EVALUATION OF KNOWLEDGE PRACTICE ON ANTIMICROBIAL PROPHYLAXIS IN SURGERY AMONG SURGEONS AND CLINICAL PHARMACISTS AT KENYATTA NATIONAL HOSPITAL

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DECLARATION

This research proposal is my original work and has not been presented for the award of a degree in any other University

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DEDICATION

I dedicate this work to my lecturers who have guided, instructed, corrected and inspired me as I pursued my post graduate studies.

I also dedicate this research to my wife Dinnah Aloo Musungu and our lovely daughters Maya and Neema for their support and love they have shown me during the time I pursued my studies.

Above all, I dedicate it to my employer MINISTRY OF HEALTH for giving me this chance to advance my studies.

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ACRONYMS

AVMs-	Arteriovenous Malformations
AIC-	Antibiotic-Impregnated Catheters
ASA -	American Society of Anaesthesiologists
AI-	Antibiotic Impregnated Ventriculostomy
ASHP-	American Society of Health Systems Pharmacists
ABLC-	Antibiotic Loaded Cement
BBB-	Blood Brain Barrier
CSF-	Cerebral Spinal Fluid
CRF-	Case Report Forms
CDC-	Centre for Disease Control and Prevention
CoNS-	Coagulase-negative Staphylococci
CRP-	C - reactive protein
CMS-	Centres for Medicaid and Medicare Services
CME-	Continuous medical education
CABG-	Coronary Artery Bypass Grafting
EVD-	External Ventricular Drains
ESR-	Erythrocyte Sedimentation Rate
HCWs-	Health-care workers
HAIs-	Hospital Acquired Infections
HIV-	Human Immunodeficiency Virus
IDSA -	Infectious Diseases Society of America
ICP-	Intracranial Pressure
ITT-	Intention-to-Treat
IVH -	Intra-ventricular Haemorrhage
IR-	Interventional Radiology
KAP-	Knowledge, Attitude and Practice

KNH-	Kenyatta National Hospital
MRSA-	Methicillin- Resistant Staphylococcus Aureus
MIC-	Minimal Inhibitory Concentrations
NNIS-	National Nosocomial Infection Surveillance system
NIH-	National Institute of Health
NSSI-	Non-Surgical site infections
PTFE-	Polytetrafluoroethylene
RR-	Relative Risk
RCT-	Randomised Controlled Trials
SCIP-	Surgical Care Improvement Project
SIR-	Society of Interventional Radiology
SIS-	Surgical Infection Society
SHEA-	Society for Healthcare Epidemiology of America
SSI-	Surgical Site Infection
SAP-	Surgical Antimicrobial Prophylaxis
SIGN-	Scottish Intercollegiate Guidelines Network
SSHAIP-	Scottish Surveillance of Healthcare Associated Infection Programme
SOPs-	Standard Operating Procedures
TJR-	Total Joint Replacement
UTI-	Urinary Tract Infections
VP-	Ventriculo-Peritoneal
VRE-	Vancomycin Resistant Enterococcus
WBC-	White Blood Count

ABSTRACT

Background

Surgical site infections are major contributors to increased mortality and healthcare costs globally which can be reduced by appropriate prophylactic antibiotic use which is guided by selection of antimicrobial agent (s), route of administration, timing of first dose and duration of prophylactic therapy. There is limited published literature on clinicians knowledge and practice on antimicrobial prophylaxis in surgery and hence the impetus for the present study.

Objectives

To evaluate the knowledge and practice of surgeons and clinical pharmacists on antimicrobial prophylaxis in surgery at KNH.

Methodology

A cross sectional design was used where sixty one respondents were selected using stratified random sampling at KNH. The target population comprised of consultants surgeons, registrars and clinical pharmacists. Data on knowledge and practice of antimicrobial prophylaxis in surgery were collected with a structured questionnaire and analysed using STATA version 13 software. Approval to carry out the study was granted by KNH/UoN Ethical Review Committee (ERC).

Results

The ratio of males to females was 1.0 to 0.7 and the mean age of the participants was 37.7(±8.5) years. Registrar surgeons comprised the majority of the participants at 60.7% followed by consultant surgeons at 27.9%. Ceftriaxone was the most preferred antimicrobial agent in surgical prophylaxis (79.8%). Participants were aware of the timing of prophylaxis and duration of drug use. However, there were some varied reports on antimicrobial agents used in different surgery departments. On the practice, intra – venous route was preferred (98.4%) for the administration of prophylactic antimicrobial agent and timing of first dose was mostly reported to be pre – surgery (95.1%) and duration for prophylactic therapy was reported to be within 24 hours.

Conclusion

Ceftriaxone was the antimicrobial agent of choice for surgical antimicrobial prophylaxis, mostly administered via the intra – venous route. It was mostly administered pre – surgery with prophylaxis mostly lasting up to 24 hours post – surgery.

CHAPTER ONE: INTRODUCTION

1.1 Background

Surgical antimicrobial prophylaxis is defined as the use of antimicrobial agents to prevent infections at the surgical site. It must be clearly distinguished from presumptive use of drugs to treat early infections. Prophylactic antimicrobials are widely used in surgical procedures and account for substantial amount of drug use in many hospitals (1,2).

Surgical site infections (SSIs) occur in the postoperative period involving the superficial incision, deep incision and space or organ accessed at the time of surgery (2). SSIs are a major contributor to increased mortality and healthcare system costs (1,2). In United States of America alone, an estimated 30 million surgical procedures are performed each year. Surgical site infections (SSIs) are the most frequently reported nosocomial infection accounting for 14% - 16% of all nosocomial infections among hospitalised patients (2,3).

In order to accurately assess success in surgical site infection prophylaxis, a standard "acceptable" wound infection rate must be established at each institution. The efforts of Geubbels and colleagues point out the difficulties with which all countries struggle in monitoring Surgical Site Infection rates. Identification of SSIs involves interpretation of clinical and laboratory findings, and it is crucial that a surveillance programme uses definitions that are consistent and standardized; otherwise inaccurate or un-interpretable SSI rates will be computed and reported. The growing attention and advancements in the field of hospital infection prevention has mainly taken place in countries with adequate resources. Many countries with few resources have ineffective hospital infection prevention programmes(2).

While the SSI rates have decreased in countries with more resources, the relatively few studies conducted in countries with more limited health budgets identified higher rates. Extending nosocomial infection surveillance and prevention efforts to countries that presently lack effective programmes is therefore viewed as a challenge for the future(3).At Kenyatta National Hospital (KNH), a teaching and referral hospital, prophylactic antimicrobial use in surgery plays a vital role in reducing the risks for SSIs development.

