

Antimicrobial Stewardship and Infection Prevention and Control Programs across Three Healthcare Levels: A Qualitative Study

Isabel Naomi Aika (✉ isabel.aika@uniben.edu)

University of Benin

Ehijie Enato

University of Benin

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Abstract

Introduction: Antimicrobial stewardship (AMS) and infection prevention control (IPC) programs are proposed to address antimicrobial resistance. Nigeria's 5-year action plan for these programs is due for implementation by 2022. The objective of this study was to examine the perspectives, barriers and facilitators of these programs among health care managers and the current state of these programs in the three levels of healthcare facilities in Benin City, Nigeria.

Methods: Fourteen in-depth interviews were conducted among hospital manager across primary, secondary and tertiary healthcare facilities. The interviews were guided by semi-structured questionnaire. Responses were audio-taped and hand written. Data were analyzed by transcribing recorded tapes into major themes.

Results: Most of the participants viewed inappropriate prescribing as a problem both in the country and their facilities. None of the institutions have a formal AMS program (AMS), but participants believed that the presence of drug and therapeutic committee is a foundation for such a program. A majority of the participants acknowledged barriers to AMS to include lack of management backing, interprofessional rivalry, and poor laboratories. Only the tertiary institution has a formal IPC program. Some challenges to IPC across the healthcare institutions are inadequate waste disposal, lack of personal protective equipment and behavioral change among healthcare providers.

Conclusion: There is no AMS program across all facilities studied, although some forms of IPC activities are present in all healthcare institutions, only the tertiary facility has a formal IPC program. Effort should be made to strengthen AMS and IPC in the study facilities.

Introduction

Antimicrobial resistance is now a serious public health problem requiring urgent health priority both at the national and international levels. The effects of antimicrobial resistance (AMR) extend beyond the individual as resistant microbes are transmitted among humans and between humans and the environment. This connection is clearly seen from hospital settings where patients who are admitted acquire infections from the environment. Inappropriate use of antimicrobial agents and poor infection control are directly linked to widespread AMR. The prevalence of health care-associated infections (HCAI) in low- and middle-income countries (LMICs) is estimated to be between 5.7 and 19.1% or even higher.¹

In 2015, the World Health Organization (WHO) released a global action plan (GAP) on antimicrobial resistance. Antimicrobial stewardship (AMS) program alongside infection prevention control programs (IPC) are among the cornerstones of the GAP.² A well-functioning IPC program is fundamental to the success of AMS strategy, thus reinforcing the combat against AMR. While AMS is targeted towards antimicrobials, IPC focuses on preventing nosocomial infections in vulnerable patients, such infection can be from visitor-patient, visitor-healthcare worker, from patient to patient or from equipment and inanimate surfaces or items to healthcare workers which is then transmitted to patients.³ Traditionally,

these programs have been justified through measures of antimicrobial utilization with an associated reduction in the cost of antimicrobial therapy and changes in resistance rates and susceptibility patterns.

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Nigeria along with many countries in low-middle-income-countries is yet to fully implement these programs especially in its health care facilities. In a situational analysis conducted in the country, widespread antimicrobial resistance pattern was observed among *E. coli*, shigella, non-typhoidal salmonella, even among problematic antimicrobial resistant organisms such as carbapenem-resistant enterobacteriaceae, vancomycin-resistant enterococci and extended-spectrum beta-lactamase-producing gram-negative rods to salvage antimicrobials at an alarming rate.⁵ Against this backdrop, and in tune with the global call for action plan on tackling antimicrobial resistance, the Federal Government of Nigeria through the ministry of health established the country's antimicrobial resistance coordinating body at the Nigerian Centre for Disease Control (NCDC) with key stakeholders to provide support and guidance for AMR control activities in the country. The National Action Plan (NAP) as road map to curbing AMR was developed from weaknesses identified in the situation analysis report. A 5-focus strategy was adopted to address the problem of AMR within a five-year period (2017–2022) through intensifying establishment of a national infection prevention and control (IPC) program and antimicrobial stewardship programs and strengthening these programs across all healthcare levels.⁶

