



Myndigheten för
samhällsskydd
och beredskap

Kompetensutveckling i u-länder för att förebygga vårdrelaterade infektioner och antibiotikaresistens

FORSKNING

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Abstract

Health care associated infections (HCAIs) and the associated antimicrobial resistance (AMR) is a major global public health problem causing increased hospital stay, cost of therapy and mortality. The impact of HCAIs and antimicrobial resistance is much higher for developing countries because of limited resources, healthcare infrastructure and competence. The main objective of this project was to develop competence of healthcare staffs and increase the awareness through capacity building for prevention of HCAIs and antimicrobial resistance in Ethiopia.

A three-phase prospective interventional study was conducted at the country's largest teaching University Hospital in Addis Ababa, through international research collaboration between researchers from Karolinska Institutet, The Public Health Agency of Sweden and Addis Ababa University. In the 1st phase we conducted baseline surveillance of i) HCAIs and antimicrobial use, ii) colonization rate of HCAIs associated antimicrobial resistant pathogens iii) knowledge, practice and attitudes of healthcare staff towards HCAIs and antimicrobial resistance. In the 2nd phase, educational interventions were introduced based on the gap and problems identified in Phase-1. In the 3rd phase we evaluated the impact of intervention.

High prevalence of HCAI mainly in the intensive care unit (50%), pediatrics (23%), neonatal (21%), medicine (20%) and obstetrics (12%) wards was identified. The wards with high HCAI were the one with high antimicrobial use and most crowded. In one pediatrics ward, 44% of the children had HCAIs. Over all 50% of the patients were receiving antibiotic at the time of survey; being much higher in intensive care unit (100%), pediatrics (57%) and neonatal (64%) wards.

The overall gastro-intestinal colonization rate of Extended-Spectrum Beta-Lactamase (ESBL)-producing *Escherichia coli* and *Klebsiella pneumonia* in hospitalized patients was 50%; the rate being much higher in neonates (56%) and pediatrics (58%) compared to adults (45%). We found children colonized by carbapenem resistant ESBL producing pathogens. The rate of colonization with VRE in both adult and pediatric patients was 17%. VRE was absent in neonates. The overall nasal colonization rate of MRSA was much higher in hospitalized patients (49%) than outpatients (28%). In hospitalized patients the rate of MRSA colonization in adults, pediatrics, and neonates was 55%, 48% and 30% respectively.

Educational intervention was introduced based on the problems and gaps identified through the baseline surveillance. The major gap preventing the healthcare staff from practicing hand hygiene was unavailability of alcohol-based hand rub in the hospital. Through this project we established local alcohol-based hand rub production unit and distributed to all hospital staff during the intervention phase; while monitoring the rate of surgical site infections, which reduced noticeably. Convinced by the result, the hospital management has now allocated permanent budget for alcohol hand rub and sustained the local alcohol hand rub preparation facility. Our project received certificate of appreciation from the hospital management group for raising the awareness and practice of infection prevention and hand hygiene in the Hospital.

In summery, high rate of HCAs and colonization with antimicrobial resistant pathogens in hospitalized patients is a major concern that needs urgent infection prevention strategy. Most worrisome is colonization with carbapenem resistant ESBL and with the current routine practice it is a matter of time for the photogenes spreading. The burden, prevalence and the resistance pattern of MRSA, ESBL and VRE in clinical samples yet to be investigated. The project created local awareness, competence, quality control strategy and evidence based recommendations for hospital management group to establish better guidance for hospital hygiene and network for surveillance of HCAs.

Key words

Health care associated infection, antimicrobial resistance, Ethiopia, MRSA, VRE, ESBL.

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1. Background

Health care associated infections (also called Hospital acquired or nosocomial infection) is an infection acquired in the health care facilities related to a medical procedure or any new infection that becomes evident 48-hours or more after admission. The most frequent sites of infections are urinary tract, surgical site, respiratory tract and blood stream accounting for 80 % of all HCAs. One fourth of Health care associated infections (HCAs) involve patients in the intensive care units and 70 % of the microorganism are resistant for one or more antimicrobials. Transmission of Antimicrobial resistant (AMR) pathogens in healthcare facilities from patients, visitors and health care staffs may lead to outbreaks and spread to the community.