Surveillance of SSI with feedback of appropriate data to surgeons has been shown to be an important component of strategies to reduce SSI risk. To create an effective hospital infection programme, information about local patterns is essential. This type of data is useful for both

individual hospitals and national health care planners in setting programme priorities, monitoring effects of different preventive actions including appropriate prophylactic antibiotic use and in setting goals for their infection control efforts.

1.2 Problem statement

World – wide, increased prevalence of nosocomial infections has given rise to increased prevalence of SSIs among post – surgical patients, being one of the top nosocomial infections (2). Surgical antimicrobial prophylaxis among other safety practices in pre – surgery is a critical practice in reduction of incidences of SSIs. Ideally appropriate SAP practice should minimize development of SSIs to bare minimum; but studies have shown that inappropriate SAP practice is contributed by lack of knowledge and inappropriate practice on components of SAP practice such as type of antimicrobial agent, route of administration, timing of first dose and duration of therapy (5). Surgeons and clinical pharmacists can play a vital role in reduction of incidences of development of SSIs by having required knowledge and putting it into practice as per the guidelines/protocols. Published local studies on evaluation of knowledge and practice of surgical healthcare workers on SAP remain scanty if not non - existent.

1.3 Justification

Practice of SAP is limited by lack of adequate knowledge and practice in accordance with laid down guidelines/protocols. For instance, wrong timing of first dose can lead to less concentration of the drug at the time and site of incision which may not prevent proliferation of the microbes leading to infections. Prolonged duration of therapy may develop the host resistance to that particular agent (s) (1). All this may lead to increased morbidity and healthcare costs. Therefore prophylactic therapy is essential as preventive measures (2).

This study provides baseline information on knowledge and practice of the surgeons and clinical pharmacists as far as SAP is concerned. The study will also help in understanding where the gaps and strengths lie among healthcare workers on SAP practice. Furthermore, at KNH, there is no published data on knowledge and practice of surgeons on SAP, therefore this document gives the baseline information regarding SAP practice at surgery department at KNH.

1.4 Study questions

1. What are preferred antimicrobial agents for surgical prophylaxis in general, orthopaedic and neuro- surgery at KNH?
2. What routes of administration are preferred in surgical antimicrobial prophylaxis at KNH?
3. What is the preferred timing of the first dose and duration of prophylactic therapy?
4. What are the recommendations/suggestions of respondents on surgical antimicrobial prophylaxis in surgery at KNH?

1.5 Broad objective

To evaluate the knowledge and practice of surgeons and clinical pharmacists on antimicrobial prophylaxis in surgery at KNH.

1.6 Specific objectives

1. To find out antimicrobial agent (s) mostly preferred for prophylaxis in general, orthopaedic and neuro – surgery at KNH
2. To find out which route (s) of administration preferred for surgical antimicrobial prophylaxis therapy
3. To find out the preferred timing of first dose and duration of prophylactic therapy
4. To collect suggestions/recommendations of respondents regarding surgical antimicrobial prophylaxis

Theoretical and Conceptual framework

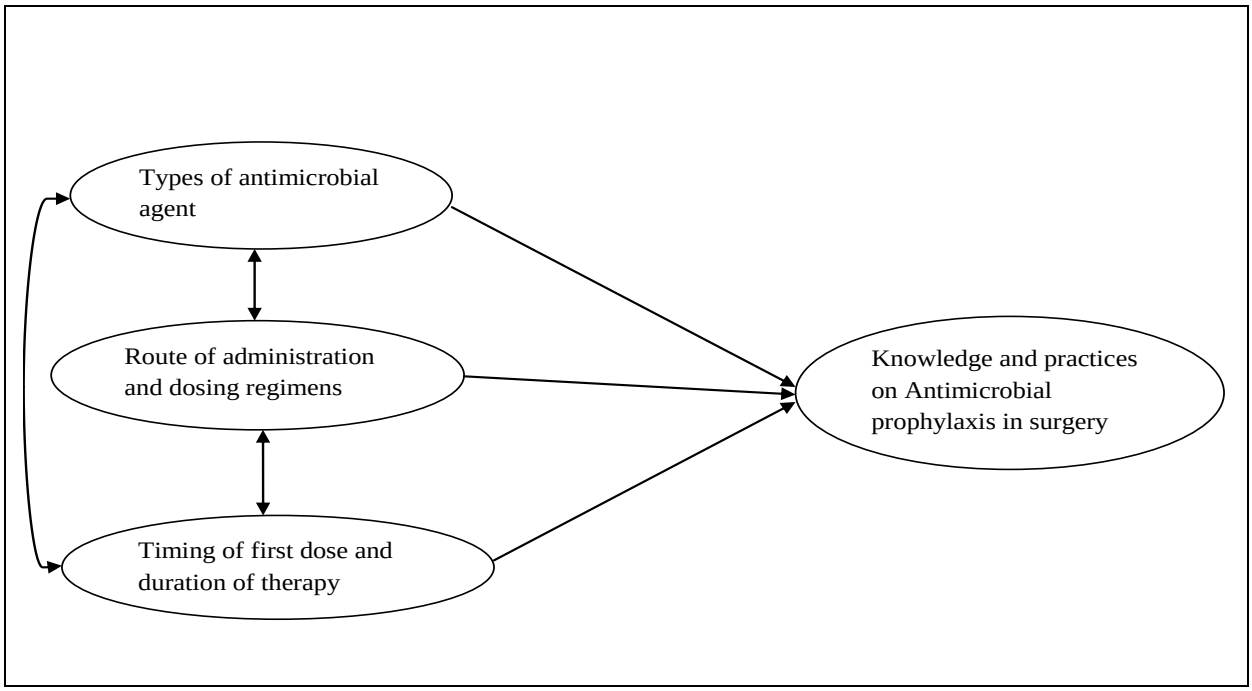

Figure 1: Theoretical and Conceptual Framework

The independent variables are; Types of antimicrobial agent, Routes of administration and dosing regimens, Timing of first dose and duration of therapy. The dependent variable is Knowledge and practice on antimicrobial prophylaxis in surgery.

Surgical Antimicrobial Prophylaxis (SAP) consists of three elements namely; selection of antimicrobial agents, route of administration and timing of first dose of antimicrobial agents and duration of prophylactic therapy.