It is observed that presence of policies in LMICs may not guarantee their implementation due to lack of strong leadership commitment⁷. This behavior can trickle down to the healthcare facility level in addition to other barriers can impede to implementation of AMS and IPC programs across the country. It is imperative that individual healthcare facility takes measures to implement AMS/IPC programs until the expected national input reinforces their effort. Understanding the perspectives of hospital and health managers to AMS is vital towards the establishment of robust and sustainable antimicrobial stewardship programs and the engagement of management in addressing potential blockades to change.⁸ This study sought to describe the perspectives, barriers and facilitators to AMS and IPC programs among health managers and the current state of these programs in the three levels of healthcare facilities in Benin City, Nigeria.

Methods

Study design/setting

This was a cross-sectional qualitative study conducted between September 2020 and July 2021. The study was conducted in Benin City, Edo State, located in Southern Nigeria. It has a population of about 5 million inhabitants. There are 3 tertiary, 38 secondary and 576 primary public healthcare facilities in the 18 local government areas of the state.⁹ The tertiary facilities are run by the federal government, while the state hospitals are managed by the state government through the Hospital Management Board (HMB). The primary health centers (PHC) are under the management of local government but currently

run by the state government. The study was carried out among healthcare managers across the three levels of care.

Data Collection

A semi-structured interviewer's questionnaire was used as data collection tool. The questionnaire was in two sections. Section one provided details of participants demographics, while section two was a 15-item questions developed from extensive literature review on AMS and IPC programs. Face-to-face interviews were conducted using the questionnaire, the interviews were audio-taped using a phone as the recording device, it was also accompanied by hand written notes of the responses. Participants were allowed to express their thoughts on issues relating to antimicrobial resistance, antimicrobial stewardship, antibiotics use, antibiotics prescription pattern and infection prevention and control practices and in some cases, follow up questions were asked to ensure sufficient clarity on participants responses on these issues.

Recruitment of participants

A total of fourteen participants were interviewed. Participants interviewed on AMS in the tertiary and secondary facilities were drawn from members of the Drug and Therapeutics Committee (DTC) which is the highest decision-making body on medication use and hospital formulary. Three members of the committee for the tertiary and secondary facilities respectively were selected for the interview. Participants recruited for IPC interview at the secondary level were drawn from the state Ministry of Health and HMB and they comprised of the Director of Nursing Services for the state working with the focal person for IPC, and the focal person for IPC activities and reporting in the state; for the tertiary institution, the chairman of the IPC unit and the chief nursing officer for IPC; at the primary healthcare facilities, four coordinators drawn from four local government areas. All participants were approached face-to-face to arrange for a convenient day and time for the interview. The average time of the interviews was 20–45 minutes.

Data Analysis

Respondents were coded as Participant T (T1-T5) for interviews among tertiary healthcare managers, S (S1-S5) and P (P1-P4) among secondary and primary managers respectively. The audio-taped interviews were reviewed and transcribed into notes based on the emerging themes. The data were interpreted within a deductive thematic analysis framework. The data were analyzed using a directed content analysis approach. Specifically, the analytical process involved independently reviewing all transcript line by line to identify text, statement or comments that fall under some predetermined themes and categories. Subsequently quotes reflecting each subtheme were categorized, and corresponding descriptions were developed, leading to reorganizing, renaming and elimination of some themes and subthemes. This procedure was then repeated for themes and subthemes requiring further analysis. Data analyses were iterative, whereby themes, subthemes and sub-categories were added to reflect variations in the data.

Results

Theme 1-Current State of Antimicrobial use

Regarding the current use of antimicrobial agents, all respondents said that irrational use of antibiotics is a major problem in Nigeria. S2 noted *“there’s no guided use, anybody just says this is what they want. As a pharmacist, we try to restrict use, but the prescribers will say by the time patients come to them, they have used several antibiotics thus leaving them with no choice but to use higher class or new generations of antibiotics. The medical representative’s influence cannot be neglected. They give data of new antibiotics or fixed-dose combinations to prescribers, those in turn end up yielding and prescribing these drugs”*.

