INTEGRATION OF CRITICAL CARE NURSES IN ANTIMICROBIAL STEWARDSHIP; OPPORTUNITIES AND BARRIERS AT THIKA LEVEL 5 HOSPITAL, KIAMBU COUNTY, KENYA

CHEGE JOSEPH WAITHANJI (BScN)

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

Signature: ……. **Date: ……**

Chege Joseph Waithanji (BScN)
R50/20915/2021

SUPERVISORS

This thesis has been submitted for review with my approval as the University Supervisor.

Signature: ……. **Date: ……**

Dr. Nickcy Mbuthia, PhD, RN

Department of Medical Surgical Nursing & Pre-clinical Sciences

Kenyatta University

Signature: ……. **Date: ……**

Ms. Grace Gachuiri,RN

Department of Medical Surgical Nursing & Pre-clinical Sciences

Kenyatta University

DEDICATION

I dedicate my thesis to my parents for their endless financial support and encouragement. They have taught me to always believe in myself and persevere.

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DEFINITION OF TERMS

Antimicrobial agent	It is a synthetic or natural substance designed to inhibit the growth or kill microorganisms such as fungi, bacteria and algae.
Antimicrobial resistance	It is the occurrence where microorganisms evolve mechanisms that protect them from the effects of antimicrobial agents.
Antimicrobial stewardship	A tool for optimizing the use of antimicrobial agents by reducing inappropriate use of antimicrobial agents and maximizing antimicrobial agent selection, route, dosing, and duration of therapy.
Intensive care unit	Specialized unit within the hospital that offers treatment and monitoring for patients who are critically ill.
Integration	Refers to the structured involvement of critical care nurses in antimicrobial stewardship activities through collaboration in decision making, implementation of stewardship practices, education and advocacy.

ABBREVIATIONS AND ACRONYMS

AMR:	Antimicrobial Resistance
ANA:	American Nurses Association
ASP:	Antimicrobial stewardship program
CCU:	Critical care unit
CDC:	Center of Disease Control
ICU:	Intensive Care Unit
MDROs:	Multidrug resistant organisms
SPP:	Species
TL5H:	Thika Level 5 Hospital
WHO:	World Health Organization

ABSTRACT

Antimicrobial stewardship optimizes appropriate use of antimicrobials through agent selection, route, dosing, and duration of therapy. It serves to optimize clinical outcomes of patients and limit adverse reactions of antimicrobials. Nurses are frontline implementers of antimicrobial stewardship. However, they face issues on inter-professional jurisdiction, hierarchical power relations within hospitals and limited training on antimicrobial stewardship. The main objective of this study is to explore the integration of nurses into antimicrobial stewardship activities in the critical care unit at Thika Level 5 Hospital. TL5H was selected for this study due to the availability of an antimicrobial stewardship program whose implementation suffers a disconnect among healthcare providers. The study used exploratory descriptive qualitative research design. Data collection was done through semi-structured interviews and NVIVO 14 software was used for thematic analysis of data. A total of 11 nurses working in the critical care unit were purposively selected and interviewed. Patient advocacy, communication and collaboration, monitoring and documenting, and patient education and empowerment emerged as important roles that nurses play in antimicrobial stewardship. Participants highlighted continuous medical education, inclusion of antimicrobial stewardship in formal nursing education, team work and organization support as major facilitators of nurses' roles in antimicrobial stewardship. The study findings revealed that stringent regulatory requirements, heavy workload, poorly regulated systems and limited knowledge on antimicrobial stewardship as the major barriers that limit nurses' role in antimicrobial stewardship. Education, teamwork, open communication and organizational support increase nurses' awareness of AMS and ensures a coordinated approach in its implementation. Nurses' inputs in decision making process on treatment plans and antimicrobial use is invaluable in promoting judicious use of antimicrobials. Future research should focus on redefining the nature, scope and influence of perceived nurses' role in antimicrobial stewardship.

CHAPTER ONE: INTRODUCTION

1.1 Background

Antimicrobials have transformed the health sector today, making it possible to treat once lethal infections (CDC, 2019). Prompt and judicious use of appropriate antimicrobial agents reduce disease severity and mortality and improve patient health outcome in sepsis (Hussain et al., 2020). The use of antimicrobials in the critical care units is exponentially high, ranging between 67% to 97% due to postoperative prophylaxis, hospital acquired infections and community acquired sepsis (Haque et al., 2018). Recently, both low- and high-income countries report significant increase in antimicrobial use per capita (Kirby et al., 2020). However, studies indicate that up to 50% of antimicrobial use is inappropriate (Hussain et al., 2020) with only 45% of patient having imaging and culture-confirmed infections (Wunderink et al., 2020). This high use of antimicrobials is associated with problems such as antimicrobial resistance (AMR), drug interactions as well as drug toxicity (Lindsay et al., 2019).

The World Health Assembly of May 2015 and the subsequent United Nations General Assembly of September 2017 recognized resistance to antimicrobial agents as a global public health threat (WHO, 2019). Overuse and misuse of antimicrobials in the clinical settings is a major cause for the emergence of antimicrobial resistance (Charani et al., 2019). Herein, hospitals implement antimicrobial stewardship to maximize the use of antimicrobials in healthcare sector today. Antimicrobial stewardship is a tool for optimizing the use of antimicrobials by reducing their inappropriate use and maximize antimicrobial agent selection, route, dosing, and duration of therapy (WHO, 2019). In Kenya, antimicrobial stewardship is implemented through the National Action Plan for

AMR which strengthen the regulatory frameworks, promote public awareness and establish surveillance systems to track AMR.

Antimicrobial stewardship serves to optimize clinical outcomes of patients and limit adverse reactions of antimicrobials (Hussain et al., 2020). It reduces development of resistance to antimicrobials, save healthcare costs, and promote behavior change in antimicrobial agent dispensation and prescription practices (WHO, 2019). The core elements of antimicrobial stewardship include upholding surveillance for AMR, monitoring the consumption of antimicrobials, continuous education for clinicians, rational use and selection of antimicrobial agents, and reassessing the prescribed antimicrobials after culture and sensitivity results (Majumder et al., 2020).

Globally, inter-professional collaboration is a major factor for the success of antimicrobial stewardship, with majority of daily nursing routines intrinsically interwoven into the fabrics of the program (Chater et al., 2022). The CDC calls for multidisciplinary approach to improving antimicrobial use in hospitals (ANA & CDC, 2017). Antimicrobial stewardship should be a core competency for healthcare providers working in the critical care units (Wunderink et al., 2020). Critical care units disproportionately confront antimicrobial resistance with multidrug resistant pathogens causing up to 30% of gram-negative bacteremia (Wunderink et al, 2020). The solutions for antimicrobial resistance are multifactorial to include the use of systems approaches, public health campaigns, reduce unnecessary use of antimicrobials as well as incorporating knowledge and responsibilities of individual nurses (Ladenheim, 2018). The implementation of antimicrobial stewardship should be multidisciplinary to involve different healthcare professionals including nurses.

In Thika Level 5 Hospital, there is relative working relationship between nurses and doctors, positioning nurses at a place to affect change in terms of infection prevention and control practices within hospitals through their involvement in decisions on selection and use of antimicrobial agents (Moore et al., 2019).

A multi-center research that was started in 2020 to assess ASP initiatives in six Kenyan county hospitals using an implementation science methodology includes Thika Level 5 Hospital. Using the RE-AIM paradigm, this study collected baseline data on variables including specified daily doses and length of hospital stay in order to evaluate antibiotic usage, resistance patterns, and prescribing practices. The study highlights Thika Level 5 Hospital's involvement in leading ASP initiatives in Kenya, despite the fact that specific outcomes are not isolated in the protocol (Maina et al., 2020). Though not well-documented, nurses are involved in administering antibiotics, monitoring patient responses, ensuring proper dosage and timing, and infection prevention and control (Nyaga, 2023).

Although several studies report on increasing efforts to implement antimicrobial stewardship across healthcare systems in developing countries, a gap exists on innovative and multidisciplinary approaches such as integration of bedside nurses in antimicrobial stewardship. In Kenya, no studies on integration of bedside nurses in ASP has been done before. Therefore, literature on the roles, facilitators and barriers of nurses' integration in ASP is inadequate. In the hospital setting, nurses take a host of activities such as timely culturing practices, antimicrobial de-escalation, and effective assessment of the patient during admission and throughout hospitalization period. However, nurse-driven

antimicrobial stewardship practices should be targeted, and initiatives on how best to integrate bedside nurses in antimicrobial stewardship are scarce.

Notwithstanding the relative lack of literature on the integration of nurses in antimicrobial optimization, few studies have recently highlighted the place of nursing that influence antimicrobial prescribing and use in hospitals. The presence of nurses in the wards on a 24/7 basis and their duties in patient advocacy and monitoring underscores their key roles in detecting and documenting patients' response to treatment and changes in the condition (Mostaghim et al., 2017). Nurses hold considerable potential for promoting judicious use of antimicrobial agents through monitoring the time, choice, dosage and duration of antimicrobial therapy (Broom et al., 2017). Nurses are first responders for antimicrobials, coordinators of care, central communicators, 24-hours monitors of patients' safety, status and response to antimicrobials (Olans et al., 2016). The involvement of nurses and their active participation in antimicrobial stewardship is a source of untapped potential that promotes successful implementation of its programs (Kirby et al., 2020).

1.2 Statement of the problem

Even though the potential for nurses to inform and advance antimicrobial stewardship is undisputed, the implementation of the program in Thika Level 5 Hospital principally focuses on doctors and pharmacists leaving behind nurses, thus leading to a disconnect among healthcare team. Nurses face issues on inter-professional jurisdiction, hierarchical power relations within hospitals and limited training on antimicrobial stewardship (Monsees, Goldman & Popejoy, 2017). Their involvement in antimicrobial stewardship is sometimes viewed as interfering with doctors' prescription (Monsees et al., 2017). As a result, the authority of doctors around prescription impedes the willingness of bedside

nurses to be engaged in the selection, use and monitoring consumption of antimicrobial (Kirby et al., 2020). The failure to integrate antimicrobial stewardship in formal nursing education limits nurses' knowledge on AMR and their involvement in antimicrobial stewardship (Abbas et al., 2019). Significantly, 57% of nurses often describe their knowledge on antimicrobial stewardship as limited or minimal (Mostaghim et al., 2017). CCUs have experienced an unprecedented spread of *pseudomonas aeruginosa* in the recent past. With up to 30% of inappropriate use of antimicrobials in critical care units (Saleem et al., 2019), 12% and 10% of *P. aeruginosa* isolates are resistant to meropenam and piperacillin/tazobactam respectively (Claeys et al., 2018). Herein, a formalized antimicrobial stewardship program with greater involvement of nurses is a valuable avenue to reduce unnecessary exposure to antimicrobials, decrease adverse drug reactions, decrease development of AMR and improve infection cure rates.

1.3 Justification

Nurses play key roles in the implementation of antimicrobial stewardship. Lack of awareness about antimicrobial stewardship and lack of comprehensive and coordinated response among healthcare providers are the leading factors influencing development and spread of AMR. AMR leads to treatment failures, increase morbidity and mortality of illnesses, relapse of infections after initial treatment, increased spread of MDROs, increased use of antimicrobials and consequently increasing healthcare costs. Nurse-led interventions in AMS reduce unnecessary antimicrobial prescriptions, significantly reducing mortality and morbidity rates among ICU patients (Apisarnthanarak et al., 2018). According to Lofgren et al. (2017), nurses' involvement in AMS activities reduce healthcare costs through minimizing unnecessary antimicrobial prescription and shortens

hospital stays.