Treatment of HCAs is complicated due to high prevalence of multi-drug resistant organisms like Methicillin resistant *Staphylococcus aureus* (MRSA), extended spectrum beta-lactamase (ESBL) producing gram negative bacteria and Vancomycin resistant *Enterococci* (VRE). An ESBL is a bacterial enzyme with the ability to break down beta lactam antibiotics belonging to the penicillin and cephalosporin classes, but not carbapenems. ESBLs are most commonly produced by *Escherichia coli* and *Klebsiella pneumoniae*, which are normal gut flora. Enterococci are facultative anaerobic Gram-positive coccoid bacteria that live in the gastrointestinal tract of most individuals. Vancomycin-resistant enterococci (VRE) are strains of *Enterococcus faecium* and *Enterococcus faecalis* that have become resistant to vancomycin. Methicillin-resistant *Staphylococcus aureus* (MRSA) is a bacteria that is resistant to many antibiotics. Some individuals can carry MRSA on their skin or nose. In the community, most MRSA infections are skin infections. In health care facilities, clinical infection with MRSA causes life-threatening bloodstream infections, pneumonia and surgical site infections.

Individuals who carry these bacteria's are called "colonized" with the pathogen. Colonization is the presence, growth and multiplication of a microorganism in or on a body site without signs and symptoms of illness. Colonization predisposes the patient to recurrent infections and cross-transmission to cause clinical infections. These bacteria can spread from one patient to another via healthcare workers contaminated hands that touch either colonized/infected patients or a contaminated environment and then touch another patient. Therefore hand hygiene and environmental surface cleaning are important measures to prevent spreading or transmission of multi-drug resistant microorganisms.

1.1 The global burden of Health care associated infection and Antimicrobial resistance

Antimicrobial resistance and health-care associated infections is the most serious global health threats causing prolonged hospital stay, long-term disability, high cost of therapy, excess morbidity and mortality [1]. The emergence and spread of antimicrobial resistance has rendered many formerly easily treatable infections more difficult to manage. WHO stated, "A paradigm shift has occurred in our world that cannot be reversed – multidrug resistant pathogens are here to stay. Gains in many areas of infectious disease control are seriously jeopardized by the spread of antimicrobial resistance and the world is urged to take action". According to WHO estimates, hundreds of millions of patients are affected each year worldwide.

AMR and HCAs are global health problems that require local, national and global responses. The impact is more severe for sub-Saharan African countries because of limited resource, competence, poor health care infrastructure and sanitation. Antimicrobial resistance emerges mainly due to irrational use of antibiotics. Evidently antibiotics are widely and inappropriately used in Africa. In Africa, of all those who receive antibiotics, 31.7 % do not receive a prescription from a doctor and about 26.4% obtain antibiotics from an informal dispenser [2]. The burden of antimicrobial resistance is unbearable for sub-Saharan Africa, a content that is highly affected by poverty, HIV/AIDS, TB and malaria. The lack of routine drug sensitivity testing and surveillance in many resource-limited countries contributes for misdiagnosis and irrational use of antimicrobial drugs.

Population mobility is a main factor in globalization of public health threats and spread of antimicrobial drug-resistant organisms [3]. There is increasing evidence that travelers contribute to the spread of antimicrobial drug resistance pathogens [4]. Therefore establishing effective AMR surveillance and intervention in Africa must be taken into consideration in the global fight against antimicrobial resistance.