Selection of antimicrobial agent should be done in a way that its pharmacokinetic properties enables it to be concentrated above its minimum inhibitory concentration in the tissues within 60 minutes of incision and be cleared from system within 24 hours of operation when the prophylaxis is terminated.

It is recommended that route of administration should be intravenous so that within 60 minutes following administration of the drug, concentration at the site of incision will be adequate to prevent infection.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter portrays different studies done on surgical antimicrobial prophylaxis in different parts of the world. The various aspects covered include the types of antimicrobial agents used, routes of administration, timing of first dose and duration of therapy.

2.2 Types of Antimicrobial Agents for Surgical Prophylaxis

Antimicrobial prophylaxis in surgery is aimed at reducing the incidences of SSIs(1). Surveillance of SSIs in developing countries is sub - optimal and therefore most cases go unreported which pose a major challenge (1). The English Nosocomial Infection National Surveillance Scheme (NINSS) report that the overall incidence of SSIs is 4.3% of all surgical operations, of which 25% were serious deep or organ/ space infections(1). In Nigeria, the SSIs are the second most prevalent hospital acquired infections at 27.0% (4,5).

Most surgical procedures do not require prophylactic or post-operative antimicrobial agents(1). However, certain patient-related and procedure-related factors alter the risk/benefit ratio in favour of prophylactic antimicrobial use(1). Choice of prophylactic antimicrobial agents is determined by the type of surgical procedure(6). Those with higher risks involve areas where microbial seeding is likely; such as mouth, gastro-intestinal tract, genito-urinary tract, and respiratory tract require antimicrobial prophylaxis (1,6).

In clean procedures, prophylaxis is generally beneficial only when prosthetic material or devices are being inserted or when consequences of infection are known to be detrimental to host (7). Antimicrobial agents are also chosen depending on the likely pathogens in the site of incision(8,9). Table 1 below shows the common antimicrobial agents used in surgical prophylaxis.

Table 1: Prophylatic antimicrobial agents used for specific surgical procedures

Type of Procedure	Recommended Agents	Alternative agents in patients with β-lactam allergy	Strength of evidence
Gastroduodenal Procedures involving entry into lumen of gastrointestinal tract (bariatric, pancreaticoduodenectomy)	Cefazolin	Clindamycin/vancomycin+ aminoglycoside or aztreonam or fluoroquinolone	A
Procedures without entry into gastrointestinal tract (antireflux, highly selective vagotomy) for high-risk patients	Cefazolin	Clindamycin/vancomycin+ aminoglycoside or aztreonam or fluoroquinolone	**A**
Biliary tract Open procedure	Cefazolin, cefoxitin, cefotetan, ceftriaxone ampicillin-salbactam	Clindamycin/vancomycin+ aminoglycoside or aztreonam or fluoroquinolone OR Metronidazole+aminoglycoside /fluoroquinolone	**A**
Laparoscopic procedure Elective, low-risk	None	None	**A**
Elective, high-risk	Cefazolin, cefoxitin, cefotetan, ceftriaxone ampicillin-salbactam	Clindamycin/vancomycin + aminoglycoside/aztreonam/ fluoroquinolone OR Metronidazole+aminoglycoside or fluoroquinolone	**A**
Appendectomy for uncomplicated appendicitis	Cefoxitin, cefotetan, cefazolin + metronidazole	Clindamycin+aminoglycoside/ aztreonam/fluoroquinolone OR Metronidazole+aminoglycoside or Fluoroquinolone	**A**
Small intestine Non-obstructed	Cefazolin	Clindamycin+aminoglycoside or aztreonam/fluoroquinolone	**C**
Obstructed	Cefazolin + metronidazole, cefoxitin, cefotetan	Metronidazole+aminoglycoside or Fluoroquinolone	
Hernia repair (hernioplasty and herniorrhaphy)	Cefazolin	Clindamycin, vancomycin	A
Colorectal	Cefazolin + metronidazole, cefoxitin, cefotetan ampicillin-salbactam,ceftriaxone+ metronidazole, ertapenem	Clindamycin + aminoglycoside or aztreonam/fluoroquionolone Metronidazole+aminoglycoside or fluoroquinolone	
Head and neck Clean	None	None	**B**
Clean with placement of prosthesis (excludes tympanostomy tubes)	Cefazolin, cefuroxime	Clindamycin	**C**

Clean-contaminated cancer surgery	Cefazolin + metronidazole, cefuroxime + metronidazole, ampicillin-salbactam	Clindamycin	**A**
Other clean-contaminated procedures with the exception of tonsillectomy and functional endoscopic sinus procedures	same as above	Clindamycin	**B**
Neurosurgery Elective craniotomy and cerebrospinal fluid-shunting procedures	Cefazolin	Clindamycin, Vancomycin	A
Implantation of intrathecal pumps	same as above	Clindamycin, Vancomycin	**C**
Cesarean delivery	Cefazolin	Clinamycin+Aminoglycoside	**A**
Hysterectomy (vaginal or abdominal)	Cefazolin, cefotetan, cefoxitin, ampicillin–Salbactam	Clindamycin or vancomycin + aminoglycoside/aztreonam or Fluoroquinolone Metronidazole + aminoglycoside or fluoroquinolone	**A**
Orthopedic Clean operations involving hand, knee, or foot and not involving implantation of foreign materials	None	None	**C**
Spinal procedures with and without instrumentation	Cefazolin	Clindamycin, Vancomycin	**A**
Hip fracture repair	Cefazolin	Clindamycin, Vancomycin	**A**
Implantation of internal fixation devices (eg plates, wires, screws, nails)	same as above	same as above	**C**
Liver transplantation	Piperacillin-tazobactam, cefotaxime + ampicillin	Clindamycin or vancomycin + Aminoglycoside/aztreonam or Fluoroquinolone	**B**
Pancreas and pancreas–kidney transplantation	Cefazolin, fluconazole (for patients at high risk of fungal infection [e.g., those with enteric drainage of the pancreas])	Clindamycin or vancomycin + Aminoglycoside/aztreonam or Fluoroquinolone	**A**
Total Joint Replacement (TJR)	same as above	Clindamycin or vancomycin + Aminoglycoside/aztreonam or Fluoroquinolone	**A**

(1)

2.3 Indication for Prophylactic Antimicrobial use in Surgery

Risks factors for SSI depend on either patient or surgical related factors. Patient related factors include age, nutritional status and pre-existing infections. Surgical factors are duration of procedure and the type of operation which can be clean, clean-contaminated, contaminated or dirty- infected (1,10).