1.4 Research Questions

1. What are the nurses' perceived roles in antimicrobial stewardship in the CCU at Thika Level 5 Hospital?
2. What are the perceived facilitators of nurses' role in antimicrobial stewardship in the CCU at Thika Level 5 Hospital?
3. What are the perceived barriers of the nurses' role in antimicrobial stewardship in the CCU at Thika Level 5 Hospital?

1.5 Research objectives

1.5.1 Broad objective

To explore the integration of nurses into antimicrobial stewardship activities in the critical care unit at Thika Level 5 Hospital.

1.5.2 Specific Objectives

1. To assess the nurses' perceived roles in antimicrobial stewardship in the CCU at Thika Level 5 Hospital
2. To identify perceived facilitators of nurses' role in antimicrobial stewardship in the CCU at Thika Level 5 Hospital.
3. To determine the perceived barriers of the nurses' role in antimicrobial stewardship in the CCU at Thika Level 5 Hospital.

1.6 Delimitation and limitation

This study used a single center and a small sample size of 11 nurses; therefore, the findings might not be generalized to other healthcare facilities.

1.7 Theoretical framework

This study adopts the theoretical domains framework (TDF). Formulated by a group of health psychologists in 2005, TDF is a planning tool that assists in identifying determinants of facilitators and barriers of an implementation strategy alongside appropriate techniques to address them (McGowan, Powell & French, 2020). The proponents of this theory aimed to change behaviors of healthcare providers by identifying and describing the factors that influence a certain behavior. Importantly, TDF only assist in identifying and describing factors that influence a given behavior, and not explaining the causes or testable relationships of elements of the behavior. It offers a theoretical lens upon which a researcher can view the affective, environmental, cognitive, and social influences of a behavior (Atkins et al., 2017). The theory is made up of 14 domains that consist of 84 components as discussed below.

Knowledge: An awareness of the existence of something, for example, procedural knowledge.

Skill: An ability or proficiency acquired through practice, for example, competence.

Social/professional role and identity: A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting, for example, professional confidence.

Beliefs about capabilities: Acceptance of the truth, reality or validity about a talent or facility that a person can put to constructive use, for example, self-confidence.

Optimism: The confidence that things will happen for the best or that desired goals will be attained, for example, optimism, pessimism.

Beliefs about consequences: Acceptance of the truth, reality or validity about outcomes of a behaviour in a given situation, for example, outcome expectancies.

Reinforcement: Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus, for example, rewards.

Intentions: A conscious decision to perform a behaviour or resolve to act in a certain way, for example, stability of intentions.

Goals: Mental representations of outcomes or end states that an individual wants to achieve, for example, goal/target setting.

Memory, attention and decision processes: The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives, for example, decision-making.

Environmental context and resources: Any circumstances of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behavior, for example, resources.

Social influences: Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours, for example, social pressure.

Emotion: A complex reaction pattern, involving experiential, behavioural and physiological elements, by which the individual attempts to deal with a personally significant matter or event, for example, anxiety.

Behavioural regulation: Anything aimed at managing or changing objectively observed or measured actions, for example, self-monitoring.

When used in a study, TDF provides a broader perspective of a problem and a means to understanding the potential solutions in theoretical terms (Atkins et al., 2017). TDF helped in formulating the interview guide and served as a coding framework in the data analysis

in this study. It assisted the researcher to structure the study by identifying the most relevant factors that influence antimicrobial stewardship practices through the domains of knowledge, skills, social influence, environmental context and resources.

1.8 Significance of the study

This study will help improve knowledge of nurses on antimicrobial stewardship on judicious use of antimicrobials by highlighting their roles and how they are connected with the core elements of AMS including surveillance and rational use of antimicrobials. Besides, this study will help promote behavior change among clinicians in antimicrobial prescribing and dispensing. Implementation of antimicrobial stewardship at healthcare facility level is meant to reduce overuse and misuse of antimicrobial. Therefore, this study will help the hospital optimize the use of antimicrobials, improve quality of care, and ultimately reduce unnecessary healthcare cost. According to McCullough et al. (2017), nurse-led antimicrobial stewardship reduce antimicrobial use by 25-30% with a cost saving benefit of $25 to $100 per day. Patients will benefit from improved health outcomes and reduce cost of care. This study will further increase body of knowledge in the nursing profession.

CHAPTER TWO: LITERATURE REVIEW

This chapter reviews literature pertaining to the integration of nurses in antimicrobial stewardship. Particularly, the review focuses on roles, facilitators and barriers of nurses' integration in antimicrobial stewardship. Some of the databases used in this literature review include google scholar, PubMed, science direct. The key words used in the search of literature include: antimicrobial stewardship, critical care units, and nurses' integration.

2.1 Role of nurses in antimicrobial stewardship

The Joint Commission and CDC advocates for engagement of nurses in ASP as a part of the multidisciplinary approach to the judicious use of antimicrobial agent to curb adverse effects of overuse and misuse of antimicrobials (The Joint Commission, 2016). Nurses consider themselves as antimicrobial stewards (Polisetty et al., 2022). A study on the past, present and future engagement of nurses in ASP reiterated the significance of engaging nurses across all initiatives due to relevance of their routines in daily patient care (Olans, Hausman & Olans, 2020). In a multisite study in pediatric and general hospitals, nurses agree that they have roles in antimicrobial stewardship; to include patient advocacy and knowledge on antimicrobials use (Mostaghim et al., 2017).

American Nurses Association (ANA) acknowledges that there are several areas where nursing and antimicrobial stewardship overlaps in the clinical setting. During admission of a patient in the hospital, nurses are involved in the initial assessment of the patient, take history on drug allergies, take samples for culture and sensitivity, and administer and record antimicrobial use (Manning & Pogorzelska-Maziarz, 2017). In patient safety monitoring, nurses monitor and record patients' response to antimicrobial, follow up and communicate

laboratory and radiology reports, monitor and report adverse events, review patients' clinical prognosis and changes in medications, and monitor and initiate changes in isolation precautions (Polisetty et al., 2022). During discharge, nurses assess patients' capacity to take oral medications, and educate patient and family about adherence to discharge medications (ANA & CDC, 2017). All these nursing roles are part of antimicrobial stewardship activities such as accurate antimicrobial allergy history, early and appropriate cultures, early initiation of antimicrobial, antimicrobial adjustments and de-escalation, and monitoring of adverse events and antimicrobial resistance (Olans, 2017).

The widespread involvement of nurses in activities relating to the use of antimicrobials calls for their integration in antimicrobial stewardship (Olans et al., 2016). The involvement of nurses in ASP includes a myriad of activities such as antimicrobial de-escalation, effective assessment and timely culturing practices (Carter et al., 2018). As part of the antimicrobial stewardship team, nurses question the route of antimicrobial administration, reassess the antimicrobial therapy in 2-3 days, and reconcile antimicrobials during all transitions of patient care (Wright, 2019). Reconciliation of antimicrobials helps in determining whether a duplicate therapy has already been ordered or whether the culture and sensitivity results are negative for a pathogen. Nurses usually engage physicians whenever reconciliation exhibits that a narrow spectrum antimicrobial can be substituted with a broad-spectrum antimicrobial (Manning et al., 2017).

Antimicrobial stewardship is part and parcel of nursing function of patient advocacy. A multisite study on nurses' role in antimicrobial stewardship found out that facilitating appropriate culture techniques, changing from IV medications to per oral antimicrobials

and questioning the necessity of cultures were priority nursing practices in antimicrobial stewardship (Carter et al., 2018). Nurses are highly confidence when obtaining samples for cultures, assessing adverse drug reactions and they take part in patient education (Monsees et al., 2018). Nurses are always present every time an antimicrobial is administered and thus, they are well positioned to influence efforts that support rational use of antimicrobials (Srinivasan, 2018). In a study on nurses' experiences in judicious use of antimicrobial in the CCU, the findings established their significant potential in minimizing antimicrobial use, errors and time-to-antimicrobial administration (Padigos et al., 2021).

Nurses can participate in antimicrobial stewardship at different capacities. A study on nurses' role in ASP in the United Kingdom established that employing a consultant nurse is ideal to transform antimicrobial stewardship practices in the hospital, consequently increasing nurses' involvement in program (Castro-Sánchez et al., 2019). Consultant nurse roles have been in existed in the UK for over two decades with core functions leveraging on professional leadership; education, training and development; research and service development; and expert practice. A multisite study on clinical nurses as active partners in antimicrobial stewardship found out that nurses in the critical care, surgical and stepdown units regularly initiate discussions with prescribers on antimicrobial dosing and duration (Greendyke et al., 2016). A scope review of nurses' role in antimicrobial stewardship by Van Huizen et al. (2021) concluded that their primary function ASP is to monitor judicious antimicrobial prescribing practices. Nurses occupy a conscious and essential position in

hospitals and they can act as brokers of doctors' antimicrobial prescription based on their capacity to challenge doctors' decisions, thus improving patient safety (Broom et al., 2017).

In high-income African countries like South Africa, nurses are integral to antimicrobial stewardship (AMS), engaging in activities such as monitoring antibiotic prescriptions, infection prevention, and patient education through structured AMS programs (Apisarnthanarak et al., 2018). In low-resource settings like rural Uganda and Tanzania, nurses focus more on basic infection prevention, monitoring patient outcomes, and educating patients on the dangers of self-medication due to limited resources and formal AMS programs (Barlam et al., 2016). Nurses in hospital settings, especially in urban areas, play a proactive role in AMS, while those in primary care often face challenges in enforcing strict antibiotic use guidelines. Cultural and policy variations across Africa influence nurses' roles in AMS, with many regions relying on traditional medicine and self-medication, making education essential. In Kenya, urban nurses are more involved in structured AMS due to better infrastructure, while rural nurses face limited diagnostic tools, a high burden of infectious diseases, and increased self-medication practices (MOH, 2017). Despite challenges such as lack of formal AMS training and limited resources, nurses remain key players in promoting proper antibiotic use and infection prevention across the country.

2.2 Facilitators of nurses' roles in antimicrobial stewardship

Continuous medical education of nurses is a key facilitator of nurses' integration in antimicrobial stewardship. Nurses are enthusiastic about continuous medical education on antimicrobial stewardship program (Greendyke et al., 2016). A study on attitudes and

beliefs of frontline nurses on antimicrobial stewardship found out that virtual education significantly increased nurses' awareness on antimicrobial stewardship (Polisetty et al., 2022). Virtual case-based simulation improves nursing students' knowledge on antimicrobial use and resistance (Manning et al., 2018). A survey by education and antimicrobial stewardship experts reached a consensus on the need to train undergraduate nurses on antimicrobial proficiency (Courtenay et al., 2018). Nurses consider in-service training every 6 months, manager and physician support as well as saving time for education as pathways to address knowledge gaps in antimicrobial stewardship (Hendy et al., 2022).

Inclusion of antimicrobial stewardship in formal nursing education is a key facilitator to nurses integration in the program. A multisite qualitative research on reconsidering roles of nurses in ASP articulated that educating nurses on antimicrobial stewardship is a critical milestone in empowering healthcare professionals to take part in the program (Kirby et al., 2020). Nurses are equally qualified to actively take part in antimicrobial stewardship programs. Knowledge on microbiology and pharmacology in nursing education should be presented as an applied science whose application and relevance in clinical practice is regularly reinforced (ANA & CDC, 2017). A study in Japan on nurses' roles in ASP recognized strengthening nursing education as a major facilitator in improving nurses' participation in antimicrobial stewardship (Sakaguchi, et al., 2022).