1.1.1 Health care associated infections and antimicrobial resistance in Ethiopia

Rates of HCAs are markedly higher in many developing countries, especially for infections that are largely preventable. In Ethiopia, initial studies were conducted in collaboration with researchers from Sweden during 1983-1990 on the prevalence of HCAs among patients admitted in Tikur Anbessa Hospital (TAH), Addis Ababa, which is the largest referral university Hospital in Ethiopia. The reported rate of wound infection from the surgical ward was 59%, followed by Urinary tract infection (26%) and respiratory tract infections (6%), whereas among Obstetrics and Gynecological patients it was 47% and 15%, respectively. Majority of the isolated bacteria were gram-negative mostly resistant to the commonly used antimicrobials [5-7]. Later a high level (63%) of hospital acquired multi-drug resistant bacterial infection was detected for many years at TAH compared to 7% at Karolinska Hospital [8]. A similar high rate of HCAI prevalence was reported from different parts of the country: on postoperative infections in Gondar, *Northwest Ethiopia*, a rate of 38.7% was reported [9]. The overall surgical wound infection rate was 54.2% among post-operative patients in Yirga-Alem Hospital, *South Ethiopia*. A more recent study from Mekele Hospital, *North Ethiopia*, reported 27.6% of HCAs caused by gram negative bacteria mostly resistant (>80%) to commonly used antimicrobials.[10]

From these studies it is obvious that antimicrobial resistance and HCAI is a major problem in Ethiopia. The need for HCAI surveillance program and appropriate guidelines for prudent use of antimicrobials is indispensable and urgently needed. What makes the present study unique is its focus on intervention testing to limit impact of HCAs in Ethiopian setting. Many HCAs are preventable through surveillance and intervention program. [11] Areas within hospitals that have the highest rates of antimicrobial resistance also have the highest rates of antimicrobial use. Therefore the present study focused on two major areas that are inseparable (HCAs + antimicrobial use and resistance). The goal was through capacity building to establish competence for sustainable HCAI surveillance program and better guidelines for proper antimicrobial uses and infection control program in Ethiopian settings.

2. General objectives

The general objective of the study were:

- 1) To build the local capacity and competence of healthcare workers for infection prevention and to establish sustainable HCAI surveillance team for early outbreak detection and management.
- 2) To introduce educational interventions based on assessment and feedback of the local data.
- 3) To provide evidence-based recommendations to key hospital administrators and for prudent antimicrobial use and infection control.
- 4) To establish sustainable infection control network and identify links for preparation and management of response to emergencies related to epidemics and pandemics.
- 5) To promote the rational use of antimicrobials and hand hygiene for prevention of AMR and HCAs in the Ethiopian setting.

2.1 Specific objectives

- a. Surveillance of HCAs and antimicrobial use.
- b. To evaluate colonization rate and resistance pattern of HCAs associated multi-resistant bacteria in particular Methicillin resistant *Staphylococcus aureus* (MRSA), extended spectrum beta-lactamase producing gram negative bacteria (ESBL) and Vancomycin resistant *Enterococci* (VRE) in hospitalized patients.
- c. Surveillance of the current Knowledge, Attitudes and Practice (KAP) of health care facilities towards HCAs.
- d. To test & evaluate intervention program to reduce HCAs and promote rational antimicrobial use.

The study was conducted through a well-established international collaboration between researchers from Sweden (Karolinska Institutet, The Public Health Agency of Sweden, EUCAST Laboratory for Antimicrobial Susceptibility Testing) and Addis Ababa University in Ethiopia.



Figure 1: The study site, Tikur Anbessa Hospital is the largest public referral Hospital in Ethiopia

3. Methods

A prospective interventional study was conducted in three phases at Tikur Anbessa University Hospital (TAH), Addis Ababa, Ethiopia during 2011 -2013. TAH is the biggest teaching University affiliated Hospital in Ethiopia, where patients from different parts of the country are referred for better management. The hospital provides service to both outpatient and inpatient admitted at *Medical, Surgical, Obstetric & Gynecologic, Orthopedics, neonatal and Pediatrics* wards. TAH has a total of about 500 beds capacity, Intensive care Unit (ICU) with bed capacity of 12, operation rooms for major and minor procedures. There are ≥ 500 health professionals (medical doctors, Nurses, laboratory personnel, pharmacists) working in TAH.