The most common microorganisms implicated in infections include *Staphylococcus* spp, *Streptococcus* spp and *Pseudomonas* spp. Micro-organisms can infect a surgical wound through various forms of contact such as touch of a contaminated caregiver or surgical instrument, through inhalation, or through spread of micro-organisms that are already in or on the body. The degree of risk for an SSI is linked to the type of surgical wound in a patient (3,11).

2.4 Surgical Wound Classification

Operations can be categorised into four classes as shown in Table 2 with an increasing incidence of bacterial contamination and subsequent incidence of postoperative infections(12).

Table 2 : Surgical wound classifications

Class	**Definition**
Clean	Operations in which no inflammation is encountered and the respiratory, alimentary or genitourinary tracts are not entered. There is no break in aseptic operating theatre techniques
Clean-contaminated	Operation in which the respiratory, alimentary or genitourinary tracts are entered but without significant spillage
Contaminated	Operations where acute inflammation (without pus) is encountered, or where there is visible contamination of the wound. Examples include gross spillage from a hollow viscous during the operation or compound/open injuries operated on within 4 hours
Dirty-contaminated	Operation in the presence of pus, where there is a previously perforated hollow viscous, or compound/open injuries more than 4 hours old

(2)

2.5 Surgical Antimicrobial Prophylaxis

It is now estimated that as many as 60% of SSIs are preventable, due to use of recommended evidence-based practices such as the timing of the first dose and dose individualisation,

selection, frequency, duration and route of administration of perioperative prophylactic antibiotics(3).

Perioperative administration of antimicrobials reduces the risks for SSIs(1,13). The appropriate timing of prophylactic antimicrobial agent should attain optimal tissue and serum levels during the entire operation (14,15). Selection, timely administration, dosage and other appropriate use of perioperative prophylactic antibiotics is an important element in reduction in the risks for developing surgical site infection (16,17). The selection of prophylactic antimicrobial agent should be based on the type of surgery and published evidence-based recommendations (3,9).

To encourage appropriate prophylactic antimicrobial use, some performance measures have been adopted which specifies the antimicrobial selection, timing, dose and dosage individualization, frequency and duration of prophylactic therapy(1,2). Despite the high quality evidence to support preventive antimicrobial use in surgery, compliance with guidelines is still sub-optimal in many health organizations globally, mostly due to patient, healthcare workers (HCWs), and system level factors (2).With massive efforts towards improving antimicrobial prophylaxis use in surgery, non-compliance with these guidelines by HCWs can have significant consequences for healthcare organizations and hospitals (18). The different agents used for prophylaxis are shown in Table 3.

The optimal time for administration of drugs is within 60 minutes before surgical incision. Some agents like fluoroquinolones and Vancomycin require administration over 1-2 hours before surgical incision (1,2).

It is recommended that dosing be done on weight basis in obese patients and there is need for repeat doses during prolonged procedures. Obesity has been linked to an increased risk of SSIs. The pharmacokinetics of drugs may be altered in obese patients, so dosage adjustments based on body weight may be warranted in these patients. For all patients, intra-operative re-dosing is needed to ensure adequate serum and tissue concentration of the antimicrobial agent if the duration of the procedure exceeds two half-lives of the drug or there is excessive blood loss during the procedure(1,2,19).

Table 3: Recommended doses and re-dosing intervals for commonly used antimicrobials for surgical Prophylaxis

Antimicrobial	Recommended doses		$T_{1/2}$ in adults with normal renal function	Recommended re-dosing interval(from initiation of preoperative dose)
	Adults	Pediatrics		
Ampicillin–sulbactam	3g (ampicillin 2g/sulbactam 1g)	50 mg/kg of the ampicillin component	0.8–1.3	2
Ampicillin	2g	50mg/kg	1–1.9	2
Aztreonam	2g	30 mg/kg	1.3–2.4	4
Cefazolin	2g, 3g for patients weighing ≥120kg	30 mg/kg	1.2–2.2	4
Cefuroxime	1.5g	50 mg/kg	1–2	4
Cefoxitin	2g	40 mg/kg	0.7–1.1	2
Cefotetan	2g	40 mg/kg	2.8–4.6	6
Ceftriaxone	2g	50–75 mg/kg	5.4–10.9	NA
Ciprofloxacin	400mg	10 mg/kg	3–7	NA
Clindamycin	900mg	10 mg/kg	2–4	6
Ertapenem	1g	15 mg/kg	3–5	NA
Fluconazole	400mg	6 mg/kg	30	NA
Gentamicin	5 mg/kg based on dosing weight (single dose)	2.5 mg/kg based on dosing weight	2–3	NA
Levofloxacin	500mg	10 mg/kg	6–8	NA
Metronidazole	500mg	15 mg/kg Neonates weighing <1200 g should receive a single 7.5-mg/kg dose	6–8	NA
Moxifloxacin	400mg	10 mg/kg	8–15	NA
Piperacillin-tazobactam	3.375g	Infants 2–9 mo: 80 mg/kg of the piperacillin component Children >9 mo and 100mg/kg of the piperacillin component	0.7–1.2	2
Vancomycin	15 mg/kg	15 mg/kg	4–8	NA
Oral antibiotics for colorectal surgery prophylaxis (used in conjunction with a mechanical bowel preparation)				
Erythromycin base	1 g	20 mg/kg	0.8–3	NA
Metronidazole	1 g	15 mg/kg	6–10	NA
Neomycin	1 g	15 mg/kg	2–3 (3% absorbed under normalgastrointestinal conditions)	NA

(1)

On duration of prophylaxis,new recommendations state that shortened postoperative course of antimicrobials involving a single dose or continuation of less than 24 hours should be upheld. Further clarity on the lack of need for postoperative antimicrobial prophylaxis based on the presence of indwelling drains and intravascular catheters is also available (1).

2.6 Surgeons' knowledge and practice about prophylactic antimicrobial use in surgery

A number of international and local guidelines are available on Surgical Antimicrobial Prophylaxis (SAP). Guidelines are intended to provide practitioners with standardized approach to the rationale, safety and effective use of antimicrobial agents for the prevention of SSIs based on currently published clinical evidence and emerging issues (1).

Prophylaxis refers to prevention of an infection and can be characterised as primary prophylaxis, secondary prophylaxis or eradication. Primary prophylaxis refers to prevention of an initial infection; secondary prophylaxis refers to prevention of recurrence or reactivation of a pre-existing infection; eradication refers to elimination of a colonised organism to prevent the development of an infection (17).

