	5 [41.7%]	7 [58.3%]		
None	2 [3.1%]	63 [96.9%]		
Occupation				
Prof Nurse	1 [33.3%]	2 [66.7%]	0.648	0.87
Staff Nurse	1 [12.5%]	7 [87.5%]		
Other	34 [14.5%]	200 [85.5%]		
Age				
< 25 years old	10 [18.5%]	44 [81.5%]	0.663	0.82
25-45 years old	18 [13.4%]	116 [86.6%]		
> 45 years old	8 [14.0%]	49 [86.0%]		

The difference was statistically significant regarding the main route of transmission for MRSA and ESBL producing organism among the CHUK departments (P=0.001) and education level with P=0.001.

III.3. DESCRIPTIVE ANALYSIS OF THE HEALTHCARE PROVIDERS.

3.3.1 Healthcare providers Knowledge:

For the 13 questions in the questionnaire, level of knowledge was assigned as follows: if ≤7 appropriate responses = limited level of knowledge, if 8-10 appropriate responses = average level of knowledge and if >10 appropriate responses = sufficient level of knowledge.

Table 8: Knowledge on MRSA and ESBL producing organisms

Healthcare providers characteristic	Frequency	%
Knowledge about MRSA and ESBL		
Nothing	25	10
Little	58	23.2
Some	128	51.2
A lot	39	15.6
Thinking that MRSA/ESBL are		
Virus		
Yes	2	0.8
No	223	89.2
Unknown	25	10
Parasite		
Yes	10	4
No	215	86
Unknown	25	10
Fungal		
Yes	8	3.2
No	215	86
Unknown	27	10.8
Bacteria		
Yes	35	14
No	190	76
Unknown	25	10
Resistant bacteria		
Yes	227	90.8
No	7	2.8
Unknown	16	6.4
Total	250	100
Severe infection		
Yes	143	57.2
No	90	36
Unknown	17	6.8
Resistant infection		
Yes	230	92
No	5	2
Unknown	15	6

Half of healthcare providers have limited knowledge regarding MRSA and ESBL producing organisms 128 (51.2%), but more than half of them 227 (90.8%) agree that MRSA and ESBL producing organisms are resistant bacteria and 230 (92%) agree that they can cause severe infections.

Table 9: Knowledge of the CHUK healthcare workers about route of transmission of MRSA and ESBL producing organisms

Healthcare providers characteristic	Frequency	%
Through air circulation		
Yes	63	25.2
No	151	60.4
Unknown	36	14.4
Through insufficient HCW hand hygiene		
Yes	190	76
No	43	17.2
Unknown	17	6.8
Through hospital devices colonization		
Yes	186	74.4
No	33	13.2
Unknown	31	12.4
Through bad luck		
Yes	19	7.6
No	200	80
Unknown	31	12.4
Sharp object		
Yes	102	40.8
No	97	38.8
Unknown	51	20.4

There was average knowledge about the route of transmission of MDROs among healthcare providers, 190 (76 %) agree with healthcare workers hands as the main route of transmission, 186 (74.4%) believed it is colonized devices and 102 (40.8%) sharp objects.

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3.3.2 Healthcare providers attitudes

Table 10: Attitudes of healthcare providers regarding preventive measures against transmission of MRSA and ESBL producing organism infections at CHUK.

Characteristics	Frequency	%
Washing hand after handing patient		
Yes	174	69.9
No	76	30.5
Washing hands before and after food intake		
Yes	237	94.8
No	13	5.2
Patient education about hygiene		
Yes	207	82.8
No	43	17.2
MRSA/ESBL case isolation to avoid transmission		
Yes	69	27.6
No	181	72.4
Hand hygiene good way for prevention of MDRO bacteria transmission		
Yes	228	91.2
No	22	8.8
Hand hygiene prevent individual transmission		
Yes	208	83.2
No	42	16.8

Most of healthcare providers 236 (94.4%) agree that hand hygiene using soap and water is preferable method of infection control.

