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Appraisal of Institutional Antimicrobial Stewardship in Selected Public Health Facilities in Nigeria

Joshua Olusegun Obasanya
Walden University

Walden University

College of Social and Behavioral Sciences

This is to certify that the doctoral dissertation by

Joshua O. Obasanya

has been found to be complete and satisfactory in all respects,
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the review committee have been made.

Review Committee
Dr. Victoria Landu-Adams, Committee Chairperson,
Public Policy and Administration Faculty

Dr. Joshua Ozymy, Committee Member,
Public Policy and Administration Faculty

Dr. George Kieh, University Reviewer,
Public Policy and Administration Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
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Abstract

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

The misuse of antimicrobials (AM) constitutes a huge problem in developing countries, including Nigeria, posing severe public health threats to the populace's health. Misuse contributes to the high consumption of AM, driving the emergence and spread of antimicrobial resistance (AMR). Establishing functional antimicrobial stewardship (AMS) programs at the health facility levels is recognized as an effective and efficient strategies to tackle AMR. Literature is replete with evidence of poor prescription practices, but few studies assessing the factors contributing to inappropriate use of AM in Nigeria exist. The purpose of this study was to improve the understanding of AMS practice at the three-tiered level of care to promote rational use of AM. The theoretical framework is the theory of planned behavior. A qualitative case study was used with a purposeful sample size of 30 participants drawn from two primary, two secondary, and two tertiary health facilities in Nigeria. Data were coded and categorized for thematic analysis. Emergent themes include lack of AMS programs, no guidelines, lack of modern equipment and incorrect diagnosis, absence of continuous medical education, limited access to quality-assured and affordable medicines, imbalance of power among professionals, and pervasive external influence of pharmaceutical marketing companies. The recommendation is to strengthen AMS programs' policy and governance framework at the national and health facility levels. Strengthening process governance aligned with the aims and structure of the AMS program would contribute to positive social change through rational AM use. Rational AM use would preserve universal access to quality-assured, effective, and affordable AM for those seeking care in Nigeria.

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Dedication

I dedicate this PhD work to family and friends who stood by me through this journey.

Acknowledgments

With a heart of gratitude, I would like to express my most profound appreciation to my committee chair, Dr Victoria Landu-Adams, my committee member Dr Joshua Ozymy, the university research reviewer, Dr George Kieh and the academic program coordinator Dr Karen Schafer for their guidance and inciteful comments and feedback throughout the dissertation process. I also give special thanks to Dr Marcia Ann Kessack and Dr Heather Mbaye, who also guided me in the initial stages of the dissertation journey.

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Chapter 1: Introduction to the Study

The focus of this study is the experiences of system actors on antimicrobial stewardship (AMS) in selected public health care facilities in Nigeria. Even though antimicrobial resistance (AMR) is a natural evolutionary phenomenon, inappropriate human antibiotic use, among other factors, is accelerating its progress (Bebell & Muiru, 2014; Davies & Davies, 2010; Doron & Davidson, 2011; Klein et al., 2018) . Estimates showed that AMR accounts for about 700,000 deaths yearly, with projections reaching 10 million deaths per year by 2050 (O'Neill, 2014). In the United States, the Centers for Disease Control and Prevention (CDC) has estimated that more than 2 million infections and 23,000 deaths are due to antibiotic resistance each year. AMR is associated with a significant worsening of clinical outcomes, increased lengths of hospital stay, and risk of death (Llor & Bjerrum, 2014). Researchers have also established that the cost of managing patients with multi-drug resistant infections is higher (approximately $6,000-30,000 dollars) than with those due to antimicrobial-susceptible infections (Marks et al., 2014; Pooran et al., 2013; World Bank, 2017). Low-income regions like Africa are likely to be the worst hit by declining effectiveness of antibiotics because of the greater burden of infectious diseases, structural weaknesses in health systems, and poor infection prevention, among others (Bebell & Muiru, 2014; Okeke et al., 2007; Tiong et al., 2016). While the magnitude of the burden is not yet specified in Nigeria, available evidence has shown a high proportion of bacterial resistance to many antibiotics (Adefehinti et al., 2012; Gidado et al., 2017; Nigeria Centre for Disease Control, 2017; Raji et al., 2013; World Health Organization [WHO], 2019).

This introductory chapter commences with the background of AMR in health care settings, particularly in low- and medium-income countries (LMIC), highlighting the need for functioning institutional AMS at the health facility. The research questions will lead to the understanding of the factors promoting or inhibiting the establishment of functioning AMS programs. The conceptual framework for the study was the theory of planned behavior (TPB), formulated by Ajzen in 1991. Other sections of the chapter highlight the nature of the study, definitions of terms, assumptions, scope and delimitations, significance of the study including the social change implications at the global, national, community and the individual levels. The chapter ended with the summary of the chapter.

Background

Discoveries of penicillin by Alexander Fleming in 1928 and synthesis of the first sulphonamide (prontosil) in 1935 heralded the beginning of the modern antibiotic era in which there have been remarkable successes in the ability to treat infections, advancement in medical and surgical procedures including cancer chemotherapy and surgical transplants, as well as improvement in life expectancy (Khanal et al., 2011). Widespread use and overuse of antibiotics had led to emergence of drug-resistant bacteria, which cause infections that are practically untreatable with almost all currently available agent (A. Broom et al., 2015; Khanal et al., 2011; Klein et al., 2018; Spellberg, 2014). This is particularly worrisome in health care settings where inappropriate antibiotic prescribing amongst medical practitioners is highly prevalent (Anyanwu & Arigbe-osula, 2012; Davey et al., 2017; Eshiet et al., 2015; Goff & File, 2018).

Antibiotic resistance has become a global problem and has constituted a great public health threat since the last couple of decades (Ferri, 2017). In a pan-European study, Collignon et al., (2015) identified poor governance and corrupt practices, especially in supervision and enforcement of laws which guard against AMR promoting practices as key contributors to AMR. This problem is particularly worse in the LMICs, where the burden of bacterial infection is enormous, and access to modern diagnostic equipment and second line antibacterial drugs are restricted (Rahman et al., 2016; Khanal et al., 2011). About 700,000 annual deaths are caused by AMR worldwide thereby compromising the fundamental human right to health as enshrined in the constitution of the WHO (Daulaire et al., 2015)

Factors other than volume of antibiotic usage also promote and aggravate AMR. Wallinga et al. (2015) established that tackling AMR in a dynamic and complex health system demands a multifaceted approach. Appropriate policy as well as multilevel interventions are therefore required to achieve an overwhelming positive effect (Heyman et al., 2014; Wallinga et al., 2015).

In 2015, the WHO presented a unified approach to control the emergence and spread of AMR. The 68th World Health Assembly adopted the Global Action Plan on Antimicrobial Resistance and recommended its adaptation and implementation at the national and subnational levels (WHO, 2015) The Global Plan outlined five strategic objectives: (a) creation of awareness through effective communication and training; (b) strengthening surveillance systems; (c) reducing the incidence of infections through effective sanitation, hygiene, and preventive measures; (d) optimizing AMS in animal

and human health; and (e) encouraging investments in AMR control to achieve sustainability. The WHO also presented a framework of action to be taken by member states, partners, and international donors if the strategic objectives must be achieved. The tripartite of the WHO, the Food and Agriculture Organization of the United Nations (FAO) and the Organization for Animal Health (OIE), relying on the World Health Assembly Resolution WHA68.7, developed a *Global Framework for Development and Stewardship to Combat Antimicrobial Resistance: Draft Roadmap*, which proposed a global approach to stewardship and access (WHO et al., 2017).

In 2016, the World Bank simulated the consequences of AMR on the world economy by 2050. According to the report, failure to address the issues of AMR could lead to a loss of 3.8% of the annual global domestic product by 2050, with an annual shortfall of $3.4 trillion by 2030 (World Bank, 2017). The World Bank scenario also showed that the annual reduction of the global gross domestic product (GDP) creates progressive distortions that has a disproportionate impact on the economies of LMICs. Although, the estimated cost of tackling AMR is enormous, investments in the actions that contribute to the control of AMR today would yield remarkable expected economic rate of return in the future (Baur et al., 2017; World Bank, 2017).

AMS entails using antimicrobials in appropriate and proper ways, and it also involves actions that promote appropriate treatment of patients requiring antimicrobials through sustained access to effective antimicrobial therapy in the society for long period of time (Aryee & Price, 2015; Dyar et al., 2017) The term *antimicrobial stewardship* was first used in a published article in the United States in 1996 and later included the

American guidelines for the prevention of AMR in hospitals (McGowan & Gerding, 1996; Shlaes et al., 1997). It has evolved over the years from a narrow context of programs within individual hospitals to one that has been embraced and implemented in many countries, and recently gained a broader perspective by encompassing animal health in a one health AMS (Minnesota Department of Health, 2018). It has been variously conceptualized as a set of coordinated interventions, a program, a philosophy, or an ethic, and described more recently as a coherent set of actions that promote using antimicrobials in ways that ensure sustainable access to effective therapy for all who need them (Dyar et al., 2017).

Antimicrobials are used commonly in both human and veterinary health sectors against bacteria, viruses, fungi, and parasites. The consumption data received from the 29 European Union/European Economic Area (EU/EEA) countries showed that 60% of all antimicrobials sold in 2017 were consumed in the food producing animal health sector (European Centre for Disease Prevention and Control et al., 2021). However, this study focuses on the human health component of AMR.

AMS has not been institutionalized in most of Africa, including Nigeria; a recent systematic review of AMS interventions in LMICs, including studies from just two African countries, reveals that AMS is restricted to tertiary care centers in urban areas (Dijck et al., 2018; Howard et al., 2014). There is lack of evidence on the effectiveness of AMS programs across these countries as they majorly focus on mere quantitative reduction in antibiotic use rather than improving patient outcomes, decreasing AMR, and increasing cost effectiveness of care (Dijck et al., 2018). In the report of an international

cross-sectional survey of AMS in hospitals across 660 hospitals in 67 countries Pulcini et al., 2019 revealed that the main barriers to implementing AMS programs in LMICs were lack of infrastructures and manpower as well as poor political commitment. Among the countries, 52% had existing national AMS standards with only 20% in Africa and North America, while 62% had a specific AMS committee with only 12% in Africa (Howard et al., 2014). The limitations to AMS suggest a dare need for actionable plans to embrace the identified core elements which describe the essential and minimum standards for AMS program in hospitals worldwide (Pulcini et al., 2019).

Hospitals still have a few effective antibiotics against multi-drug resistant bacteria; hence they are important locations for optimizing antibiotic use to minimize evolution of AMR. Unfortunately, however, these hospital-based control strategies have significantly failed to positively influence prescribing behavior (Broom et al., 2014; Goff & File, 2018; Hulscher et al., 2010). Desired change in antibiotic prescribing, ultimate goal of stewardship, is hindered majorly by the disposition of prescribers who often see antibiotic use as a social practice rather than being influenced by standard recommendations and norms.

AMS programs across societies have had limited impacts because they have been designed without paying proper attention to socio-cultural and behavioral factors (Hulscher et al., 2010; Naylor et al., 2017). Understanding such prescribers' mindset is necessary to provide insights to solving this problem and thereby promoting and supporting organizational and practice changes (A. Broom et al., 2015).

In most of the literature on AMR, the term *antimicrobial* is most often used as a synonym with *antibiotic*. In this study, the term *antimicrobial* will therefore be used interchangeably with the term *antibiotic*.

Problem Statement

The misuse of antibiotics constitutes a huge problem in developing countries posing serious threats to the health of the populace. It is particularly worrisome in Nigeria, where it cuts across all levels of the society (Anyanwu & Arigbe-osula, 2012; Bernabé et al., 2017; Eshiet & Effiong, 2015; Nigeria Centre for Disease Control, 2017; Raji et al., 2013; Sanya et al., 2013) For the purpose of this study, antibiotic misuse involves cases of over-prescription and mis-prescription (Luyt et al., 2016) in terms of choice of antibiotics, duration, dosage and indication for therapy (Charani et al., 2010). The misuse contributes to excessive consumption which, in turn drives the emergence and spread of AMR (Hou et al., 2014; Klein et al., 2018). During a survey to analyze the trends and drivers of antibiotic consumption globally, Klein et al. (2018) examined antibiotic use in 76 countries over 16 years from 2000 to 2015. National sample surveys of antibiotic sales were used to estimate the total volume of sales of each antibiotic. Antibiotic consumption for each country was reported monthly or quarterly and broken down between the retail and hospital sectors. During the 16-year period of the survey, antibiotic consumption, expressed in defined daily doses (DDD) increased by 65% (21.1–34.8 billion DDDs), and the antibiotic consumption rate increased by 39% (11.3–15.7 DDDs per 1,000 inhabitants per day). AMR restricts treatments of infections and reduces the gains of modern medicine (Adefehinti et al., 2012; Llor & Bjerrum, 2014).

Establishing a functional AMS program remains one of the most potent strategies to tackle AMR (Bebell & Muiru, 2014; WHO, 2015). AMS is also aimed at changing prescribers' behavior which is normally influenced by social norms and beliefs as well as attitudes (A. Broom et al., 2014).

Literature reviewed for this study contributed to evidence that poor prescription practices occur commonly in health facilities in LMICs, but most of the studies rarely examined AMS beyond tertiary care facilities (Dijck et al., 2018). Other factors aggravating the burden of AMR in Sub-Saharan Africa include power and social interactions among professionals within the health facilities, as well as uncoordinated AMR response due to poor governance practices at institutional level and beyond (A. Broom et al., 2015; Howard et al., 2014; Hulscher et al., 2010). Several studies, however, revealed that hospital AMS interventions have largely improved compliance to institutional antibiotic guidelines and patient's outcome (Dijck et al., 2018; Mas-Morey et al., 2017), but few have focused on the challenges of establishing effective antibiotic stewardship programs in every health facility (Birnbaum, 2015). A recent systematic review of hospital AMS in LMICs contains data from only two countries from Africa, namely, Kenya and South Africa (Dijck et al., 2018).

None of the literature reviewed elucidated the perspectives of the health care workers and the contextual factors promoting or limiting sustainable antibiotic governance across different levels of health care such as the primary, secondary and tertiary levels in Nigeria. Recommendations on the effectiveness of AMS in developing countries including Nigeria is therefore difficult to make (Cox et al., 2017; Pulcini et al.,

2019; Tiong et al., 2016). The findings of the study will contribute to increased awareness amongst those who prescribe antibiotics within the health system, leading to the use of the right testing with associated reduction in uncertainty of diagnosis; appropriate treatment with good prognosis; reduction in antibiotic use leading to lower adverse effect, and, ultimately, contributing to lower AMR rates as well as lower health care costs (Cox et al., 2017; Nathwani et al., 2012; Schuts et al., 2016).

The AMR burden is more pronounced on the low socio-economic class of the society who generally have poor access to effective and affordable medicines (Daulaire et al., 2015; Khanal et al., 2011; Tshefu et al., 2015) The findings of this study will also contribute to equity in terms of universal access to quality, effective and cheap antibiotics at the health facility level (Hogerzeil, 2011).

Purpose of the Study

The purpose of this study was to improve the understanding of the practice of AMS at three-tiered levels of care. To address this gap, I used the qualitative approach. The qualitative study focused on the experiences of healthcare workers regarding AMS, its challenges as well as make recommendations for improvement at selected tertiary, secondary and primary health facilities in selected states in Nigeria. By understanding the scope, functionality and the factors promoting or hindering AMS, the research can make a practical contribution to the development of policy and operational guidelines that will promote rational use of antibiotics at the health facility level.

Research Questions

There are three research questions generated from the problem statement and purpose of this study:

1. What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on system processes for AMS in selected public health facilities in Nigeria?

2. What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on the scope and functionality of AMS system in selected public health facilities in Nigeria?

3. What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on factors that hinder or promote AMS in selected public health facilities in Nigeria?

Conceptual Framework

This study was guided by the conceptual framework developed from the theory of planned behavior (TPB). The TPB evolved from the theory of reasoned action (Ajzen, 1985, 1991) to predict an individual's intention to engage in a behavior. Ajzen (1985) posited that there are three conceptually independent determinants of intentions: attitudes towards the behavior, subjective norms, and perceived behavioral control that predict the intention to perform behaviors of different kind (Ajzen, 1985)

The TPB explains human behavioral variability across situations and permits prediction of a specific behavior in a given situation. Attitude toward the behavior refers to the degree to which an individual has a favorable or unfavorable appraisal of the

behavior in question. The second antecedent is subjective norm, a social factor that refers to the perceived social pressure to perform or not to perform the behavior. The third predictor of intention is the degree of perceived behavioral control, which refers to people's perception of the ease or difficulty of performing the behavior of interest. Ajzen and Madden (1986) showed that perceived behavioral control remains a significant predictor of behavioral intention after controlling for attitude and subjective norms (Ajzen, 1985, 1991; Ajzen & Madden, 1986).

The behavior of interest is AMS, which is responsible use of antibiotics. The TPB found successful applications in studies dealing with variety of issue like smoking, drinking, health care utilization and election participation in which choices must be made among alternatives (Ajzen, 1991; Ajzen & Madden, 1986).

Nature of the Study

For this study, I employed a qualitative method involving in-depth interview of system actors and the review of existing policies and practices. This approach is widely accepted to improve the understanding of the experiences of individuals (Creswell, 2013). This was an exploratory study involving use of themes and emerging concepts in the literature. The qualitative approach was considered the most appropriate means by which the objectives of this study could be explored given its ability to describe and explain phenomena in a manner that quantitative research would neither do, nor be able to attach sufficient meaning to (Ritchie & Ormston, 2013). The qualitative case study was used in studying the perceptions of system actors towards AMS. Allowing system actors to tell their stories in the course of their work with the use of key in-depth interview

guidelines assisted in gathering rich information about the experiences of the system actors as regards AMS.

The scope of the study included the evaluation of individuals' perceived experiences of how AMS functions at the various levels of health care. Participants included managers of facilities and individual health care workers who are engaged in antibiotic prescription. Thus, the findings of the study showed will enabling individual and environmental factors that may influence responsible use of antimicrobials.

Definition of Terms

Antimicrobial resistance: The loss of effectiveness in any anti-infective medication. Anti-infective medication includes the four major categories: antibacterial, antifungal, antiviral and anti-parasitic medication.

Antimicrobial stewardship: Organizational or health care system wide approach to promoting and monitoring judicious use of antimicrobials to preserve their future effectiveness.

Behavior: An individual's observable response in a given situation with respect to responsible use of antimicrobials (i.e., AMS).

Public health care facility: A health care facility financed and managed by either the local, state, or federal government of Nigeria.

Experience: For the purpose of this study, experience is the representation and understanding of the prescribers and nonprescribers at the health facility, which may be physical, emotional, social and cultural factors, and how these factors influence their perception and choices (Boylorn, 2012).

System actors: These are the prescribers and non-prescribers in the public health facilities. The prescribers are the physicians while the non-prescribers are the nurses, the AMS team and the hospital management.

Assumptions

The first assumption in this study was that the qualitative approach was the most appropriate means by which the objectives of this study could be explored given its ability to describe and explain phenomena in a manner that quantitative research would neither do, nor be able to attach sufficient meaning to. Secondly, I assumed that the selection of system actors who have worked for at least 6 months within the facility would assist in gathering honest and rich information about the experiences of the system actors with regards to AMR as at the time of data collection. The third assumption was that the sampling of at least 30 health care workers would lead to data saturation that enables emergence of themes.

Scope and Delimitations

The scope of this study was to explore the meaning of experiences of the system actors regarding the lack of the implementation process, best practices, and challenges from instituting AMR-coordinated prevention and control. The focal point of the interview was system actors who have worked for at least 6 months. These individuals were able to tell their stories regarding AMS. The aim of the study was also to advance recommendations and practical approaches that policy makers, health professionals, and facility managers could adopt to limit the spread of AMR at the primary, secondary, and

tertiary levels of health care. The findings of this study could also assist to define gaps

and areas of future research.