In a study carried out in Palestine, overall compliance with the standard guideline on SAP use was 2% of total study population. Timing of first dose was appropriate in 50% of cases, antimicrobial agent selection was correct in 18% and duration of prophylactic antimicrobial therapy was appropriate in 32% of the study population (20).

In Jordan, a survey indicated that 12.3% of surgeons used the antimicrobial prophylaxis regularly in high risk procedures. On choice of antimicrobial agent, 1.7% of patients received appropriate antimicrobial agent. On duration of SAP therapy, 39.4% of patients received prophylaxis for recommended period, 58.9% of patients received prophylaxis for longer than recommended time. Majority (99.1%) of patients received the first dose within recommended time prior to incision, and 97.0% of patients received an unnecessary midnight dose of intravenous antimicrobial agent the night before surgery (21).

A wide variation exists among surgeons regarding selection of the prophylactic antimicrobial agents and duration of prophylactic therapy. It was observed that inappropriate antimicrobial selection and prolonged duration of prophylactic therapy varied widely(22). A study in Qatar reported that overall use of antibiotics was 89%, and the practice did not match the recommended hospital protocols (25). Prolonged antibiotic use was the most common reason for non-adherence followed by use of alternative antibiotics to that recommended in the protocols.

In Greece, patients who underwent clean surgery and those who underwent clean – contaminated surgery were evaluated for surgical antimicrobial prophylaxis and compliance was different (26). All patients received prophylactic first dose within recommended time.

In Brazil choice of antimicrobial agent was generally appropriate and duration of prophylaxis optimal in 36.3% of cases (27). Appropriateness of indication of antimicrobial prophylaxis was found to be over 70%. Appropriate timing of the first dose and termination of therapy was not correct in few cases but selection of antimicrobial agent was appropriate (23).

In an audit of elective procedures regarding antimicrobial prophylaxis in Netherlands, the elements of surgical antimicrobial prophylaxis found to be largely in concordance with local hospital protocols were; choice of antimicrobial agent and duration of prophylaxis. However , dose, dosing interval, and timing of first dose were below average (24). A review carried out in Japan on three key elements of surgical antimicrobial prophylaxis showed that antimicrobial selection, timing of first dose, dosage interval and treatment duration was appropriate in less than 50% of cases (25). The commonly used antibiotic was Cefazolin and its choice was appropriate in 62% of surgical procedures. Gentamycin, Metronidazole and ceftriaxone were the most inappropriately antibiotics used. Duration of therapy was appropriate in only 59.5% of cases (26).

A study on patients who underwent gastric and colorectal surgeries, justified no need for prolonged prophylactic therapy to prevent SSIs (30). However 12.2% developed SSI. In SSI positive group, operative time was longer, blood loss was more and prophylaxis was longer than in SSI negative group, justifying need for intra-procedural re-dosing to minimise risks of developing SSIs.

In Serbia, in one hospital, the most frequently antimicrobial agent used for prophylaxis was ceftriaxone (31). More than half of the patients undergoing elective operations received prophylactic therapy longer than prescribed in the guidelines and there was no data on timing of the first dose of prophylactic therapy. In the second hospital, timing of first dose of prophylactic therapy was better and duration of prophylactic therapy was optimal.

A study in Nigeria found that 79.1% considered prophylactic antimicrobial agents being administered by anaesthetists, at the time of anaesthesia induction. Majority preferred anaesthetists administering the drug provided the surgeon indicates time for administration. 69.3% administered the prophylactic drug before application of tourniquet and 77.2% before skin incision (27).

In Kenya, a study done to explore surgical antimicrobial prophylaxis was done to develop a policy. The findings impacted positively considering the number of operations that used pre – operative antibiotics for prophylaxis and number of post – operative cases that terminated antibiotic use within recommended time period. This was reflected in the reduction in incidences of SSIs and therefore reduction in overall healthcare costs in surgical patients (28).

CHAPTER THREE: METHODOLOGY

3.1 Research Design

This is a cross-sectional study where the different cadres of workers in the Department of Surgery were approached and requested to fill a pretested questionnaire. A cross sectional study design is preferred in this research since it is relatively easy, quick and economical to conduct, and does not require follow-up of study participants.

3.2 Study Setting

The study was carried out at Kenyatta National Hospital (KNH). KNH is the largest national referral and teaching hospital in Kenya as well as the East African region, which also serves as a primary healthcare facility for the residents of Nairobi County. The hospital has a staff capacity of 6000, bed capacity of 1800 with an average annual out-patient attendance of 600,000 and an in-patient attendance of 90,000. KNH has 50 wards, 22 outpatient clinics, 24 theatres and an Accident & Emergency department.

The institution receives patients on referral from other hospitals and institutions countrywide for specialized healthcare services. It also provides teaching facilities for the University of Nairobi and the Kenya Medical Training College and for research either directly, or through other collaborating health institutions.

The study was carried out in the department of surgery which has various sub-departments in various fields that operate seven days a week. The patients who need surgical procedures are booked, assessed and operated by a team of medical staff led by a specialist surgeon in the area of operation. This made it conducive for the attaining the target sample size.

3.3 Target Population

The study included consultant surgeons, registrar surgeons and clinical pharmacists in surgery department. These cadres were chosen based on close involvement on surgical antimicrobial prophylaxis in terms of prescription, administration and offering advice. Other cadres like nurses who also get involved were not included due to the fact that they do not form a part of decision making on antimicrobial prophylaxis. Different categories of healthcare providers in the target population are shown in Table 4.

3.4 Inclusion Criteria

Surgeons and clinical pharmacists who consent and work in the surgery departments were included in the study.

3.5 Exclusion Criteria

Surgeons and clinical pharmacists who did not consent and do not work in the surgery departments. Other cadres who do not form part of decision making team and either work in the department or not.

3.6 Sampling

3.6.1 Sample Size Determination

The sample size for the study participants was drawn from consultants and registrars in general, orthopedic and neuro surgery as well as clinical pharmacy. The three departments in surgery have the most number of staff that would enable me attain the target sample size. From KNH records, the cadres of health care workers who are currently working in the department of surgery are 150 and are distributed in different areas as shown in Table 4 below.

According to Borg and Gall, at least 30% of the total population is representative for this type of study [32].To caters for non-responses 40% will be used.