3.3.3 Healthcare providers practices

Table 11: Knowledge on hand hygiene agents

Healthcare providers characteristic	Frequency	%
Alcohol used		
Yes	151	60.4
No	99	39.6
Soap and Water		
Yes	236	94.4
No	14	5.6
Water alone		
Yes	28	11.2
No	222	88.8

Most of healthcare providers 236 (94.4%) agree that hand hygiene using soap and water is preferable in infection control.

Table 12: CHUK healthcare providers behaviors and attitudes to prevent MDRO transmission

Healthcare providers characteristic	Frequency	%
Washing hand after handing the patient		
Yes	174	69.6
No	76	30.4
Washing hands before and after food intake		
Yes	237	94.8
No	13	5.2
Patient education about hand hygiene		
Yes	207	82.8
No	43	17.2
MRSA/ESBL isolation to avoid transmission		
Yes	69	27.6
No	181	72.4

Half of healthcare providers 174 (69.6%) just agree that they wash hand after handing patients, 234 (94.8) of them agree that they wash hands before and after food intake and 207 (82.8%) agree that they educate patients about nosocomial infections and 181 (72.4%) said that isolation of patients with infections due to MDROs is not enough to prevent transmission.

Table 13: Choices of antibiotic for treatment of MRSA and ESBL producing organisms.

Healthcare providers characteristic	Frequency	%
Coartem		
Yes	5	2
No	223	89.2
Unknown	22	8.8
Beta-lactam alone		
Yes	18	7.2
No	185	74
Unknown	47	18.8
Amino glycoside alone		
Yes	15	6
No	169	67.6
Unknown	66	26.4
Cephalosporin		
Yes	61	24.4
No	128	51.2
Unknown	61	24.4
Bactrim/vancomycin		
Yes	123	49.2
No	49	19.6
Unknown	78	31.2
Rifampicin		
Yes	39	15.6
No	106	42.4
Unknown	105	42
Carbapenem		
Yes	163	65.2
No	45	18
Unknown	42	16.8

There were 18 (7.2%) healthcare providers who still know that beta-lactam can be used in treatment of infections caused by multi-drug resistant organisms and just half of healthcare providers 163 (65.5%) knew correctly that the use of carbapenem in management of infections due to multi-drug resistant organisms is appropriate, there were some of them 61 (24.4%) who still believe that cephalosporin can be used in management of infection due to MDR bacteria (ESBL producing). most of healthcare providers had no knowledge about the use of rifampicin

for the same bacterial infection due MDR bacteria and disagreed the use of Coartem in thecase of nosocomial infections caused by MDROs.

Table 14: Association between knowledge of routes of transmission of MRSA and ESBL producing organisms and socio-demographic characteristics among HC providers in CHUK (N=250)

Healthcare providers socio-demographic characteristic	Route of Transmission			
	known	**Unknown**	**P-Value**	**Chi^2**
Sex				
Female	74 [53.2%]	65 [46.8%]	0.897	0.02
Male	60 [54.1%]	51 [45.9%]		
CHUK department				
Medical	29 [45.7%]	24 [45.3%]	0.181	8.86
Surgery	26 [57.8%]	19 [42.2%]		
Gynecology-Obstetric	34 [59.6%]	23 [40.4%]		
Emergency	9 [30%]	21 [70%]		
Pediatric	19 [65.5%]	10 [34.5%]		
ICU	14 [51.9%]	13 [48.1%]		
ENT	3 [33.3%]	6 [66.7%]		
Occupation				
Profession nurse	10 [55.6%]	8 [44.4%]	0.362	3.19
Staff nurse	59 [48.0%]	64 [52.0%]		
Internal ship	19 [59.4%]	13 [40.6%]		
Medical officer	46 [59.7%]	31 [40.3%]		

There was no statistically significant difference regarding route of transmission between who knew and who didn't in sex group P= 0.897, in service groups and in occupation groups. .