The most antibiotic use problem identified is wrong selection of antibiotic followed by overprescribing. The issue of inappropriate prescribing may tend to be higher in PHC settings of which a majority do not have laboratories and some have nurses or community health extension workers as managers. Many of these facilities admitted to having access to antibiotics that should ideally be restricted for use in primary care such as fluoroquinolones and cephalosporins, and it seems some of the personnel do not understand antibiotic use restriction (P1, P2).

Theme 2- Laboratory and Antimicrobial Resistance Surveillance Report

The secondary and tertiary healthcare facilities have laboratories, in the primary healthcare centres, only one of the four local government sampled has a laboratory in the local government headquarter where culture and sensitivity tests can be done. The others refer patients to other laboratories (either in the state hospital or privately owned (P1, P4). The tertiary institution alone has regular surveillance report only on HCAs because of the stand-alone infection control unit that gives updated reports. Respondents linked antimicrobial resistance to patients who have either self-medicated or have been given antibiotics in drug outlets like patent medicine dealers or pharmacies and to poor infection control in hospitals. The pattern of resistance in HCAs shows coagulate negative, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella* spp, *Providential* species, *Enterobacter*, *Citrobacter*, alkaliginase. The highest resistance being coagulase negative *Staph aureus*, and the lowest is Alkaliginase and *Citrobacter* (T4).

Regarding resistance to antimicrobial agents, S1 pointed that *“from lab results, the sensitivity pattern can be very discouraging. Common ones like Penicillins (amoxyl) Cephalosporins (Ceftriaxone) etc are no more effective, some organisms are only sensitive to fluoroquinolones and imipenem which are not cheap. it therefore becomes difficult to start requesting for drug like imipenem to treat common urinary tract infection”*.

Theme 3- Presence and functionality of Formal Antimicrobial Stewardship Practice

The idea of AMS in practice setting was welcomed by all responders in the tertiary and secondary facilities as a means to restrict antibiotic use, unfortunately none of the facilities have a formal AMS program. Most participants identified the role of government policy as key to institutionalizing AMS, in

addition to providing national guideline on antimicrobial use which is currently lacking. T2 mentioned *“Government involvement if it is committed will have positive impact, in addition to policy makers. I am not aware of antimicrobial guideline, what I am aware of is guideline for use of drugs in hospitals i.e standard treatment guideline. I can’t say it’s being in use”*.

At the primary healthcare level, the concept of antimicrobial stewardship was vague to most of the participants, thus they were briefly enlightened. P4 said, *“I don’t really understand what it means. But if it has to do with effective use of antibiotics then it is a program that should be encouraged and taken seriously”*.

Theme 4: Likely Barriers to AMS

Barriers	Response
Management backing/commitment	<p>T3- <i>“AMS is difficult because we are going to experience friction e.g autonomy in auditing prescriptions, without management backing it won’t work”</i></p> <p>T2- <i>“there is no commitment from the leadership of the hospital. In Nigeria, we have this general attitude of not implementing policies.”</i></p>
Interprofessional rivalry	<p>S2- <i>“likely barrier is our professional rivalry, it’s for everybody to realize that we are in this workplace for the benefit of patients”</i></p> <p>T3- <i>“one of the things with bringing guideline for hospital use is if the hospital has an antibiogram. To do this effectively, we need very good working relationship with pharmacist, doctors, clinical microbiologists etc. in most institutions in Nigeria, there is this rivalry that may make it difficult to work together seamlessly”</i></p>
Shortage of healthcare professionals	<p>S3- <i>“In the state, generally, there’s a dearth in manpower. Imagine no qualified staff to run those specialized laboratories”</i>.</p> <p>T3- <i>“AMS is an intensive program, we are few with other professional duties, so there will be need for dedicated staff”</i></p>
Poor laboratory services	S3- <i>“in the institution, reporting is a problem, poor lab services like we talked about. Antibiotic resistance involves testing”</i>
Lack of training for healthcare professionals	S1- <i>“In my institution, adequate education of health professionals and update on current use of antimicrobial guidelines is a big challenge”</i>