Limitations

A major limitation of this study is that qualitative research is often criticized as

being biased. This implies that the passion of the researcher for coordinated AMR control

may introduce bias and affect the scope of the study; however, the theoretical framework

adopted for the study helped regulate the scope of the inquiry. In addition, I limited my

expectations to actual experiences of the participants only.

Significance

AMR continues to threaten recent advances in modern medicine at the global and

national levels. With political endorsement of action by the United Nations General

Assembly to tackle AMR, national governments and nongovernmental organizations are

collaborating to build mechanisms for coordinated prevention and control of AMR.

Establishing a functional AMS program remains one of the potent strategies to tackle

antibiotic resistance (Howard et al., 2014). This will also aid in the achievement of the

United Nations sustainable development goals (SDGs) for 2030.

AMS is an established practice in high-income countries but with very little

uptake in the LMICs of Africa and Asia (Birnbaum, 2015; Dijck et al., 2018). The

findings from this study contribute to the body of knowledge needed to understand the

scope and how AMS system functions across various levels of care. Health authorities at

all levels can use the findings of this study too develop a framework for institutionalizing

antibiotic stewardship mechanism with the overall aim of promoting responsible use of antibiotics and, ultimately, slowing the development of AMR that might result from it.

Social Change Implications

AMR threatens the global health security as well as the global economy, wiping off billions of dollars from the global economy (Hutchinson, 2017; O'Neill, 2014). The World Bank (2017) posited that antimicrobials are a global "public good" that must be protected at all costs. Failure to protect this "public good" will undermine global economic growth, advance poverty and ultimately, prevent the achievement of the United Nations SDGs by 2030 (Jasovský et al., 2016; World Bank, 2017).

The loss of the effective power of antimicrobials has a pervasive and disproportionate influence on the poor, particularly in LMICs (Cox et al., 2017; Llor & Bjerrum, 2014a). Drug resistance prevents equitable access to effective, safe, quality-assured and affordable medicines that save lives (Bloom et al., 2017; Daulaire et al., 2015; Heyman et al., 2014; Pulcini et al., 2017; World Bank, 2017).

The results of this study may contribute to social change by creating awareness among the national government and health authorities on the security and economic approaches required to tackle AMR challenge. The results will highlight the critical responsibility of the government to protect the effectiveness of antimicrobials as a public good, which may lead to promulgation of new policies.

Therefore, the understanding of the factors promoting or affecting the institutionalization of AMR stewardship in selected health facilities will promote AMS, contributing to global health security and economic growth, thereby promoting the

progress towards the achievement of the SDGs; promoting universal and equitable access to effective, cheap, quality and live-saving antimicrobials amongst the poor, leading to reduction in avoidable health costs and ultimately, contributing to improvements in the quality of care (well-being) at the community and individual levels (Daulaire et al., 2015; Davey et al., 2013; Dijck et al., 2018; Jasovský et al., 2016; Schuts et al., 2016).

Summary

The widespread use and overuse of antimicrobials and the lack of coordinated policy and stewardship contributed immensely to the emergence and spread of AMR. AMR is a global problem but particularly affects LMICs more. Although antimicrobials are used in both human and animal health care sectors, this study focused on the risk of AMR in humans. The effective prevention and control interventions are multipronged and include AMS at all levels of human health care. This study will contribute to the body of knowledge through the understanding of the contextual factors promoting or limiting sustainable antimicrobial governance at the facility level.

The next chapter captures the literature search strategy, theoretical framework, and the literature review as it relates to the history, burden of AMR, AMS governance, and the principles guiding effective AMS programs.

Chapter 2: Literature Review

This study is designed to explore and understand the experiences of system actors on the functionality of AMS in selected health facilities in Nigeria using a conceptual framework that adapts the TPB. One of the potent strategies to tackle AMR is the establishment of functional AMS programs (Howard et al., 2014; Nathwani et al., 2012; WHO et al., 2017). Hence, understanding the contextual factors promoting or preventing sustainable AMS governance at the facility level is therefore crucial.

This chapter consists of 12 sections. The first section presents the literature search strategy utilized for the study. The second section analyzes the theoretical framework underlying the study. The third section describes the history of AMR, whereas the fourth section presents the burden of AMR as a major public health problem. In the fifth section, factors responsible for AMR are extensively discussed; the sixth section examines AMR interaction with SDG, whereas the seventh section discussed AMR and Governance. The next three sections focus on AMS, national drug policy and AMS and principles governing effective AMS program, respectively. The last two sections discuss AMR and AMS in Nigeria, respectively.

This study will contribute to the body of knowledge needed to understand the scope and dynamics of AMS system across various levels of care. The findings from this study will be useful in developing the much-needed framework for institutionalizing AMS mechanisms, with the overall aim of promoting responsible use of antimicrobials and potentially slowing the development of AMR.

Literature Search Strategy

For a comprehensive literature search, I searched both Google Scholar and PubMed (NCBI) engines using the following key terms: "antimicrobial resistance" or "antimicrobial stewardship" or "antimicrobial stewardship and universal health coverage" or "antimicrobial resistance and governance" or "antimicrobial stewardship and governance" or "antimicrobial resistance and sustainable development goals" or "appraisal of institutional antimicrobial stewardship."

In brief, the first step involved searching Google Scholar using the title of the paper, "Appraisal of Institutional Antimicrobial Stewardship in Selected Public Health Facilities in Nigeria," as key words. The next step involved running a search using key words, which were key components of the different subthemes for review as listed above on Google Scholar. These steps were repeated using PubMed as the search engine. Overall, over 50 articles were selected based on relevance to the identified themes and year of publication. Reference was made to more than 20 articles in the course of the review.

Theoretical Foundation

The TPB was used in this study by applying it to selected public health facilities with established AMS programs. The TPB evolved from the theory of reasoned action (Ajzen, 1985, 1991) to predict an individual's intention to engage in a behavior. The TPB posited that three conceptually independent determinants of intentions—attitudes towards the behavior, subjective norms, and perceived behavioral control—predict the intention to perform behaviors of different kinds (Ajzen, 1985, 1991).

The TPB explains human behavioral variability across situations and permits prediction of a specific behavior in a given situation. Attitude toward the behavior refers to the degree to which a person has a favorable or unfavorable appraisal of the behavior in question. The second antecedent is subjective norm, a social factor that refers to the perceived social pressure to perform or not to perform the behavior. The third predictor of intention is the degree of perceived behavioral control, which refers to people's perception of the ease or difficulty of performing the behavior of interest.

Central to the TPB is the individual's intentions to perform a given behavior (see Figure 1). The motivational factors that influence a behavior are captured by intentions. They demonstrate how hard people are willing to try, or how much of an effort they are planning to exert, in order to perform the behavior. As a rule, the stronger the intention to engage in a behavior, the more likely its performance should be. In addition, the more favorable the attitude and subjective norm with respect to the behavior, and the greater the perceived behavioral control, the stronger an individual's intention to perform the behavior under consideration should be. This will result in compliance with guidelines, rules, and regulations (Ajzen & Madden, 1986; T. J. Madden et al., 1992).

Figure 1

Theory of Planned Behavior
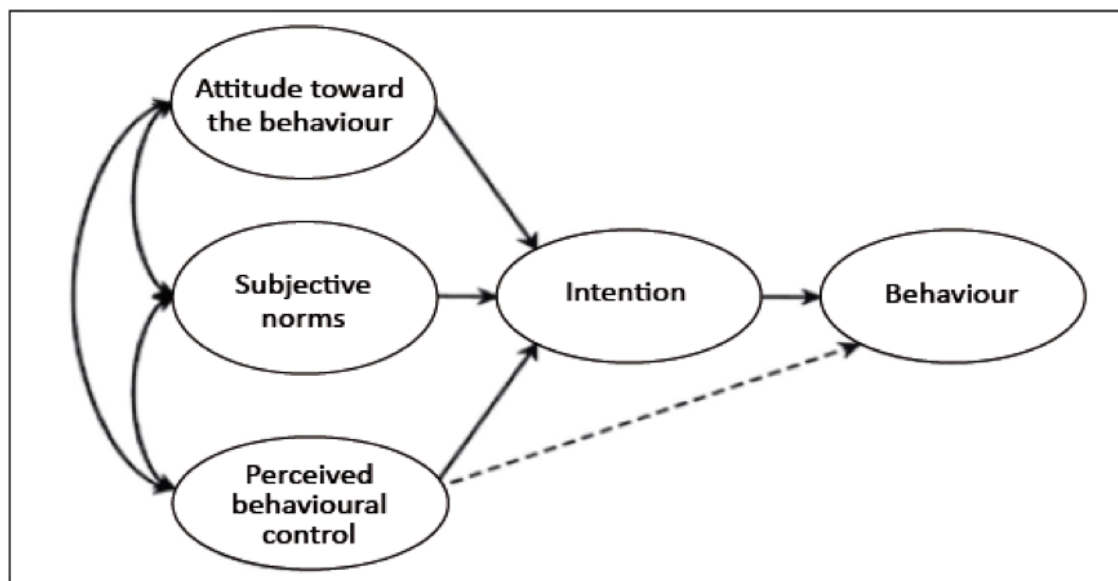
Note. From "The Theory of Planned Behavior," by I. Ajzen, 1991, *Organizational Behavior and Human Decision Processes*, *50*, pp. 179-211 (https://doi.org/10.1016/0749-5978(91)90020-T).

Antibiotic prescribing practice is presumed by the TPB to be influenced by behavioral intentions and the perceived behavioral control of the prescribers, with the former serving as a motivational factor and the latter reflects the ability of the prescribers to fulfill their intentions (see Figure 2). Attitudes, subjective norms and perceived behavioral controls are linked to each other, and they can influence the behavioral intentions of the prescribers (Ajzen, 1991). Attitude is defined as the degree to which a prescriber is in favor of the use of antimicrobials for patients (Walker et al., 2001). Possible questions to assess attitude towards the use of antimicrobials are the usefulness, appropriateness, responsiveness, harmfulness, and goodness of prescribing antimicrobials

for patients(Francis et al., 2004). Subjective norms measure the perceived social pressure to which a prescriber is subject in relation to antimicrobial prescriptions (Ajzen, 1991; T. J. Madden et al., 1992). Questions related to degree of pressure arising from patients, colleagues and the society can be used to assess subjective norms.

Figure 2

Application of Theory of Planned Behavior to Antimicrobial Stewardship (AMS)
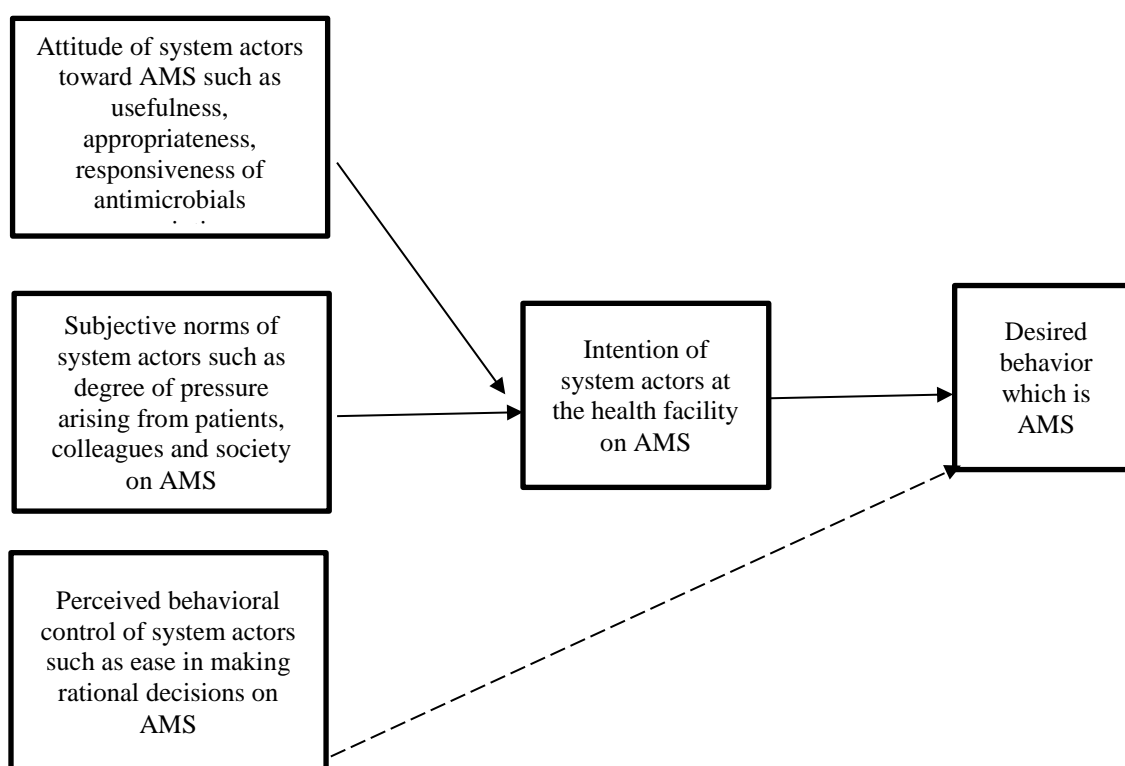
Perceived behavioral control measures how easy a prescriber feels in making a rational decision on antimicrobial prescriptions (Ajzen, 1991). Perceived behavioral control comprises self-efficacy, referring to the ability of a prescriber to prescribe antimicrobials appropriately, and controllability, referring to the extent to which a prescriber can decide whether or not to prescribe antimicrobials (Walker et al., 2001).

Behavioral intentions measure the degree to which a prescriber is willing to prescribe antimicrobials (Ajzen, 1991). Information on whether a prescriber wants, expects, and plans to prescribe antimicrobials and to reduce antimicrobial prescriptions can be used to assess behavioral intentions (Francis et al., 2004). Perceived behavioral control reflects the self-efficacy and controllability of physicians on prescribing behaviors (T. J. Madden et al., 1992). Environmental factors, such as preferred drug list, financial incentives, and patient demands, can also influence physician's controllability of antibiotic prescribing, resulting in different prescribing decisions as well (Lambert et al., 1997).

In a study to determine the antibiotic prescribing behaviors of primary care physicians in Hubei of China, Liu et al. (2019) applied the TPB among 503 prescribers within 65 primary care facilities and examined four behavioral aspects leading to antibiotic prescribing based on TPB, namely, attitudes, subjective norms, perceived control of behaviors and intentions. Results showed that the participants showing a more favorable attitude toward antibiotics had a higher intention to prescribe antibiotics and a lower intention to reduce antibiotic use. Those who perceived lower social pressure and higher control over prescribing behaviors reported a higher intention to reduce the use of antibiotics. However, such intention did not translate into prescribing practice although stronger perceived behavioral control was directly linked with lower antibiotic prescriptions. Weaker perceived behavioral control was evident in the participants who showed a less favorable attitude toward antibiotics. Attitudes, subjective norms, and perceived behavioral control in relation to antibiotic use were linked with intentions to

prescribe antibiotics; therefore, important determinants of antibiotic prescribing practice (Liu et al., 2019).

Literature Review

AMR is a global problem that is aggravated by the pervasive misuse of antimicrobials at the individual, health facility, and community levels (Klein et al., 2018). AMR disproportionately burdens individuals of low socioeconomic status who generally have poor access to effective and affordable medicines (Daulaire et al., 2015; Hogerzeil, 2011; Khanal et al., 2011; Tshefu et al., 2015; WHO et al., 2017). Other factors shown to have aggravated the burden of AMR in sub-Saharan Africa include the power and social interactions among professionals within the health facilities as well as the uncoordinated AMR response from poor governance and practices in formal institutions and beyond (A. Broom et al., 2014; J. K. Broom et al., 2017; Hou et al., 2014).

AMS, an intervention to optimize antibiotic use, has become a global tool recommended by the WHO within its Global Action Plan to contain antibiotic resistance (Dijck et al., 2018). It is an established practice in high-income countries but with very little or no uptake in LMICs in Africa and Asia. AMS is aimed at changing prescribers' behavior, which is normally influenced by social norms and beliefs as well as attitudes. A report of an internet survey conducted by the International Society for Chemotherapy, aimed at documenting efforts on hospital AMS suggested that there is a wide variation in the state of development and implementation of AMS all over the world (Howard et al., 2014). Several reports, however, have indicated that hospital AMS interventions have largely improved compliance to institutional antibiotic guidelines and patient outcomes

(Dijck et al., 2018). More importantly, core elements of successful hospital AMS programs including leadership commitment, accountability, expertise in antimicrobial medicines, training and education for behavior change are now available for adoption and implementation (Charani et al., 2013; Pulcini et al., 2019).

Many studies have established irrational use of antibiotics by clinicians at all levels of care, but there is a dearth of evidence on the challenges of establishing effective AMS programs in every health facility (Birnbaum, 2015). A recent systematic review of hospital AMS in LMICs contains data from only two countries from Africa: Kenya and South Africa (Dijck et al., 2018). None of the literature reviewed for this study elucidated the perspectives of the clinicians and the contextual factors promoting or limiting sustainable antibiotic governance across different levels of healthcare, the public facilities at the primary, secondary, and tertiary levels. Recommendation on the effectiveness of AMS in developing countries, including Nigeria, is therefore difficult to make. Establishing a functional antibiotic stewardship program remains one of the potent strategies to tackle AMR (Cox et al., 2017; Pulcini et al., 2019; Raji et al., 2013; West & Peterside, 2012; WHO, 2019).

History of AMR

The discovery of antibiotics saved many lives and contributed, over the years, to the improvement in health of the populations around the world (Reddy et al., 2015). In 1928, Alexander Fleming, a Scottish scientist working in St Mary's Hospital, London, discovered that mold from a Penicillium fungus had antibacterial properties. The antibiotic was named Penicillin and was first released for widespread use in the early

1940s. Since the period from 1950 to 1960, which is often regarded as the golden age of antibiotic discovery, a few new antibiotics introduced are modifications and adaptations to existing antibiotics, which have been in decline. No new classes of antibiotics have been developed since 1987 (Timeline taken from the World Economic Forum, Global Risk Report 2013).(WEF, 2013).

Resistance to antimicrobial agents was first identified in the 1940s. The first Methicillin-Resistant Staphylococcus Aureus bacterium was identified in 1962, only 2 years after methicillin was introduced. Penicillin resistance was identified even before its release for extensive use, and gentamycin-resistant enterococcus was identified in 1979 after 12 years of its use (CDC, 2013). The misuse of antibiotics is a major cause of antibiotic resistance, which has become a growing concern of public health importance. Antibiotic-resistant micro-organisms can spread to and negatively impact the health of people who are not exposed to them, as well as the healthcare workers, veterinary, and agriculture industries, making it one of the world's most urgent public health problem(CDC, 2013). More than two million people are infected with antibiotic-resistant organisms resulting in approximately 23,000 deaths annually (CDC, 2013). Of particular interest is the rapid global spread of multiresistant bacteria, for some of which there is no available treatment.

Currently, diminishing antimicrobial effectiveness pose an intimidating peril to human and animal health, and therefore to overall global development. Deaths from drug-resistant infections are projected to increase from currently 700,000 to 10 million annually, and cost estimates are as high as US$100 trillion worldwide by 2050 (O'Neill,

2014). The prospect of the world entering a "post-antibiotic era," in which common infections and minor injuries can no longer be cured, is therefore a real possibility for the 21st century (WHO, 2014).

During a survey to analyze the trends and drivers of antibiotic consumption globally, antibiotic use in 76 countries over 16 years from 2000 to 2015 was examined. National sample surveys of antibiotic sales were used to estimate the total volume of sales of each antibiotic. Antibiotic consumption for each country was reported monthly or quarterly and broken down between the retail and hospital sectors. During the 16-year period of the survey, antibiotic consumption, expressed in defined daily doses (DDD), increased by 65% (21.1–34.8 billion DDDs), and the antibiotic consumption rate increased by 39% (11.3–15.7 DDDs per 1,000 inhabitants per day). The mean antibiotic consumption rate across countries increased by 28% from 16.4 (SD 9.9) DDDs per 1,000 inhabitants per day to 20.9 (SD 9.8), and there was 25% increase in median antibiotic consumption rate. The study therefore showed statistically significant evidence linking high antibiotic consumption with the growth of AMR globally (Klein et al., 2018).