Table 15: Association between attitudes on MRSA and ESBL producing organisms and socio-demographic characteristics among HC providers.

Healthcare providers socio-demographic characteristic	Attitude to prevent MRSA/ESBL producing organisms		P-Value	Chi^2
	Appropriate	**Inappropriate**		
Sex				
Female	67 [48.2%]	72 [51.8%]	0.053	3.73
Male	40 [36.0%]	71 [64.0%]		
CHUK department				
Medical	23 [34.4%]	30 [56.6%]	0.031	13.85
Surgery	16 [35.6%]	29 [64.4%]		
Gynecology-Obstetric	28 [49.1%]	29 [50.9%]		
Emergency	17 [56.7%]	13 [43.3%]		
Pediatric	15 [51.7%]	14 [48.3%]		
ICU	4 [14.8%]	23 [85.2%]		
ENT	4 [44.4%]	5 [55.6%]		
Occupation				
Profession nurse	12 [66.7%]	6 [33.3%]	0.017	10.11
Staff nurse	58 [47.2%]	65 [52.8%]		
Internal ship	8 [25.0%]	24 [75.0%]		
Medical officer	29 [37.7%]	48 [62.3%]		

There was statistically significant difference regarding attitudes of prevention of infections due to MDROs between CHUK department P=0.031 and different Occupations P=0.017.

CHAP. IV. DISCUSSION

This survey which assessed 245 patients and 250 healthcare providers found that patients had limited knowledge regarding MRSA and ESBL producing organisms: majority of them never heard about MRSA and ESBL producing organisms, more than half of them ignore that these organisms can cause severe sickness and death (see table 2). This result however, varies from a study conducted in 2009 in Dundee, Scotland, UK in which they found sufficient knowledge by the public around MRSA [31].However our study results were comparable to the results of a study conducted in department of veterans affairs in USA as it also showed gaps in general knowledge around MRSA[37]. It is plausible that in our setting as well as in the veterans affairs hospital in USA there is insufficient education of patients around MRSA and ESBL producers, or that they have become more widespread [1,2] and that the treatment become difficult with increased length of the hospital stay, medical cost, can cause serious infections and death [3,4,5,6,7,21].

The finding that patients disagreed that MDROs were transmitted through HCWs unsanitized hands reflects poor knowledge around MRSA and ESBL organism transmission and that HCWs serve as main vectors or reservoirs and victims of MDROs can cross transmit their organisms in LTCFs[12]. Majority of patients said they disagree that it can be transmitted through hospital devices or procedures, or visitors or family members colonized with MDROs constitute known for risk factor for transmission of these organisms [4,10,16] . It was disheartening that patients denied any discussion with the HCWs regarding MDROs, and this mirrors findings of studies done in 2009 in Dundee, Scotland, UK and in 2013 in Germany [32, 37].

Our study showed a gap in HCWs education of the patients around MDROs. This has not been uniformly shown and likely represents hospital or facility based efforts emphasizing engagement and education of patients around nosocomial infection. Indeed a study conducted in September 2010 in USA showed sufficient knowledge around MRSA infections after education by healthcare providers [38]. Teaching patients and care givers is the best way to prevent spread of MRSA and ESBL producing organisms [9,24,23]. Most of patients didn't believe that bad luck or witchcraft can be the cause of nosocomial infections, most of the patients agreed with nasal and auxiliary swab for MDRO surveillance, although there was limited acceptance of rectal swab as screening test, likely due to privacy concerns or insufficient education about its utility. Indeed, the axillae and nose are common sites of colonization of MRSA [13] and the rectum for ESBLs

producers because the intestine is the most site of colonization[5]. Studies conducted in 2013 in Korea [11] and in 2012 in specialized hospital in Addis Ababa [22] to determine colonization rates of MRSA and ESBLs and carbapenemase producing organisms by performing nasal, inguinal, pharyngeal swab for MRSA and rectal swab for ESBL, showed these are meaningful ways to assess colonization so these methods are useful to detect carriers or infected patients and to inform preventive measures to stop cross transmission of the organisms.