Theme 5: Facilitators to instituting AMS

All respondents expressed willingness to start off AMS and believed their institutions have the capacity to fully implement the program and to sustain it. The presence of an already functional Drug and Therapeutics Committee (DTC) was cited as an initiator to AMS. In the tertiary institution, T1 stated *“we*

already have a crop of professionals who are interested in this program, the necessary professionals are present in this hospital'

In the secondary healthcare facilities, participants noted that the DTC is new. S2 said *"currently due to staff strength depletion, the committee is not meeting up to its responsibility. It's a new committee. The pandemic made transfer of staff to the isolation center for Covid, that has affected its running"*

Another facilitator mentioned by a responder in the tertiary institution is the information technology unit. T3- *"The information technology unit in the hospital can be leveraged on. For example, the antibiogram I talked about can be generated from the infrastructure already on ground"*

Infection Prevention and Control (IPC) program

Theme 1- Thoughts about IPC

Some participants reported that the recent pandemic highlighted the importance of IPC in healthcare systems. Only the tertiary hospital reported having a formal IPC team with a reporting channel, funding and guideline. In the secondary and primary facilities there is no formal IPC, but IPC activities are carried out by the IPC pillar an offshoot from COVID pandemic charged with the responsibility to oversee the IPC activities in all state hospitals (T5, S4). One of the participants S5 from the state ministry of health noted *"I don't think we have a formal IPC as described, but part of what Edo State IPC pillar is doing is to inform the various hospital and the public on prevention of nosocomial infection which is key to preventing spread of infection"*.

All respondents from PHC mentioned that they are under the State's IPC program and they receive equipment for their IPC activities from the State's team. Most respondents revealed that the head of the PHC coordinates IPC activities in the facility and reports to the PHC coordinator of the local government who in turn reports to the State coordinator of IPC.

Theme 2- Role of Training in IPC activities

All facilities engage in training and retraining on a regular basis, some respondents noted that they have attended at least a training on IPC in the past one year (P3,P4). T4 mentioned *"last year alone, we had nothing less than 8 trainings, educating healthcare workers on hand hygiene and waste management, because we know that the hands of these healthcare workers are the most important vehicle for transmitting infections."*

S4 added *"that's the bedrock of IPC. Training helps to reinforce knowledge already acquired and also add new knowledge"*

Theme 3- Provision of Adequate Personal Protective Equipment (PPEs)

The tertiary institution has a logistic unit that supplies all PPEs. The COVID-Pillar which is an arm of the state's COVID committee provides PPEs to all state hospitals and PHCs. However, some respondents

reported that provision of such materials are not sufficient and that they had to buy some IPC materials with their personal money (P2,P1, P3). T4 commented on some innovations the unit made recently to cope with inadequate PPEs *"we have a logistic unit that ensures we have all PPEs. In fact, we had an indigenous production of some PPEs especially during the hit of COVID as there was tendency of worldwide shortage of PPEs, we started making things, cloth face masks for our admin personnel, long sleeve covers, aprons, face shield. We also made UV light equipment to disinfect some of our PPEs like face shields and eyewear"*.

Theme-4 Adequate waste Disposal, Clean and Safe Environment

All responders said they had a system of waste disposal, but only the tertiary facility have good waste segregation into infectious, non-infectious, highly infectious and sharps (T4, T5) At the secondary level one participant (S5) explained the inadequacy in the waste disposal system *"I think we still need training on segregation where the waste is generated, we just dump everything together which can be risky for those disposing it eventually, that is scavengers, then good sterilization is needed especially in rural areas where they boil their instruments, that will help"*.

Most of the respondents in PHC facilities stated that they take wastes that require incineration to University of Benin Teaching Hospital or the World Health Organization waste disposal facility (P1,P2).