AMR as a Major Public Health Concern

AMR has increasingly emerged as a major public health concern, with the evolution in antibiotic development unable to keep up with the increasing rate of antibiotic-resistant microorganisms. This emerging trend has serious implications for infection management worldwide, given the important role of antibiotics in infectious disease control (Barlam et al., 2016). Indeed, this trend is associated with increasing morbidity and mortality in consideration of the decreased susceptibility to common first-

line antibiotic regimen, as well as the necessary switch to alternative antibiotics, which could be associated with deleterious effects (Charani et al., 2010). These alternative antimicrobial agents are also more expensive and coupled with the increased length of hospital stay associated with AMR contribute to rising costs of health care service delivery. In this light, AMR constitutes a great challenge to universal health coverage (Bloom et al., 2017; Jasovský et al., 2016).

Inappropriate use of antibiotics remains the single most important factor contributing to AMR including wrong selection, dosing, and use. Nearly 50% of outpatient prescriptions are inappropriate worldwide, and at least 30% of the outpatient prescriptions in the United States are not necessary (Charani et al., 2010).

AMR has considerable human and economic cost. Research estimating the impact of AMR and its impact on economic growth projected a loss of up to 100 trillion U.S. dollars by 2050 if resistance is left unchecked (O'Neill, 2014). In addition, the loss in global output would increase through time, so by 2050, the global GDP will decrease annually between 2% and 3.5%; and 10 million more people would be expected to die every year than would be the case if resistance was kept to today's level (O'Neill, 2014). The overall effects of AMR have necessitated collective action to improve accessibility to antimicrobial agents whilst maintaining equity and effectiveness (Jasovský et al., 2016)

Factors Responsible for AMR

The development of AMR is directly linked to usage (Llor & Bjerrum, 2014; Ventola, 2015), as appropriate use of antibiotics prevents the occurrence of antibiotic resistance (Sanchez et al., 2016). Antimicrobial misuse limits available treatment options

and therefore increases the difficulty in effective treatment of infections caused by resistant strains. Antibiotic misuse involves cases of overprescription and misprescription, in terms of choice of antibiotics, duration, dosage and indication for therapy (Charani et al., 2010; Newton et al., 2014).

According to Charani et al (2013) certain factors are responsible for antimicrobial misuse. These include the use of poorly designed decision systems such as outdated treatment guidelines and incorrect drug charts. Added to this is lack of understanding of the core principles of pharmacology and microbiology, and failure to fully appreciate the harmful effects of indiscriminate use of antibiotics. In many cases, junior doctors, often without supervision, write prescriptions; also, in most cases, the patients are hardly referred to specialist medical microbiologists except when complications ensue.

Generally, antibiotics are prescribed by all doctors, which affect the quality of prescriptions, resulting in greater use of broad-spectrum agents, and a longer duration of treatment than necessary. Prescribing etiquette and multidisciplinary management of patients have also been identified as determinants (Charani et al., 2010). Another significant factor worthy of note is the availability of antimicrobial agents as over the counter drugs, as opposed to prescription only drugs (Morgan et al., 2011; Zaman et al., 2017). Generally, a proper understanding of these factors is vital in inculcating the habit of responsible antibiotic use among all healthcare professionals.

Broom et al. (2014) used the Bourdieusian theory of practice to demonstrate that doctors' suboptimal prescribing is a logical choice within the context of the social world of the hospital. The primary concern of the Bourdieusian theory is the dynamics of power

in the society, especially the diverse and subtle ways in which power is transferred and social order maintained within the social world. It is a social theory which understands the 'society' as the ensemble of social relationships. The article recommended that awareness of the context of the hospital and the logics underpinning the practice is essential to addressing the antibiotic stewardship.

Broom et al. (2017) also studied clinical and social barriers to AMS in pulmonary medicine and identified mistrust in clinical guidelines and diagnostic challenges as clinical barriers, while and fear and hierarchy were classified as social barriers. The study further explored the perspectives of thirty (30) health professionals (pulmonary clinicians and nurses) on antibiotic use in hospital pulmonary infections. The study participants perceived mistrust and limited diagnostic capacity as contributors to excess antibiotic use. The interpretation of ambiguous results was reported to have engendered under- or over-prescribing depending on the perspective of the treating team. These findings underline the relevance of making concerted efforts to systematically understand as well as develop and implement interventions to address specific clinical issues for effective and sustainable change in antibiotic use to be attained.

AMR and the United Nations' SDGs

AMR is a major global challenge, as the diminishing efficacy of antibiotic therapy poses a major threat to the health of both human and animal populations. The idea that there would be a time when common bacterial infections would have no cure is certainly not beyond the realms of possibility. In response to this threat, the WHO provided guidance on control measures as far back as 2001, but his failed to achieve its targets due

to incoherent policies, inadequate financing and manpower for proper implementation (Wallinga et al., 2015). However, the issue has recently gained international prominence as the health and financial consequences are quite glaring.

In 2015, the 68th World Health Assembly in Geneva recognized the health and economic consequences of AMR, particularly the dearth on new antimicrobials in the development pipeline and invited Member States to adopt, adapt and mobilize resources to implement proposed actions in the Global Action Plan on AMR (WHO, 2015).

The United Nations General Assembly, in 2015 adopted the 17 Global Goals known as the *sustainable development goals*. The resolution entitled *Transforming our World: The 2030 Agenda for Sustainable Development* aims to create a better world by 2030.(United Nations, 2015). Though AMR response was not part of the SDGs, it was, indeed, acknowledged that AMR has implications on the achievement of several SDGs.

SDG 1: End Poverty in All its Forms Everywhere

From an international development perspective, drug resistance affects mostly the poor who are at increased risk of exposure to these diseases and cannot access quality healthcare services since many pay out-of-pocket. As a result, there is a negative impact on national economic performance, which could ultimately contribute to slowing down progress towards SDG 1.

SDG 2: End Hunger, Achieve Food Security and Improved Nutrition, and Promote Sustainable Agriculture

Increased demand for animal protein has rapidly expanded intensive production systems. According to the FDA (2011) about 80% of all antimicrobials produced in the

United States were ordered for use in the agriculture sector. This needs to be resolved in order to meet the indicators of SDG 2, pertaining to implementing sustainable food production systems and resilient agricultural practices.

SDG 3: Ensure Healthy Lives and Promote Well-Being for All at All Ages

It would be impossible to achieve most of the specific targets of SDG 3 without the availability of effective antibiotics, given their role in treatment of maternal and child infections that are principal causes of morbidity and mortality. There is also a need to pay attention to developing resistance to treatments for HIV, tuberculosis (TB) (multidrug and extended drug resistance), and malaria, which could pose a major challenge to the achievement of SDG target 3. In fact, drug-resistant pathogens could reverse the recent positive trend of falling global mortality rates from infectious diseases, which have decreased from 23% to 17% of total deaths over the last 15 years. A clear example is the threat to safe surgical interventions, cancer treatment, and organ transplants, where access to effective antibiotics is essential.

AMR also has serious implications on universal health coverage, as resistance promotes increasing healthcare costs impacting the health system negatively, especially in low and middle-income countries. No health system will be sustainable without effective antibiotics, hence the need to look at antibiotic resistance from a health system's perspective.

SDG 6: Ensure Availability and Sustainable Management of Water and Sanitation for All

Hospitals, antibiotic manufacturing plants, and agriculture generate waste products that contribute to increased amounts of antibiotic residues and resistant bacteria in aquatic ecosystems.

SDG 8: Promote Sustained, Inclusive, and Sustainable Economic Growth, Full and Productive Employment, and Decent Work for All

Resistance to antimicrobial agents has increased morbidity and mortality, adding extra financial burden to government as well as lowering productivity, household income, and tax revenues, thus reducing GDP. Such economic burden may undermine efforts for sustainable economic growth as emphasized in SDG 8.

SDG 12: Ensure Sustainable Consumption and Production Patterns

Antibiotics need to be viewed as a scarce and potentially nonrenewable global resource.

SDG 17: Strengthen the Means of Implementation and Revitalize the Global Partnership for Sustainable Development

Global sustainability efforts require partnerships between governments, civil society, and the private sector as called for in the final SDG 17. Conceiving AMR as a sustainability issue needs policy guidance at all policy levels, from global to the local (Jasovský et al., 2016).

AMR and Governance

Governance system is a framework that defines the processes, roles, by which an organization or society makes decisions and determines participation (Graham, Amos & Plumptre, 2003). Despite the recognition of AMR as a global threat, this problem continues to grow over the years unabated (Martin, 2006; Wallinga et al., 2015). Wallinga et al. (2015) suggested that poor governance at the global and national levels contributed to AMR policy failure and proposed socio-ecological and bio-ecological approaches to address policy failure across all levels. The paper suggested that effective policy change requires effective governance (Wallinga et al., 2015).

In a similar study, Collington, et al. (2015) supported the hypothesis that poor governance and corruption contribute to irresponsible use of antimicrobials. The authors found that a higher level of corruption is associated with higher levels of antibiotic resistance. Collington and colleagues proposed that improvement in governance and control of corruption at all levels of care can be an important factor in reversing high levels of antibiotic resistance. The team therefore concluded that more appropriate prescribing pattern and better AMS were likely to result in lower levels of antibiotic resistance (Collignon et al., 2015).

Effective AMR response requires that the adopted governance framework aligns with the national health system of the country. Birgand et al. (2018) identified two main governance approaches: top-down power approach (through hierarchy) and the network governance approach which has the concept of democratization and collaboration as an emergent governance model. Birgand et al. suggested that the complexities of the AMR

response including the extensive involvement of variety of stakeholders require a network approach. In this multi-stakeholder approach, the central government or organization takes a less directive and more guiding role, maintains a balance between regulation and persuasion and support the stakeholders to achieve a shared organizational goal (Birgand et al., 2018). Effective governance may be a single most important action that can promote rational use of antimicrobials, thus contributing to AMR prevention and control.

AMS

With the growing development of AMR, judicious use of antibiotics in health-care setting is an important public health issue. In 2014, the CDC recommended that all acute care hospitals implement antibiotic stewardship programs. The goal was to ensure that each infected patient receives the proper dose of the most appropriate cost-effective antimicrobial for an accurate period, thereby minimizing the likelihood of AMR and other possible adverse effects (CDC, 2013; Pollack et al., 2016). This need was recognized in the National Action Plan for Combating Antibiotic-Resistant Bacteria issued by the White House in March 2015 (Barlam et al., 2016). The CDC highlighted the need to improve antibiotic use as a key strategy required to address the problem of antibiotic resistance in the U.S.

AMS can be described as a multidimensional approach to ensure optimization of antibiotic prescription by tailoring prescription of the most suitable antimicrobial agent to individual patients and clinical presentations. Boucher et al (2011) defined AMS as "the optimal selection, dosage, and duration of antimicrobial treatment that results in the best

clinical outcome for the treatment or prevention of infection, with minimal toxicity to the patient and minimal impact on subsequent resistance" (Boucher et al., 2011). AMS is the umbrella term used to define comprehensive quality improvement activities that together represent a cohesive program aiming to optimize the use of antimicrobials, improve patient outcomes, reduce the spread and development of AMR, and reduce the incidence of healthcare acquired infections (Davey et al., 2013).

The increasing emergence of multi-drug resistance in the context of managing both hospital and community acquired infections, especially in the background of diminishing availability of new treatment options, has raised the profile of stewardship programs within healthcare organizations to facilitate more responsible antimicrobial use and control of infections (Charani et al., 2010). Currently, hospital based AMS programs have been instituted in many countries to help clinicians optimize treatment of infections with the aim of reducing AMR and other adverse effects of antibiotics misuse (Elligsen, Walker, Simor & Daneman 2016). In addition, the adoption of best practice requires a conducive environment that makes prudent antibiotic prescribing the path of least resistance.

Hou et al., (2014) evaluated the short-term effect of antibiotic stewardship strategies including formulary restriction, preauthorization, perioperative quinolone restriction, and control of total antibiotic consumption in the Intensive Care Unit at a tertiary hospital in China. The total antibiotic consumption in the ICU significantly decreased after the implementation of AMS. There was a reduction in the DDDs per 100 patient-days from 197.65 to 143.41. Moreover, the initial use of no antibiotics or of a

single antibiotic significantly increased ($p < .001$) and the use of two antibiotics in combination significantly decreased ($p < .001$). These results showed that implementation of AMS in a short period in the ICU dramatically reduced antibiotic consumption and significantly improved antibiotic resistance, which led to more reasonable antibiotic selections by ICU physicians. (Hou et al., 2014).

The National Drug Policy and AMS

The increasingly global problem of AMR can be resolved or minimized by enacting regulation, legal framework, and reinforcement. Although most high income countries (HICs) have reinforced their regulation of antibiotics mainly through "prescription-only status", this is not the case in low and middle income countries (Plumet, 2018). In addition, regulatory enforcement of AMS is a problem in both high income countries (HIC) and LMICs.

Boevi et al. (2018) studied the legal framework of AMS in 24 European Countries, Turkey, and Israel. The study established the legal framework in most countries as heterogenous and weak, and recommended that more regulations are necessary at all levels to tackle AMR. Instituting appropriate legal framework would promote strategies ensuring prudent and responsible antimicrobial use (Beović et al., 2018).

In Nigeria, the National Drug Policy (NDP) was first launched in 1990 and revised in 2003. The Federal Ministry of Health in collaboration with the WHO published the most recent edition in 2005. The goals of this policy are "to make available at all times to the Nigerian populace adequate supplies of drugs that are effective, affordable,

safe and of good quality; to ensure the rational use of such drugs; and to stimulate

increased local production of essential drugs (Federal Ministry of Health, 2005).

The strategies for implementing the NDP emphasize rational drug use which

requires that the right drugs be used for the right indications in the right dose and dosage

form for the right duration. Hence, the rational drug use aims to eliminate the problems of

under- and over-prescription, inappropriate prescription, and the use of new, expensive

drugs when equally effective, well tried, safe and cheaper alternatives are available. To

achieve this, the NDP posited that health personnel involved in the diagnosis, prescription

and dispensing of drugs, as well as consumers, should receive adequate theoretical and

practical training in rational drug use; and that up-to-date Standard Treatment Guidelines

and a National Formulary be made available to all prescribers at all levels of care.

Another strategy of the National Drug Policy is to enforce its goals by the

strengthening of administration, legislation, and regulatory controls relating to drug

prescription, dispensing and consumption. Similarly, AMS also emphasizes the principle

of rational drug use as stipulated by the National Drug Policy. To achieve optimal

antimicrobial therapy, the right dosage of the right antimicrobial directed to the right

pathogen should be administered for a right duration of therapy.

Against this background, the National Drug Policy controls the use of all drugs in

Nigeria, though there is no specific reference to antimicrobial regulation. It is expected

that if its strategies are implemented, there should be an overall improvement in the use

of antimicrobial agents with a resultant reduction in the development of AMR.

Principles Governing Implementation of Effective AMS Programs

The CDC (2013) recognizing the global threat of AMR and the consequences of inaction on population health and the economy, called on health care providers in the United States to institute AMS within their facilities. This pioneering step was enhanced with the publication and release of the "Core Elements of Hospital Antibiotic Stewardship Programs" that guided facilities to institute AMS. These core elements were subsequently updated in 2015 and 2019. In 2019, the CDC reported that considerable progress was made by hospitals in establishing the AMS in the United States since 2014. The proportion of acute care hospitals that reported having all the seven core elements of AMS in place increased from 41% in 2014 to 85% in 2018 (CDC, 2019).

Recognizing that AMS helps to control AMR, most countries, particularly in sub-Saharan Africa are instituting mechanisms meant to contribute to the optimization of the use of antimicrobials (Baur et al., 2017; Cox et al., 2017; WHO, 2019). Specific guidelines and recommendations are therefore important to provide step-by-step actions towards implementation of AMS programs at the national and facility levels (Storey, Pate, Nguyen & Chang, 2012). Based on the experiences of stakeholders in establishing AMS around the globe, the WHO (2019) recommended six health-care facility core elements (see Figure 3) for implementing AMS programs in resource-limited settings.

The health-facility core elements for implementing AMS include hospital leadership commitment that recognizes AMS as a priority and has dedicated necessary human and financial resources to AMS, accountability and responsibility measures that put in place a multidisciplinary team with the appointment of a focal point for AMS

activities, AMS actions that include the use of up-to-date standard treatment guidelines

amongst other activities and regular audit of specified antibiotic therapy or clinical

conditions.

Other health-care facility core elements are education and training of healthcare

workers and patients about optimal use of antibiotics and adverse drug reactions as well

as resistance; monitoring and evaluation highlighting the appropriateness of antibiotic

use, the trends of antibiotic susceptibility and resistance rates for a range of high priority

pathogens. The sixth health-care facility core element is the reporting and feedback on

antibiotic use and resistance pattern to health workers and facility managers.

Figure 3

Health-Care Facility Core Elements for Antimicrobial Stewardship Programs (World Health Organization, 2019)

Effective AMS programs must be individualized and tailored to local requirements, pattern of prescriber behavior, and available resources (Barlam et al., 2016; CDC, 2019; WHO, 2019). The influence of every category of healthcare provider on antibiotic prescription is also a key consideration in the design of an effective and sustainable model. As such, all categories of healthcare providers should be actively involved in the decision-making process (Charani et al., 2010).

Dedicated material and human resources are required in achieving an effective AMS program. If properly implemented, the program should ultimately be self-sustaining through savings in both the direct cost of antibiotics and other indirect costs (Luyt, 2016).

Using scientific evidence as the basis of AMS program implementation increases its credibility and encourages adoption. However, this would require overcoming the challenge of insufficient implementation research evaluating the impact of organizational culture, prescriber behavior as well as efficacy of these programs. Evidence-based approach is crucial in developing the best implementation model for effective stewardship programs (Barlam et al., 2016).

The Nigeria Situation: AMR in Nigeria

Misuse of antimicrobials constitutes a huge problem in developing countries posing serious threat to the health of the populace. Nigeria, like many developing countries is faced with the challenges associated with AMR. AMR is particularly worrisome in Nigeria where it cuts across all levels of the society (Adefehinti et al., 2012; Anyanwu & Arigbe-Osula, 2012; Bernabé et al., 2017; NCDC, 2017; Raji et al., 2013). Drug misuse extends to the agricultural sector where antimicrobials are liberally used therapeutically and for growth promotion (Oloso et al., 2018). These problems of drug use can exacerbate AMR and infectious disease management. In July 2018, as part of the mandate of NAFDAC in safeguarding the health of Nigerians, the regulator warned about the threat of AMR in both humans and animals. It is important to note that antimicrobial use and misuse is driven by patients, farmers and the general populace who demand

antimicrobials for real or presumed infections and procure them from unsanctioned sources even when they are not prescribed (Oloso et al., 2019).

According to Nigeria's legislation, antimicrobials should only be dispensed with prescription. There is little or no monitoring system of prescription; hence, only prescribed medicines are sold over the counter by pharmacies and patent medicine vendors. A combination of other factors ranging from a shortage of licensed prescribers and medicines in some areas, to proliferation of under-regulated patent medicine vendors and hawkers in others, means that Nigeria suffers severe access problems whilst simultaneously facing a crisis of irrational drug use. Unrestricted access, poor prescription pattern, overuse and misuse contribute to high consumption that drives the emergence and growth of AMR (Babatola et al., 2021; Erhun 2001).

Several studies in Nigeria have consistently shown that antibiotic misuse is pervasive in hospital and community settings (Lamikanra et al., 2011; Umeokonkwo, et al., 2019). This is partly responsible for the high prevalence of multidrug resistance in community and hospital acquired infections in Nigeria. A study to explore the level of antibiotic misuse, knowledge of antibiotics and disposal system for leftover antibiotics among four hundred non-medical undergraduate students at a Nigerian University revealed that 68% of the respondents obtained their antibiotics through doctor's prescriptions. However, gross antibiotic misuse was shown with majority, (about 75%) either keeping leftover antibiotics for future use or throwing it away with refuse. Seventy two percent of respondents sometimes forgot to take the antibiotics. Major reasons for non-adherence included financial constraints (73; 18.3%), long duration of treatment (70;

17.5%), side effects experienced (60;15.0%), polypharmacy (56;14.0%), tablet size (45;11.3%), and perceived low level of confidence in the prescriber (11; 2.8%) (Sanya et al., 2013).