Most of the patients had appropriate attitudes regarding prevention of the cross of MDR bacteria (see table 3) and most of them preferred hand hygiene using soap and water as main hand hygiene practice. Furthermore, patients said they were not satisfied with HCWs hand hygiene, likely because they didn't observe them washing hands in front of them which may also have been impacted by the availability of water. Some patients reported feeling stigmatized with isolation in case of symptoms related to MDROs infections, a barrier which should be addressed by patient education in order to increase acceptance of the practice. Otherwise, rooming carriers of MDROs in a single room is among infection control measures advocated and contribute to preventing and control of the spread of these organisms [9], Studies conducted in 2 regions of Germany in 2012 [32] showed similar result as our study.

HCWS agreed that the good agent for hand hygiene is soap and water (see table 2), similar results were found in studies conducted in 2016 in the University of Aden [8] and in 2010 in Mashhad hospital [29]. However, it makes sense that HCWs are more likely to clean their hands as recommended, if water and soap or alcohol based hand rubs (ABHR) are available and placed closer to the patients [28]. The preference for soap and water likely reflects availability of these modalities in resource limited settings. This preference for soap and water is an interesting observation as ABHR is superior to ordinary soap and water regarding the efficacy to remove micro-organisms[13] and ABHR is national and international recommended modality to prevent cross of MDROs[8]. Only half of HCWs agreed that they wash hands after handling patients (See table 3), may be because alcohol or soap and water were either not available, or reflect high workloads or limited knowledge around MDROs bacteria[12]. It has been established that hand hygiene is the simplest and most important infection control measure for preventing and containing MDROs infections[23,24] and hand hygiene after touching patients constitutes an important opportunity for hand hygiene [13]. Therefore provider education, reminders,

observation and other evidence based strategies need to be employed to improve hang hygiene compliance.

Most HCWs didn't agree with isolation as an infection control measure. Isolating patients with MDRO infections is considered an important measure to reduce risk of transmission of these organisms [9,13]. Concerns might be interference with patient care, patient stigma or prolonging duration of patient contact; however these considerations should not preclude proper practice.

Most HCWs knew that these infections can't be treated by coartem (an antimalarial) and believed that beta-lactam antibiotics should not be used to treat MDR bacteria, but some of them still believe that beta-lactams and third generation cephalosporins can be used. MRSA and ESBL producing organisms are resistant to major antibiotics classes including (Penicillins, third generation cephalosporins)[1,7,6,25,39], and therefore lack of knowledge of the antimicrobial spectrum of activity of common antibiotics may not only fuel AMR but also result in adverse outcomes for the patients who are treated inappropriately for their infection. While, HCWs agreed the use of vancomycin in case of nosocomial infections caused by MRSA as vancomycin still serves as the cornerstone of the treatment of MRSA [6,21,24], only few HCWs knew that rifampicin can be used in some cases of nosocomial infections caused by MRSA, probably because it is better recognized for its use for the treatment of tuberculosis infections in our setting. Indeed, rifampicin can be combined with vancomycin in serious infections caused by MRSA such infective endocarditis [24]. Only half of HCW agreed with the use of carbapenems in case of ESBL producing organism infections, which are considered as the drug of choice for treatment of ESBL producing organism infections [21]. Clearly more education around antibiotics and their spectrum of activity is needed in our hospital setting.

Our study showed half of HCWs had limited knowledge regarding MRSA and ESBL producing organisms as the most common cause of nosocomial infections likely due to insufficient training or education around these organisms. HCWs are positioned at the apex of antimicrobial resistance phenomenon by their poor infection prevention practices [12,13] and MRSA and ESBL producing organisms are the most bacteria causing healthcare associated infection (HAIs)[17].