Some participants reported that things are put in place to ensure safe and clean environment in their facilities. Cleaners are trained on proper cleaning practice and waste management (S5, P4, T5). Participant T4 detailed *"Our environment is regularly cleaned. Now and during the hit of COVID, we use 0.5% sodium hypochloride solution to clean the floor, the walls and high touch areas such as door knobs and switches even the bedding and mattresses, and everything with same solution. We clean the wards and clinics at least twice daily."*

Theme 5- Hand Hygiene Practice in IPC

Compliance with hand hygiene practice was reported to be generally good at the all facilities, although many participants agreed that there is a decrease in hand washing compared to a year ago when we were in the heat of the COVID-19 pandemic which heightened the level of awareness to strictly adhering to hand hygiene measures among healthcare providers. At the secondary facility, S2 gave a positive response and added areas of improvement *"People are strict about it. Each unit has wash hand basin and water. Management has provided liquid soap too. But we can do better in a modern way, instead of bucket we should have running taps in work stations and toilets. Nowadays, you don't even touch tap heads, they use sensors, same thing goes for soap, this helps control/prevent infection"*.

Theme 6- Challenges, Strength and Sustainability of IPC Activities

Limited supply of waste disposal materials and PPEs was cited in all facilities as a major challenge, in the primary and secondary facilities, lack of transportation and shortage of staff hinders waste disposal and other IPC activities. In the tertiary institution, behavioural change or lack of compliance especially by

new healthcare workers is another limitation observed, it was noted that other healthcare providers still need to imbibe the culture of IPC activities notably hand hygiene and not something done out of fear (T5, S4, P1, P3).

Regarding the strength of IPC activities, the tertiary institution highlighted management commitment for allowing the IPC team to be self-running. Although no formal IPC in secondary and primary institutions, most respondents praised the government for the provision of PPEs compared to before even if they are sometimes not sufficient and training as their strength and expressed that likely in the future the ideal IPC program will be practiced (T4, S4, P1,P3, P4).

Regarding sustainability of IPC activities, T4 said *“as long as the IPC committee is sustained in the facility which is over 20 years now plus an enabling environment for the IPC committee to work, it will go far and be sustained”*.

S5 said *“on a scale of 1–10, I will say 5. You know as government changes, things can change”*.

Discussion

This study sought to examine antimicrobial stewardship and infection prevention control activities across the three level of healthcare in Benin City, Nigeria. Irrational use of antimicrobials was noted in all healthcare settings, there are no restrictions of antimicrobial use even in primary healthcare centers where antibiotics in the WHO watch category are often prescribed to patients.¹⁰ It has been estimated that about 30–50% of antibiotic consumption in hospitals in LMICs is inappropriate. Factors contributing to this include lack of regulation, misuse of antibiotics for treatment of viruses causing upper respiratory tract infections and acute bronchitis in the community.¹¹ In rural and under-resourced settings of these countries, where access to qualified healthcare workers is severely constrained, universal health coverage has been erroneously equated with the availability of antimicrobials.¹²

Antimicrobial Stewardship Program (AMS)

There's is no formal antimicrobial stewardship in all facilities sampled, the presence of DTC was perceived as a facilitator to starting AMS program. Such finding was reported in Kenya among healthcare professions.⁸ In many low-resource settings, adaptations have been made if it is difficult to have a stand-alone AMS team, similar committee as the IPC or in this case DTC and AMS committees may be merged into one. This method was adopted in Barbados where the AMS was linked with existing IPC program during an outbreak, this subsequently led to creating an AMS stand-alone committee.¹⁰ In some small facilities, an AMS champion can be identified instead who can either be a pharmacist or nurse, this often eliminates the issue of staff shortage.¹³ This option will offer an opportunity for PHC to control simple infections, thus reducing the reliance on over-the-counter medications and self-medication. Participants suggested that government policy and implementation of AMS in all health facilities will prove to be instrumental in formalizing AMS. Among the barriers identified in this study are three from the core