3.1 Baseline point prevalence surveillance (Phase-1)

- i. ***Surveillance of HCAI and antimicrobial use:*** was assessed in 347 hospitalized patients using a protocol from European Centre for Disease Prevention and Control (ECDC).
- ii. ***Surveillance of colonization with AMR pathogens:*** Microbiological screening for MRSA and antimicrobial resistance pattern was done from nasal swabs collected from hospitalized patients (n=398) and outpatients (n=460). Prevalence of gastrointestinal colonization and resistance pattern of VRE as well as ESBL producing *Klebsiella* spp and *Escherichia coli* was analyzed from fecal samples collected from hospitalized patients (n=300). Preliminary screening was done using specific chromogenic agar followed by VITEK-2 identification and antibiotic susceptibility testing (AST). Interpretation of AST result was done according to EUCAST.
- iii. ***Surveillance of Knowledge, Attitudes and Practice (KAP):*** of health professionals on hand hygiene, HCAs and AMR was conducted in March 2013. A standardized questionnaire adopted from WHO and other litterateurs was prepared in English and translated to the local language Amharic. All health workers (Medical doctors, consultants, residents, nurses and midwives) available during the survey were included in the study. The questioner was self administered to health professionals (n=305) and the completed questionnaires were collected, entered into the database and analyzed.
- iv. ***Surveillance of infrastructure and compliance to guidelines:*** Available guidelines and compliance towards antibiotic use, consistent practice of preventive procedures such as hand hygiene, respiratory protection, use of surgical antimicrobial prophylaxis and aseptic manipulation of invasive devices was assessed by direct observation.

3.2 Educational intervention (Phase-2):

A three-month educational intervention was introduced based on identified problems and gaps from the baseline survey through capacity building educational training. Co-investigators from the Public Health Agency of Sweden, Karolinska Institutet and Addis Ababa University participated in the intervention. The main focus was promoting the hand hygiene for prevention of AMR and HCAs. Educational programs addressing the identified gaps in antimicrobial use, hygiene, infection prevention practices were developed based upon materials

from the WHO, International Federation of Infection Control and experiences in Sweden. The educational intervention was conducted in the form of seminars, workshops and group discussions. The research team from The Public Health Agency of Sweden /Folkhälsomyndigheten/ with long experience on infection prevention, Hospital and hand hygiene matters participated actively on site during the educational intervention and shared their experiences with the local healthcare staff, Hospital management group and infection control team.

3.3 Evaluation of the intervention (Phase-3)

Compliance with regulations and change of health workers attitude towards hygiene and prudent antimicrobial use was evaluated to assess the success of interventions. Point prevalence surveillance was done to assess prevalence of HCAs, and KAP of health care staffs after the intervention. Comparison of data before and after intervention evaluated the effectiveness of intervention. We assessed the extent to which the objectives are met, the goals accomplished, whether the activities are being performed according to requirements and to identify aspects that may need improvement.



Figure 2: Jens Odlander, Ambassador of Sweden in Ethiopia visited the study site and project activity at Tikur Anbessa Hospital.

4. Result

4.1 Baseline point prevalence surveillance

4.1.1 Point prevalence of Health care associated infections and antimicrobial use

Surveillance of HCAs and antimicrobial use was done in 347 hospitalized patients. We identified a high prevalence of HCAs in patients admitted at the intensive care unit (50%), pediatrics (23%), neonatal (21%), medicine (20%) and obstetrics (12%) wards. The wards with high HCAI were the one with high antimicrobial use and most crowded. The prevalence of HCAI in one particular crowded pediatric ward was 44%. Overall 50% of the patients were receiving antibiotic. All patients admitted at the intensive care units (100%), 57% of patients in pediatrics ward and 64% of the newborns in neonatal ward were receiving antibiotics at the time of survey.