Fostering inter-professional collaboration positively influence nurses' participation in ASP. A study by Courtenay et al. (2018) views antimicrobial stewardship as a collective endeavor and a responsibility for all healthcare professionals involve directly in patient care in hospitals. Despite the existing inter-professional dynamics, it is epistemologically

consistent to encourage inter-professional collaboration to a range of healthcare professional groups antimicrobial stewardship programs (Kirby et al., 2020). Findings from a study on influence of collaborative community hospital network for ASP elucidate that a collaborative and consultative network is essential in acquiring knowledge and skills that foster long-term growth of antimicrobial stewardship (Moehring et al., 2021).

Organizational support is a major support factor to nurses' integration in antimicrobial stewardship. The hospital management can provide antimicrobial stewardship education to nurses, involve them in stewardship rounds, encourage them to take part in journal clubs and be champions of antimicrobial stewardship as a way to involve them fully in ASP (ANA & CDC, 2017). In an exploratory study on nurses' perception and attitudes in antimicrobial stewardship, nurses mentioned antimicrobial stewardship teams, infection control teams and pharmacists as sources of support for their involvement in stewardship programs (Mostaghim et al., 2017). Robust organizational structures, strong nursing leadership and utilization of technology were identified as enablers of nurses' participation in ASP (Padigos et al., 2020).

Technological support, policy changes, and organizational culture are key facilitators of antimicrobial stewardship (AMS) in combating antimicrobial resistance (AMR). Information technologies like electronic health records (EHRs) and clinical decision support systems (CDSSs) help healthcare providers make informed antibiotic prescribing decisions and reduce misuse by offering real-time data and evidence-based guidance (Van Santen et al., 2020). National and institutional policies, including structured AMS programs and antibiotic distribution regulations, significantly improve antibiotic use and

reduce misuse, as seen in countries like the United States and Kenya (Anderson et al., 2018). Strong leadership and interdisciplinary collaboration within healthcare institutions promote effective AMS by encouraging teamwork and ensuring adherence to protocols. Organizational cultures that prioritize continuous education and staff accountability lead to better antibiotic prescribing behaviors and increased engagement in AMS efforts. Ultimately, a supportive culture within healthcare settings, combined with technological and policy-driven initiatives, strengthens AMS and helps combat antibiotic resistance.

2.3 Barriers of nurses' integration in antimicrobial stewardship

Limited knowledge on antimicrobial stewardship is a major barrier to nurses involvement in ASP. The integration of nurses in the program is largely absent, with a multisite survey indicating that only 38% of bedside nurses were knowledgeable on ASP (Carter et al., 2018). Majority of nurses feel they receive little in way of formal education on antimicrobial stewardship, and the glean information they have about the program is either reactive or incidental (Kirby et al., 2020). A study on nurses' experiences in antimicrobial stewardship identified minimal knowledge on antimicrobial use, culture of deference to doctors and inter-professional dissonance as major barriers to nurses' involvement in ASP (Padigos et al., 2021). Therefore, nurses often feel insecure about their knowledge on microbiology and antimicrobial use, and thus perceive antimicrobial stewardship as not their function since they are not prescribers (ANA & CDC, 2017). Nurses are less confident in reviewing microbiology results in determining the appropriateness of an antimicrobial agent (Monsees et al., 2018). On the contrary, antimicrobial stewardship is part and parcel of nursing based on the inclusion of microbiology and pharmacology in the formal nursing curriculum. However, there is need to improve the existing approach to pharmacology,

microbiology and applied clinical training to include concepts on antimicrobial stewardship.

Nurses are crucial in a successful implementation of an antimicrobial stewardship due to their roles in research, education, policy and practice. However, there is limited knowledge on their engagement in antimicrobial stewardship programs (Manning & Pogorzelska-Maziarz, 2018). Nurses have not been widely engaged in antimicrobial stewardship since many nurses in hospital settings do not take part in antimicrobial prescribing (Srinivasan, 2018). There is significant association between nurses' belief on practice and their confidence to perform ASP activities. However, organizational factors such as lack of a safety culture is a primary obstacle to nurses integration into ASP activities (Monsees et al., 2020).

Organizational culture influence perceptions on nurses' role in ASP. Failure to include them in ASP rounds, disregard of nursing input in the rounds and interdisciplinary poor relations are major barriers towards their integration the program (Monsees et al., 2018). From an international survey to review the implementation of ASP in different settings, it was found out that nurses' input in the decision making process was least influential compared to recommendations by senior doctors and pharmacists (Charani et al, 2019).
Lack of multidisciplinary approach in antimicrobial stewardship is a major hindrance to nurses involvement in the programs. A study done to assess the differences in decision making on antimicrobial use found out that majority of ward rounds where decisions on antimicrobial use were done included doctors, pharmacists and infectious disease consultant, with exception of nurses (Charani et al., 2019). Complicated inter-professional

jurisdiction and authority of doctors around antimicrobial prescription makes nurses feel that they have less control on antimicrobial stewardship practices (Kirby et al., 2020). Relatedly, a study on nursing practices in antimicrobial stewardship found out that lack of teamwork and empowered in terms of inter-disciplinary roles discourage nurses' involvement in ASP (Abbas et al., 2019).

Workflows and regulatory requirements affects nurses' participation in antimicrobial stewardship (Castro-Sánchez et al., 2019). A study on the influence of educational intervention on nurses' perception on antimicrobial stewardship, nurses reported that high workload and lack of training as barriers to their participation in ASP (Hendy et al., 2022). Similarly, a qualitative study on nurses' perceived roles and barriers to ASP in Thailand found out that lack of formal policies, traditional professional hierarchies and failure to prioritize antimicrobial activities are major factors that contribute to inconsistencies in nurses' engagement in ASP (van Gulik et al., 2021).

Without clear policies, leadership endorsement, or adequate resources, nurses struggle to integrate stewardship into their practice. Gotterson et al. (2021) emphasize that insufficient organizational recognition of nurses' potential in AMS—such as undefined roles in policy documents—creates a structural impediment. Castro-Sánchez et al. (2019) further illustrate this in the UK context, noting that while "vertical" AMS nursing models (specialized roles) can thrive with institutional backing, the absence of such support in "horizontal" or "hybrid" models leaves nurses' responsibilities ambiguous. Gotterson et al. (2021) identify "nursing workflow, workload, and workarounds" as a critical impediment, noting that stewardship tasks are often sidelined due to time constraints. Furthermore, Castro-Sánchez

et al. (2019) point to tensions between sepsis protocols (often physician-led) and AMS objectives, where nurses advocating for judicious antibiotic use may face pushback, further isolating nurses.

2.4 Gaps in Knowledge

There is need for longitudinal studies on the impact of nursing education on antimicrobial stewardship and the impact of nurses-led interventions in the implementation of antimicrobial stewardship in resource-limited critical care settings such as Kenyan context. These data acknowledge an existing gap in adequate training of nurses on antimicrobial stewardship which negatively influence their participation in decision making and implementation of stewardship programs. Whilst historically and culturally, the expectation is that medical doctors lead in key decisions in healthcare institutions, this literature review demonstrates that other clinicians such as nurses play critical roles in antimicrobial stewardship. There is a deficit in data on consistent policies and guidelines that support the integration of nurses in antimicrobial stewardship. Furthermore, data on the education of nurses on antimicrobial stewardship remains limited.

2.5 Summary

Nursing expertise and values around best practice and patient advocacy represent a potentially untapped resource for antimicrobial stewardship. Patient care in hospitals include a multitude of healthcare professionals including doctors, nurses, pharmacists and allied healthcare professionals. These different professionals have their own values, behaviors and language. Cultural differences between these professionals and their specific specialties shape the shared knowledge leading to variations in patient care. Whereas nurses have crucial roles to play in antimicrobial administration, opinions and

recommendations of medical doctors is the most influential factor in antimicrobial prescription. Whilst antimicrobial policies exist in many hospitals, the surveillance of antimicrobial consumption is not universal. Notably, on the job training of antimicrobial stewardship among nurses remains low. Organizational culture influences the participation of nurses in antimicrobial stewardship.

CHAPTER THREE: MATERIALS AND METHODS

This chapter describes the study design that was used in the study. The chapter further describes the study area, population, sample, the sampling procedure, sample size determination, data collection method, trustworthiness, and pretesting. Data collection process, data management, data analysis, ethical consideration and limitations of the study are also described in this chapter.

3.1 Research Design

This study used exploratory descriptive qualitative research design. Exploratory descriptive qualitative research design is a purposive, systematic and broad ranging design that allows the researcher to uncover new knowledge in an area where little is known (Howes, 2019). It illuminates the full nature of a little understood phenomenon. The rationale for using exploratory descriptive qualitative design is its ability to allow the researcher an opportunity to explore a topic with limited coverage in literature. The design further allows participants in the study to take part in developing new knowledge relevant to the given phenomenon (Rendle et al., 2019). Essentially, exploratory descriptive qualitative design gives a detailed account of the nurses' roles in antimicrobial stewardship and facilitators and barriers of their involvement in the program from participants' own perspectives. The design is relevant to this study as it allowed the investigator to contextualize how nurses perceive their roles within the context of the study and uncovers the facilitators and barriers towards nurses' roles in antimicrobial stewardship.

3.2 Location of study

The study area is Thika Level 5 Hospital in Kiambu county, Kenya. Thika Level 5 Hospital is a county referral hospital and one of the biggest in Kiambu county with modern equipment for diagnosis and treatment of patients from Kiambu County and beyond. The hospital has a 7 bed ICU capacity and offers both inpatient and outpatient services. It specializes in critical care services, renal, medical and surgical services, obstetrics and gynecology, pediatric surgical service among other services. The choice of TL5H is based on its implementation of antimicrobial stewardship program in 2020 aimed at introducing antimicrobial guidelines and ASP protocol to monitor antimicrobial usage, assessing antimicrobial resistance patterns and promoting de-escalation practices. However, the implementation has principally focused on doctors and pharmacists, leaving behind nurses who are involved in direct care of the patients.

3.4 Study population

The study population were trained critical care nurses working in the main adult ICU. The main adult ICU had 18 critical care trained nurses working in different shifts. Focusing solely on nurses brings about single-perspective bias by excluding other stakeholders in AMS such as physicians and pharmacists. Therefore, underestimating or underestimating nurses' contribution to AMS. For instance, barriers identified by nurses such as stringent regulatory requirement of doctors in antimicrobial prescription may stem from doctors' decision-making process.

3.5 Sampling Techniques

The study used purposive sampling technique to recruit participants in the main adult ICU at Thika Level 5 Hospital. Purposive sampling method is a sampling technique method that

allows the investigator to select participants with specific characteristics (Palinkas et al., 2015). It involves selection of persons who have knowledge and experience on the phenomenon under investigation (Campbell et al., 2020). Purposive sampling is appropriate in exploratory descriptive qualitative research because it allows researchers to intentionally select participants who can provide rich, relevant, and diverse insights into the phenomenon being studied. This method focuses on choosing individuals or cases based on specific characteristics, experiences, or knowledge that align with the research objectives, rather than aiming for statistical representativeness. The researcher considered the availability and willingness of an individual to participate in the study. Nurses who have worked in the main adult ICU at Thika Level 5 Hospital for over six months were included in the study. Newly employed nurses were excluded from the study.