Table 4 : Sample size determination

S/No	Cadres	Department	N	Sample (40%xn)
1	Consultants	General Surgery	18	7
		Orthopaedic Surgery	18	7
		Neuro – Surgery	9	4
		Clinical Pharmacy	6	3
2	Registrars	General Surgery	47	19
		Orthopaedic Surgery	35	14
		Neuro – Surgery	8	3
		Clinical Pharmacy	9	4
Totals			**150**	**61**

A total of 61 healthcare workers were included in the study.

3.6.2 Sampling procedure

The researcher obtained a list of names of consultant and registrars from the head of Department of surgery and Department of Pharmaceutics and Pharmacy practice. From the list obtained, the workers were stratified into categories depending on qualification. The groups included; consultant and registrar surgeons and clinical pharmacists. Simple random sampling was employed to select the name of the respondent in the list from each category. This was accomplished by tossing a coin and whoever scores the head was selected. The selected respondent was approached and requested to consent after explanation regarding what the research entails. After consenting he was given a questionnaire to fill and return as soon as possible to the researcher or his assistants.

3.7 Data collection

Data was collected using a structured questionnaire with closed and open ended questions. Closed questions would restrict respondents within given choices and open ended would follow up to the initial question to expound on the choice given. The questionnaire was self-administered and participants were given a period of time to fill in the questionnaire then collected by the research team. The questionnaire was pre-tested by use of a pilot study among colleagues and modifications made before they were distributed to the target sample.

Details to be obtained from respondents included demographic information: age, sex, level of education and years of experience. Other details with regard to prophylactic antimicrobial use included antimicrobial agent selection, route of administration, frequency of administration, timing of first doses, duration and dose.

3.8 Data management

After questionnaires had been filled, they were stored securely in lockable storage units which were only accessible to the researcher. Data back-up was enhanced using flash disks and CD-ROM. Files containing electronic data were closed when computers were left unattended and stored in password-protected computers or files. Access to questionnaires was limited to the principal investigator and supervisors.

3.9 Data analysis

All analysis was performed by use of statistical package for Social Sciences (SPSS) version 16 statistical program. Descriptive analysis was used to demonstrate characteristics of the study sample.

Response on preferred first dose timing and duration of therapy, preferred antimicrobial agent (s) and route of administration was evaluated.

CHAPTER FOUR: RESULTS

4.1 Socio – Demographic characteristics of the study participants

The socio – demographic characteristics of 61 respondents included in this study are shown in Table 5.

Table 5 : Socio -Demographic characteristics

Variable	n (%)
Age groups (Years)	
20-29	6 (9.8)
30-39	38(62.3)
40-49	9(14.8)
50-59	6(9.8)
60+	2(3.3)
Gender	
Male	35 (57.4)
Female	26 (42.6)
Marital status	
Single	16 (26.2)
Married	43 (70.5)
Divorced/separated	2 (3.3)
Level of education	
MMED	16 (26.2)
MPHARM	3 (4.9)
MBBS	35 (57.4)
PHD	3 (4.9)
Other	4 (6.6)
Speciality	
Consultant surgeon	17 (27.9)
Registrar surgeon	37 (60.7)
Consultant clinical pharmacist	3 (4.9)
Registrar clinical pharmacist	4 (6.6)
Consultants	
General Surgery	8 (13.1)
Neuro – Surgery	3 (4.9)
Orthopaedic Surgery	7 (11.5)
Clinical pharmacy	3 (4.9)
Registrars	
General Surgery	19 (31.2)
Neuro – Surgery	3 (4.9)
Orthopaedic Surgery	14 (23)
Clinical Pharmacy	4 (6.6)
Mean Age in years of participants(±SD)	37.7 (8.5**)**

The minimum age of the study population was 28 and the maximum was 62 years. The mean age of the study population was 37.7 years. Among the study population, majority (62.3%) were in the age group of 30 – 39 years and minority (3.3%) were in the age category of 60 – 69 years. Male gender was highest (57.4%) compared to the female gender (42.6%).

Majority (70.5%) of respondents were married, followed by those who were single (26.2%) and least were divorced and separated at 3.3%. Most (57.4%) respondents had the highest academic qualification as bachelor of medicine and bachelor of surgery, followed by those with Masters of Medicine at 26.2% and least were those with Doctor of Philosophy and Masters of Pharmacy at 4.9%. Most (60.7%) respondents were registrar surgeons and the least were Consultant Clinical Pharmacists (4.9%). Among the registrars, majority (31.2%) were from general surgery department. Respondents' years of experience varied between 2 to 15 years with most frequent being 3 years (29.5%), followed by 4 years (27.9%).

4.2 Knowledge and Practice

The results of assessment of knowledge and practice of surgeons and clinical pharmacists on surgical antimicrobial prophylaxis use in surgery at KNH are shown in Table 6.

Table 6 : Knowledge and Practice of respondents

Advocacy for SAP use in surgery	**n**	**%**
Yes	58	95.1
No	3	4.9
Preferred antibiotics in general surgery		
Ceftriaxone	59	96.7
Azithromycin	1	1.6
Cotrimoxazole	1	1.6
Preferred antibiotics in Neuro – Surgery		
Amoxicillin	3	4.9
Ceftriaxone	50	82
Ciprofloxacin	8	13.1
Preferred antibiotics in Orthopaedic surgery		
Ceftriaxone	37	60.7
Clindamycin	24	39.3
Preferred route of administration		
Intramuscular	1	1.6
Intravenous	60	98.4
Timing of first dose		
Pre – surgery	58	95.1
Post – surgery	1	1.6
Intra – surgery	2	3.3
Duration for prophylactic therapy		
5 days	8	13.1
24 hours	53	86.9

Majority (95.1%) of the respondents advocated using surgical antimicrobial prophylaxis in surgery to reduce incidences of SSIs.

The preferred antimicrobial agent (s) for prophylaxis in general, orthopaedic and neuro – surgery was ceftriaxone. However, 39.3% of the respondents preferred use of clindamycin or vancomycin for surgical prophylaxis in orthopaedic surgery.

Intravenous route was preferred for administration of drug. Pre – surgery administration of first prophylactic dose was mostly preferred, followed by intra – operative and lastly post – operative. Twenty four hours duration of prophylactic therapy was preferred by majority (86.9%) of the respondents as opposed to 13.1% who preferred 5 days.

4.3 Respondents views and suggestions

Out of the 61 respondents, majority (78.7%) did not give any views as opposed to 21.3% who gave their comments on prophylactic antimicrobial use in surgery. They gave different comments as shown in Table 7.