4.1.2 Rate of colonization with antimicrobial resistant pathogens

Extended Spectrum Beta-Lactamas (ESBL) pathogens: The overall gastro-intestinal tract colonization rate with ESBL-producing *E. coli* and *K. pneumoniae* spp was 50%. The rate being much higher in neonates (56%) and pediatric patients (58%) compared to adults (45%). The proportion of ESBL producing *E. coli* in adults, children and neonates was 44 %, 48% and 15.4% respectively. Of all ESBL producing gram-negative pathogens, *E. coli* accounted 88%, 63% and 13% in adult pediatrics and neonates respectively. In contrast colonization with ESBL producing *K. pneumoniae* was much common in neonates (80%) and pediatrics (33%) compared to Adults (12%). We found few children colonized with ESBL producing *K. pneumoniae* isolates resistant to carbapenem.

Methicillin-resistant *Staphylococcus aureus* (MRSA): Nasal Carriage of Methicillin Resistant *Staphylococci* prevalence was calculated by dividing the number of cases with MRSA colonization by the total number of nasal swab collected from each patient stratified by age group adult, children and neonates. The overall nasal colonization rate of MRSA was much higher in hospitalized patients (49%); than outpatients (28%). In hospitalized patients the rate of MRSA colonization in adults, pediatrics, and neonates was 55%, 48% and 30% respectively.

Vancomycin-resistant *enterococci* (VRE): The rate of gastro-intestinal tract colonization rate with VRE was 17% in hospitalized adults and children. None of the newborn patients were colonized with VRE (0%).

4.1.3 Surveillance of Knowledge, Attitudes and Practice (KAP):

The perception and KAP of healthcare workers on HCAs and hand hygiene was assessed to identify gaps to be addressed in the intervention phase of the study. Majority (69.2%) of the health workers were educated in hand hygiene during college training. Only 19% of the health professionals received formal hand hygiene training in the last three years. About 3 out of 4 health care workers (76.4%) believe that “among all patient safety issues”, hand hygiene has low or moderate priority. Only about a quarter believe hand hygiene is a high priority. About 78% of the health workers reported dispensed liquid soap and water as the most appropriate to use for hand cleaning. About half (56%) of the health workers reported Alcohol-based hand rub as the most appropriate to use for hand disinfection, whereas 46% reported medicated liquid soap and water is the most appropriate to use for hand disinfection. Unavailability of water, soap and

detergent or alcohol-based hand rub was the main factors for preventing health workers from hand washing or cleaning. About 37% of the health professional believed that more than 50% of hospitalized patients develop HCAs after Hospital admission. About 71% of the health care workers have cared for or treated patients with hospital-acquired infections during the past three months. Majority of the health care workers believe that the impact of HCAI on patients clinical outcome is high or very high.

4.2 Intervention

Result from the surveillance study was given as a feed back in the form of seminar, group discussions and min-conference to Hospital management group, the entire health care staff and infection control team. We conducted several repeated face-to-face small-group discussions with medical doctors, nurse and midwives. The total number of wards included in the group discussion were 22 and with a total of 402 nurses and > 100 and medial doctors. There were about 15-20 participants in each group discussion. We combined different ward nurses together for the discussion and a total of 20 rounds of group discussions.



Figure 3: Group discussion with nurses during the intervention phase

The major gap preventing healthcare staffs at TAH from practicing hand hygiene was unavailability of alcohol-based hand rub at the hospital. Therefore during the intervention phase, we established a local alcohol-based hand rub preparation unit at the hospital pharmacy. Alcohol hand rub was prepared using the WHO formula and distributed to all hospital staff during while monitoring the incidence of surgical site infections.



Figure 4. Alcohol-based hand rub produced locally for distribution to health professionals at Tikur Anbessa Hospital.