3.5 Sample size

Data saturation and redundancy was achieved at 11 participants. Data saturation emerges in an event where participants repeat themes during the interviews (Saunders et al., 2018). Upon reaching the 11^{th} participant, no new themes, insights and variations in experience emerged from additional interviews. Sample adequacy was executed when the researcher noted redundancy during the interviews. The iterative analysis of data from a purposively selected, diverse group showed redundancy after 9 participants, with the 11th confirming that the range of perspectives was fully captured.

3.6 Data collection Instruments

The researcher used semi-structured interview guide to assist in collection of qualitative data during the interviews. The semi structured interview guide consisted of a list of questions and follow-on prompts, grouped based on the research objectives.

3.7 Pretesting

Pretesting was done at Machakos Level 5 Hospital on five critical care nurses. Machakos Level 5 Hospital is a level 5 county referral hospital located in Machakos county with a bed capacity of 450. The facility offers specialized critical care services and has one operational intensive care unit. Machakos Level 5 Hospital was selected because it is at the same level with TL5H and offers similar specialized services. The researcher purposively selected 5 critical care nurses who mirror the characteristics of the target population but were not part of the final study. The researcher then conducted simulated interviews using the semi-structured interview guide. Upon pretesting, the researcher identified leading and overlapping questions which were addressed by substituting with open-ended questions and consolidating overlapping questions into single broader prompt respectively.

3.7.1 Trustworthiness

Trustworthiness is defined as the degree of confidence in the methods, data, and interpretations (Connelly, 2016). For rigor and trustworthiness, the researcher adopts the Lincoln and Guba model (1985). Based on the model, trustworthiness is achieved through credibility, dependability, authenticity, transferability and confirmability in a qualitative study. To ensure credibility, the researcher employed member checks through real-time validation during the interviews where he summarized and paraphrased participants' response and asked for confirmation of meaning. To ensure dependability, the research provided adequate contextual information about data collection, analysis and interpretation (Connelly, 2016). For confirmability, the researcher offered an audit trail by systemically labelling and storing the audiotapes, transcripts and observation notes with timestamps and dates to ensure that the raw data is traceable and preserved for future review. For

transferability, the investigator employed thick description, detailing the participants, settings and methods used in data collection to evaluate whether the findings are applicable in other situations (Amankwaa, 2016). To ensure authenticity, the researcher employed proper documentation, such that other researchers can be able to follow the investigative process and come up with similar findings. Triangulation was through the incorporation of the Theoretical Domains Framework vide the domains of knowledge, skills, social influence, environmental context and resources

3.8 Data Collection Techniques

This study used semi structured interviews in data collection. The principle investigator conducted semi structured face to face interviews in a private room and data storage through an audiotape recorder. Interviewing is a type of qualitative data collection method that involves face to face conversation between the investigator and participants with the purpose of collecting qualitative data to achieve the research objectives (Alshenqeeti, 2014). Semi-structured interview is a type of interview where questions in the interview guide are based on a predetermined thematic framework (Kallio et al., 2016). Semi-structured interview was appropriate in this descriptive exploratory study as it allowed the investigator a little more leeway to expound on the subject matter.

The researcher offered an audit trail by systemically labelling and storing the audiotapes, transcripts and observation notes with timestamps and dates to ensure that the raw data is traceable and preserved for future review. The audio tape gadget had a password only known to the researcher. The audiotapes were transcribed through listening and typing out everything said. Identifiable information was removed to maintain anonymity of the participants. The research then reviewed the scripts for accuracy and completeness,

comparing it with the original audiotape. The researcher ensured confidentiality by assigning a unique number (C01-C11) to the interview tool rather than indicating names of the participants. The transcriptions, notes and other related records from the interviews were stored in a secure, locked location that is only accessible to the investigator. The researcher was honest, open-minded and respectful to protect human subjects. The recordings are protected for future use in reanalyzing and verifying research findings.

3.9 Data Analysis

The researcher used NVIVO 14 software and thematic analysis in data analysis. Themes were developed from a group of repeating ideas and are used as descriptor, attribute, element and concept to answer research questions. In theme development, the researcher began by describing meaning of category and further differentiates themes in terms of level of abstraction and depth. Theme development encompasses four phases, namely: initialization, construction, rectification and finalization (Vaismoradi et al., 2016). In the initialization phase, the researcher read the transcripts and highlighted meaning units therein, coding and searching for abstractions, and writing reflective notes. Construction phase involved classifying, comparing, labelling, translating and transliterating, and defining and describing. Rectification involved immersion and distancing of relating themes to develop knowledge. Finalization phase involved developing the story line from the data.

The themes were validated and refined through iterative process involving generation of preliminary codes from the data and grouping the ideas into potential themes. Thereafter, the themes were compared against a dataset for conformity with recurring patterns and meaningful insights that led to merging of themes that lack support. Validation further

incorporated member checking where the researcher would ask the participants to verify interpretations during the interviews. The use of NVIVO 14 software is justified in the study due to its ability to streamline data management, enhance the depth of analysis, supports rigor and transparency and iterative design support where the research can revisit and recode data as new insights emerge, mirroring the fluid non-linear nature of the research design used in this study.

3.10. Logistical and Ethical Consideration

Ethical approval was obtained from Kenyatta University Ethics Review Board: *Ref: KU/ERC/APPROVAL/VOL.1*, National Commission for Science Technology and Innovation (NACOSTI): *Ref No: 759136*, Kiambu Research Board: *Ref. No: KIAMBU/HRDU/AUTHO/2023/09/13/Waithanji JC*, and Thika Level 5 Hospital Research and Ethics Committee: *Ref No. CGK/TL5H/09/09/2023*. Participants were recruited voluntarily and the purpose and benefits of the study was explained to the participants and informed consent obtained. Confidentiality was marinated through anonymization where codes C01 to C11 were used instead of the names of the participants. The interviews were conducted in private rooms to prevent eavesdropping. Debriefing was done at the end of the interviews to explain how participants' input would contribute to the research, reinforcing respect and transparency.

CHAPTER FOUR: RESULTS

4.1 Introduction

The study sought to explore the integration of critical care nurses in antimicrobial stewardship at Thika Level Five Hospital, Kiambu County, Kenya. The objectives of this study were to explore the perceived roles of nurses in antimicrobial stewardship, to describe the perceived facilitators of nurses' role in antimicrobial stewardship and to describe perceived barriers of nurses' role in antimicrobial stewardship in the intensive care unit. This chapter presents the findings based on the objectives of the study. The demographic characteristics of the study participants are also included.

4.2 Characteristics of Study Participants

A total 11 nurses working in the main intensive care unit of the hospital were individually interviewed. The researcher gathered the demographic profile of the nurses to include age, gender, religion, years of working experience and level of education. There were 7 female participants and 4 male participants. Their ages ranged between 24 to 35 years with a mean age of 30.5 years. All the participants had worked in the ICU for a minimum of 1 year in the critical care unit. 7 participants had higher national diplomas in critical care nursing, 2 had bachelors of Science degree in nursing and 2 had both higher national diploma and bachelors of Science degree in nursing as indicated in table 4.1.

Table 4.1: Characteristics of study participants

Participant No.	Age	Gender	Religion	Years of experience	Level of education
C01	32	Male	Christian	3	Higher national diploma
C02	29	Female	Christian	3	Higher national diploma
C03	29	Female	Christian	5	Higher national diploma
C04	35	Female	Christian	5	Higher national diploma
C05	24	Male	Christian	1.5	BSc nursing
C06	30	Female	Christian	2	BSc nursing
C07	31	Female	Christian	5	BSc nursing and Higher national diploma
C08	30	Female	Christian	3	Higher national diploma
C09	28	Male	Christian	2	Higher national diploma
C10	35	Female	Christian	1	BSc Nursing and Higher national diploma
C11	32	Male	Christian	5	Higher national diploma

4.3.Nurses' perceived roles in antimicrobial stewardship

This section describes the overreaching themes and sub-themes on the first research objective on nurses perceived roles in antimicrobial stewardship in the intensive care unit

at Thika Level Five Hospital. Although the understanding of the term antimicrobial stewardship differed among the participants, there was agreement that nurses play significant roles in the program.

4.3.1.Theme 1: Advocacy

The first overreaching theme on the perceived nurses' roles in antimicrobial stewardship was advocacy. Advocacy leverages on speaking on behalf of the patient. Nurses herein ensure that patient care is in line with the needs of the patient and works to minimize harm to the patients. They confirm collection of samples prior to initiation of antibiotics, they monitor prescriptions for dosage and dosage schedule for antimicrobials, and adherence to treatment guidelines. Advocacy contributes to antimicrobial stewardship by protecting patients from unnecessary antimicrobial prescriptions, fostering team-based care and curbing antimicrobial resistance through surveillance.

> ***C02:*** *"I advocate for the patient to determine whether the antimicrobials are right for the patient, or maybe when we need to change the antimicrobial therapy."*
>
> ***C03****: "I play a role in patient advocacy. For instance, when I find a drug has been used for so long, so I advise on the cessation of use."*
>
> ***C04****: "we are the patients' advocate. We try and explain to the patient about the use of any antibiotic. Especially for patients who we send to buy drugs for themselves, we try and explain more about that antibiotic and why we are sending them to buy that antibiotic instead of using the one that we have in the hospital."*

4.3.2.Theme 2: Communication and collaboration

Nurses are team players in antimicrobial stewardship in the unit. They participate in decision making, and collaborate with the doctors, pharmacists and the laboratory

technicians. They promote responsible use of antimicrobial agents in the ICU through recommending the cessation of antimicrobial use for their patients. This is based on the completion of the prescribed dosage and the laboratory findings. Further, they participate in the collection of samples for culture and sensitivity studies. The samples range from tracheal aspirates, wound swabs, blood culture, urethral catheter tips, urine and stool. These samples are often collected during routine nursing care activities such as during wound care, elimination care and tracheostomy care. They follow up the results in the laboratory and communicate the findings of the culture and sensitivity studies and discuss with both the physicians and pharmacists on the implications and potential adjustments of the treatment regimen. Upon receiving the results, nurses file the reports in the patients' file. Communication and collaboration ensure AMS stakeholders share critical information promptly, thus enabling informed decisions on selection and de-escalation of antimicrobials.

> ***C10:*** *"we emphasize on multidisciplinary approach in patient care, so that it does not become a one cadre role. Herein, I participate in the selection of antibiotic in the unit in consultation with the doctor. Also, I do suggest to the doctor the need for culture and sensitivity study."*
>
> ***C01:*** *"we take samples for culture and sensitivity studies in the laboratory in the absence of the phlebotomist."*
>
> ***C02:*** *I participate in the decision making on every antibiotic use, when it should be commenced or when it should be stopped if there need be. I also participate in the collection of samples for those patients who have wounds, and we think they might be infected, so we have to collect the samples for the pus swabs, for such things, that is the things we participate."*

4.3.3.Theme 3: Monitoring and documenting

Monitoring and documenting was the third overreaching theme that emerged on the perceived roles of nurses in antimicrobial stewardship. Essentially, nurses monitor treatment outcomes; both desired and undesired as well as documenting treatment and treatment outcomes in the intensive care unit. Moreover, nurses record patients' response to antimicrobial therapy. They do so by assessing the vital signs, review laboratory data, and tracking symptom improvement. They also conduct follow-up assessments to gauge the effectiveness of an antimicrobial agent. Upon the assessment, nurses are able to discuss with the doctor whether to continue or change the medication. Monitoring and documenting fosters timely adjustments of antimicrobial agents such as de-escalation and discontinuation to prevent antimicrobial resistance.