elements for AMS programs toolkit by World Health Organization,¹⁰ and these are; lack of management commitment, lack of training of healthcare professionals, and poor laboratory services for surveillance. The need for hospital managers to be committed and accountable with respect to AMS cannot be overemphasized even with the existence of government policy, they play a significant role in determining the value of an AMS to the institution otherwise such programs have a tendency to fail. Besides, recalcitrant prescribers may thwart attempts to improve antimicrobial use without fear of sanction.^{4,14} Absence and poorly equipped laboratory impede AMS activities. Antibiograms are usually developed based on laboratory reports and are regularly updated based on a review and analysis of facility antibiotic use and antibiotic-resistant bacteria. The antibiogram may help to inform updates of clinical guidelines.^{15,16} In a report by the Nigerian's Center for Disease Control, only about 6% of public health facilities in Nigeria have a laboratory, and two-thirds of these laboratories do not have adequate qualified personnel to handle the assigned diagnostic tasks⁵. Healthcare professionals who are AMS champions require adequate initial and ongoing training on AMR, antimicrobial prescription behavior and use of standard treatment guidelines. Lack of antimicrobial use guideline is contributory to inappropriate prescribing in hospitals, as some respondents noted. Healthcare facilities should have available, up-to-date recommendations for infection management based on international/national evidence-based guidelines and local/national susceptibility patterns (where possible), to assist with antibiotic selection for common clinical conditions (indication, agent, dose, route, interval, duration).¹⁷ Enhancing the availability of guidelines for frequently encountered infections and clarifying key guideline recommendations such as treatment duration were identified effective AMS interventions in a survey of hospital staff across 58 LMICs including those primary healthcare centers⁷.

Inter-professional rivalry is a foreseen challenge to AMS that should not be overlooked. Teamwork in the Nigerian healthcare system is marked by interprofessional disputes that are very intense. Some surveys in the country have also suggested the overwhelming recognition of interprofessional conflicts by health professionals, with perceived differential treatment between the professions, the assertion of role boundaries, and communication barriers as predominant causes. In terms of its impact on health workers, one survey in the North-eastern region found interprofessional conflicts to be associated with diminished motivation.^{18,19} Until these disputes are resolved and all members of the healthcare team share common goals, AMS program will suffer some setback when it eventually kicks off.

Infection Prevention and Control Programs

Infection prevention and control activities are present in all healthcare facilities, clearly the recent COVID-19 pandemic brought the need for such programs to the limelight. Only the tertiary institution has a formal IPC unit, in the secondary facilities and by extension the primary care centers that are under the management of the state government, IPC activities are channeled through the COVID-pillar an arm that is dedicated to reducing infection and spread of coronavirus through IPC activities.

Standard precautions are the core component of IPC, it includes appropriate use of personal protective equipment, environmental cleaning/disinfection and medical waste disposal, and hand hygiene

practices.²⁰ When implemented correctly by health workers, these precautions keep the worker protected from infection and prevent infection from spreading among patients.²¹ Participants in this study disclosed that to some extent that they comply with the use and provisions of these components, the tertiary institution seem to have better efficiency in IPC program clearly due to the dedicated unit, this underscores the benefits of having such stand-alone unit in healthcare facilities. Management support and dedicated team with guideline have been reported to be the strength of successful IPC activities.^{20,22}

Some drawbacks to IPC activities across all healthcare facilities as noted by participants are shortage of PPEs, inadequate waste disposal measures and behavioral change by healthcare providers. In the face of the ongoing pandemic, inadequate PPEs turned into a global issue as the need for such became heightened. A study in Nigeria also described such shortages especially among frontline workers, with such shortages, there's tendency to share among workers, reuse or even attend to patients bare, with the attendant risk of transmitting infections.²² In the tertiary institution, one way the IPC unit accommodated for the shortage was to make indigenous PPEs, this action can be replicated in other healthcare institutions in the country.

Proper waste segregation denotes separating wastes in coded bins as non-infectious, infectious, highly infectious and sharps. Inappropriate waste segregation and disposal means that all waste is treated the same, leading to improper segregation, making the total waste infectious. This causes a huge problem not just for the waste handlers but for the rest of the population. Many healthcare facilities in Nigeria do not have resources such as incinerators and consumables to properly treat healthcare wastes (sometimes hazardous and infectious) before disposal²³. As seen from these interviews, the PHC do not have such facilities, they have to travel far to the closest incinerators, the same thing goes for the secondary healthcare facilities, if those in the city center where the study was conducted lament over the issue of waste segregation and disposal and poor transportation facilities, those in farther local government areas and rural communities obviously bear more burden.