In Rwanda, precisely at CHUK hospital, the prevalence of MRSA and ESBL producing organisms is high. A study conducted in 2013 at CHUK hospital showed that among 154 positive cultures performed on urine, blood, wound swab and sputum specimens, 31.4% of E.coli and 58.7% of Klebsiella isolated were resistant to at least one of the third generation cephalosporins, 8% of E.coli were resistant to Imipenem and 82% of S. aureus were MRSA, 6% were VRSA (vancomycin resistant staphylococcus aureus)[7] . Two other similar studies conducted in Manipol hospital, Bangalore, India in 2007 [36] and in the U.S in Stronger hospital in 2011[35] found high prevalence of MRSA and ESBL producers.

Half of HCWs disagreed that air circulation is the route of transmission of MDROs, but 63 (25.2%) still believe it, 190 (76%) HCWs agreed that insufficient HCWs hand hygiene is the way of transmission of these organisms, and 186 (74.4) HCWs believed that device colonization is a way of transmission, and most of them didn't agree that bad luck can cause nosocomial infections and 102 (40.8%) agreed that it can be transmitted through sharp objects. This reflects that a significant proportion of HCWs have inappropriate beliefs regarding MDRO transmission and is quite concerning.

LIMITATIONS

A limitation of the study is that educational level and poor health literacy among patients and some healthcare workers may have impacted their responses to the study questionnaire. Also, it is possible that healthcare workers may have over reported their frequency of compliance to hand hygiene practices.

CHAP.V.CONLUSION AND RECOMMENDATIONS

V.1 CONLUSION

Results of this study are highly suggestive of limited level of knowledge by patients and limited knowledge by HCWs regarding nosocomial infections due to multidrug-resistant organisms precisely MRSA and ESBL producing organism, specifically their modes of transmission , the severity of infections they cause and how to treat them. HCWs demonstrated average knowledge about poor hand hygiene as the mean way of transmission of MRSA and ESBL producing organisms.

We found that there was difference by services and by occupation regarding appropriate attitudes and means of preventing the spread of MDROs.

V.2 LOCAL RELEVANCE OF THE STUDY AND RECOMMENDATIONS

V.2.1 Local relevance of the study

Our findings have some important implications for clinical practices in healthcare setting , as discussed earlier, MRSA and ESBL producing organisms are recognized as principal pathogens that are easily transmitted in healthcare setting , it contribute significantly to high mortality and prolonged length of stay among hospitalized patients, the significant proportion of infection are transmitted between patients via healthcare providers hands.

Healthcare providers in CHUK as well as in other hospitals of Rwanda must observe methods of infection control and discuss with the patients about severity of infections caused by MRSA and ESBL producing organisms, the modes and means of preventing their transmission.

V.2.2 Recommendations

To train all healthcare providers to better know that nosocomial infections caused by MRSA and ESBL producing organisms are life threatening and the main way to prevent their cross transmission between patients is proper hand hygiene.

To organize training of all healthcare providers on infection control

To organize discussions between healthcare providers and patients containing details about the severity of infections caused by MRSA and ESBL producing infections, how they are transmitted and how they may be prevented.

To ensure that water and soap but preferably ABHRs are provided and available at all clinical care sites as it is the national and internationally recommended primary method for healthcare providers and patients to perform hand hygiene.

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APPENDICES

1. **Consent forms form and data collection for healthcare providers.**
2. **Consent form and Data collection for patients.**
3. **Data collection for the rest part of the study.**

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Protocol research

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Consent form

I, DrKabwa Yuma agneau postgraduate in college of medicine and health sciences, school of medicine, internal medicine department university of Rwanda, I hereby conducting a study entitled "Assessing healthcare providers attitudes, knowledge around infectious control surveillance and practices on MRSA and ESBL in services of CHUK Kigali."