> ***C02:*** *"I participate in the monitoring the response of the patient clinically and also symptomatically."*
>
> ***C03:*** *"We do monitor the duration of use of antibiotics. In our treatment sheet, we have the days where it is well indicated how many days is the patient supposed to get the antibiotics. In our nurses' sheet, there is a way we write today the patient is doing day 2 of the drug. In case we have reached day 7, We stop the antibiotic. If an antibiotic has not worked, we now talk to our consultant and the pharmacist and they are going to guide us on how we are going to do it."*
>
> ***C04:*** *"Like for antibiotic is given for a period of one week, we have a documentation in which each and every day we have to document the day of antibiotic use. For instance, we document today is day 3 or day 4 of antibiotic use."*

4.3.4. Theme 4: Patient education and empowerment

Participants highlighted that they play an important role in patient education as far as antimicrobial use is concerned. The content leverage on the benefits, risks and adverse effects of the antimicrobial agents. Nurses further empower patients on the importance of adhering to the antimicrobial agents to include dosage and timing of administration, and safety measures. Patient education and empowerment decreases unnecessary antimicrobial demand, improve treatment efficacy and increase awareness of stewardship principles.

> ***C06: "****Upon discharge, we advise patients on drug compliance and duration."*
>
> ***C08:*** *"We offer education to the patient on antimicrobial use."*
>
> ***C09:*** *"We teach patients on antimicrobial therapy."*

4.4.Perceived facilitators of nurses' role in antimicrobial stewardship

This section describes the themes of the second research question on the perceived facilitators of nurses' role in antimicrobial stewardship.

4.4.1. Theme 1: Continuous medical education

Continuous medical education (CME) was the first theme identified as a major facilitator of nurses' role in antimicrobial stewardship. CMEs build capacity for nurses on antimicrobial stewardship. Capacity building is invaluable in increasing nurses' knowledge on the program and promoting better practices in the use of antimicrobials in the unit. These training for nurses on antimicrobial stewardship program would offer ongoing support and updates on disease control and surveillance, emerging infections, antimicrobial resistance and would allow nurses to adopt to evolving practices and guidelines in antimicrobial stewardship.

C02: *"The institution here, the ICU specifically, we do participate in CMEs where we have different sections of antimicrobial stewardship lessons we get to acquire more knowledge on antimicrobials stewardship".*

C05: *We normally have CMEs in the hospital especially on Wednesday. So we can learn from there.*

C01: *one means of promoting is nurses' role in antimicrobial stewardship is through organizing these CMEs and allocating more time that is required for the CMEs.*

4.4.2. Theme 2: Inclusion of antimicrobial stewardship in formal nursing education

Inclusion of antimicrobial stewardship in formal nursing education emerged as a theme and an important facilitator of nurses' role in antimicrobial stewardship. Participants proposed this inclusion as an initiative to better prepare future nurses to fulfil their role in responsible use of antimicrobials. Educated nurses have the ability to advocate for evidence-based antibiotic use and collaborate with other stakeholders to effectively implement AMS protocols.

C02: *"I suggest the inclusion of antimicrobial stewardship in the curriculum of all nursing programs. This is to begin with diploma level, diploma nurses, degree nurses, and also to ensure that antimicrobial stewardship is put in place in different units.*

C06: *"Learning institutions should include antimicrobial stewardship in the nursing education. Maybe, it can be incorporated in some units in school."*

C05: *"I think they can include it on the training of the students. So that when the students are coming from the schools, they know about antimicrobial stewardship before they come to the hospital. That will be easier."*

C08: *"Schools can incorporate antimicrobial stewardship in their curriculum where it can be taken as a small sub unit for more learning."*

4.4.3. Theme 3: Team work

Team work emerged as the third overreaching theme on facilitators of nurses' role in antimicrobial stewardship. Participants highlighted that nurses are proactive in engaging physicians and other healthcare professionals on issues pertaining to drug administration, drug reaction and monitoring challenges for a unitary effort to be forged by the multidisciplinary team. Efficient communication promotes continuous consultation between nurses and doctors on all aspects of patient care including assessment, diagnosis, planning, intervention and evaluation. Nurses communicate laboratory results to doctors as well as reporting adverse drug reactions. Therefore, teamwork fosters mutual accountability and strengthens systemic efforts to combat antimicrobial resistance through continuous consultation.

C05: *"Multidisciplinary collaboration between the nurses and the doctors is good. I can rate it at 70%. And with effective communication between the inter-professional workers, we exchange ideas and teach each other."*

C07: *"I think also multidisciplinary collaboration between nurses and doctors which involve continuous consultation. The communication here between the nurses and the doctors is good and promotes multidisciplinary collaboration between the different professionals."*

C11: *"We have efficient communication between different healthcare providers. That is, doctors, nurses and pharmacists".*

C02: *"The hospital can put in place measures to ensure multidisciplinary*

collaboration is ensured in the ICU because in the ICU we depend on different disciplines which come in to place and that one will ensure"

4.4.4. Theme 4: Organizational support

Organization support emerged as an important facilitator of nurses' role in antimicrobial stewardship. Herein, participants highlighted that provision of continuous training, access to resources, clear guidelines on antimicrobial stewardship, and empowering nurses to make informed decisions pertaining to antimicrobial use in the facility as important initiatives by the organization to facilitate nurses' participation in antimicrobial stewardship. Some participants suggested that recognizing the efforts of nurses' in antimicrobial stewardship and granting them authority to advocate for responsible use of antimicrobial in the facility fosters their roles in the program. Therefore, aligning organization goals with antimicrobial stewardship enhance interdisciplinary collaboration and strengthens systemic efforts to improve clinical outcomes of patients and reduce antimicrobial resistance.

C06: *"The organization offers supports in terms of training and conferences outside the hospital where we get to learn a lot of things."*

C07: *"We also have organizational support in form of offering training and provision of adequate resources."*

C01: *"The hospital can be promoting nurses, not only monetary but also taking them out for retreats."*

4.5. Perceived barriers of the nurses' role in antimicrobial stewardship

This section describes themes derived to answer the third research question on the perceived barriers of the nurses' role in antimicrobial stewardship. Six major themes and

subtheme were developed in this section.

4.5.1.Theme 1: Stringent regulatory requirements

Nurses agreed that stringent regulatory requirements were a barrier to nurses' role in antimicrobial stewardship. The regulatory requirements leverage on who prescribes the antimicrobials. Wherein it falls under the scope of medical doctors/physicians, participants highlighted that nurses play an important role in antimicrobial selection, administration and monitoring patients' response to the treatment. Some participants mentioned undefined organizational culture on drug prescription makes nurses feel excluded on decisions on antimicrobial use in the unit. Herein, nurses are left as implementers of doctors' prescriptions.

> ***C10:*** *"Doctors have too much authority on drug prescription and thus the role of the nurse is left to implement what the doctor has prescribed. The nurse is not given a chance to give an input or to suggest which is the correct antibiotic or the duration of time for which the patient is supposed to use the antibiotic. So you just implement the doctors' orders. And the nursing council does not give you the autonomy to prescribe an antibiotic as a nurse."*
>
> ***C01:*** *"Regulatory requirements on drug prescription affect our role as nurses as some doctors feel superior than the nurse and they are supported by their board. So the role should be regulated where the nurse is given a chance whether to agree or disagree with the doctor since the nurse is a patients' advocate."*
>
> ***C02:*** *"The regulatory requirements on drug prescription affect me as a nurse. As an ICU nurse I think I have a big role to play in antimicrobial stewardship. Remember that the antibiotics that the doctors are prescribing, I am the nurse who*

administers them. So sometime you may find that I have a patient who is reacting to the drug or maybe having some side effects to a certain antibiotic. And the fact that I as a nurse cannot be listened to by the doctors, and maybe that the nurses do not have the ability to prescribe drugs or advise the doctor, it limits me. So I think the NCK and KMPDC should come up with new ways to ensure that nurses are also having roles to participate and doctors should also be able to accommodate nurses' opinions."

4.5.2. Theme 2: Heavy workload

Heavy workload is the second overreaching theme on barriers of nurses' role in antimicrobial stewardship. Participants highlighted that sometimes patient to nurse ratio is high whereby they are forced to care for two to three critically ill patients in the unit. Therein, they are overwhelmed with routine patient care activities such as bed-bath, feeding and elimination. Therefore, not actively involved in ward rounds where decisions on treatment plans and antimicrobial selection are made. Moreover, preoccupation with routine nursing care activities for the patients makes nurses forgo monitoring duration of antimicrobial use.

C03: *"And then there is heavy workload, sometimes you are so busy… like you don't even have the time to check like what day are we doing of this antibiotic."*

C06: *"The ratio between the patients and the nurses is imbalance. Patients are many and nurses are few, so there is heavy workload on us."*

C05: *"One of the you may find a heavy workload. Because sometimes you find that we do not have the one-to-one nurse patient ratio. So the workload is higher and you cannot deliver as much."*

4.5.3. Theme 3: Poorly regulated systems affecting multidisciplinary collaboration and communication

Participants highlighted that opportunities for nurses to give their inputs in treatment planning and antimicrobial agent selection is limited. Some participants indicated that sometimes doctors overlook their inputs on antimicrobials selection or adjustment in treatment regimens. This in turn demoralizes nurses' involvement in decisions in antimicrobials selection as they assume that even if they give their inputs, it may not be considered. Besides, sometime the doctor will consult the physician through phone calls and the physician will give orders which will then be written in the treatment sheet without getting the input of the nurses. Efficient communication would otherwise lead to a collaborative approach between them and the doctors and a comprehensive understanding of treatment plans of patients. Nurses are key frontline caregivers and would offer invaluable insights into the response of the patient to antimicrobials, side effects and the adherence to the antimicrobial regimen.

> ***C02:*** *"We find that many patients are being attended by different teams of care, so sometimes we lack multidisciplinary collaboration due to different aspects of care. This team can suggest this, and another team can suggest a different thing. So the lack of collaboration between the different disciplines is what brings the barriers around. Sometime maybe when the nurse suggests something or notes something and informs the doctor, the doctor don't put into consideration the opinion of the nurses, thus making the communication to be inefficient."*
>
> ***C03:*** *"I would say sometimes a doctor may not take my input into consideration. That becomes a challenge. Sometimes when the doctor who is around is not*

communicating, I won't even tell him or her that we are not supposed to use this drug… the days are overdue. We will just continue."

C06: *"Sometimes we also have inefficient multidisciplinary approach to patient care. Therefore, the hospital should promote good communication between the nurses and the doctors and give the nurses more liberty where they can choose maybe treatment because we are also knowledgeable."*

4.5.4. Theme 4: Limited knowledge on antimicrobial stewardship

Participants agreed that limited knowledge on antimicrobial stewardship and nurses' role in the program was a barrier of nurses' participation in antimicrobial stewardship. Some participants suggested that the knowledge for nurses on antimicrobial treatment indication, dosage and duration was also limited, therefore, hindering their participation in decision making processes of antimicrobial selection.