In a similar study, pattern of antibiotic usage by the 3,435 participants from the general adult population in the city of Benin was assessed in a cross–sectional study. The 3435 respondents were made up of 743 (21.6%) housewives, 467 (13.6%) taxi drivers, 892 (26.0%) students, 288 (8.4%) teachers, 85 (2.5%) lawyers, 741 (21.5%) traders and 219 (6.4%) others. Results showed that 43.1% and 56.9% of the populace took full and incomplete regimens, respectively. It was also found that lawyers, teachers and students took antibiotics without prescription even for unspecified ailments, which contradicts the WHO guidelines on the usage of antibiotics (Clarence et al., 2008). This finding in Benin City can be extrapolated to Nigeria in general because Benin City is a multi-religious, multi-ethnic city in Nigeria.

In 2015, Eshiet and Effiong (2015) investigated the use of antibiotics in a tertiary health care facility in Uyo, Southern-Nigeria. A cross sectional assessment of the pattern of use of antibiotics was conducted among 511 randomly selected cohorts. Results showed that relevant laboratory investigations were requested in only 96 (18.8%) of the 511 cohorts. It was noted that antibiotics were largely misused and prescribed for patients with conditions such as malaria, diabetes mellitus and hypertension without a documented indication for antibiotic use (Eshiet & Effiong, 2015).

Anyanwu and Arigbe-Osula assessed the prescribing pattern of antibiotic use in the treatment of prevalent pediatric diseases at Federal Medical Centre Owerri. A

retrospective study covering January 2002 to December 2006 was done by reviewing the medical records of 5,968 pediatric inpatients aged 0-12 years. The most common disease in this hospital was malaria followed by bronchopneumonia Out of the 5968 children clinically diagnosed with these diseases and treated with antibiotics, specimens were taken for culture in only 1648 cases (33%) to identify pathogenic organisms. This revealed again significant irrational antibiotic use in hospital setting in Nigeria (Anyanwu & Arigbe-Osula, 2012).

In 2018, Oloso et al. reviewed AMR in food animals and the environment in Nigeria in response to the call by the Nigeria Centre for Disease Control to review the burden of AMR in Nigeria using a "One Health Approach". Systematic Reviews and Meta-Analyses of previous studies (2000-2016) to evaluate the contributions of food animals and the environment to the AMR burden in Nigeria. Three areas were focused on: AMR, residues, and antiseptics studies. Out of the forty-eight antimicrobial studies, only one did not report multidrug resistance. At least eighteen bacterial species were found to be resistant to various locally available antimicrobials. All sixteen residue studies reported high levels of drug residues either in the form of prevalence or concentration above the recommended international limit. Fourteen different resistant types were found in some commonly used antiseptics. In food animals meant for the human food chain, high levels of residues and AMR were found. It was therefore concluded that high levels of residues and antimicrobials discharged into environments sustain the AMR pool (Oloso et al., 2018).

In Nigeria, there has been an increase in AMR infections in pneumonia, urinary tract infections, meningitis and tuberculosis amongst others (Nigeria Centre for Disease Control, 2017). These infections constitute a public health burden to the Nigeria population necessitating urgent attention. This problem of AMR affects, mostly, the poor because the high cost of novel antimicrobials prevent equitable access to effective, safe, quality-assured and affordable medicines that save lives (Daulaire et al., 2015; Hogerzeil, 2011).

AMS in Nigeria

AMS is an established practice in high-income countries, but with very little uptake in the low-and middle-income countries of Africa and Asia. This was evidenced by a systematic review of hospital AMS in LMICs. Only Kenya and South Africa in sub-Saharan Africa met the inclusion criteria, an indication that AMS has not been institutionalized in most of Africa, Nigeria inclusive (Dijck & Arnoldine, 2018)). Approaches to reducing AMR include instituting AMS programs in hospitals. In 2018, Fadare et al. studied the status of AMS Programs in Nigeria tertiary healthcare facilities using seventeen out of 25 tertiary health care facilities across five out of the six geo-political regions in Nigeria. Results revealed that only six (35.3%) had a formal organizational structure and a team responsible for AMS. Treatment guidelines based on local AMR patterns in the facilities were available in only four (23.5%) facilities, policies on approval for prescribing specified antimicrobial agents and formal procedures for reviewing their appropriateness after 48 hours was present in only two (11.8%) facilities. The cumulative antimicrobial susceptibility report for the previous year was available in

only three (17.6% facilities) and only one facility routinely monitored antimicrobial use (Fadare et al., 2019).

A major contributory factor to non-implementation of AMS in the hospital setting is poor prescription and adherence to guidelines among clinicians and prescribers. In a cross-sectional study to determine the knowledge, belief and practice of interventions to contain AMR among physicians in Sokoto, North-West Nigeria, one hundred and five (105) physicians were sampled from the population of 400 physicians working across the State. Eligible participants for the study were selected using a multistage sampling technique. Using self-administered questionnaire relevant data was obtained from the respondents and results showed that about 57.1% of the participants lack the up-to-date information on AMR. Majority of the participants (81.9%) had no training on AMR. About two-third (67.6%) use results of anti-microbial sensitivity test (AST) test to guide patient's antimicrobial treatment and 69.5% of the respondents were aware of general interventions to contain AMR. Similarly, about seventy-three percent of the respondents were not aware of the WHO global strategy for the containment of AMR. Majority of participants agreed or strongly agreed AMR as worldwide and national problem, but few considered AMR as problem in their own hospitals (Ahmad et al., 2015).

Summary

In summary, both historical and contemporary evidence in the current review suggests that AMR remains a serious threat to global health, particularly in developing countries including Nigeria. The factors contributing to the persistence and re-emergence of AMR are diverse and, in recent times, context-specific; for example, local belief

systems driving AMR in one area could be invalid in another area, and vice-versa. The

current evidence also underlines the importance of adopting effective measures in

tackling AMR towards realizing key SDGs in developing settings. Nonetheless, the

available evidence on AMR situation and, indeed, the drivers is scant and lacks depth

given the reliance on quantitative methodology. To this end, the current study seeks to fill

the gap and make a significant contribution to mitigating the growing AMR burden in

Nigeria. Moreover, findings from the proposed study will contribute to the body of

knowledge needed to understand the scope and how an AMS system functions across

various levels of care. The findings will also be useful in developing the much-needed

framework for institutionalizing AMS mechanisms, with the overall aim of promoting

responsible use of antimicrobials and potentially slowing the development of AMR.

Chapter 3: Research Method

Qualitative researchers attempt to "understand individuals, groups, and phenomena in their natural settings in ways that are contextualized and reflect the meaning" (Ravitch et al., 2016). The qualitative case study is preferred, particularly at the initial stages of examining a phenomenon and when an in-depth knowledge of the phenomenon is required to understand the different factors and how they interact with each other (Burkholder et al., 2016). Knowledge is, therefore, a product of contextual, historical, or subjective circumstances (Burkholder et al., 2016).

This chapter describes the overall structure of the study, highlighting the research design and rationale as well as my role as the researcher. The identification and selection of participants is presented in the section on sampling logic. Other sections describe the essential steps in collecting and analyzing data for the research. Issues of trustworthiness, and ethical implications associated with this study are also addressed in this chapter.

Research Design and Rationale

The inquiry questions were derived from the purpose of the study. To answer these questions, the qualitative case study approach was adopted.

Research Design

The scope of the study included the evaluation of system actors' perceived experiences of how AMS functions at the various levels of health care. Participants included managers of facilities and individual health care workers who are engaged in antibiotic prescription. Thus, the results of the study generated credible data apposite to

the creation of enabling individual and environmental factors that may influence

responsible use of antimicrobials.

The three research questions generated from the problem statement and purpose

of this study are listed below:

1. What are the experiences of system actors' attitudes, subjective norms and

    perceived behavioral control on system processes for AMS in selected public

    health facilities in Nigeria?

2. What are the experiences of system actors' attitudes, subjective norms and

    perceived behavioral control on the scope and functionality of AMS system in

    selected public health facilities in Nigeria?

3. What are the experiences of system actors' attitudes, subjective norms and

    perceived behavioral control on factors that hinder or promote AMS in

    selected public health facilities in Nigeria?

Rationale

This qualitative case study employed in-depth interviews of system actors

regarding AMS, its challenges as well as recommendations for improvement at selected

tertiary, secondary and primary health facilities in selected states in Nigeria. This

approach is widely accepted to improve the understanding of experiences of individuals

(Creswell, 2013). It is interpretive, acknowledging the perspectives of the study

participants on AMS. The qualitative approach was considered the most appropriate

means by which the objectives of this study could be explored given its ability to describe

and explain phenomena in a manner that quantitative research would neither do, nor be

able to attach sufficient meaning to (Ritchie, 2003). The qualitative narrative approach

was used in studying the perceptions of system actors towards AMS. Allowing system

actors to tell their stories in the course of their experiences with the use of in-depth

interview guidelines assisted to gather rich information about the experiences of the

system actors with regards to AMS.

Role of the Researcher

As the researcher, I personally collected of data for the research. Qualitative

research often involves observing, interviewing, and examining documents and audio-

visual materials (Patton, 2015). However, as at the time of data collection certain

nonpharmaceutical interventions such as wearing of face masks, observation of safe

distancing, lockdowns, and restriction of movement were in place due to the COVID

pandemic; hence, I conducted telephone interviews with the selected participants using an

in-depth interview guide. All interviews were audio-recorded. Major points and issues

raised by the participants were written down in a notebook.

In view of a possible interference of my prior knowledge with the objectivity of

my presentation of findings, I employed *bracketing*, the process in which a researcher

attempts to subjugate their personal experiences and concentrates on the phenomenon

being studied was employed (Creswell, 2013). To deal with this, adherence to the

questions and prompts in the in-depth interview guidelines during data collection was

ensured.

Methodology

The purpose of this study was to explore the perceptions of system actors in public health facilities about AMS and to improve the understanding of the practice of AMS at the three-tiered levels of health care. To address the gap, the study focused on the experiences of system actors at selected public tertiary, secondary and primary health facilities in selected states in Nigeria. By understanding the scope, functionality, and factors hindering effective AMS, the research can make practical contribution to the development of policy and operational guidelines that will promote rational use of antimicrobials.

Participant Selection Logic

The study was carried out in Nigeria, a federal republic in West Africa. Nigeria has a land mass of 910,770 km^2 with an estimated population of 208 million. It is bounded by Niger in the north, Chad in the northeast, Cameroon in the southeast, and Benin in the west, while its coast in the south is located on the Gulf of Guinea in the Atlantic Ocean. Nigeria is made up of 36 states and the Federal Capital Territory. Administratively, the states are further subdivided into local government areas (LGAs), with a total of 774 LGAs in Nigeria. Nigeria is aggregated into six geopolitical zones: North-West, North-East, North-Central, South-East, South-South, and South-West. The six geopolitical zones can be categorized into two major regions: North and South.

The federation has three tiers of government namely: federal, state, and local, and responsibility for health service provision in the public sector is based on these three tiers. The levels of care in the public sector are primary, secondary, and tertiary. The

primary level is financed and managed by the local government, the secondary by the state, and the tertiary by the federal government. Primary health care (PHC) facilities exist at all the LGAs, they form the entry point of the community into the health care system. PHC facilities provide preventive, curative, promotive and pre-referral care to the population. PHC facilities are typically staffed by nurses, community health workers, community health extension workers (CHEWs), junior CHEWs, and environmental health officers. They are headed technically and administratively by the PHC coordinator or a Medical Officer of Health, where one exists. The PHC coordinator is assisted by program officers and unit heads.

The secondary health facilities, referred to as general hospitals, provide medical and laboratory services, as well as specialized health services such as surgery, pediatrics, obstetrics, and gynecology to patients that are referred from the PHC level. Medical officers, nurses, midwives, pharmacists, laboratory specialists, and community health officers are the typical staff at secondary health facilities. They are headed by medical directors.

The tertiary health facilities form the highest level of health care in Nigeria and include specialist and teaching hospitals, as well as federal medical centers. These health facilities treat patients referred from the primary and secondary health facilities. The tertiary health facilities have expertise and technological capacity that enable them to serve as resource centers for knowledge generation and diffusion. Each state has at least one tertiary health facility headed by chief medical directors.

The study was conducted in two Nigerian states (see Figure 4). One state each was selected from the North and South regions of Nigeria by simple random sampling using balloting. Health care workers in selected public health care facilities in Nigeria who occupy strategic level of management and who are system actors in an AMS program constituted the participant population for this study. With regards to the data collection, purposive sampling was used within the selected public health care facilities at all levels of health care. Purposive sampling is usually informed by the type of participants, the study site, and the required sample size (Creswell, 2013). When properly used, the purposive sampling technique enhances the recruitment of information-rich cases. Creswell (2013) and Patton (2015) suggested that, as much as possible, the participants selected should be persons who can offer an in-depth comprehension of the phenomenon being studied. I ensured a spread across cadres and gender; thus, a total of 30 individuals were recruited for this study.

Figure 4

Map of Nigeria Showing Visited States in Yellow
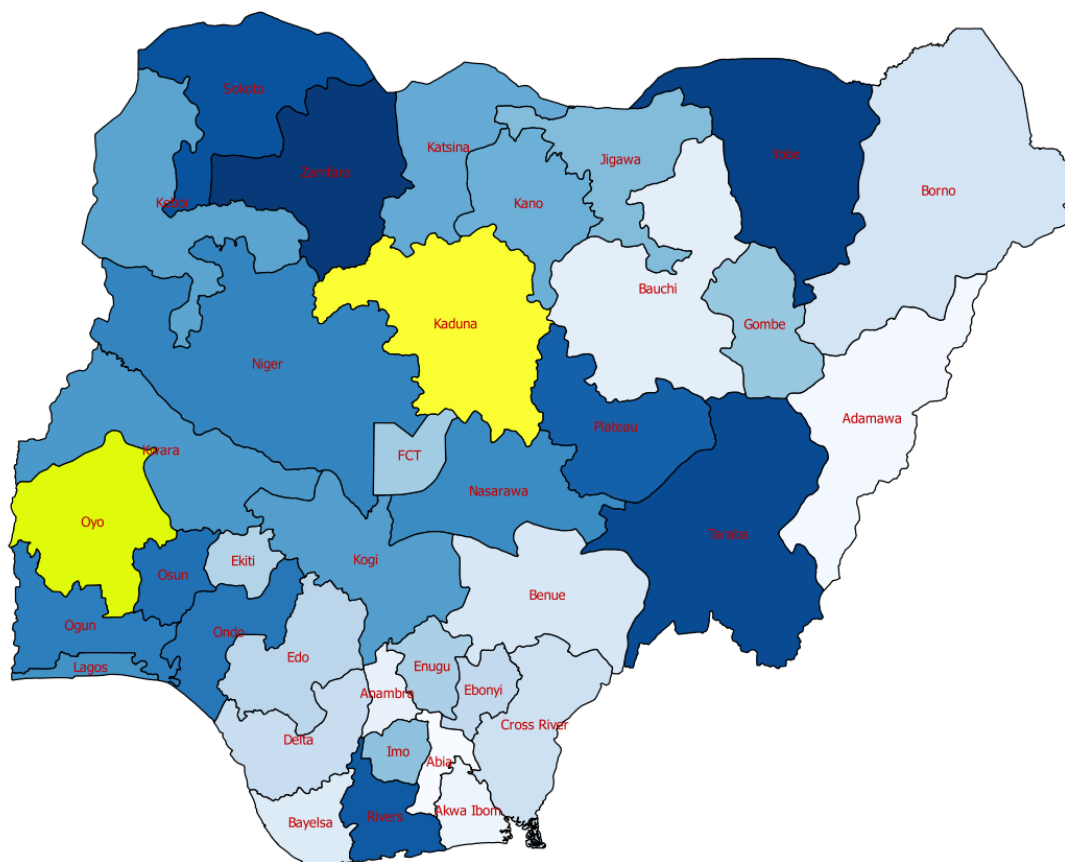
Sampling Strategy

A multistage sampling technique was used.

- **Stage 1**: One state each was selected by balloting from the north and south regions of Nigeria.

- **Stage 2**: From each of the selected states, one primary, one secondary, and one tertiary health facility were selected by balloting. A list of all public health care facilities was obtained from the state ministry of health in the

selected states. The list was further separated into primary, secondary, and tertiary public health care facilities. These served as sampling frames from which public health care facilities to be studied were selected.

- **Stage 3**: Using a nonprobability sampling technique (purposive sampling), five healthcare workers meeting the predefined inclusion criteria in the selected public health care facilities were interviewed.

Inclusion Criteria

- Health care workers or professionals working in the selected public health facilities for at least 1 year.

- Healthcare workers or professionals included medical doctors working in internal medicine, pediatrics, medical microbiology, nurses, CHEWs, pharmacist, medical laboratory scientists.

- Participants were willing to provide informed verbal consent especially for audio recording.

Exclusion Criteria

Health care workers who have worked in selected public health facilities who are on leave and inaccessible at the time of data collection were excluded.

A screening tool was designed and utilized for the data collection exercise. This tool was administered to prospective study participants to assess their eligibility status for the study. Participants found to be eligible were recruited for the study. The screening tool contained relevant questions such as: "How long have you been working in this health facility?" Other related questions were also asked.

Sample Size Determination

Evidence suggests that there are no standard rules for determining sample size in qualitative research, however researchers more than often adopt the concept of saturation (Mason, 2010; Saunders et al., 2018). Morse (2015) described saturation as the building of rich data through comprehensives of data and the attainment of a point beyond which set of participants' responses have some common features. Similarly, Fusch and Ness (2015) suggested that the saturation point is reached when comprehensive data is obtained, rich enough "to replicate the study when the ability to obtain additional new information has been attained and when further coding is no longer feasible". Saturation enables the collection of objective and subjective data that facilitates the understanding and making sense of the complex phenomenon of study (Hennink et al., 2017; Morse, 2015). Exactly how much extra data is needed depends on the purpose of the study, characteristics of the study population, emerging categories, and linkages (Hennink et al., 2017). In this study, the heterogeneity of the study participants, scope of the study, quality of the data, available resources (e.g., time required for interviewing participants, transcribing the interviews, among others), are important criteria used in deciding a final sample size (Boddy, 2016; Saunders et al., 2018). Therefore five health care workers were interviewed in each selected public health facility, totaling 30 interview sessions as the minimum sample size in this study.

Data Collection Methods

This study utilized a qualitative data collection method through in-depth interview. Data collection took place over a 6-week period. Interviews were conducted by

me. Given the on-going COVID-19 pandemic and the various prevention and restriction of movement laws enforced by the Nigeria Centre for Disease Control, the electronic media option was adopted in place of face-to-face interview sessions. The electronic data collection method, via the telephone, was also done in strict compliance with the Walden University Institutional Review Board (IRB) requirements.

I sent an email to the Chief Medical Officers (CMOs) or coordinators of the selected public health facilities to inform and seek the approval of all necessary authorities. The approvals were conveyed through letters of cooperation received from the management of the six participating health facilities. The CMOs sent a list of nominees eligible for the interview, after which I contacted individual prospective participants via email. Emails including the consent forms were forwarded to the prospective participants to seek their approval. Each respondent received a call seeking their informed consent to a convenient appointment for a telephone interview. Semistructured interviews with in-depth interview guide were conducted through phone calls for an average duration of 45 minutes. An interview guide, constructed by me, was the main data collection tool for the study. The guide consisted of eight questions. With the confidentiality of the process assured, and the approval of respondents received, I connected the telephone to a recording device and voice amplifier to ensure that responses were accurately captured. The in-depth interview guide was used to obtain information on their perceptions of AMS with a more detailed exploration of the factors responsible for these views. Respondents willingly provided details on the subject matter and cited real-life examples of situations surrounding it. Respondents were provided the

opportunity to ask questions concerning any of the issues discussed during the interview. I conducted the interviews without deviations from the procedures required by the IRB of Walden University. The recordings were transcribed verbatim and played back twice to prevent omission of vital information. The review of the transcript and the recordings enabled a deeper appreciation of the data collected from each respondent. The email correspondence was kept safe and confidential in password-protected storage accounts to prevent leak/hack of information by a third party outside the research context.