I hereby asking healthcare providers _____permission of contracting or participating him/herself in our study entitled as above for the interest of

Rwandans after completion of data collection and analysis of the results. There will be no identification of patient's names in this study so as he / she fears to be involved in the study and I will keep confidentiality of every healthcare providers and I will put the data in office and rock. No one else will be in contact with these data except me and investigator assistants.

The study is about to assess the healthcare providers knowledge on MRSA and ESBL (what they know about the organism), how they can be transmitted and what to do to prevent transmission of their: This is achieved by giving response to questionnaire.

The prevention from those microbes is achieved by observing proper hand hygiene for health care professionals and patients; this survey is done under strict privacy in good confidentiality between the researcher and participants.
The results will help us to institute the system of teaching patient measures for preventing the transmission of these MDR organisms

I_____hereby confirm that I understand the content of this document and the nature of this research project; I consent to participate in this research project. I understand that I have the liberty to withdraw from the project at anytime I desire

We thank you to have accepted to participate in research project.
Signature of the respondent.

Assessing healthcare providers attitudes, knowledge around multidrug resistant organism surveillance and infection control practices at CHUK , Kigali

Date (dd/mm/yyyy)

Site : hospital

Department

1 Gender ☐ Male ☐ Female

2 Demographics

What is your current post?

☐ Professional Nurse ☐ Staff nurse ☐ internal ship ☐ Medical doctor

3 MRSA and ESBL Knowledge

1 How much would you say you know about MRSA(methicilin resistant staph aureus) and ESBL(extend spectrum beta-lactamase)

Nothing	A little	Some	A lot	A great deal

2 Do you think that MRSA and ESBL are

1 Virus	Y	N	U
2 Parasite	Y	N	U
3 fungal	Y	N	U
4 simple bacteria	Y	N	U
5 resistant bacteria	Y	N	U

3 Do you agree with any of these statements?

1	MRSA and ESBL cause malaria	Y	N	U
2	MRSA and ESBL cause simple infection	Y	N	U
3	MRSA and ESBL cause severe infection	Y	N	U
4	MRSA and ESBL cause severe and resistant infection	Y	N	U

4 Do you agree that main route of transmission of MRSA and ESBL is

Air circulation	Y	N	U
Healthcare worker hand	Y	N	U
Exposed to colonized surface	Y	N	U
Bad lucky	Y	N	U
Sharing noninvasive objects	Y	N	U

4 MRSA (Methicillin resistant staph aureus) and ESBL (Extended spectrum betalactamaset) attitudes

1 Do you agree with the following statements?

- Hand hygiene forms an important practice to prevent cross of MRSA and ESBL infection

  Yes No

- Hand hygiene practices prevent an individual from getting infection

  Yes No

- Do you educate friends, patients and colleagues to practice hand hygiene?

  Yes No

5 MRSA and ESBL practices

1 Washing hands before and after food intake Yes No

2 Choice of agent hand hygiene

- Alcohol Yes No
- Soap and water Yes No
- Water Yes No

3 Habit of hand wash after handing each and every patient Yes No

4 Isolation of every MRSA and ESBL symptomatic patient is enough to prevent transmission Yes No

5 Do you think that MRSA infection can be treated by:

1	Coartem	Y	N	U
2	Betalactams alone	Y	N	U
3	Aminoglucozides alone	Y	N	U
4	Cephalosporines alone	Y	N	U
5	Bactrim/vancomycin	Y	N	U
6	Rifampicin	Y	N	U

6 Do you think that ESBL infection can be treated by

1	Carbapenems	Y	N	U
2	Betalactams	Y	N	U
3	Aminosides	Y	N	U
4	Cephalosporines	Y	N	U

NB: ESBL= Extended spectrum betalactamase, MRSA= Methicillin resistant staph aureus

Assessing patient's attitudes and beliefs around multi-drug resistant organism surveillance and infection control practices at CHUK, Kigali.