C02: *"you sometimes find that we have limited knowledge due to the evolving technology and the evolving healthcare, you find that maybe we lack knowledge in antimicrobial stewardship."*

C03: *"The knowledge is limited… even though you go for those CMEs, there are some things that you are not going to put everything into practice because of the heavy workload and everything else, not everything you are going to put in your mind.*

C04: *"For the knowledge, we still need seminars and more CMEs to insist on it.*

C08: *"We have sometimes limited knowledge in antimicrobial resistance. That is when you are not informed.*"

4.6. Summary

In summary, perceived nurses' roles in antimicrobial stewardship included advocacy through close monitoring dosage and dosage schedule, communication and collaboration, monitoring and documenting, and patient education and empowerment. Promoting responsible use of antimicrobial agents is a key principle in antimicrobial stewardship, and herein involves monitoring duration of antimicrobial use, monitoring patients' response to antimicrobials, and recommending cessation of antimicrobial use. Continuous medical education, inclusion of antimicrobial stewardship in formal nursing education, team work and organizational support were stated as the major facilitators of nurses' roles in antimicrobial stewardship. Knowledge limitation, heavy workload, poorly regulated systems affecting multidisciplinary collaboration and communication and stringent regulatory requirements were identified as barriers to nurses' role in antimicrobial stewardship.

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATION

This chapter discusses the results of the study. This study sought to explore nurses' role in antimicrobial stewardship, and determine facilitators and barriers of nurses' roles in antimicrobial stewardship.

5.1 Perceived nurses' role in antimicrobial stewardship

From the study findings, it was established that nurses play different roles in antimicrobial stewardship.

5.1.1 Theme 1: Advocacy

Nurses act as patients' advocate in the use of antimicrobial agents. Patient advocacy is embedded in nursing practice. Herein, nurses in the critical care unit intercede on behalf of patients on matters involving patients' safety when it comes to the use of antimicrobial agents in the unit. They monitor dosage and dosage schedule in advocating for proper use of antimicrobial agents. This finding corroborates with a multisite study on nurses' role in antimicrobial stewardship by Carter et al. (2017) which established that antimicrobial stewardship is an extension of the role of nurses in patient advocacy. Herein, nurses ensure appropriate culture techniques, prompt conversion of intravenous to oral antimicrobials and questioning the necessity of culture and sensitivity studies for patient with indwelling catheters. In a multisite study in general and pediatric hospitals by Mostaghim et al. (2017), nurses agreed that they act as patient advocates in antimicrobial stewardship. Similar findings by Srinivasan (2018) indicate that nurses are well positioned to influence efforts that support rational use of antimicrobials since they are present every time an antimicrobial agent is administered to the patient. Nonetheless, Padigos et al. (2021)

highlighted the significant potential for nurses in minimizing use and errors to promotes judicious use of antimicrobial. Moreover, Hamdy et al. (2019) indicate that nurses monitor patients and serves as testimony of how a prescription affects them. Nurses have a duty to speak up and uphold patients' safety in fulfilling their patient advocacy role (Alingh et al., 2019; Davey & Aveyard, 2022).

5.1.2 Theme 2: Communication and collaboration

This study established that nurses are team players in antimicrobial stewardship. They participate in decision making on antimicrobial use in the unit. They collaborate with other members of the healthcare team, including doctors, pharmacists and laboratory technicians. Their roles herein entails confirming appropriateness of antimicrobial prescription, reporting adverse effects of antimicrobial agents in the unit as well as recommending the cessation of antimicrobial use based on results of culture and sensitivity studies. This finding corroborates with a study by Davey and Aveyard (2022) that found out that nurses' initiate discussions on evaluation of treatment plan after two days of the commencement of antimicrobials. Similarly, a multisite study on clinical nurses as active partners in antimicrobial stewardship established that nurses in the critical units regularly initiate discussions with physicians on antimicrobial dosing and duration (Greendyke et al., 2016). In this context, nursing as a profession should be recognized as the operational and communication hub within antimicrobial stewardship (Rout et al., 2021). According to Wiley and Villamizar (2019) nurses convey appropriate patient information on antimicrobial dosage, indication and duration during transition of care and patient rounds to other members of the healthcare team to ensure reconciliation of medication.

Furthermore, nurses question de-escalation of antimicrobials from broad spectrum to narrow spectrum, and switch of intravenous to oral antimicrobials (Hamdy et al., 2019). A study by Broom et al. (2017) established that nurses occupy a conscious and essential position in healthcare facilities which makes them act as brokers of doctors' antimicrobial prescription based on their capacity to challenge doctor's decisions. Similarly, a study by Wright (2019) affirms nurses' participation in decision making on antimicrobial use to include questioning the route of antimicrobial administration, reassessing the antimicrobial therapy in 2-3 days and reconciling antimicrobials during all transitions of patient care.

Nurses follow up the laboratory results, communicate and consult with the physicians on the findings and their implications. This finding corroborates with the results of a multisite study on nurses' role in antimicrobial stewardship that stated that nurses facilitate appropriate culture techniques and questions the necessities of cultures (Carter et al., 2018). Monsees et al. (2018) observed that nurses are highly confident in obtaining culture samples. According to the Australian Commission on Safety and Quality in Health Care (2018), nurses' involvement in antimicrobial specimen collection includes timely transfer of specimens to the microbiology laboratory to ensure the quality of the specimen is maintained. However, sometimes they are less confident in reviewing microbiology results during decision making processes in the selection of appropriate antimicrobial agents (Monsees et al., 2018).

5.1.3 Theme 3: Monitoring and documenting

Monitoring and documenting was the third theme on the perceived nurses' role in antimicrobial stewardship. Nurses monitor desirable and undesirable treatment outcomes

through assessment of vital signs, review of laboratory data and tracking of symptom improvement. They conduct follow-up assessments to gauge the effectiveness of antimicrobial therapy. This finding corroborates with a study by Riley and Olans (2021) on roles of nurses in the critical care unit that established that nurses are involved in improving antimicrobial use by documenting when an antimicrobial agent was started and prompt physicians to provide an antimicrobial timeouts and review. Similarly, Schaffart (2020) found out that monitoring which involves observing patients, taking vital signs, measuring patient complaints and documenting their clinical observation is an important nursing role in antimicrobial stewardship. In a study on scope review of nurses' role in AMS, Van Huizen et al (2021) found out that nurses play a critical role in monitoring judicious antimicrobial prescribing practices in acute care settings which goes in handy in preventing misuse of antimicrobial agents and emergence of antimicrobial resistance.

Nurses monitor patient's response to antimicrobial regimen through daily observation, document adverse effects and initiate necessary actions pertaining to the treatment plan of the patient (Madran, 2022). According to Rout (2021), bedside nurses play a critical role in monitoring compliance to best practices in antimicrobial stewardship through communication of patient response to antimicrobial regimen that influence prescription decisions in the unit. Similarly, Ladenheim (2018) highlights that nurses are involved in monitoring and interpretation of signs and symptoms using different tests such as C-reactive protein point-of-care test that support antimicrobial prescription. According to the Australian Commission on Safety and Quality in Health Care (2018), nurses are primary

drivers in data monitoring through provision of feedback on adverse drug reactions, antimicrobial resistance and the spread of *clostridium difficile* in the unit.

5.1.4 Theme 4: Patient education and empowerment

This study found out that nurses undertake patient education as part of their role in antimicrobial stewardship in the unit. The details of patient education leverage on the importance of completing the dose of an antimicrobial regimen and the side effects of the drug to the patient. This finding corroborates with studies by Newland et al. (2018) and Schaffart (2020) that highlighted that nurses talk to their patients about how they should take antimicrobials appropriately to prevent misuse and antimicrobial resistance. Riley and Olans (2021) state that nurses play an important role in patient education by relaying discharge instructions on what adverse reactions the patient need to notify the doctor about. According to Ladenheim (2018), nurses play a crucial role in patient education which is significant in fostering the principles of antimicrobial stewardship. Similarly, Hamdy et al. (2019) highlight that nurses explain to patients why antimicrobial therapy is unnecessary in viral infection and the potential consequence of overuse of antimicrobial agents. In this context, Madran (2022) suggests that nurses need to be trained regularly to be able to provide accurate and updated information to patients and their families about antimicrobial resistance.

5.2 Facilitators of nurses' role in antimicrobial stewardship

5.2.1 Theme 1: Continuous medication education

In this study, it was established that continuous medical education (CME) is a major facilitator of nurses' role in antimicrobial stewardship. Popularly known as CME, it

increases nurses' knowledge on antimicrobial agents, emerging infections, antimicrobial stewardship and resistance to antimicrobials. These findings are comparable with Greendyke et al. (2016) who stated that nurses are enthusiastic about continuous medical education. Improved nurses' education is an important enabler of nurses' participation in antimicrobial stewardship (Gotterson et al., 2021). A study by Polisetty et al. (2022) on attitudes and beliefs of frontline nurses on antimicrobial stewardship established that virtual education through CMEs increased nurses' knowledge on antimicrobial stewardship. In service training was further established to be a facilitator to improving nurses' knowledge in antimicrobial stewardship. This sentiment is in line with a study by Hendy et al. (2022) on knowledge gaps in antimicrobial stewardship that established that in-service training after every 6 months to be a pathway in addressing limited knowledge among nurses on antimicrobial stewardship. In this context, the focus should be to build capacity for nurses on antimicrobial management by protocol, clinical practice guidelines, assessment of patient response to antimicrobials, and evaluation of safe transition from intravenous to oral antimicrobial agents (Olans et al., 2016).

5.2.2 Theme 2: Inclusion of antimicrobial stewardship in formal nursing education

This study established that the inclusion of antimicrobial stewardship in formal nursing education is an important facilitator of nurses' role in antimicrobial stewardship since it will nature junior nurses who will be knowledgeable on judicious use of antimicrobials. This finding corroborates with Davey and Aveyard (2022) who established that introduction of formal training on antimicrobial stewardship and protected teaching time will address knowledge deficit among nurses. A survey by antimicrobial stewardship

experts reached out on a consensus on the emerging need to train undergraduate nurses on antimicrobial proficiency (Courtenay et al., 2018). Similarly, a multisite qualitative survey on considering roles of nurses in antimicrobial stewardship concluded that educating nurses on antimicrobial stewardship is a crucial milestone in empowering nurses to take part in the program (Kirby et al., 2020). Equally, Van Huizen et al. (2021) in a study on reviewing the scope of nurses in antimicrobial stewardship established that the nurses' role in antimicrobial stewardship can be supported through education. Sakaguchi et al (2022) in a study in Japan on nurses' role in ASP recognized strengthening of nursing education as a major facilitator in promoting nurses' involvement in antimicrobial stewardship. Moreover, pharmacology and microbiology lessons in nursing education should be presented as applied sciences whose application and relevance in clinical practice should be regularly reinforced (ANA & CDC, 2017). Madran (2022) highlights that even nursing students should be included in training on antimicrobial resistance. In this context, Olans et al. (2016) argue that educating nurses on antimicrobial stewardship is not meant to turn them into antimicrobial prescribers, but to recognize and utilize their roles in the program.

5.3.3 Theme 3: Teamwork

Teamwork was established to be an important facilitator of nurses' role in antimicrobial stewardship. A multidisciplinary approach to antimicrobial stewardship is essential in knowledge exchange between different professionals and ensures comprehensive understanding of patients' condition and the treatment plan. By participating in multidisciplinary teams, nurses are actively involved in making informed decisions on antimicrobial use. This finding is comparable with a study by Courtenay et al. (2018) that

viewed antimicrobial stewardship as a collective endeavor and a responsibility for all healthcare professionals involved directly in the care of patients. Kirby et al. (2020) argue that despite the existing dynamic by different cadres in the care of patients, it is epistemologically prudent to emphasize on inter-professional collaboration to a range of healthcare professionals in antimicrobial stewardship.