The in-depth interview guide that I developed based on the research questions was used for data collection. The guide was made up of eight questions, title of the thesis, the time of the interview, the date and the venue, the name of the interviewer and the profession and position of the interviewee.

The instrument was used to collect relevant information on respondents' perceived experiences of how AMS functions at the various levels of health care. Standardized open-ended interviews were conducted because the open-ended nature of these questions allows participants to richly present their perceptions and viewpoints addressing the objectives of the study (Daniel, 2010).

Data Analysis

Data from the in-depth interviews were transcribed verbatim with names and other identifiers removed. Halcomb et al. (2006) described transcription as the way of converting spoken words into written text. Verbatim transcription thus means converting audio taped interview into text word for word (Halcomb & Davidson, 2006). Where necessary, the data were reconciled with field notes. The data were, thereafter, imported

into qualitative data management software: NVivo version 13. The transcript was then coded and grouped into thematic areas and labeled using appropriate headings. Descriptive accounts of the respondents' perception were illustrated as interaction themes and illustrative quotes.

Data was analyzed using thematic analysis which allows the researcher to search, identify, analyze and report themes in the data collected (Braun & Clarke, 2006). Specifically, an inductive approach to thematic analysis was chosen for the analysis of collected data. Here, unlike the deductive approach, the identified themes are strongly linked to the data themselves (i.e., data coding is done such that an attempt is not made to fit the themes into a pre-existing coding frame or interviewer's guide). Overall, the six-phase approaches recommended by Braun and Clarke (2006) for thematic analysis of data were adopted, bearing in mind that these phases are not a linear process, but more of a recursive process where one moves back and forth as the need arises. The six phases are briefly described below.

Familiarisation With Data

This process began with listening to the interview recordings and followed by a verbatim transcription of the audio-recordings in a way which is true to its original form. The transcription process was followed by repeated and active reading of transcripts for at least three times until the researcher became familiar with the data. During this phase, field notes that were written during and immediately after each interview, thoughts and ideas were also referred to.

Generating Initial Codes

This phase, which was influenced by the decisions made at the outset regarding the specific approach to thematic analysis, involved identifying codes from the transcripts and organizing data into meaningful groups. To ensure consistency in coding and enhance credibility, 5-7 randomly selected transcripts were independently double coded. Comparison of the outcomes were made for any discrepancies and resolution.

Searching for Themes

Using MS Excel tables as a means of visual representation, this phase involved sorting the initial codes into provisional themes and sub-themes, and then assembling all the relevant coded data extracts within these themes and sub-themes into a thematic table.

Review of Initial Themes

This phase involved reviewing and refining the identified themes from the previous phase. In addition, all the collated extracts from the dataset for each initial theme were re-read the second time until internal homogeneity and external heterogeneity was attained. Internal homogeneity means that the data allocated to a theme are meaningfully related to each other, while external heterogeneity means that there are clear and identifiable differences between themes.

Defining and Naming Themes

This phase involved defining and further refining the themes and sub-themes for analysis as needed. The research primarily focused on identifying the core of each theme and deciding what aspect of the data each theme represents. This phase ended with the

finalizing of theme and sub-theme as per specific names and the creation of a final thematic table.

Producing the Report

This stage involved describing and substantiating the final themes and sub-themes with appropriate data extracts from the transcripts. Moreover, participants were assigned unique study identifiers, with quotations prefixed with the identification number of the participant speaking.

Using the thematic analysis approach recommended by Lochmiller (2021), the research adopted the analytic technique which included three components namely: individual codes, categories and generated codes.(Lochmiller, 2021) Accordingly, the analytical procedure identified code as well as defined the emerging pattern, using such pattern to determine the categories and subsequently, generated the themes.

Issues of Trustworthiness

Trustworthiness in qualitative research refers to the extent to which people will have full confidence in the findings from the study and is akin to reliability, validity, and objectivity in traditional quantitative research (Lincon & Guba, 1985). To guarantee trustworthiness, the processes involved in data collection and generation of the results of the study were clearly outlined and seen to conform to a high standard of qualitative research (Graneheim & Lundman, 2004). Criteria for trustworthiness included credibility, transferability, dependability, and confirmability (Shenton, 2004; Graneheim & Lundman, 2004).

Credibility is equivalent to internal validity in quantitative research (Morrow, 2005). It is concerned with the assurance that the generated data and the procedures involved in the data analysis relate to the main phenomenon of the study (Graneheim & Lundman, 2004). It also entails spending considerable time with the study participants, acquiring a keen sense of observation, triangulation of data sources, engaging other researchers or peers in reviewing the findings of the study, analysis of information from deviant cases, enhancing the reflexivity of the researcher, and member checking (Buchbinder, 2011; Creswell, 2013). Credibility was achieved in this case by ensuring that the reported findings reflected the experiences of the study participants regarding the central phenomenon of the study, and by employing the above strategies recommended by Creswell and Morrow.

Transferability mirrors external validity in quantitative study. This refers to the degree to which the readers of the study can generalize the findings of the study to their own setting and how the researcher can convince them of the general application of the findings (Graneheim & Lundman, 2004; Leung, 2015; Morrow, 2005). As a researcher, transferability is achieved in the study by providing a detailed description of the phenomenon of inquiry, supplying adequate information about the researcher, succinctly describing the procedures involved in data collection and analysis as well as the description of the geographical location (Shenton, 2004).

Dependability is synonymous with reliability in quantitative study and details the extent to which the data change over time and how the researcher can account for these changes in the data analytic process (Graneheim & Lundman, 2004; Leung, 2015;

Morrow, 2005). Dependability is achieved in the study by keeping an audit trail of timetable of the research activities and procedures and factors that impacted on these processes.

Confirmability corresponds to objectivity in quantitative study. This is achieved when the readers of the research findings confirm that the findings are adequate to address the central phenomenon (Morrow, 2005). This factor is addressed in the study by ensuring that data collected was rich both in quantity and quality and that the analytical process was clearly understood by readers of the research findings. This is further strengthened by reflexivity in the entire research process, which involves bracketing the influence of my own personal views and experiences in interpreting meanings to the views of the participants and developing strategies to deal with this.

Ethical Procedures

According to Burkholder (2017), ethical issues are often context dependent. In the preparatory stages of this research, the possible risks and potential benefits of the study were considered and appropriate steps that protected participants were taken in the process of participants' recruitment, data collection, data storage, analysis and dissemination. The study was carried out in collaboration with the IRB at Walden to ensure the ethical codes and principles were observed.

Ethical approval of the study was sought from the Walden IRB (IRB approval number 05-19-20-0652308). Permission for the study was also sought from the management of participating public health care facilities. Informed consent was obtained from each respondent via email before conducting the interview.

Respondents' names were not recorded during the interview and the information

given cannot be traced back to respondents. The data and notes taken were kept securely

in a computer/notebook only accessible to the principal investigator. Data collected were

used only for research purposes. All the data obtained from the study will be kept for at

least 2 years.

The study will have eventual benefit to the health care workers through enactment

of policies and interventions. This will create enabling individual and environmental

factors that may influence responsible use of antimicrobials.

Respondents were duly informed of their right to decline from participation in the

study at no loss or threat to them. During the interview sessions, the respondents could

decline to answer any question that made them uncomfortable. Respondents were free to

withdraw at any time during the interview. There would be no adverse effects if

respondents took such decisions. Respondents were equally informed of the liberty to

raise any concerns that they might have during the interview. Due to the non-invasive

nature of the study, it will pose minimal harm to the respondents.

Summary

The information provided in Chapter 3 detailed how qualitative data were

collected to explore the lived experiences of system actors regarding the status of AMS

programming in selected public health facilities in Nigeria. Given the prevailing situation

of the COVID-19 pandemic as at the time of the conduct of the study, all COVID-19

infection preventive measures prescribed by the Nigeria Centre for Disease Control were

strictly observed. Thus, letters of invitation and consent to participate in the study were

communicated and received via emails, and all interview sessions were conducted via the

telephone. The qualitative data were transcribed, coded, and grouped into themes. NVivo

software was used to analyze the data.

Chapter 4: Results

The purpose of the study was to appraise the institutional AMS in selected public health facilities among state actors including doctors, pharmacists, nurses, midwives, medical laboratory scientists, primary healthcare center coordinators, immunization officers and CHEWs working in primary, secondary, and tertiary health facilities in Nigeria. While evidence suggests that poor prescription practices are common in health facilities in LMICs, most of the available studies rarely examined AMS, beyond tertiary healthcare facilities (Dijck et al., 2018). Other factors aggravating the burden of AMR in sub-Saharan Africa, include power and social interactions among professionals within the health facilities, as well as uncoordinated AMR response due to poor governance practices at institutional level and beyond (A. Broom et al., 2014, 2015; Howard et al., 2014).

This chapter presents the findings of the study that appraised the institutional AMS in selected public health facilities in Nigeria among the state actors. Thirty health professionals with 1 to 32 years of experience were interviewed using in-depth interview guide. The three research questions addressed in this study were as follows:

1. What are the experiences of system actors' attitudes, subjective norms, and perceived behavioral control on system processes for AMS in selected public health facilities in Nigeria?

2. What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on the scope and functionality of AMS system in selected public health facilities in Nigeria?

3. What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on factors that hinder or promote AMS in selected public health facilities in Nigeria?

This study was guided by the TPB. Ajzen (1985) posited that there are three conceptually independent determinants of intentions (i.e., attitudes towards the behavior, subjective norms, and perceived behavioral control) that predict the intention to perform behaviors of different kind.

This chapter discusses how data for the study were obtained and the processes of generating themes and meanings from the data. Information was obtained from participants to support the identified themes and results. The chapter concludes with a summary of three themes obtained from responses of participants. These themes will be further discussed and interpreted in specific terms in Chapter 5.

Study Settings

The data collection took place across selected public health facilities in Nigeria, a federal republic in West Africa with a land mass of 910,770 km^2 and an estimated population of 208 million. Nigeria is bounded by Niger in the north, Chad in the northeast, Cameroon in the southeast, and Benin in the west, while its coast in the south is located on the Gulf of Guinea in the Atlantic Ocean. Nigeria is made up of 36 states and the Federal Capital Territory. Administratively, the states are further subdivided into a total of 774 LGAs. The country is aggregated into six geopolitical zones: North-West, North-East, North-Central, South-East, South-South, and South-West. The six geopolitical zones can be categorized into two major regions: North and South.

The responsibility for health service provision in the public sector is based on three tiers. The levels of care in the public sector are primary, secondary, and tertiary. The primary level is financed and managed by the local government, the secondary by the state, and the tertiary by the federal government. PHC facilities exist in all the LGAs, forming the community's entry point into the health care system. PHC facilities provide preventive, curative, promotive, and pre-referral care to the population. PHC facilities are typically staffed by nurses, community health workers, CHEWs, junior CHEWs, and environmental health officers. They are headed technically and administratively by the PHC coordinator or the medical officer of health, where one exists, who is assisted by program officers and unit heads.

The secondary health facilities referred to as general hospitals provide medical and laboratory services, as well as specialized health services such as surgery, pediatrics, obstetrics, and gynecology to patients who are referred from the PHC level. Medical officers, nurses, midwives, pharmacists, laboratory specialists, and community health officers are the typical staff at secondary health facilities. They are headed by medical directors.

The tertiary health facilities form the highest level of health care in Nigeria and include specialist and teaching hospitals, as well as federal medical centers. They treat patients referred from the primary and secondary health facilities. The tertiary health facilities have expertise and technological capacity that enable them to serve as resource centers for knowledge generation and diffusion. Each state has at least one tertiary health facility. They are headed by chief medical directors.

The study was conducted in two Nigerian states. One state each was selected from the Northern and Southern regions of Nigeria by simple random sampling, using balloting. Health care workers in selected public health care facilities in Nigeria who occupy strategic level of management, are system actors, and have responsibilities for patient care constituted the participant population for this study. With regards to the data collection, I used purposive sampling within the selected public health care facilities at all levels. Purposive sampling is usually informed by the type of participants, the study site, and the required sample size (Creswell, 2013). When properly used, a purposive sampling technique enhances the recruitment of information-rich cases. Creswell (2013) and Patton (2015) suggested that, as much as possible, the participants selected should be persons who can offer an in-depth comprehension of the phenomenon being studied. Moreover, attempts should be made to ensure a spread across cadres and gender. These criteria informed the recruitment of a total of 30 participants for the present study.

Though at different levels, the participants and I are employed in the healthcare delivery sector and, given that personal and organizational factors could impact the findings of the study, care was taken to ensure that all interviews were conducted through telephone and that all COVID-19 preventive, measures applicable in Nigeria were applied. The invitation to prospective participants and consent forms were sent from my Walden University email address. Individuals who were known to me were excluded from the study.

Description of Study Participants

Of the 36 health care workers eligible for the study, only 30 gave consent for participation giving a response rate of 83.3%. Using in-depth interview guide, I interviewed these 30 professionals with years of experience ranging from 1 to 32 years. Sociodemographic characteristics of participants are further described in Table 1.The interview sessions were audio-recorded and transcribed. During the sessions, the respondents were asked questions on their work in their respective facilities, their knowledge, attitude, subjective norms and perceived behavioral control on system processes, the scope and functionality as well as factors that hinder or promote AMS. To maintain confidentiality, participants were assigned unique identification numbers from 1 to 30.

Table 1

Sociodemographic Characteristics of Participants in Interviews on AMR (N= 30)

Variable	Frequency (%)
Sex	
Male	14(46.7)
Female	16(53.3)
Type of Health Facility	
Tertiary	9 (30.0)
Secondary	10 (33.3)
Primary	9 (30.0)
Ministry of Health	2 (6.7)
Number of years in the health facility	
0-10	19(63.4)
11-19	4(13.3)
20-29	4(13.3)
≥ 30	3(10.0)
Department in the health facility	
Medicine	6(21.4)
Pharmacy	3(10.7)
Nursing services	8(28.7)
Microbiology	3(10.7)
Laboratory	3(10.7)
Pediatrics	3(10.7)
Others	2(7.1)
Designation	
Physician	8(26.6)
Nurse	8(26.6)
Pharmacist and Pharmacy technician	5(16.7)
Laboratory scientist and technician	5(16.7)
CHO&CHEW	4(13.4)
Number of years in the current position	
0-5yrs	22(73.4)
6-9	4(13.3)
≥ 10	4(13.3)

Data Collection

Data collection took 6 weeks. I sent an email to the CMOs or coordinators of the selected public health facilities to inform and seek the approval of all necessary authorities. Approvals were conveyed through letters of cooperation received from the management of the six participating health facilities. Each of the CMOs sent a list of nominees eligible for the interview, and I subsequently contacted prospective participants via email. Emails including the consent forms were forwarded to the prospective participants to seek their approval. Each respondent who gave informed consent was also called to seek a convenient appointment for a telephone interview. The phone interview tool was used in recognition of the Covid-19 precautionary measures, as recommended by the WHO, Nigeria Centre for Disease Control, and the Walden University IRB. Interactions took the form of semistructured interviews with in-depth interview guide, through phone calls with an average duration of 45 minutes. The interview guide, which was designed by me, was the main data collection tool for the study. The guide consisted of eight questions. Having assured the confidentiality of the process and received the approval of the respondents, I connected the phone to a recording device and voice amplifier to ensure that every response is accurately captured. The respondents were willing to give details on the subject matter and cited real-life examples of situations surrounding it. The interviews were conducted without deviations from the procedures approved by the Walden University IRB. The recordings were transcribed verbatim and back-played twice to prevent omission of vital information. The review of the transcript and the recordings enabled a deeper appreciation of the data collected from each

respondent. The email correspondence was kept safe in password-protected storage

accounts to prevent leak/hack of information by a third party outside the research context.

Thematic Analysis of Data

After transcription, each transcript was reviewed alongside the recording to

ensure the accuracy of the transcripts. Where necessary, the data were reconciled with

field notes made during the interview sessions. The Microsoft Word documents were

properly arranged before importing into the NVivo software. The transcripts were labeled

into the appropriate NVivo headings before organizing the participant's responses to each

interview question by appropriate research questions for each participant. Specifically, an

inductive approach to thematic analysis was chosen for the analysis of collected data.

Here, unlike the deductive approach, the identified themes are strongly linked to the data

themselves (i.e., data coding is done such that an attempt is not made to fit the themes

into a pre-existing coding frame or interviewer's guide). Overall, the six-phase approach

recommended by Braun and Clarke (2006) for thematic analysis of data was adopted,

bearing in mind that these phases do not constitute a linear process, but more of a

recursive process where one moves back and forth as the need arises. The six phases are

(a) familiarization with data, (b) generating initial codes, (c) searching for themes, (d)

review of initial themes, (e) defining and naming themes, and (f) producing the report.

Coding With NVivo and Theme Generation

The analysis was done using NVivo (Version 13), a software that made for an

easier and more systematized analysis. The use of the software was supported with prior

manual coding that involved several coding stages, which succeeded lengthy reading of

the interview transcripts in search of key textual information provided in participants'

response for familiarization with words, phrases or clauses that represented same

meaning to the participants across the research questions and objectives. These identified

words, phrases, and clauses were used in setting the first series of pattern codes that were

used in creating phrases, clauses, and sentence patterns for thematic naming and

identification that were used in result interpretation.

Theming Process

Using the manual process described above, transcripts were rearranged, and data

subsequently uploaded on the NVivo software. To generate nodes from the research

questions, I used the auto-coding command prompt feature that was available on the

software. There were 320 distinct codes generated from the initial coding cycle and

blended into 182 nodes (these codes were generated from the responses provided by the

participants that addressed the eight interview questions representing the parent nodes in

the software). These nodes were reorganized into smaller units through a categorization

process that later generated 64 parent nodes. The final three themes that evolved from the

64 parent nodes were assembled using the cross-matching merging process (parent nodes

that addressed the same objectives and research questions were compared and renamed).

These categories of nodes were retraced to further compare them for interlinked

connections, linkage, thematic association, and coinage, to drag them together for

objective markings. I then reviewed the key thematic findings to see their correlation with

the study objectives.

Evidence of Trustworthiness

According to Ravitch and Carl (2016), data collection and analysis must be subjected to rigor and validity. This is more so because qualitative research is inductive and findings may be influenced, among other reasons, by the interaction between the research participant and the observer (Burkholder et al., 2016; Golafshani, 2003). Trustworthiness in qualitative research is challenging but could be addressed by assuring credibility, transferability, dependability, and confirmability.(Leung, 2015; Lincoln & Guba, 1985; Shenton, 2004;).

Credibility is understood to be the extent to which the study measures what it intended to measure (Leung, 2015; Shenton, 2004;). Credibility is guaranteed in the present study through a thorough alignment of the study problem with the purpose, research questions, methodology and recruitment of appropriate participants with responsibilities for patient treatment and care. The purposive sampling method, coupled with the procedure giving prospective participants the right of refusal to participate, ensured the recruitment of information-rich study participants. Moreover, the data and the generated themes were further subjected to verification with a colleague.

This study was conducted in a specific situation and environment, so ensuring transferability which is the extent to which the findings could be applied to other situations. In this study, transferability is established through a thorough description of the context and populations in which the study was conducted. According to Lincoln and Guba (1985), the results of this study could be applied to other situations if the situations are similar enough. Readers, therefore, could relate the context to their situations and

make informed decisions about a possible generalization of the findings (Armstrong, 2010; Lincoln & Guba, 1985).

Dependability addresses the issue of reliability (Shenton, 2004). To ensure achievement of similar result in the same context using the same participants, the study provided an in-depth detail of study design, selection of information-rich participants, data collection and analysis using the NVivo software program.