Table 7: Respondents' views and suggestions

No suggestions/views	**N**	**%**
Yes	48	78.7
No	13	21.3
More studies on SAP needed		
Yes	1	1.6
No	60	98.4
SAP need to be embraced in general surgery		
Yes	2	3.3
No	59	96.7
SAP poorly practised in general surgery		
Yes	1	1.6
No	60	98.4
Trainings and workshops on SAP essential		
Yes	1	1.6
No	60	98.4
SAP should be made mandatory in surgery		
Yes	1	1.6
No	60	98.4
Sensitization on guidelines needed		
Yes	2	3.3
No	59	96.7
No need for SAP in clean procedures		
Yes	1	1.6
No	60	98.4
SAP well practised in general surgery		
Yes	4	6.6
No	57	93.4

Most (78.7%) respondents did not give any comment on antimicrobial prophylaxis in surgery. A few (21.3%) gave varied comments on the same. However, 6.6% reported that surgical antimicrobial prophylaxis was well practised in general surgery, 3.3% suggested that sensitization on guidelines was needed. 3.3% of respondents commented that SAP practice should be embraced in general surgery since most procedures there are at increased risk of developing SSIs. 1.6% each commented that there was no need for SAP in clean procedures, SAP be made mandatory in surgery, trainings and workshops on SAP was key to practice and more studies on SAP practice needed at KNH.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter discusses the study results and compares them with other findings done elsewhere. It also tries to explain the disparities between results from other studies and endeavours to offers scientific explanation for the study findings. Conclusions and recommendations are also included.

5.2 Discussions

In the study, use of antimicrobial agent (s) for prophylaxis in surgery was generally supported by majority of the respondents indicated in other studies (21). The probable reason is that prophylactic use of antimicrobial agent (s) in surgery has a big impact in reduction of developing SSIs which reduces overall health care costs. However, in this study, minority did not support use of SAP. This could be due to the fact that some respondents were from orthopaedic and neuro – surgery departments where most procedures are clean and do not require antimicrobial prophylaxis due to low risks of developing SSIs not unless prosthesis is involved (1).

The antimicrobial agent (s) used in SAP vary widely depending on pharmacokinetic properties of the agents. In this study, it was clear that the antimicrobial agent of preference was ceftriaxone as opposed to cefazolin in other studies (26). In KNH, cefazolin was not easily available unlike ceftriaxone and thus its choice for prophylaxis. However in orthopaedic department, clindamycin was equally preferred for prophylaxis probably because of preferential concentration in bone tissue as indicated in literature (19).

Administration of prophylactic first dose was purely pre – surgery (10). By the time first incision is made, it is expected that the antimicrobial agent's concentration at the site of incision will be above inhibitory concentration so that any microbes responsible for causing SSI can be inhibited. Intra – surgery administration is also possible but only in special cases such as excessive haemorrhage and prolonged procedure so as to maintain the concentration of the agent above MIC (22).

It is recommended in the guidelines that duration of prophylactic therapy should be terminated within 24 hours post – surgery (16, 17). In this study, majority (86.9%) preferred to terminate prophylactic therapy within 24 hours post – surgery.

However some respondents preferred to continue with therapy up to 5 days. Continuing with prophylactic therapy past 24 hours post-surgery can cause resistance to that particular agent and does not have any added advantage in preventing SSIs (2).

5.3 Limitations of the study

The study involved only consultant surgeons, consultant clinical pharmacists and registrar surgeons. The information that the study gathered was limited considering there are other cadres such as clinical officers, anaesthetists and nurses who also get involved in the prophylactic antimicrobial use in surgery. Considering the time period available for data collection, the study could only consider the cadres that are closely involved in the prescribing, administration and offering advice on the prophylactic antimicrobial use in surgery. The participants influence from colleagues could have influenced the kind of response the participants gave since it was a self – administered questionnaire.

5.4 Conclusions

Ceftriaxone was the most common antimicrobial agent used in surgical antimicrobial prophylaxis. Route of administration of prophylactic antimicrobial agent was dominantly intravenous. Timing of first dose was mainly pre – surgery and duration of prophylactic therapy was within 24 hours. These three components of surgical antimicrobial prophylaxis in surgery indicated that both knowledge and practice of surgeons at KNH are above average.

5.5 Recommendations

5.5.1 Recommendations for policy and practice

1) Surgical antimicrobial prophylaxis in surgery; especially in dirty contaminated procedures should be practiced to reduce the incidences of development of SSIs. KNH management should build on these findings and develop protocols and guidelines and disseminate them adequately so as to optimize the practice of SAP in surgery.
2) Trainings and continuous medical education should be upheld both at the national and local level so that all surgeons should be at same level in terms of practice regarding surgical antimicrobial prophylaxis in surgery. This will help improve on grey areas like duration of prophylactic therapy.

5.5.2 Recommendations for further research

Research should be carried out to determine the effectiveness of different antimicrobial agents used for prophylaxis in surgery.

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APPENDICES

Appendix I: Informed Consent Agreement Form

EVALUATION OF KNOWLEDGE AND PRACTICE AMONG SURGEONS AND CLINICAL PHARMACISTS ON ANTIMICROBIAL PROPHYLAXIS AT KENYATTA NATIONAL HOSPITAL

Title: Evaluation of knowledge and practices among surgeons and clinical pharmacists on antimicrobial prophylaxis in surgery at Kenyatta National Hospital.

Institution: Department of Pharmaceutics and Pharmacy Practice, School of Pharmacy, University of Nairobi, P.O BOX 30197-00400, Nairobi.

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Tel: 0722436019

Ethical Approval Board:

Kenyatta National Hospital/ University of Nairobi Ethical and Research Committee, P.O BOX 20723-00100, Nairobi.

Tel: 2726300/2716450 Ext 44102

Permission is requested from you to enroll in this medical research study. The following general principles which apply to all participants in a medical research:

i. Your agreement to participate in this study is voluntary.

ii. You may withdraw from the study at any time without necessarily giving a reason for your withdrawal.

iii. After you have read the explanation please feel free to ask any questions that will enable you to understand clearly the nature of the study.

Introduction

The purpose of this study is to evaluate the knowledge and practice of Surgeons and Clinical Pharmacists on antimicrobial prophylaxis in surgery at KNH. Antimicrobial prophylaxis is a routine practice that is applied to surgeries that pose high risk of developing SSIs, which in turn is main cause of mortality and morbidity and prolonged hospital stays among surgical patients.