A study by Moehring et al. (2021) on influence of collaborative community hospital network established that consultative and collaborative network is crucial in acquiring knowledge and skills that forms the basis for long-term growth of antimicrobial stewardship. In this context, nurses play a central role in multidisciplinary collaboration by providing links that enhance antimicrobial stewardship efficiency (Olans et al., 2016). Bos et al. (2023) suggest that there is urgent need to strengthen team communication in antimicrobial stewardship by addressing physician-nurse hierarchy to promote open and effective communication. Prior to formulating effective partnership between physicians and nurses, there is need to address uncertainty about the scope of nurses in antimicrobial stewardship (Greendyke et al., 2019). Essentially, having a clear definition of roles of different members of the healthcare team will foster respect for the significant contribution of all those involved in antimicrobial stewardship and promote multidisciplinary collaboration (Bransby et al., 2023).

5.2.4 Theme 4: Organizational support

Organizational support was mentioned in this study as an important facilitator of nurses' role in antimicrobial stewardship. Organizational support leverage on nurses' training, providing access to resources and empowering nurse to make informed decisions regarding

antimicrobial use. Organizational structures provide frameworks that define roles and responsibilities of different cadres in the unit and ensures that nurses have a clear understanding of their contributions in antimicrobial stewardship. This finding is comparable with a study by Padigos et al. (2020) that highlighted robust organizational support, technology and strong nursing leadership as enablers of nurses' involvement in antimicrobial stewardship. Herein, organizations can encourage nurses to take part in journal clubs and become champions of antimicrobial stewardship (ANA & CDC, 2017). On the contrary, Van Gulik et al. (2021) in a study on barriers to nurses participation in ASP that established that failure to prioritize antimicrobial activities, lack of formal policies and traditional professional hierarchies are barriers to nurses' roles in antimicrobial stewardship. Hospital culture greatly influences antimicrobial prescription behavior. The traditional hierarchical structure of the wards reserves decisions on antimicrobial selection to physicians who are viewed to be more knowledgeable (Davey & Aveyard, 2022). As a consequence, nurses are reluctant to take an active role in antimicrobial stewardship (Best & Smith, 2019).

5.3 Barriers of nurses' role in antimicrobial stewardship

5.3.1 Theme 1: Stringent regulatory requirements

This study established that stringent regulatory requirements on drug prescription act as a barrier to nurses' role in antimicrobial stewardship. The regulatory requirements give doctors the authority to prescribe medications. Therefore, nurses feel their inputs in making decisions on antimicrobial selection would not yield much since doctors will make the ultimate decision. This finding is comparable with a study by Srinivasan (2018) which

found out that nurses are less involved in antimicrobial stewardship since they are not involved in antimicrobial prescription. Similarly, failure to involve nurses in antimicrobial stewardship rounds and disregard of the inputs acts as a barrier of nurses' role in antimicrobial stewardship (Monsees et al., 2018). An international survey on the implementation of ASP in different settings by Charani et al. (2019) established that nurses' inputs in decision making processes were least influential compared to inputs from pharmacists and senior doctors. The scope of practice for nurses and clear distinction of physician's role in drug prescription and nurses' role in drug administration limit nurses' role in antimicrobial stewardship (Abbas et al., 2019).

5.3.2 Theme 2: Heavy workload

Second, this study established that heavy workload hinders nurses' role in antimicrobial stewardship. Heavy workload and a busy schedule forces nurses to focus on routine nursing care activities such as bed-bath, feeding, oral care and pressure area care, leaving doctors to do ward-rounds and make treatment plans and antimicrobial agent selection by themselves. This finding corroborates with a study by Ladenheim (2018) that found out that heavy workload force nurses to unintentionally neglect their roles in antimicrobial stewardship since they have to prioritize routine patient care activities. Workflows influence nurses' role in antimicrobial stewardship (Castro-Sanchez et al., 2019). Hendy et al. (2022) highlight that high workload for nurses limit their time to participate in antimicrobial stewardship.

5.3.3 Theme 3: Poorly regulated systems affecting multidisciplinary collaboration and communication

This study established that poorly regulated systems affecting multidisciplinary collaboration and communication act as a barrier to nurses' role in antimicrobial stewardship. Nurses are key frontline caregivers and their insights offer invaluable support in antimicrobial stewardship. However, the inefficiency in communication leaves them to act as implementers of doctors' prescription and give treatment blindly. Inefficient multidisciplinary approach further undermines nurses' role in antimicrobial stewardship such that their inputs in the selection of antimicrobial agents is overlooked. This finding is comparable with a study by Charani et al. (2019) that found out that nurses were exempted in majority of ward rounds where decision on antimicrobial use were done. Equally, a study by Abba et al. (2019) established that lack of teamwork and undefined inter-disciplinary roles limit nurses' involvement in antimicrobial stewardship. In this context, inappropriate communication methods hinder consideration of nurses input in decision making processes of antimicrobial selection and use (Madran, 2022). According to van Gulik et al. (2021), lack of formal policies that articulate nurses' role in antimicrobial stewardship and traditional professional hierarchies hinder nurses' involvement in antimicrobial stewardship in hospitals. An open communication culture and structured communication tool such as SBAR can resolve inefficiencies in communication.

5.3.4 Theme 4: Limited knowledge

Limited knowledge on antimicrobial stewardship was identified as a barrier to nurses' role in antimicrobial stewardship. The variability of nurses' knowledge leverage on their

knowledge of antimicrobial treatment indications, dosage and duration which consequently hinders their participation in antimicrobial stewardship. This finding is comparable with a multisite study on the integration of bedside nurses in antimicrobial stewardship that found out only 38% of bedside nurses were knowledgeable about antimicrobial stewardship (Carter et al., 2018). Similarly, a study by Manning and Pogorzelska-Maziarz (2018) on engagement of nurses in antimicrobial stewardship established that limited knowledge among nurses was a barrier to their involvement in the stewardship program. Davey and Aveyard (2022) indicate that nurses' input on decisions on antimicrobial use is inadequate due to limited knowledge on antimicrobial prescription. Gaps in education about proper use of antimicrobials limit nurses' involvement in antimicrobial stewardship. According to WHO (2019), only 13% of nursing courses include the principles of antimicrobial stewardship in their curriculum, with minimal focus given to the conversion of intravenous to oral antimicrobial agents and the use of only one antimicrobial agent as a postoperative prophylaxis. The preexisting theory-practice gap in formal nursing education hinders nurses from applying their skills and realizing their potential in antimicrobial prescription (Ladenheim, 2018).

5.4 Conclusion

Recognizing important roles that different member of the healthcare team play creates a safer and more collaborative multidisciplinary approach in antimicrobial stewardship. Despite variability in nurses' knowledge on antimicrobial stewardship, nurses are aware of their roles in the program. Nurses play a cognizant role in antimicrobial stewardship. Their inputs in decision making process on treatment plans and antimicrobial use is essential

since they are the frontline caregivers of the patient and they are actively involved in patient assessment, monitoring patients' response to antimicrobial as well as reporting adverse reactions of antimicrobial agents. Contribution of nurses in important decisions on antimicrobial use in the unit is limited due to inefficient communication between doctors and nurses and stringent regulatory requirement that reserve the prescription authority to doctors. If implemented successfully, continuous medical education and inclusion of antimicrobial stewardship in formal nursing education are some of the strategies to build capacity among nurses in antimicrobial stewardship and consequently their involvement in the program.

5.5 Recommendations

5.5.1 Recommendations from the study

i. Continuous medical education on antimicrobial stewardship in the unit to increase nurses' knowledge on antimicrobial stewardship. It would be invaluable in making nurses understand their roles in antimicrobial stewardship and thus, they will become more proactive in promoting responsible use of antimicrobials in the unit.

ii. Inclusion of antimicrobial stewardship in formal nursing education to nature responsible future nurses in antimicrobial use. It will build capacity among nurses. Therefore, encourage nurse-led discussions on antimicrobial selection and increase their confidence in challenging prescriber's decisions.

iii. Use of multidisciplinary approach in antimicrobial stewardship to involve bedside nurses since they are involved in patient assessment, drug administration, monitoring duration of drug use and monitoring and recording

patients' response to antimicrobials.

iv. Institute open communication culture within the hospital through the use of a structured communication tool such as SBAR. This will encourage efficient communication between nurses and doctors through consultative meetings to facilitate inter-professional collaboration.

v. Make it a policy for nurses to join major ward rounds to allow them give inputs on treatment plans of patients in the unit.

5.5.2 Recommendations for further research

Further clarity on how critical care nurses should perform their roles in complex working environment in the intensive care units is essential. Future research should focus on redefining the nature, scope and influence of perceived nurses' role in antimicrobial stewardship.

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APPENDICES

APPENDIX 1: INFORMED CONSENT FORM

My name is **JOSEPH WAITHANJI CHEGE** (Master student from Kenyatta University). I am conducting a study titled "**Integration of critical care nurses in antimicrobial stewardship; opportunities and barriers at Thika Level 5 Hospital, Kenya.**" The information will be used to improve knowledge of nurses on antimicrobial stewardship on judicious use of antimicrobials and promote behavior change among clinicians in antimicrobial prescribing and dispensing.

Procedures to be followed

Participation in this study will require that I ask you some questions. I will record the information you provide in a questionnaire.

Voluntarism

You have the right to refuse participation in this study. You will get the same services and care whether you agree to join the study or not and your decision will not change the care you will receive. Please remember the participation in this study is voluntarily. You may ask questions related to the study at any time.

You may refuse to respond to any questions and you may stop an interview at any time. You may also stop being in the study at any time without any consequences to the services you receive here or any other organization now or in the future.

Discomforts and Risks

Some of the questions you will be asked are on intimate subject and may be embarrassing or make you uncomfortable. If this happens, you may refuse to answer these questions if you so choose. You may also stop the interview at any time. The interview may add approximately half an hour to the time you wait before you receive your routine services. During the removal of blood there will be some pain or discomfort but we will try our best to minimize this by being gentle.

Benefits

If you participate in this study you will help us to learn how to provide effective screening services that can improve knowledge of nurses on antimicrobial stewardship on judicious use of antimicrobials.

Reward

There are no rewards or any payment to you if you participate.

Confidentiality

The interviews and examinations will be conducted in a private setting within the clinic. Your name will not be recorded on the questionnaire. The questionnaires will be kept in a locked cabinet for safe keeping at Kenyatta University. Everything will be kept private and only shared with the study team.

Contact Information

If you have questions about the study call the **Joseph Waithanji Chege:** 0719 224825 or Supervisor Dr. Nickcy Mbuthia 0722786043.

However, if you have questions about your rights as a study participant: You may contact Kenyatta University Ethical Review Committee Secretariat on chairman.kuerc@ku.ac.ke,

Participant's statement

The above information regarding my participation in the study is clear to me. The study has been explained to me and I have been given a chance to ask questions and my questions have been answered to my satisfaction. My participation in this study is entirely voluntary. I understand that my records will be kept private and that I can leave the study at any time. I understand that I will still get the same care and medical treatment whether I decide to leave the study or not and my decision will not change the care that I will receive from the clinic today or that I will get from any other clinic at any other time.