As a public health specialist participating in the programmatic prevention and control of AMR in Nigeria, the researcher is aware of personal and institutional biases that may influence the analysis of data and subsequent results. Hence, researcher's biases were curbed to ensure objectivity. Objectivity was further ensured through designing the data collection tools, audio-recording, triangulation of information such as interview transcript and field notes, and member checking of the collected data (Buchbinder, 2011). The in-depth description of the methodology enables other researchers to scrutinize the integrity of the study (Shenton, 2004). Finally, the findings in this study were explained through the lenses of the TPB conceptual framework. The interview questions were structured and guided with the help of TPB propositions. The results of this study were presented according to each research question; relevant themes were used to address each research question of the study.

Table 2

Summary of Research Questions and Emergent Themes

Research Question	Theme	Subthemes
RQ1: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on system processes for antimicrobial stewardship in selected public health facilities in Nigeria?	Theme 1: Enabling structures for optimum antimicrobial use	Knowledge of system actors about use of antibiotics No system in place Internal system process External system process
RQ2: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on the scope and functionality of antimicrobial stewardship system in selected public health facilities in Nigeria?	Theme 2: Defining how well AMS functions	Functionality of AMS Committee Availability of guidelines and Strict Adherence to Standard Operating Procedures Emphasizing Importance of Continuous Medical Training
RQ3: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on factors that hinder or promote antimicrobial stewardship in selected public health facilities in Nigeria?	Theme 3: Enabling actions for rational/optimum use of antimicrobials	Lack of Antimicrobial Stewardship Committees and Guidelines Healthcare Workers' Roles and Authority (Imbalance of Power) Lack of Modern Equipment and Incorrect Diagnosis Continuous Medical Education and Training Access to quality-assured and affordable medicines Sub-standard and Falsified Medical Products Pervasive External Influence

Results

This study set out to explore three research questions with the aim of having a better understanding of the practice of AMS at the three-tiered levels of care in Nigeria. The study, therefore, explored the experiences of healthcare workers regarding AMS. This section covers how identified themes were used to address the research questions. Three main themes and fourteen sub-themes were identified from the analysis of the research data.

Theme 1: Enabling Structures for Optimum Antimicrobial Use

RQ1: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on system processes for AMS in selected public health facilities in Nigeria?

The participants in this study discussed their understanding of the use of antimicrobials and structures set up within respective facilities to enable optimum use. The participants revealed that the structure for optimal antimicrobial use is partly guided by the roles and responsibilities of each level of health care in Nigeria. The structure in place therefore differs according to the level of health care facility. Based on the account of the stakeholders assessed, majority of the facilities set up an in-house or internal structure that does checks and balance and control the practice regarding the use of antimicrobials, while in some, the pattern of antibiotic use is influenced by the pharmaceutical companies that adopt all sorts of smart marketing strategies to convince healthcare workers to use their products. The four key sub-themes were generated namely: "knowledge of system actors", "no system in place", "internal system process" and "external system process" as sub-thematic titles.

Subtheme 1a: Knowledge of System Actors About Use of Antibiotics

Almost all the healthcare workers interviewed had good knowledge of antimicrobial use. They described the general indications for the use of antimicrobials for conditions caused by bacteria, fungi, viral and parasitic infections. Participant 9 said,

Generally, antimicrobials are agents that are used in treating microbial-related infections either to eradicate organisms completely or inhibit their growth. We

have various antimicrobial agents depending on the clinical use. These could be antibiotics which are generally used for bacterial infections, antiviral for viral related infections, anti-parasitic for parasitic infections. They are used in managing infections that could either be because of bacteria, fungi, parasite, or virus.

Participant 2 said, "They are agents used to eliminate microorganisms. They can be antibacterial, antiviral, antifungal and anti-parasitic." This view was also corroborated by Participant 3 who said, "They are drugs used for the treatment of bacteria and disease that erupts from bacteria and it is generally prescribed by doctors."

Some of the respondents emphasized that before antimicrobial is prescribed there is need for laboratory confirmation of the disease condition and identified organism causing disease. They emphasized that the irrational use of antibiotics is not good. Some respondents also mentioned that antimicrobials should be used based on laboratory evidence. According to Participant 5, "Before we use any antibiotics or antimicrobials, it must be evidence-based for these drugs to be applied to some people." Participant 26 offered a compelling rationale for the right use of antibiotics saying that irrational use of antimicrobials can promote resistance to existing antibiotics. This participant said, "I know we shouldn't use antibiotics irrationally, we should gate-keep the higher-level antibiotics as the organisms are getting resistant to the few new ones coming out" Participant 7 also observed that "We prescribe them based on symptoms of diseases. Before we do that, we send them for laboratory investigation to confirm a disease." According to Participant 30, "Abuse of antibiotics is leading to resistance pattern in the

community. When we did some study on pneumonia and pattern of prescription of

antibiotics, we discovered that there is now resistance to some group of drugs they were

sensitive to before. Antibiotics generally, is lifesaving."

These comments, in broad terms suggest that participants at all levels of care

understood the indications for the right prescription and use of antimicrobials and that

responsible use may contribute to the prevention and control of AMR.

Subtheme 1b: No System in Place

Based on the responses of the interviewee, most of the facilities had no system in

place to promote responsible use of antimicrobials. Participants mentioned that they

arbitrarily prescribed and dispensed antimicrobials to the patients that presented at the

facilities with known symptoms. Participant 1 stated:

There are no departments in charge of antimicrobial use except the drug advisory

committee. The committee oversees procurements, monitoring of drug

interactions or adverse drug reactions. There is an infection control unit, and we

have 2 infection prevention officers- a nurse and a doctor delegated. With the

advent of the Coronavirus, they have been empowered for infection prevention

and control activities.

Participant 1 also went further to state that "There is no written protocol for

antibiotic use. There is no protocol." This point was observed by Participant 12 saying:

I don't know if medical practitioners have a particular guideline. There is no

structure in place for antimicrobial use. Some of the guides are made available to

the doctors. We don't have any infection control unit. We don't have training on

the use of antimicrobials, but recently, they started clinical meetings every week

though it is not really on antibiotics. It is on a particular disease, they talk about

the epidemiology, treatment, drugs that can be used and antibiotics that can treat

that ailment.

Participant 14 also reflected that,

Antimicrobials are used regularly especially for infection and morbidities in

children. A challenge is inappropriate use and lack of guidelines. I think we have

a huge problem with antimicrobials generally. Also, about quality assured

products. There are a lot of issues about the general use of antimicrobials.

Participant 2 argued that:

Antimicrobial usage in our facility and Nigeria is not optimal. There are a lot of

indiscriminate usage. In Nigeria, there is no implementation of antimicrobial

stewardship program, no policy regarding it, no regulation on the use of

antimicrobials. Anybody can go to pharmacies/medicine vendors to buy; most

medical practitioners feel nobody can regulate them.

In one of the tertiary facilities, most respondents expressed the lack of a system

for optimum use of antimicrobials. Participant 13, however, offered a different

perspective about why the facility might be considered to have an appropriate structure

for AMS. The participant reported,

To some extent, we have some level of antimicrobial stewardship. We have

Infection control unit that tend to monitor the use of antimicrobials within the

hospital. Although this unit is usually not well-developed in most federal

institutions within developing countries. To some extent, we have some level of

stewardship. Antimicrobials are being used generally on patients.

These responses suggest that healthcare workers recognize the importance of

responsible or rational use of antimicrobials. They also understood that the set-up of a

purposeful structure with responsibility to guide its functions is critical.

Most of the participants argued further that the lack of AMS in their facilities

gave room to misuse or overuse of antibiotics. According to Participant 16, "I will say

not too well because most of the antibiotics we use are not based on sensitivity carried

out. Most of the times they just use a broad spectrum to treat infection when a patient

comes with complaints." In addition, Participant 18 corroborated this point and said,

It is being used effectively but I noticed that they don't do proper follow-up. They

don't normally observe drug interaction. Secondly, I observed antibiotic overuse.

Like cases of patient with liver cirrhosis, there are some drugs that are

contraindications, but all those things are not been taken into consideration. They

just prescribe and the patient will be on longer period of drugs.

Almost all the respondents at the PHC facilities said that they did not have an

AMS committee in place but observed that they used the standing order guidelines to

manage patients. According to them, nurses and community health workers at the PHC

levels are obliged to follow the guidelines for treatment of common illnesses as outlined

in the "standing order." They also observed that the monitoring of the use of standing

order guidelines is weak. Participant 21 also corroborated this observation saying,

According to the guidelines as a community health officer, we have a standing

order given to us. If I want to treat a patient, I will follow the guidelines in the

standing order." One other respondent also reported that: "We act according to

what we see in our standing order... We don't have infection control unit in our

facility.

Participant 30 revealed that "AMS is set up all over the world to control antimicrobial

prescription and enforce its proper use. The committee is hardly found in hospitals in

Nigeria, but it is an ideal requirement by the World Health Organization".

The data from most participants showed that their facilities had no structures in

place to regulate antimicrobial use.

Subtheme 1c: Internal System Process

The participants in this study were selected from two primary, two secondary and

two tertiary facilities. Of these, only one tertiary facility had the AMS committee in

place. The participants from this facility acknowledged the existence of a facility wide

AMS committee. As Participant 25 reflected, "In March 2015, the hospital inaugurated

an antimicrobial stewardship committee and we have had meetings and deliberations

about antibiotics.". This observation was also reported by Participant 26, "We have a

bigger committee- the clinical stewardship team consisting of infectious diseases

specialists, microbiologists for both adults and pediatrics. We have a team where we

review and do antimicrobial rounds."

While majority of the respondents stated that AMS committees did not exist in

their facilities, they confirmed the existence of alternative platforms which they

considered to have similar functions as that of the AMS. It was stated that some of the

facilities across the country had drug advisory committees that oversee several actions

regarding the procurements and monitoring of drug interactions and or adverse drug

reactions (including antimicrobial). In addition to the action of the drug advisory

committees, some other participants reported that they have special treatment and drug

dispensing units, infection control units that regulate the use of antimicrobials. According

to Participant 1, "We also have a drug advisory committee that is responsible for

producing monthly drug bulletin and advise doctors about the antibiotics that are

available with the current profile of those drugs." Participant 4 reported,

> We have drug advisory committee that is headed by the Deputy Director of
>
> Pharmaceutical Services. The team comprises nurses, doctors, laboratory
>
> technicians and other health workers in the hospital. We have infection control
>
> unit that is overseen by a doc.

Furthermore, some respondents narrated that their facilities had no AMS, but the

pharmacy department monitored drug use within their facilities. AMS was described as

the responsibility of the pharmacist (at the secondary level) and that of the pharmacy

technician (at the PHC level) rather than a collaborative set of actions across professions

and departments. Participant 12 captured the point; thus, "In terms of antibiotic use, we

have a drug information unit and informatics. Those are units of departments created by

the pharmacy so that they monitor antibiotics use and other things." Another interviewee

argued that while an infection control committee exists in his facility, there is no specific

structure established to contribute to AMS. As Participant 13 observed,

Generally, I can't really say of a specific structure. Like I earlier mentioned, in

developing countries the level of antimicrobial stewardship is limited. ... We do

not have a department in charge of antimicrobial use. We do have an Infection

control unit within the hospital. We also have a pharmacology unit within the

department. However, the level of engagement with regards to monitoring the use

of antibiotics is what I'm not so certain about.

The data suggests that while most facilities do not have structures for AMS,

participants viewed the functions of the drug advisory or infection control committees as

alternatives.

Subtheme 1d: External System Process/Influences

In most facilities, including those with established AMS programs or drug

advisory committees, it was reported that there was a practice in place whereby

pharmaceutical companies influenced the healthcare workers to use of their products.

These companies provide information on the dosing and combination, and possible

adverse reactions to staff members using drug information leaflets. These myriads of

information constitute the guidelines that regulate the use of these promotional

antimicrobial drugs within some facilities. This view was shared by Participant 4:

Aside those pharmaceutical companies that come to advertise their products, from

there we have the knowledge of all the antimicrobials being used; it [information

leaflet] makes it possible for anyone that knows the mode of action and normal

dosage to prescribe it even in the absence of a doctor. ... The system helps in

enhancing the use of antimicrobials in terms of providing continuous medical education on the latest drugs.

Participant 4 also considered that the interventions of the pharmaceutical companies are complimentary, providing information on new medications coming into the market. The participant said, "The system helps in enhancing the use of antimicrobials in terms of providing continuous medical education on the latest drugs" Participant 5 reflected "Occasionally the pharmaceutical companies will come with their drugs and train us on the way they want it to be administered, but we have our meeting quarterly at [location redacted]". The external influence of pharmaceutical companies in the way antimicrobials are used in patient care is further emphasized by Participant17, "Depending on companies, the company that wants to introduce antimicrobials initiates training and mobilizes people for the training"

While the training activities offered by pharmaceutical companies seem to be broadly accepted among healthcare workers, Participant 17 called for caution, "They bring a lot of things as marketing strategy to sell their brands but let us be sure to know if the antimicrobial they are coming with is sensitive and specific to a particular infection." This deviation from a broad reflection of participants was also observed by another health worker. Participant 1 stated,

> We have had 2 hospital-wide trainings this year, the pharmaceutical companies that hold trainings are not targeted at antimicrobial use. They come to present based on the drugs; we must have [sic] a dozen of such presentations this year. They don't have a structure of focusing on a class of drugs for training.

Theme 2: How Well AMS Functions in Facilities

RQ2: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on the scope and functionality of AMS systems in selected public health facilities in Nigeria?

The report from this appraisal study showed that AMS in Nigeria is not well established. At the PHC facilities, healthcare workers leveraged on the existing standard operating procedures in antimicrobial prescription and dispensing. The respondents from the two secondary facilities observed that they had no AMS committees, while only one of the two tertiary facilities had established an AMS committee. Most facilities had some treatment guidelines, but these were seldom followed. In addition to that, healthcare workers are often trained by their hospital management boards and pharmaceutical companies to keep them informed about the current trends on new antimicrobial drugs, how they should treat their patients using antimicrobial drugs and the likely outcomes. On the other hand, most facilities also relied on the expertise of experienced physicians that understands the symptoms of several diseases to prescribe antimicrobial to patients in place a standard guideline. This theme is categorized into three sub-themes, namely, functionality of AMS committees, availability of guidelines/strict adherence to standard operating procedures and emphasizing importance of continuous medical education.

Subtheme 2a: Functionality of AMS Committee

Only one of the six facilities reportedly established an AMS committee. The participants from this facility discussed the functionality of the AMS structure in terms of regularity of meetings and the monitoring of responsible use of antimicrobials across the

facility. The data showed that the health care workers in this facility are generally aware of the threat of AMR to patient care and therefore sought to address the challenge. Participant 29 said, "The AMS was set up at the instance of the then chief medical director after the Infectious Diseases group in the hospital advocated for it." The data emphasized that the AMS committee exists but do not meet regularly. The committee has not met in about one year, as Participant 26 stated,

> We have an antimicrobial stewardship committee in the hospital. The problem is if it's working regularly. Since the covid last year, there have not been many meetings. We have a bigger committee- the clinical stewardship team consisting of infectious diseases specialists, microbiologists for both adults and pediatrics. We have a team where we review and do antimicrobial rounds.

In a similar comment, Participant 25 said:

> In our department, they came up with an antibiotic book. They have done a first edition and are working on a revised edition. I am not aware of any other unit in the hospital that has such guide. I still feel that we can do a lot more than what we are doing now. In March 2015, the hospital inaugurated an antimicrobial stewardship committee and we have had meetings and deliberations about antibiotics. Covid came and everybody went to sleep.

In general, participants seem to agree that isolated departments or units do maintain policies for antimicrobial use. Participant 25 noted,

> Antimicrobials are used regularly especially for infection and morbidities in children. A challenge is inappropriate use and lack of guidelines. I think we have

a huge problem with antimicrobials generally. Also, about quality assured

products. There are a lot of issues about the general use of antimicrobials.

Participant 29 noted "AMS works differently for various units. The Pediatric and

Adult medicine units appear to be more diligent with ensuring adherence." Participant 25

suggested, "I will rate 4.5 on a scale of 1 to 10. We can do a lot better by making the right

choices."

The data demonstrated that the structure of AMS alone does not prevent misuse or

overuse of antimicrobials. Without reasonable investments in the processes that enables

the system to function, rational use of AM remains daunting.

Subtheme 2b: Availability of Guidelines and Strict Adherence to Standard Operating Procedures

Findings from this appraisal study also showed that some of the facilities, PHC,

based their antimicrobial drug administration on the existing standard operating

procedures and guidelines for drug administration. By training, community health

workers, including nurses providing primary healthcare services, are required to utilize

treatment guidelines as outlined in the standing order guidelines. Standing order

guidelines are a set of instructions that guide the treatment of common illnesses at the

PHC level. As participant 22 stated,

> There is a standing order which is a set of specific orders to manage the patients.
>
> We refer to it if the patient actually needs it. There are columns for age,
>
> complaints and management. There is dosage and duration on the standing order.
>
> For any side effects, there is a column that says you should refer.

The respondents emphasized that community health workers are not expected to issue medications, including antimicrobials, outside the provisions of the Standing orders. Participant 21 also indicated, "According to the guidelines, as community health officer, [sic] we have a standing order given to us. If I want to treat a patient, I will follow the standing order guidelines." Participant 7 also offered similar reflection, "We have a guideline for treatment … the person that consults [sic] write the antibiotic for the patient. We don't give unless we follow the guidelines in the standing orders on the prescription of such drugs." One other respondent also said, "The guideline is only for the community health practitioners. We must not treat anything out of that standing order. The guideline tells us to refer any case that is not in it to the secondary facility. The guideline talks about the dosage, duration and side effect."

Beyond the PHC facilities, respondents acknowledged that there are guidelines in place designed to guide treatment and use of antimicrobials within the hospitals. However, these guidelines are not always followed by healthcare providers to make decisions. They relieved their experiences that medical officers often prescribe antimicrobials based on individual experiences. Participant 14 asserted that

> There is a guideline which is readily available. A lot of people don't follow the guideline in terms of dosage, particular antibiotics and duration of administration. A lot of people place their judgment on what they have seen their superiors use for a particular medical condition and also based on their individual experience of such antibiotics and the responses of the patient.

Participant 9 said,

The hospital has a guideline that we use for different infections being suspected that patient comes with. Some of the doctors use clinical experience as regarding prescription pattern to choose antimicrobial agents to place the patient on. Of course, the guideline supersedes everything.

According to Participant 29, "In different units they have SOP that states what antibiotics to use. The problem is how strictly the documented law is being followed". Providing further insight on compliance, Participant 29 said, "most times, the clinicians in different units will have gone through the artillery of available antibiotics ranging from what they have in their SOP to others". The lack of adherence to guidelines was also highlighted by Participant 30 thus "the problem with individual compliance is that patients discontinue the medication after feeling better. This also breeds AMR. The fault can also be from the doctor who writes inadequate regimen".

Furthermore, other interviewees explained that the guideline they use is inadequate. Participant 13 said,

With respect to specific diagnosis, we have a standard treatment guideline from the department that has recommendations for use of antibiotics depending on the diagnosis that has been made on a particular patient. There is no mention of side effects in the guideline. Probably the misuse and overuse were mentioned to some extent. Most times, there is a dosing and duration for antibiotics which is in the guideline.

This view is supported by Participant 26 "The guide has the appropriate use, dosing, alternatives, appropriate cultures, maybe not side effects."

Subtheme 2c: Emphasizing Importance of Continuous Medical Training

All participants emphasized continuous medical education and suggested that it is one of the means of keeping staff abreast of current trends and happenings in their profession. Participants observed that experiences from on-the job training they attended led to awareness of new antimicrobials, and thus beneficial to patients and healthcare workers alike. As Participant 4 mentioned,

If there are any new drugs in circulation before it is [sic] being sent to the market, they will first bring it [sic] to hospital and there is some sort of continuous medical education so that the doctors that will prescribe will know everything about the drug. The pharmacy department oversees the training for the health workers.