Proper Hand hygiene is a significant component of IPC, this simple evidence-based practice has been shown to have great impact on reducing hospital acquired infection and antimicrobial resistance.²⁴ This study shows that there's good compliance to hand hygiene, like some participants noted, "it is the good side of COVID-19". Although this practice is still valued by the public and healthcare professionals in particular, some participants described a drop in the intensity of the practice compared to the hit of the pandemic. Behavioral change and poor hand washing infrastructure were noted for this observation. Some facilities improvised during the hit of the pandemic with mobile plastic buckets located in strategic places around now have available few of these buckets. The burden of moving these buckets to get water, bringing them to their stations and discarding the used water can be discouraging, difficult to sustain and time consuming. This challenge was noted across all healthcare facilities studied, but more in the secondary and primary care areas. Similar challenge was reported in a study among 8 countries in Africa including Nigeria, A number of sites lacked functional water points in patient care area.²⁵ It is

challenging to prevent the spread of infections within and outside healthcare settings if the basic infrastructure to improve hygiene and sanitation is lacking.

All participants remarked positively as to the role of training in IPC. Training and retraining remind healthcare professionals on strict adherence to IPC measures and are key in forestalling the impact of unforeseen epidemics.²⁶ While the importance of training cannot be overemphasized, it alone is not enough to change one's culture. In a study conducted in Africa, participants noted the need for behavioral change (another drawback to IPC compliance) interventions, monitoring and follow-up in addition to in-service training. Hand hygiene and waste segregation are widely recognized as practices that need continuous reinforcement just like other behaviors that require changes in medical settings.²⁷

The strength of this study lies in the fact that responses were from key informants, for AMS those involved in decision making on drug-related use in the healthcare facilities, and for IPC, those who are directly involved in IPC activities either in their facilities alone or by extension in the state. This gives a near representation of the state of these activities in Edo State. A limitation to this study is that it may not be a representation of what happens in the country at large.

Conclusion

This study has showed non-existence of AMS practice across healthcare levels in the study area, and likely barriers. Healthcare professionals expressed willingness to adopt AMS practice with the DTC which is functional to be a starting point. The various healthcare facilities are actively involved in IPC programs, the tertiary facility have more robust program because of the dedicated IPC unit compared to other institutions. The study also identified some lapses and challenges in IPC across all facilities; inadequate waste disposal facilities and behavioral change are some drawbacks. Considering the fact that the 5-year plan for implementing these programs will soon elapse, legislative action, funding, and public policy strategies are needed, hence government and hospital administrators/managers need to work more closely to achieve the aims of the country's action plan to curb antimicrobial resistance. The need for strengthening PHC facilities (particularly manpower and diagnostic infrastructure) will also reduce health inequalities, including controlling simple infections, hence reducing the reliance on over the counter medications is revealed in this study.

Declarations

Ethics Approval and Consent to participate: Ethical Clearance was obtained from the department of Medical Services of Edo State Ministry of Health (Reference No- HA-737/45) and the Health Research Ethics Committee of University of Benin Teaching Hospital, Benin City, Edo State (Reference Number- ADM/E22A/VOL.VII/14831011). All participants of the study were orally informed about the objectives and anonymity of the study and informed consent were sought from participants before commencement of Interview. All data collected were kept confidential.

Consent for Publication: N/A

Availability of Data and Material

S1: Questionnaire for IPC qualitative study

S2: Questionnaire for AMS qualitative study

Data-1: AMS Qualitative Transcription

Data-2 IPC Qualitative Transcription

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Authors Contributions: All authors developed concept and design of the study, INA acquired data, analyzed data and drafted the article, all authors interpreted data, reviewed article content and approved final version.

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Author's Contribution: All authors participated in conception and design of the study. IA acquired and analyzed data, and drafted the manuscript. All authors interpreted data, revised drafted manuscript, read and approved the final manuscript.

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