Investigators statement

I, the undersigned, have explained to the volunteer in a language s/he understands, the procedures to be followed in the study and the risks and benefits involved

Name of Interviewer: ***Joseph Waithanji Chege*** Date: September 13th 2023

Signature: _____

APPENDIX 2: INTERVIEW GUIDE

a. Perceived nurses' role in antimicrobial stewardship

1. Tell me what you understand about antimicrobial stewardship?
2. Whose responsibility is antimicrobial stewardship?
3. Do you think nurses have a role to play in antimicrobial stewardship in the ICU?
4. What are these nurses' role in the intensive care unit?

b. Facilitators of nurses' role in antimicrobial stewardship

5. Describe some of the things that facilitates nurses' role in antimicrobial stewardship in the intensive care unit?
6. Describe what the hospital can do to facilitate nurses' role in antimicrobial stewardship in the critical care unit?
7. What can learning institutions do to facilitate nurses' role in antimicrobial stewardship?
8. What can regulatory body (Nursing Council of Kenya) do to facilitate nurses' role in antimicrobial stewardship?

c. Barriers of nurses' role in antimicrobial stewardship

9. What are some of the barriers you encounter when performing your roles in antimicrobial stewardship here in the ICU?
10. What is your opinion on nurses' knowledge on antimicrobial stewardship?
11. How would you describe organizational support on antimicrobial stewardship?

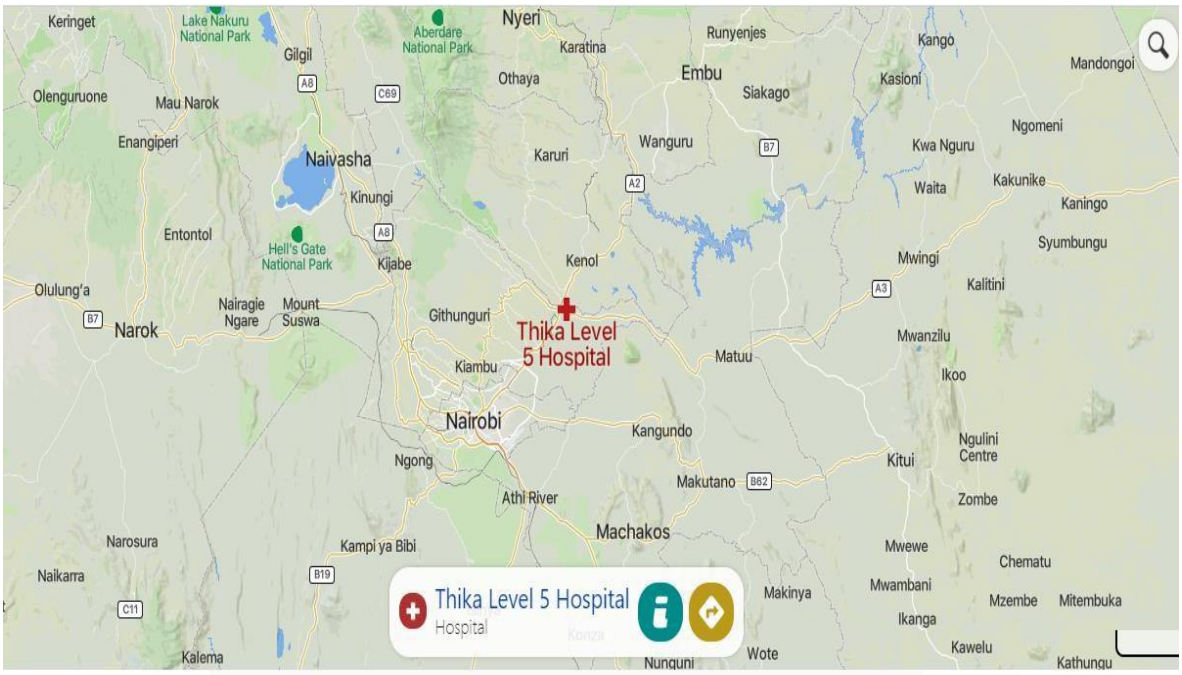
12. How would you describe multidisciplinary collaboration and nurses' role in antimicrobial stewardship in the ICU?
13. What is your opinion on availability of time for nurses to participate in antimicrobial stewardship in the ICU?
14. How would you describe regulatory requirements on drug prescription (NCK and KMPDC) and its influence on nurses' roles in antimicrobial stewardship in the ICU?

APPENDIX 3: THEORETICAL FRAMEWORK DOMAIN

Table 1 Theoretical domains presented with explanatory definition and sample construct

Domain	Definition and example of a construct
Knowledge	An awareness of the existence of something, for example, procedural knowledge
Skill	An ability or proficiency acquired through practice, for example, competence
Social/professional role and identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting, for example, professional confidence
Beliefs about capabilities	Acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use, for example, self-confidence
Optimism	The confidence that things will happen for the best or that desired goals will be attained, for example, optimism, pessimism
Beliefs about consequences	Acceptance of the truth, reality or validity about outcomes of a behaviour in a given situation, for example, outcome expectancies
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus, for example, rewards
Intentions	A conscious decision to perform a behaviour or resolve to act in a certain way, for example, stability of intentions
Goals	Mental representations of outcomes or end states that an individual wants to achieve, for example, goal/target setting
Memory, attention and decision processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives, for example, decision-making
Environmental context and resources	Any circumstances of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behavior, for example, resources
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours, for example, social pressure
Emotion	A complex reaction pattern, involving experiential, behavioural and physiological elements, by which the individual attempts to deal with a personally significant matter or event, for example, anxiety
Behavioural regulation	Anything aimed at managing or changing objectively observed or measured actions, for example, self-monitoring

APPENDIX 4: STUDY AREA



APPENDIX 5: RESEARCH APPROVALS

KENYATTA UNIVERSITY
OFFICE OF THE EXECUTIVE DEAN GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 020-8704150

Our Ref: R50/20915/2021 **DATE:** 24th March 2023

Director General,
National Commission for Science, Technology and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MR. JOSEPH WAITHANJI CHEGE – REG. NO. R50/20915/2021

I write to introduce Mr. Joseph Waithanji Chege who is a Postgraduate Student of this University. He is registered for M.Sc. degree programme in the **Department of Medical Surgical Nursing And Preclinical Sciences.**

Mr. Joseph Waithanji Chege intends to conduct research for a M.Sc. Thesis Proposal entitled, ***"Integration of Critical Care Nurses in Antimicrobial Stewardship; Opportunities and Barriers at Kenyatta University Teaching, Referral and Research Hospital, Kenya".***

Any assistance given will be highly appreciated.

Yours faithfully,

KENYATTA UNIVERSITY OFFICE OF EXECUTIVE DEAN GRADUATE SCHOOL
24 APR 2023

PROF. ELISHIBA KIMANI
EXECUTIVE DEAN, GRADUATE SCHOOL

Joseph Waithanji Chege,
20915.2021@students.ku.ac.ke.
0791252278.
September 8, 2023

To the Executive Dean, Graduate School,
Kenyatta University,
P.O. Box 43844 – 00100,
Nairobi, Kenya.

KENYATTA UNIVERSITY
OFFICE OF THE CHAIRMAN
13 SEP 2023
P.O. BOX - 00100 NAIROBI

Recommended & forwarded
13/9/2023

Through Chairperson, Medical-Surgical Nursing,
Kenyatta University,
P.O. Box. 43844 – 00100,
Nairobi, Kenya

Dear Madam,

RE: CHANGE OF RESEARCH SETTING - REF NO: R50/20915/2021

I am writing this letter to request a change of research setting from Kenyatta University Teaching, Research, and Referral Hospital (KUTRRH) to Thika Level 5 Hospital, Kiambu County, Kenya.

Reason for the change of the research setting is based on the refusal of KUTRRH to grant permit for collection of data in the facility due to the lack of a standing committee on research.

Research topic: **Integration of critical care nurses in antimicrobial stewardship: opportunities and barriers at Thika Level 5 Hospital, Kiambu County, Kenya.**

Attachments include Approvals from Kenyatta University Ethics Review Committee and Graduate school.

Looking forward to your feedback.

Sincerely,
Joseph Waithanji Chege.
R50/20915/2021

APPENDIX 6: RESEARCH PERMITS

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **759136**

Date of Issue: **18/September/2023**

RESEARCH LICENSE

This is to Certify that Mr.. JOSEPH WAITHANJI CHEGE of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kiambu on the topic: Integration of critical care nurses in antimicrobial stewardship; opportunities and barriers at Thika Level 5 Hospital, Kiambu County, Kenya for the period ending : 18/September/2024.

License No: **NACOSTI/P/23/27922**

759136

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

COUNTY GOVERNMENT OF KIAMBU
DEPARTMENT OF HEALTH SERVICES
P.O Box 2344 - 00900 Kiambu, Kenya
Tel: 254 709 877 000 Email: info@Kiambu.go.ke Website: www.Kiambu.go.ke Twitter: @KiambuCountyGov

Ref. No: KIAMBU/HRDU/AUTHO/2023/09/13/Waithanji JC
Date: 13 Sep 2023

TO WHOM IT MAY CONCERN,

RE: CLEARANCE TO CONDUCT RESEARCH IN KIAMBU COUNTY

Kindly note that we have received a request by **Mr. Joseph Chege Waithanji** of **Kenyatta University** to carry out research in Kiambu County, the research topic being on ***"Integration Of Critical Care Nurses In Antimicrobial Stewardship; Opportunities And Barriers At Thika Level 5 Hospital, Kiambu County, Kenya"***.

We have duly inspected his documents and found that he has been cleared by **Kenyatta University Centre For Research Ethics And Safety** until **27 Jun 2024**. He thus does not need any further clearance with another regulatory body in order to conduct research within the county of Kiambu.

However, it is incumbent upon the facility in which the research is being carried out to ensure that they are conversant with the remit of the study and operate in line with their institutional norms on conducting research. This note also accords him the duty to provide feedback on his research to the county at the conclusion of his research.

DR. M. NDIRITU NDIRANGU
COUNTY HEALTH RESEARCH DEVELOPMENT UNIT
KIAMBU COUNTY

COUNTY GOVERNMENT OF KIAMBU

DEPARTMENT OF HEALTH SERVICES

Telephone: +254722106797
Email address: thika15hospital@gmail.com

When replying please quote:

THE MEDICAL
SUPERINTENDENT,
P. O. BOX 227 – 01000,
THIKA

Ref: CGK/TL5H/09/23/2023

Date: 13th October, 2023

APPROVAL TO CARRY OUT RESEARCH

PRINCIPAL INVESTIGATOR: CHEGE JOSEPH WAITHANYI

RE: A STUDY ON INTEGRATION OF CRITICAL CARE NURSES IN ANTIMICROBIAL STEWARDSHIP; OPPORTUNITIES AND BARRIERS AT THIKA LEVEL 5 HOSPITAL.

Following deliberations by Thika Level 5 Hospital's Training, Research and Ethics Committee (TREC), and subject to provision of all the necessary licenses and ethical approvals, your proposal to carry out the above referenced research, at this facility, has been approved.

This approval is subject to the following mandatory conditions:

1. You shall submit a copy of the abstract of the final report, through the above contact details.
2. Where called upon, you shall be expected to make a feedback presentation to the hospital's Training, Research and Ethics Committee.
3. You shall maintain ethical consideration and the research subjects' confidentiality as outlined in your proposal.
4. Any patient confidential information that you may access during your research should not be used without consent.
5. You shall make payments of applicable research fees to the hospital before commencing research activities.

This letter is valid up to 30th June, 2024. For any queries feel free to contact the committee chair through the Medical Superintendent's office or Training, Research and Ethics Committee Office.

Thank you and all the best.

SUSAN GATEL
FOR: CHAIRPERSON, TRAINING RESEARCH & ETHICS COMMITTEE
THIKA LEVEL 5 HOSPITAL