Healthcare workers recognized that the training activities are both external and internal but expressed frustrations that respective facility management seldom organizes continuous medical education on rational use of antimicrobials for their staff. As Participant 9 reflected, "In my department, we have had like one or two workshops on rational drug use. I don't think I know of the hospital organizing any workshops. They may have been conducted before I joined the service of the hospital." Similarly, participant 12 observed that

In terms of training, I won't say it is [the hospital] that is training us directly. As a department, we usually bring in pharmaceutical company [sic] like the ones that sell antibiotics. They come to give presentations. Every Wednesday, we have in-house clinical presentation- we present to one another about infection control to

increase knowledge of one another. We also have house presentations from company [sic] where they present to the doctor so they can improve their knowledge about new antibiotics coming in. We don't do our presentations together.

A similar view was expressed by Participant 14 indicating,

We do have trainings from time to time in form of seminars, departmental presentations or hospital presentations in general. It's just that the level of organization of that unit and the frequency of trainings is not adequate. Trainings might be once in 6 months plus or minus.

Participant 15 discussed the importance that the facility staff attach to acquisition of knowledge and the internal action taken to step down information. Participant 4 mentioned,

Anytime there is a workshop, we send our doctors and nurses and they come to give us feedback by doing step-down training for others that are not allowed to go for the training. If anyone attends a meeting that is beneficial to the health of the staff and patients, we usually call a general meeting of hospital workers including the gateman to disseminate the information.

Participant 30 revealed that, "There is training and retraining of hospital staff to update their knowledge about antimicrobial prescription. The logistics to organize the committee is a problem."

These quotes suggest that healthcare workers appreciate the importance of continuous medical training. These training are largely organized by external entities.

They however expressed their frustration that training plans exist but are not implemented effectively. Sessions are poorly organized and too few. In their opinion, the facility management should dedicate resources to organize more workshops on rational use of antimicrobials.

Theme 3: Factors Influencing Rational/Optimum use of Antimicrobials

RQ3: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on factors that hinder or promote AMS in selected public health facilities in Nigeria?

The participants in each of the study sites discussed what they considered as situations hindering the rational use of antimicrobials and how to improve the situation in their clinical settings. They suggested that the factors hindering rational antimicrobial use are interplay of patient-related factors and some others related to inefficiencies in the health system bothering on quality of care. In broad terms, participants suggested that lack of structures for AMS is a barrier to rational use of antimicrobials and, consequently, contributes to the emergence and spread of AMR. The data also include conversation on the importance of guidelines, adherence to guidelines as well as the provision of crucial equipment to support quality patient care. The asymmetry of power within the health facility environment was also a significant finding.

The main theme is subdivided into lack of AMS committees and guidelines, roles and authority (imbalance of power), lack of modern equipment and incorrect diagnosis, continuous medical education and training, access to quality-assured and affordable medicines, and substandard or falsified medications (poor regulations).

Subtheme 3a: Lack of AMS Committees and Guidelines

Respondents stated that having a committee within the health care facility that

provides guidelines and oversees antimicrobial usage within the facility will be good to

enhance rational use of antimicrobials. They also emphasized the need to develop and

distribute AMS guidelines among the facility staff. Some participants expressed concern

that existing AMS Committees were not functioning. As Participants 25 noted, "In March

2015, the hospital inaugurated an antimicrobial stewardship committee and we have had

meetings and deliberations about antibiotics. Covid came and everybody went to sleep"

According to Participant 13, "The level of control and guide of antimicrobials is not

adequate."

Participant 3 offered a strong rationalization that a functional AMS committee

will contribute to stopping indiscriminate use of antimicrobials. The participant said,

> The first thing is to set up and empower antimicrobial stewardship committee.
>
> Policy should be set up and implemented. Attitudinal change is very important by
>
> educating the community. We have available data to substantiate it that people
>
> use antimicrobials indiscriminately.

Participant 10 also mentioned, **"**When guideline is given, we will follow it." Participant

16 said, "It will be good if we have a guideline on how to use the antimicrobials."

Participant 25 also corroborated the information provided by other participants.

Participant 25 noted,

> Antimicrobials are used regularly especially for infection and morbidities in
>
> children. A challenge is inappropriate use and lack of guidelines. I think we have

a huge problem with antimicrobials generally. Also, about quality assured

products. There are a lot of issues about the general use of antimicrobials.

Participant 29 advocated a systematic approach to tackling AMR stating,

For effective antimicrobial use, there is need for a few works where everybody

comes in to contribute something to ensure that antibiotics is chosen properly and

used for the current number of days, just to be adequate for the condition being

treated. Also, the patient stopping it at the right time to discourage development

of resistance [sic].

The participants seemed to suggest that the existence of a functional AMS

committee will promote development of guidelines, enhance compliance with guidelines

and ultimately contribute to rational use of antimicrobials.

Subtheme 3b: Roles and Authority (Imbalance of Power)

A significant number of participants emphasized the hierarchical characteristic of

clinical practice and suggested that this plays a defining influence on rational use of

antimicrobials. This perception, informed by experiences, affirms that professional

training, roles, responsibilities, and authority of healthcare staff have profound influence

on the behavior of system actors. The hierarchical relationship is noted to have lesser

influence at the PHC level. Participants at the PHC level noted the importance of

adherence to standing orders and described the list of actions required when a disease

condition is not found in the standing order. Participant 19 stated, "We have a guide for

community health practitioners that contains the dosage, side effects, and if the

complaints need to be referred, we do so with immediate effect."

The data highlighted that the relationship among the mix of professionals at the secondary and tertiary level differs and may affect patient care outcomes. As participant 25 said,

We have more challenges from physicians than surgeons. The attitude of the health personnel is important as there must be a paradigm shift in behavior pattern for people to imbibe and do the needful. As a physician, one of the things we do on the go is to prescribe antibiotics.

The superior medical officers and the experienced ones use their experience in giving patients drugs irrespective of the availability of the guiding principles. Data revealed that junior doctors tend to follow the prescribing patterns of their superiors for fear of disaffection. Participant 14 revealed:

There is a guideline which is readily available. A lot of people don't follow the guideline in terms of dosage, particular antibiotics and duration of administration. A lot of people place their judgment on what they have seen their superiors use for a particular medical condition and also based on their individual experience of such antibiotics and the responses of the patient. There is no particular antibiogram for the hospital.

Participant 2 noted,

For both inpatients and outpatients, most patients that come with fever, you see doctors prescribing antibiotics without really ascertaining the cause of the fever. There is a lot of prophylactic treatment- even though it might be due to viral infection, you see people recommending antimicrobials.

The uneasy relationship between medical officers and other professionals was observed as lack of trust by some participants. Participant 3 reported,

On a good day at our own end, if we notice something that is strange with the system, we should be able to notify the management. Something happened at my previous place of work, all the culture had same set of bacteria for their results. The people concerned had to look for the root cause whether it is contamination that is responsible for that scenario. However, when the HOD of the department informed the management, it was not taken seriously because it was coming from medical lab scientists. For effective infection control, everybody in the health sector must work hand-in-hand.

The far-reaching effect of the degree of authority among healthcare workers was expressed by some participants. They cited the policy that empowers nurses to give oral but allows only doctors to perform intravenous delivery of antibiotics and which sometimes affects the quality of patient care. Participant 27 noted,

It is the doctor's work to give the parenteral antibiotics as they know when they gave the last one just that there are lapses of time of medication of the patients. The (hospital) policy may affect the patients but not me as a nurse. Assuming they say nurses can give intravenous, there is no way we will miss it because we hand over our work (to each other). It is none of our business to watch the time doctor [sic] administered the last dose as they know their work. I may not want to intrude unless the patient complains.

The data also suggest that deliberate social interaction between health professionals would encourage cooperation with each other, contributing to adherence with guidelines. Participant 25 noted,

> With engagement, interaction and enlightenment, we'd make progress. There is also the aspect of administrative support. If people are well-informed and they have access to the needful, I don't see a problem with them adhering. The problem is usually lack of information and lack of access.

> Participant 29 also stated, "Coming together to reason with medical microbiologists, infectious disease clinicians may help provide proper placement on correct antibiotics for the correct number of days". Participant 14 suggested that pharmacists are crucial in the quest for enhancing rational use of antimicrobials within facilities and round-table engagement or negotiations with other professionals. According to Participant 14,

> The pharmacy department can be actively involved in rational use in terms of dosage of prescription, frequency of administration and duration of use. There is a pharmacy unit attached to most of the wards; each try to enhance rational use of drugs; they can be more active in that aspect. They (pharmacists) can call a roundtable discussion with doctors as to rational use of drugs.

The responses of the participants demonstrated that professional training, roles responsibilities and authority of system actors have a profound influence on how well rational use of antibiotics are observed within their facilities. The imbalance of power

sometimes causes unhealthy relationship among professionals that contributes to behavior that hinders performance of tasks.

Subtheme 3c: Lack of Modern Equipment and Incorrect Diagnosis

The participants emphasized the importance of having the right equipment and capacity to perform tests that enable healthcare workers to make correct diagnosis. They noted that correct diagnosis will engender appropriate treatment using the right medication for the correct duration of time. They opined that before antimicrobial is prescribed, there is the need for a laboratory confirmation of the disease condition and identified organism. Participants decried irrational prescription of drugs. According to Participant 9, "Some of the doctors use clinical experience as regarding prescription pattern to choose antimicrobial agents to place the patient on. Of course, the guideline must supersede everything." Participant 26 said, "I know we shouldn't use antibiotics irrationally, we should gate-keep the higher-level antibiotics as the organisms are getting resistant to the few new ones coming out." Another participant said, "Before we use any antibiotics or antimicrobials, it must be evidence-based for these drugs to be applied to some people." According to Participant 14,

> Getting a biogram of specific common organisms in our environment from the hospital laboratory in collaboration with clinical microbiologists will streamline the drugs to effective and affordable ones that will be made more available in the hospital pharmacy. Though cost is a major factor but there are instances where cheap antibiotics can do the work.

However, the healthcare workers expressed their concern about the lack of appropriate laboratory equipment across their facilities as hindrance to rational use of antimicrobials. Participant 2 mentioned, "Obsolete equipment, reagents not available, modern equipment not available- for example, up till now, we don't have blood culture machine for bacteria culture and sensitivity testing though we have competent personnel." Participant 2 also stated that "Monthly or yearly antibiograms are not available because a lot of equipment are needed to give regular guidelines- some are not provided, some are obsolete where they are provided." Participant 6 also supported this view:

> Some facilities send our patients out to run their tests as they don't have a functioning laboratory. Those facilities do not have a medical lab scientist, so they are using available resources like JCHEW, CHEW. They are the ones running the lab.

Participant 13 said,

> Secondly, there should be proper laboratory support. Microbiology labs should be able to give prompt and adequate support. The infection control unit needs to do more with regards to antimicrobial stewardship within the hospital so that there will be proper use of antibiotics.

> According to participant 25, "If the doctor does not make a good assessment, that is a challenge. There is also the issue of guidelines and protocols- adherence to them." Participant 30 said, "Antibiotics use in Nigeria is not good enough. There are deaths that could have been prevented if the right antibiotics were used for the right duration."

Logistic challenges in the laboratory were also identified to hinder correct diagnosis. Participant 2 said,

Most of us working in Nigeria now are working with limited materials, no power supply, information dissemination is a problem due to lack of information technology, long turnaround time, lack of equipment. We lose some organisms due to power failure.

The participants seemed to agree that making correct diagnosis through ordering the correct diagnostic may contribute to the right treatment of condition for the right duration.

Subtheme 3d: Continuous Medical Education and Training

Respondents identified lack of knowledge of new generation antibiotics among physicians as one the factors that can hinder the rational use of antimicrobials. They recognized that the occasional advertisement of new products by pharmaceutical companies helps physicians to update their knowledge. They said that facility administrations need to enroll staff for training workshops on antimicrobials. They proposed that frequent training on the use of antimicrobials can be organized for healthcare workers. They identified the role of pharmacists as vital to making the system work.

The respondents emphasized that the training and re-training of staff are vital steps to contributing to rational use. According to Participant 13,

There are so many factors that affect appropriate use of antimicrobials within the facility. One of them is lack of training. There should be regular training of health

workers, basically physicians that are involved in prescribing these medications on the proper use of antimicrobials.

Participant 2 revealed,

About three or four years ago, we had a training based on a surveillance study we did on antimicrobial usage in the hospital. We observed that a lot of our people prescribed antibiotic indiscriminately. We published the article in 2016, so, based on that we organized training for our health workers, and we have not done another one since then.

Participant 7 said, "Enroll staff into different workshops and trainings on antimicrobials for them to acquire more knowledge on those drugs. It helps us know the effect of the drugs on patients we prescribe to them [sic]." Participant 16 affirmed, "It will also be good if there can [sic] be regular training on the use of antimicrobials in the hospital. When new antibiotics come in, the medical personnel should be introduced to its use, side effects." Participant 9 also said,

Organizing trainings for the physicians, pharmacists and other healthcare workers on the importance of rational drug use is useful. The issue of essential drugs and the antimicrobial use is another thing. Training can, from time to time, remind the prescribers and other healthcare professionals that are involved in administering these drugs to patients [sic].

According to Participant 25, continuous training is crucial to the effective performance of the AMS program but must align with other AMS action processes. Participant 25 noted "Awareness and training of the doctors; they are all building blocks

of which without one, the building is not complete. After all the training, if the system to support is not there, it is going to be a challenge."

Subtheme 3e: Access to Quality-Assured and Affordable Medicines

Participants addressed the availability of quality medication and how lack of it contributes to poor treatment outcomes. Participant 26 revealed that "Availability is an issue. The commonest organism is staph. Unfortunately, we don't have an appropriate anti-staph agent. Either the antimicrobial is unavailable or expensive when you see. Availability is one of the main problems we have for anti-staph agents."

In the opinion of participants, the high cost of quality products force patients to procure cheaper, probably substandard, medicines. Most of the participants' said patients do not have money for some of the antibiotics prescribed at the hospital and this sometimes leads to non-completion of the dose of antibiotics or purchasing brands that are counterfeit. Participant 18 said, "Most of these patients come from remote areas, so even when a drug is prescribed, the cost of those antibiotics is on the high side, so patients might not be able to afford the cost of such drug". Participant 28 said, "When patients can't afford the drugs, either they don't take it for the prescribed duration or use other brands of the drugs prescribed." Participant 1 said, "Sometimes, branded drugs whose efficacy has been proven over time may be costlier than generic drugs. It might be easier for someone to buy the generic drugs than branded ones." Participant 30 noted "The problem is that the highly potent ones are very expensive."

Participant 26 noted, "Sometimes some patients buy only the starting dose or fail to follow up orally after stepping down from intravenous antimicrobial administration

and there are some infections that need to be treated for a much longer time. Once drugs

are discontinued, relapse happens. "Similarly, Participant 14 said, "Also, if the price of

the drugs is unaffordable, patient might stop the drugs midway after buying what he can

afford."

Participant 18 identified the insensitivity of prescribers to the prevailing situations

of the patient during patient care. Participant 18 suggested, "Also, the doctor making

prescription don't [sic] consider patients capacity and the cost of transportation from their

remote areas." Broadly, participants offered that availability of antibiotics within their

facilities will enhance rational antibiotic use.

Subtheme 3f: Substandard and Falsified Medical Products (Poor Regulation)

Most participants suggested that poor regulation of the quality of medicines

provides easy access to sub-standard and falsified medical products, including

antimicrobials, within and outside the facilities. They noted that substandard and falsified

medicines contribute to poor treatment outcomes, including drug resistance. They offered

that high cost of quality antibiotics encouraged patients to buy cheaper alternatives of

inferior quality. Participant 14 said, "I think we have a huge problem with antimicrobials

generally. Also, about quality assured products. There are a lot of issues about the general

use of antimicrobials." According to Participant 26,

Cost is also a problem as there are many generic brands and patients tend to buy

the cheapest of the brands. Those brands are questionable because after using the

medication for a few days, you may not get any results but if you give the

branded, you see the difference within 24 hours. Cost and fake drugs go hand in

hand.

Participant 9 said,

I am so much impressed about the research topic because we are having

emergence of resistance of antimicrobial agents; not necessarily because of

substandard drugs that are very much available in open markets, but because of

patients being treated empirically.

Participant 26 expressed concern about the preponderance of substandard and

falsified medical products saying,

We need to implement regulations, we should guard over the counter sales and

implement policies that are against buying antibiotics over the counter. I don't

know what regulations can be done to ensure the molecules are genuine and not

fake.

Subtheme 3g: Pervasive External Influence

The data revealed that pharmaceutical companies' representatives or marketers

play crucial roles in establishing or sustaining an effective AMS program. Some

participants noted that the manufacturers' representatives are directly enmeshed in the

supply of medicines to health facilities, and considered this alliance unwholesome,

contributing negatively to efforts to institutionalize AMS programs at health facilities.

Participant 3 said, "Pharmaceutical companies once in a while organize seminars and

invite our staffs from all the departments in the hospital to attend. They may dish out

information from there." Participant 4 noted,

Aside pharmaceutical companies come to advertise their products[sic], since we

have the knowledge of all the antimicrobials being used, it makes it possible for

anyone that knows the mode of action and normal dosage to prescribe it even in

the absence of a doctor.

Participant 4 saw the relationship with the representative as beneficial and

suggested that

New antimicrobials are being introduced so the pharmaceutical companies must

make it mandatory to inform health facilities about what it is all about, the mode

of action, side effects, what it contains; so people can know the appropriate

dosage to avoid drug reactions and overdose.

Participant 4 went further to provide insight into the nature of engagement with the

representatives. Participant 4 said, "We don't have any stock-outs because the

pharmaceutical companies are making money from it here, so before the supply finishes,

they bring another one since they know we are not giving it out free."

Participant 16 suggested that the unwholesome relationship of health care

professionals sometimes promotes corrupt and irrational prescription practices.

Participant 16 revealed:

The problem we have now is there are so many counterfeit drugs in the market.

The companies come to advertise their drugs to the doctors. The doctors prescribe

based on what the medical reps have given them. (If they do the right thing and

prescribe according to the person's ailment and not based on their own selfish

interest). I think it would be better a sensitivity test is done immediately from the

onset so that we avoid case of resistance. There are cases where the prescriber will prescribe, and the pharmacy doesn't have the particular brand. They (pharmacists) will give a substitute, but the prescriber rejects and tells the patient to return it. Sometimes the prescriber feels that renowned brand names are better than the others, so they tend to use them more.

Participant 17 said "Depending on companies, the company that wants to introduce antimicrobials initiate training and mobilize people for the training." Participant 17, however, proffered a solution to the negative influence of representatives. Participant 17 suggested:

They bring a lot of things as marketing strategy to sell their brands but let us be sure to know if the antimicrobial they are coming with is sensitive and specific to a particular infection. If we are trying to isolate a gram-negative organism, we don't just rely on what they write on their pack, we take a lone gram-negative, isolate and run the sensitivity test to be sure if it is actually working. There should be room for us to test the antimicrobial agent, then when it passes it, we can recommend for patient use.

Participant 17, however, suggested peer supervision to minimize the external influence of the marketers thus "The system is porous because no one is talking about it. If I am a patient and the doctor is writing a particular drug for me, I don't know the rationale behind him suggesting the drug for me, I'd just buy it. It takes a doctor to know what and why the other doctor is doing."

Summary

The qualitative case study focused on the experience of system actors on AMS. The three research questions were: RQ1: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on system processes for AMS in selected public health facilities in Nigeria? RQ2: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on the scope and functionality of AMS systems in selected public health facilities in Nigeria? And RQ3: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on factors that hinder or promote AMS in selected public health facilities in Nigeria? Using semistructured in-depth interviews, a total of thirty participants were interviewed. Interview transcripts were cleaned in Microsoft Word before the information was exported to NVivo software program for analysis. Three main themes and thirteen sub-themes were identified from the analysis of the research data.