4.3 Evaluation

After the intervention phase was completed, we have noticed a major change in attitude and practice of the health care staff and hospital management groups towards hand hygiene. The presented magnitude of HCAIs and AMR colonization rate among patients admitted at TAH made the health care staff and the management group to react jointly. Two major actions that were taken by the hospital management group include

- 1) Allocation of permanent annual budget for alcohol based hand rub and maintaining the local production unit.
- 2) Dedicated local infection prevention team consisting of medical doctors specialist in infectious diseases, nurses and microbiologists is established.
- 3) Declaration of annual hand hygiene promotion week (3rd week of January) to be celebrated by the entire hospital staff to campaign for hand hygiene for infection prevention. The first hand hygiene week was held on 13-17 January 2014. On January 17, 2014 the hospital management gave certificate of appreciation for our project for raising awareness and practice of hygiene practice.



Figure 5. Certificate of appreciation received from Tikur Anbessa Hospital.



Figure 6: Celebration of hand hygiene promotion week at Tikur Anbessa Hospital on 17 January 2014.

5. Discussion

Our result indicates HCAI and AMR is major problem for patient safety in TAH as evidenced by the high prevalence of HCAIs, mainly in the intensive care unit pediatrics, neonatal and medicine wards. More than 50% of the patients were colonized with either ESBL producing *E. coli* or *Klebsiella* species. All *Klebsiella* species isolated from neonates and 64% from children were ESBL positive, whereas in adults ESBL producing *Klebsiella* species accounted 50%. The colonization prevalence of MRSA in hospital admitted patients in Sweden is much lower (1%) [12], compared to the finding in hospitalized adult (55%) and children (48%) or newborn (30%) from Ethiopia. This indicates that a beta-lactam antibiotic is still the first choice of antibiotic for prevention of infections caused by *S. aureus* in Sweden but this treatment strategy is in danger in Ethiopia. MRSA and ESBL colonization predispose the patient to recurrent infections and cross-transmission to others. Patients colonized with MRSA are at increased risk for invasive infections compared with non-colonized patients [13]. Surgical patients with a positive nasal MRSA colonization have a 9-fold risk to develop MRSA surgical site wound infection [13] and ICU hospitalization [14].

Hospital-born babies in developing countries are at increased risk of neonatal infections because of poor intrapartum and postnatal infection-control practices. The high prevalence of colonization with ESBL and MRSA in hospitalized particularly in newborns at TAH is alarming. High prevalence of neonatal sepsis mainly due to multi-drug resistant *Klebsiella* spp. and *S. aureus* in TAH [15] and high neonatal mortality (41%) in another teaching hospital from Ethiopia is reported [16]. Hospitalized neonates are particularly vulnerable population, and infectious outbreaks of ESBL-producing bacteria such as *Klebsiella pneumoniae* in neonatal intensive care units are well described. The hospital remains the environment where the microorganism circulates most. Children with underlying conditions could act as vectors of microorganisms between the hospital and the community. Children are an important reservoir of MRSA and may play a central role in disseminating *S. aureus* and MRSA in the community and hospital settings [17].

Currently carbapenem antimicrobials (e.g., imipenem, meropenem, ertapenem) and vancomycin are the drugs to treat infections caused by ESBL producing pathogens and MRSA respectively. Most worrying, we identified children colonized by carbapenem-resistant ESBL and vancomycin resistant MRSA. These children were hospitalized in close proximity with several others in a crowded pediatric ward, where we found 44% prevalence of HCAIs. The problem is even more pressing because in a globalized world population mobility is a main factor in spreading microorganisms and their resistance genes [3]. There is evidence that evidence that international travelers contribute to the spread of antimicrobial drug resistance [4]. The healthcare systems in Africa as a whole suffer from inadequate financial resource. The spread of these multi resistant bacteria in the African region is worrisome, since there might be relatively limited availability of modern antibiotics effective against hospital-associated MRSA, like linezolid and daptomycin. Currently in Ethiopia there are no antibiotics that can be used to cure clinical infections caused by carbapenem resistant ESBL producing pathogens.