Procedure

With your permission, I kindly request you to accept to give information regarding antimicrobial prophylaxis use in surgery by filling in the provided questionnaire. The questionnaire can be filled from anywhere of your convenience and returned back to the chief investigator within the agreed period of time. All your information will be handled with confidentiality and will only be used for the purpose of this study. During the period of filling the questionnaire, I request that you may call me on phone at any convenient time to you, especially on matters regarding filling the questionnaire.

Benefits

You may not benefit from this study immediately but the results obtained will aid policy makers and the management of KNH to improve healthcare workers knowledge and practice on surgical antibiotic prophylaxis.

Risks

There will be no risks involved during your participation in this study.

Voluntarism

Your inclusion in this study is purely at your own free will and you have a right to decline to participate without any consequences or penalty. If you agree to participate in the study, you are still free to withdraw at any point for whatever reason without any consequences or penalties.

Assurance of confidentiality

All information obtained from you will be kept in confidence. At no point will you or your name be mentioned or used during data handling or in any resulting publications. Codes and numbers will be used instead of names to identify participants.

Contacts

In case you need to contact me, my academic department or the Kenyatta National Hospital/ University of Nairobi Ethics and Research Committee concerning this study please feel free to use the contacts provided above.

I kindly request you to sign the consent form attached.

I…… (Participant) of ……
Agree to enroll into the study as explained to me by Dr. …….

I…… (participant) of ……agree to allow Dr. ……. to call me through my mobile phone at the agreed time following the questionnaire filling during the study.

My signature is confirmation that I have understood the nature of the study and that whatever information that I give will remain confidential and that I have not given up my legal rights as a participant.

I also confirm that no monetary or material gains have been promised or given to me for participating in the study.

I willingly give consent to participate in this research.

Signed……..

(participant) Relationship……

Tel. (1) ……. (2) …… (3) ……

Date: ….. / …… / ……..

Signature of principal investigator…….

Date: …….. /…… /…….

Appendix II: Questionnaire

EVALUATION OF KNOWLEDGE AND PRACTICE AMONG SURGEONS AND CLINICAL PHARMACISTS ON ANTIMICROBIAL PROPHYLAXIS AT KENYATTA NATIONAL HOSPITAL

Please tick only appropriate response

A) Demographics

1. Age (years) ……
2. Gender
    a) Male ☐
    b) Female ☐
3. Marital status
    a) Married ☐
    b) Single ☐
    c) Divorced ☐
    d) Widowed ☐
    e) Separated ☐
4. Highest academic qualifications
    a) Ph.D ☐
    b) M.Med ☐
    c) MBBS ☐
    d) M.Pharm ☐
    e) Diploma in Clinical Medicine ☐
5. Speciality
    a) Consultant Surgeon ☐
    b) Registrar Surgeon ☐
    c) Clinical Officer ☐
    d) Others (Specify) …… ……
6. If Consultant surgeon, specify ….
    a) General surgery ☐
    b) Neuro – surgery ☐
    c) Orthopedic surgery
    d) Others (specify) …….. ……..

7. If Registrar, specify …..
    a) General surgery ☐
    b) Neuro – surgery ☐
    c) Orthopedic surgery ☐
    d) Others (specify) …… ……
8. If Clinical Officer, specify
    a) General surgery ☐
    b) Neuro – Surgery ☐
    c) Orthopedic Surgery ☐
    d) Others (specify) …….. ……..
9. Years of experience …….. (years)

PART B

1. Do you advocate use of antimicrobial prophylaxis in surgical patients?
    a) Yes ☐
    b) No ☐
2. If yes, which antimicrobial agent (s) do you prefer generally for the following surgical procedures (s)?
    I. General surgery
        a) Ceftriaxone ☐
        b) Azithromycin ☐
        c) Co-trimaxazole ☐
        d) Others (specify) ……
    II. Neuro – surgery
        a) Amoxicillin ☐
        b) Ceftriaxone ☐
        c) Ciprofloxacin ☐
        d) Others (specify) ……
    III. Orthopedic Surgery
        a) Doxycycline ☐
        b) Ceftriaxone ☐
        c) Sulfadoxine ☐
        d) Others (specify) ……

3. If No, why NOT?
    a) Not necessary ☐
    b) No guidelines ☐
    c) No drugs ☐
    d) Others reasons (specify) ……

4. For surgical antimicrobial prophylaxis, what is mostly recommended : -
    I. Route of administration
        a) Intra – muscular (IM) ☐
        b) Intravenous (IV) ☐
        c) Per oral (PO) ☐
        d) Topical ☐
        e) Inhalation ☐
        f) Others (specify) ……..
    II. Timing of first dose
        a) Pre – surgery ☐
        b) post – surgery ☐
        c) Intra – surgery ☐
        d) Others (specify) ……

5. In what situation would you recommend intra – operative redosing?
    a) Prolonged duration of procedure ☐
    b) Excessive hemorrhage during procedure ☐
    c) Both (a) and (b) ☐
    d) Others (specify) ……. …….

6. After how long post – surgery would you recommend termination of antimicrobial prophylaxis?
    a) 5 days ☐
    b) 24 hours ☐
    c) 60 minutes ☐
    d) 60 seconds ☐

7. Do you take into consideration the microbial sensitivity patterns in the wards before instituting prophylactic therapy?
    a) Yes ☐
    b) No ☐

8. If YES, indicate the most prevalent micro – organism encountered
    a) Staphylococci ☐
    b) Streptococci ☐
    c) Listeria ☐
    d) Bacteroides ☐
    e) E .Coli ☐
    f) Others (specify) ……
9. Which one (s) of the patients' factors would you prioritize before commencing prophylaxis?
    a) Allergy ☐
    b) Age ☐
    c) Concomitant medication ☐
    d) Metabolic abnormalities ☐
    e) Organ function ☐
    f) Genetic variations ☐
    g) Economic status ☐
    h) Others (specify) ……
10. Are the prescribed antimicrobial agents for prophylaxis available to be administered before surgery?
    a) Always ☐
    b) Most of the time ☐
    c) Sometimes ☐
    d) Rarely ☐
    e) Never ☐
    f) Others (specify) ……..
11. Are the guidelines / protocols regarding antimicrobial prophylaxis available in the hospital?
    a) Yes ☐
    b) No ☐

12. What are your own recommendations / news on antimicrobial prophylaxis in surgery?