Date (dd/mm/yyyy)

Site /ward: Medical surgery obstetrics/Gynecology Accident/Emergency

1 Gender ☐Male ☐ Female

2 Age

3 Demographics

Residential province

☐East ☐West ☐North ☐ South ☐Kigali

4 Educational level: (highest level completed)

☐ No education

☐ Primary school

☐ Secondary school

☐ College degree or highest

5 Occupations:

☐ Healthcare worker

- Prof Nurse
- Staff nurse
- Medical officer

☐ Other profession

6 Patients knowledge on MRSA and ESBL

1 Have you heard about the existence of multi-drug(Multiantibiotics)resistant:

Yes NO

2 How much would you say you know about Methicillin resistant staph aureus (MRSA)

Nothing	A little	Some	A lot	A great deal

3 How much would you say you know about extend spectrum beta-lactamase (ESBL)

Nothing	A little	Some	A lot	A great deal

4 During your hospital stay has your healthcare provider discussed with you about the possibility and risk of transmission of resistant bacteria

Yes	Never	Decline to

5 Do you agree with any of these statements? Y=Yes, N=No, U=unknown

1	MRSA and ESBL cause Severe sickness	Y	N	U
2	MRSA and ESBL cause death	Y	N	U
3	MRSA and ESBL are harmless	Y	N	U

6 Do you agree that main route of transmission of MRSA and ESBL is:

1	Air circulation	Y	N	U
2	Healthcare worker hands	Y	N	U
3	Exposure to hospital devices	Y	N	U
4	Sharing personal effects	Y	N	U
5	From visitors	Y	N	U
6	Medical or surgical procedures	Y	N	U
7	Other patient in thehospital	Y	N	U
8	Bad luck	Y	N	U
9	Witchcraft	Y	N	U

7 MRSA and ESBL Attitudes

1. Do you agree with the following statements?
   - Washing Hands is an important practice to prevent passing bacteria from one patient to another Yes No
   - Hand hygiene practices can prevent passing bacteria from healthcare workers to patients

     Yes No
   - Hand hygiene practices can prevent passing bacteria from patients to healthcare workers

     Yes No
   - Hand hygiene practices can prevent passing bacteria from caretakers

     Yes No

- Hand hygiene practices can prevent passing bacteria from you to your caretaker

Yes No

8 MRSA and ESBL infection control practices

1 Do you wash the hands before and after food intake?

Yes No

2 Which of the following are acceptable hand hygiene procedures in the hospital?

- Alcohol Yes No
- Soap and water Yes No
- Water only Yes No

3 Does healthcare provider wear gloves or washing hands before touching you?

Yes No

4 Are you satisfied with hand hygiene procedures performed by your nurses?

Yes No

5 Are you satisfied with hand hygiene procedures performed by your physicians?

Yes No

6 To assess colonization or transmission of MRSA and ESBL, which one(s) of the following surveillance procedures will you be willing to accept to be performed on you?

1	Nose swab	Y	N	Not sure
2	Axillar Swab	Y	N	Not sure
3	Rectal swab	Y	N	Not sure

7 Do you feel stigmatized if your healthcare provider isolates you from other patients if you have MRSA and ESBL infection?

Yes No

8 Would you feel stigmatized if your doctor or nurse wears gloves every time before they touch you? Yes No

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Uruhushyarwogukorerwahoubushakashatsi

Njyewe, mugangaKabwa Yuma agneau, umunyeshurimurikaminuzay'u Rwanda, mu cyicirocyakane, mw'ishamiry'ubuvuzi, mu rwegorwokurangizaicyogicirondimogukoraubushakashatsi.
None ndagusabauburenganzirabwogukorerwahoubushakashatsikugirango , mu rwegorwokurebaicyomuzikubyerekanyen'udukokotwa MRSA na ESBL producingorganisms, icyodushoboraguteramumubiri, n'uburyobwokwirindakuhandura no kwanduzaabandiutwodukoko.
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UmushakashatsiMukuru

Kabwa Yuma agneau

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