The emergence and spread of AMR pathogens pose a visible threat in many African countries. In hospitals, identification of patients colonized or infected with ESBL, VRE or MRSA and adoption of subsequent preventive measures (isolation in single-patient room or decolonization) prevent cross transmission and reduce

morbidity and healthcare costs [18, 19]. However contact isolation of patients colonized with MRSA ESBL or VRE in resource poor countries in Africa such as Ethiopia is not feasible. Thus, effective intervention measures such as hand hygiene to prevent cross-contamination and rational use of antimicrobial is the most priority options in Ethiopia. One of the major problems that prevented the health care staff at TAH from practicing hand hygiene was unavailability of alcohol hand rub in the hospital. Based on identified gaps we introduced a 3-month pilot intervention and we found a significant attitude change in health care staff towards hand hygiene. Through this project we established and sustained a local alcohol hand rub formulation unit at the largest university hospital in Ethiopia. The hospital had no permanent budget allocated to buy alcohol-based hand rub for hand hygiene. In a small intervention, we formulated and distributed alcohol hand rub to healthcare staffs while monitoring the incidence of surgical site wound infection, which reduced significantly. Our evidence-based data convinced the hospital management to sustain alcohol hand rub preparation unit and allocate a permanent budget for alcohol hand rub. The change in attitude and practice of infection prevention strategy instigated by the present project and the observed dedication of the healthcare staff and hospital management group to sustain such activity at TAH is encouraging.

Antimicrobial susceptibility testing (AST) of bacterial isolates in the laboratory is the best method to guide antimicrobial prescription but is not available routinely outside of tertiary referral hospitals in most resource poor countries including Ethiopia. Even in tertiary hospitals, the current practice of identifying infection is by clinical symptoms and in most cases the medical doctors prescribe antibiotics without prior culture diagnosis due to lack of resources. Data on antimicrobial susceptibility AMR and in hospital and community acquired infections are therefore very scarce, despite their potential to reduce neonatal and children mortality [20]. The healthcare systems in Ethiopia suffer from inadequate financing, shortages in infrastructure, medical equipment and medications, as well as adequately trained healthcare professionals. The wide spread of AMR and communicable diseases, such as HIV, tuberculosis and malaria, as well as the increasing trends in non-communicable diseases, put a particularly high burden onto healthcare systems. These factors, coupled with suboptimal sanitation and water supply facilities, are reflected in the high maternal and neonatal mortality rates and the low life expectancy estimates in Ethiopia.

Several previous studies indicated that antimicrobial resistance and HCAI are major problems in Ethiopia, a country most affected by HIV/AIDS, Tuberculosis and poverty. What makes our study unique is its focus on Intervention measures. Communicable diseases a huge cost financial cost for the Ethiopian government where as little attention is given for preventive measures such as hand hygiene and rational antimicrobial use. Through this project we established and maintained a local hand rub preparation at the largest university hospital in Ethiopia. Our evidence-based data convinced the hospital management group unit to allocate a permanent budget for alcohol hand rub. There is a need for resistance surveillance systems so that results can be linked to the incidence, prevalence, and outcome of infection. Resistance data need to be transformed into information that can be interpreted by public health policymakers. There is a need for a timely sharing of data from Africa internationally so that trends can be monitored and emerging resistance phenotypes recognized. Our project provides valuable data and contributes to global fighting on antimicrobial resistance and hospital-acquired infection.

5.1 Conclusion

In conclusion, we report high frequency of nasal colonization with MRSA and gastrointestinal colonization with ESBL producing multi-drug resistant pathogens among hospitalized patients in Ethiopia. High colonization with multi-drug resistant pathogens can predispose the patients to increased risk of invasive infections. Isolation of colonized or infected patients in a single patient-room may not be feasible in Ethiopia. Nevertheless routine infection preventions strategies such as compliance to hand hygiene principles and rational use of antimicrobial agents are urgently needed to prevent and control the spread of antimicrobial-resistant pathogens in the healthcare facilities. Educational intervention measures introduced based on the local gaps and problems are effective to limit the impact of HCAI and AMR in Ethiopian settings. Surveillance of HCAs and the local antimicrobial resistance pattern as part of infection control strategy is highly recommended.

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