In summary, findings from this study showed that most of the healthcare facilities do not have AMS platforms Where this structure exists, it is does not function optimally. Most participants did not understand the principles and functions behind AMS, therefore they frequently, considered other ad hoc arrangements operating within their facilities as alternatives. While the primary healthcare staff observe guidelines using standing orders, those at the secondary and tertiary levels do not follow guidelines promoting rational antibiotic use.

The scope and functionality of the AMS in Nigeria also varies across facilities due to lack of laboratory equipment resulting in inaccurate diagnosis, preponderance of

sub-standard and falsified medicines as well as the power play between professional

groups. The inability of patients to buy quality-assured antibiotics in sufficient doses and

for the right duration is also a significant finding.

In Chapter 5, I discuss the results and interpretation of this study. The limitations

and recommendations, including the study's potential impact for positive social change,

are also presented in this chapter

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to improve the understanding of the practice of AMS at three-tiered levels of care. The intent was to explore the experiences of system actors' attitudes, subjective norms, and perceived behavioral control on system processes for AMS, its functionality, and factors promoting or hindering AMS in selected public health facilities in Nigeria.

The literature reviewed for this study contributed to evidence that poor prescription practices occur commonly in health facilities in LMICs; however, few studies have examined AMS beyond tertiary care facilities (Dijck et al., 2018). Furthermore, a recent systematic review of hospital AMS in LMICs contains data from only two African countries, namely, Kenya and South Africa (Dijck & Arnoldine, 2018). None of the literature reviewed elucidated the perspectives of the health care workers and the contextual factors promoting or limiting sustainable antibiotic governance across different levels of health care.

For this study, I applied the interpretive qualitative case study approach. The study was guided by the TPB, which evolved from the theory of reasoned action (Ajzen, 1985, 1991) to predict an individual's intention to engage in a behavior. Three research questions guided this study:

1. What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on system processes for AMS in selected public health facilities in Nigeria?

2. What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on the scope and functionality of AMS systems in selected public health facilities in Nigeria?

3. What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on factors that hinder or promote AMS in selected public health facilities in Nigeria?

The data for this study were collected from system actors through in-depth interview using semistructured questionnaire. Participants were purposefully selected from primary, secondary, and tertiary levels of care. The thematic analysis generated three overarching themes with 13 subthemes. The findings showed that most health facilities had no appropriate system to implement AMS. In one out of six facilities where the AMS committee was established, the system functions poorly. Participants identified establishment of AMS committees, development of guidelines and adherence, availability of laboratory equipment and lack of quality-assured and affordable medicines as some of the factors affecting the optimal or responsible use of antimicrobials.

Chapter 5 contains the integration, synthesis, and evaluation of the interview and literature findings related to the study research questions. Also captured in this segment of the study are the study's limitations, recommendations for continued research, and the implication for positive social change.

Interpretation of the Findings

The study focused on how to promote optimal use of antimicrobials at the health facility level. Establishing a governance structure for AMS programs at all three-tiers of

the healthcare system encourages optimal use of antimicrobials and consequently

contributes to preventing and controlling AMR. The findings were interpreted using data

collected from in-depth interview sessions with system actors.

Findings for RQ1

RQ1: What are the experiences of system actors' attitudes, subjective norms, and

perceived behavioral control on system processes for AMS in selected public health

facilities in Nigeria?

The findings demonstrated that the AMS program is not established in most of the

facilities. Hence no systems exist in these facilities to promote rational use of

antimicrobials. Only 1 out of 5 facilities reported having an AMS committee set up. This

finding is consistent with the literature on AMS that these health facilities have not

identified AMS as a prioritized intervention.

AMR is an emerging threat to global health, and institutionalized AMS at all

levels is one of the potent strategies required to tackle it (Davey et al., 2013; WHO et al.,

2017). AMS is a set of core elements required to promote optimal use of antimicrobials

and improved patient outcomes (Dyar et al., 2017). These core elements were identified

to include leadership commitment, accountability, AMS actions, education and training,

monitoring and evaluation, and reporting and feedback (Pulcini et al., 2019; WHO,

2019). Current evidence showed that AMS at the facility level has a beneficial effect on

"predetermined patients' outcomes: clinical outcomes, adverse events, costs and bacterial

resistance rates" (Schuts et al., 2016). However, due to numerous challenges, the set-up

of AMS programs at the hospital and primary healthcare levels in LMICs are limited (Cox et al., 2017).

In 2017, Nigeria established the National Antimicrobial Resistance Program to coordinate the prevention and control of AMR (Nigeria Centre for Disease Control, 2017). Although formal structures were established at the national level, AMS has not received deserved priority at the facility levels (Fadare et al., 2019). According to Fadare et al. (2019), only 35% of healthcare facilities studied across five of the six geopolitical zones in Nigeria had formal organizational structures and dedicated teams. This literature is consistent with findings from this study that the absence of structure for AMS reflects a lack of leadership and commitment to AMS. These facilities have not considered AMS as a priority intervention. Without an AMS program, there is no systematic approach to diagnosis or right prescribing, and this implies limited access to affordable and efficacious medications to patients resulting in poor quality of care and long-term AMR problem in Nigeria.

Findings for RQ2

RQ2: What are the experiences of system actors' attitudes, subjective norms, and perceived behavioral control on the scope and functionality of AMS system in selected public health facilities in Nigeria?

The findings of this study showed that only one health facility instituted an AMS program, with a participatory team composition members drawn across departments. The study discovered that the committee developed terms of reference, work plan and guidelines for antimicrobial use. The findings also showed that system actors at this

facility did not comply with guidelines, and there was neither a system for effective monitoring nor a mechanism sanctioning noncompliance with guidelines. The committee did not meet regularly and did not have dedicated funding to facilitate its activities. The findings also revealed that training activities on AMR were planned but not implemented. At the primary healthcare facilities, the participants observed that they comply with the standing order guidelines. The standing order guidelines are a set of instructions or treatment protocols that enables nurses or community health care providers to extend care (Ibrahim, 2016; Taylor et al., 2017). The tool allows primary care staff to perform specific clinical tasks, including prescription of antimicrobials, without deferring to medical officers. The findings also revealed that the monitoring and enforcement of the use of these guidelines are seldom done. The finding additionally showed that the supervision checklist at the primary care level does not include sections on compliance with the treatment guidelines. The emphasis of supervision at this level is deeply biased towards administrative issues, number of regular attendances, number of procedures performed, number of children vaccinated, monitoring of funds disbursed and its use, sanitation, and waste disposal, amongst others.

These findings are consistent with the literature that performance is predicated on effective process governance. Based on the demand of the health staff, the hospital inaugurated an AMS committee; however, the governance mechanism meant to drive effective performance of the AMS program was not well defined. The OECD (2021) described governance as a set of rules, relationships, systems, and processes through which a group's essence and objectives are achieved or realized (G20/OECD, 2015).

According to Paim and Flexa (2011), governance that is properly aligned with structure, objectives, system processes, and performance monitoring will enhance collaboration and communication within an organization, resulting in the improved and sustained achievement of goals (Paim & Flexa, 2011). The WHO (2019) defined six core elements required to achieve a successful AMS program at the health facility level. These elements are (a) leadership commitments, (b) accountability, (c) responsible AMS actions, (d) education and training, (e) monitoring and surveillance, and (f) reporting and feedback. The WHO advises that all the core elements must align with the goals and objectives of the AMS to achieve meaningful results.

According to the New Zealand Ministry of Health (2016), the standing order guidelines are a set of protocols granting nurses, community health workers and other paramedics at the primary care facilities prescribing rights to administer controlled medicines, including antimicrobials, for prompt, accessible patient care (Ministry of Health, 2016). Findings from the current study showed that though the health staff consider standing order guidelines a valuable tool to extend care, a purposeful governance structure for ensuring compliance with standing order guidelines is deficient. The standing orders are a valuable set of protocols but require implementing quality assurance measures to improve patient care quality (Taylor et al., 2017). According to Ibrahim (2016), the proper application of standing orders can improve efficiency, boost health, staff performance, promote good health, and enhance the quality of life. In a study assessing the knowledge and practice of community health workers about pre-eclampsia in Ogun State, Nigeria, Sotunsa et al. (2016) showed that community-based health care

providers had competencies to provide appropriate care. Therefore, it is safe to state that proper application of the standing orders, including supervision and monitoring of use, by extension, will ensure compliance and contribute to optimum use of antimicrobials among nurses and community health workers at the primary health facility.

Findings for RQ3

RQ3: What are the experiences of system actors' attitudes, subjective norms and perceived behavioral control on factors that hinder or promote AMS in selected public health facilities in Nigeria?

The findings from the data collected in this study showed that participants considered the absence of a functioning AMS program crucial to promoting optimum use of antimicrobials. Results revealed that interprofessional asymmetries, lack of modern equipment to make a correct diagnosis, and continued training and retraining were considered significant influences in the appropriate use of antimicrobials in the hospital environment. It was also discovered that the high cost of quality-assured medications and the preponderance of falsified and substandard medical products are factors that interfere with responsible use of antimicrobials.

Most participants suggested that having a functional AMS committee would promote the development of guidelines, enhance compliance with guidelines, and ultimately contribute to the responsible use of antimicrobials. This finding is consistent with Davey et al. (2017), showing that an effective AMS program influences positive antibiotic prescription outcomes. The AMS program is an organization-wide approach designed to coordinate and implement interventions promoting the responsible use of

antimicrobials. The WHO (2017) recommended that establishing an AMS program goes beyond organizational structure but includes process governance. Good governance ensures that the organizational structure, guidelines, processes, including monitoring and evaluation, are aligned to achieve the desired performance (G20/OECD, 2015). Aligning core elements of AMS and managing their processes proactively and predicatively are fundamental to achieving and sustaining the improved performance of any organization or program, including the AMS programming (Jeston & Nelis, 2008).

The findings of this research also showed that professional training, roles, responsibilities, and authority influence behaviors of system actors. Some of the participants revealed that the interprofessional power relationship among physicians and between physicians and other professionals plays a defining role in the use of antimicrobials. In a study conducted among physicians and nurses in two tertiary hospitals in Australia, J. K. Broom et al. (2017) revealed that a significant number of senior physicians did not trust guidelines, either because they did not participate in the guideline development or because they (physicians) considered themselves experts in their specialties. A. Broom et al. (2015) also reported that nurses had challenges "between their desire to advocate for their patient but also to conform to the hospital hierarchical structures influencing their role." In the same study, junior physicians and nurses revealed that they defer to the opinion of senior physicians rather than the clinical guidelines.

A. Broom et al. (2015) emphasized that the moral basis of antibiotic prescribing contributes to physicians' behavior. According to these researchers, physicians are less

concerned about the long-term effect of antibiotic misuse and AMR but rather with immediate concern for patient condition and treatment outcome. Understanding the social and behavioral factors in the health facility environment will promote interprofessional negotiations and engender seamless coordination and communication within the AMS program.

This study also revealed that lack of modern laboratory equipment hinders correct diagnosis and contributes to misuse of antimicrobials. In addition to obsolete equipment, participants also noted a lack of crucial reagents. This finding is consistent with those from other climes. Africa has a high prevalence of infectious diseases, but the capacity for laboratory diagnosis is extremely limited. So, developing diagnostic testing capacity alongside AMS interventions is crucial to effective performance (Cox et al., 2017; Petti et al., 2006). Inadequate infrastructure, lack of appropriate equipment, effective standard operating procedures (guidelines for samples collection, correct pathogen identification) and weak quality control systems are common challenges affecting laboratory services in LMICs (Cox et al., 2017). While AMS is advocated to reduce antimicrobial consumption, it is crucial the patients receive correct diagnosis and retain access to appropriate treatment (Laxminarayan et al., 2016). Diagnostic stewardship is a set of steps enabling selection of the right test for the right disease condition to generate an accurate diagnosis communicated timely to the clinicians to facilitate appropriate treatment (Patel & Fang, 2018). Inappropriate use of tests can mislead physicians to make an incorrect diagnosis and misuse antimicrobials resulting in poor treatment outcomes or untreated infections contributing to the growing AMR threats in the longer term (Messacar et al., 2017).

Instituting process governance for diagnostic stewardship would align the structure,

established guidelines, diagnostic algorithms, and other processes for correct diagnosis,

avoiding overuse of tests and saving costs (G. R. Madden et al., 2018). Therefore,

functioning collaboration and cooperation between the diagnostic stewardship group and

the AMS clinical side are desired to achieve the goal of AMS.

The other findings of this study are the high cost of quality assured and effective

medications within and outside the health facilities. Participants noted that poverty forces

the patients to opt for cheaper substandard medications from community pharmacists

even when quality-assured medications are available within the facility. In this regard,

findings from this study are consistent with those from other settings. Tackling AMR

through responsible antimicrobials use demands access to effective, affordable, and

quality assured medications (Mendelson et al., 2016). Cox et al. (2017) suggested that

many LMICs struggle with limited access to effective antibiotics and poor or unregulated

access to antibiotics, which inadvertently leads to misuse. A closely related challenge is

that of limited access to effective but affordable old antibiotics. Effective leadership to

achieve appropriate access to affordable and quality-assured medicines, including old

effective antibiotics, will contribute to the responsible use of antimicrobials (Mendelson

et al., 2016; Pulcini et al., 2017).

Substandard and falsified medical products are widespread, particularly in LMICs

(Kelesidis & Falagas, 2015). The most common substandard and falsified medicines are

antibiotics and antimalarials (WHO, 2018). According to the WHO, substandard and

falsified medicines account for about 10% of global pharmaceutical commerce, and in
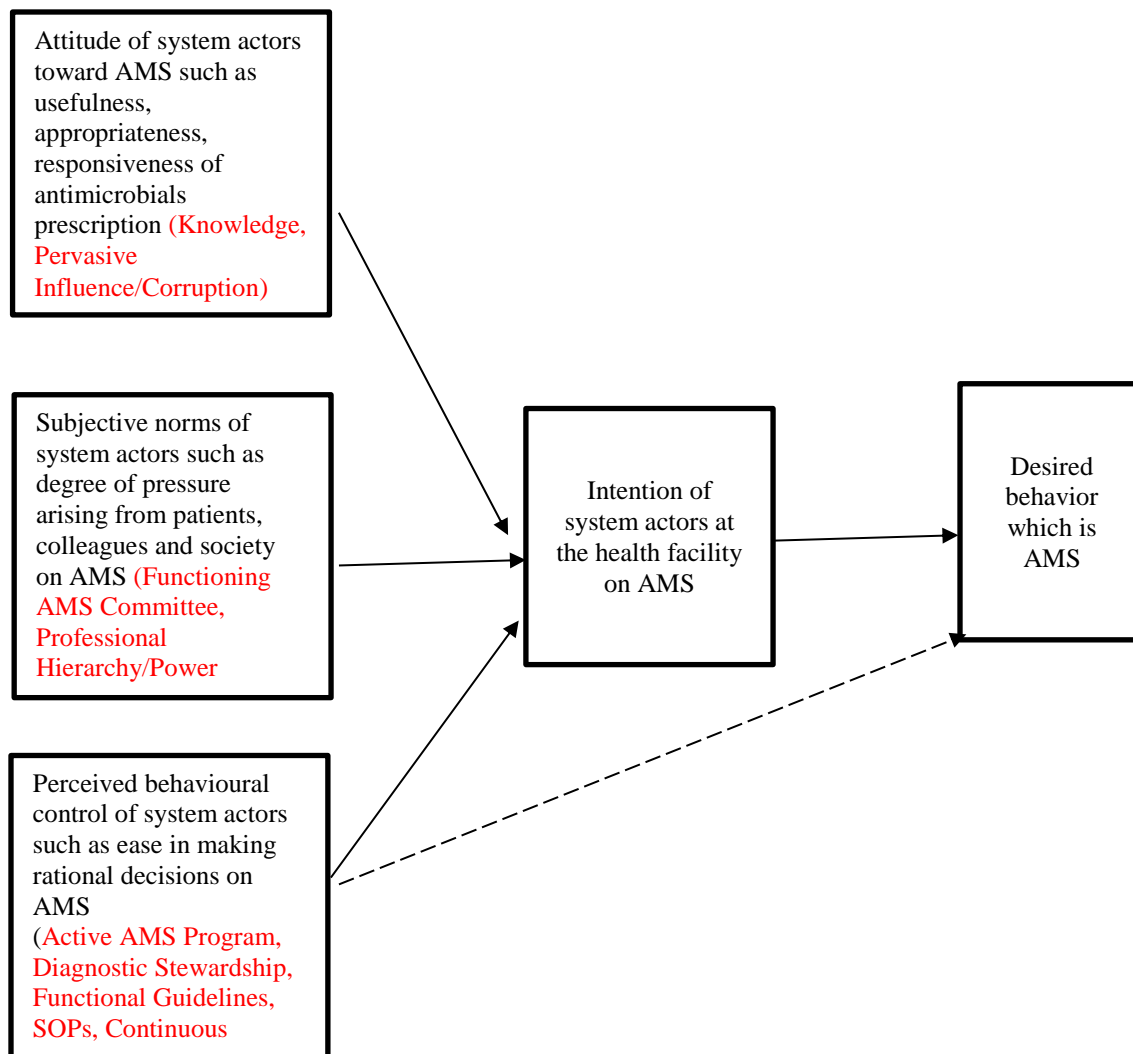
LMICs, 25 – 30% of medicines are substandard. The increasingly high cost of drugs, out-of-pocket expenses for health, poverty, and lack of sustainable financing for health contribute to patients' preference to use cheap substandard and falsified medical products widely available(Johnston & Holt, 2014). In a study conducted in Nigeria, Beargie et al., (2019) estimated that substandard and falsified antimalarials are responsible for the death of 12,300 children under the age of five, and about $893 million loss annually. In another study, Cohn et al. (2013) described how falsified medicines breached the supplies chain system, interrupting quality-assured generic medicines' availability to the patients. An effective and strict regulatory and enforcement framework are crucial to preserve the availability of quality-assured and affordable generic medicines to the patients and to reduce the impact of unregulated access to antimicrobials (Cohn et al., 2013).

The findings also highlighted the pervasive influence of medical representatives of pharmaceutical companies in increased antibiotic use. Participants in this study observed that physician-industry relationship has negative influence on professional decision making. Ezeome (2021) suggested that physician and pharmaceutical industries' contacts occur commonly in Nigeria, affecting prescribing behavior. The effect ranges from subconscious and unintentional biases in decision making to deliberate actions promoting corruption and, subsequently, affecting antibiotic use (Ezeome, 2021). In a study examining the association between physician-industry interaction, Lieb and Scheurich (2014), suggested that the physician-industry relationship is highly correlated with higher prescriptions of branded medications over a lower proportion of generic ones. Physicians need to recognize conflict of interest, understanding that they are vulnerable

to commercial manipulations (Lieb & Scheurich, 2014). In a systematic review conducted in high income countries, Brax et al., (2017) examined interactions such as detailing, industry-funded continuing medical education, and accepting gift ; and observed that 15 out of 19 studies found that physician- industry interactions contributed to "promoting a medication, and inappropriately increased prescribing rates, lower prescribing quality and or increased prescribing costs" (Brax, Fadlallah, Al-Khaled & Kahale et al., 2017). In another study which analyzed panel of data set in 28 European Union countries, Collignon et. al., (2014) also revealed that there is a powerful correlation between levels of AMR and corruption at the facility level. The research suggested that the poor quality of governance in terms of control of corruption contributes to uncoordinated AMR processes, poor monitoring and supervision, resulting in high, unregulated consumption of antibiotics. According to Collignon et. al., (2014) improving quality of governance would reduce corruption, promote better control practices, and ultimately reduce the spread of AMR. In another study conducted in the European Union, Ronnerstrand and Lapuente (2017) also highlighted the social and behavioral aspects of AMR. The study explored the correlation between corruption and antibiotic use and found that a positive association existed between "measures of corruption" and antibiotic use. Efforts to promote rational use of antimicrobials should, therefore, include effective governance of AMS program at the facility level (Rönnerstrand & Lapuente, 2017). Other measures should include education of the professionals that they are vulnerable to industry manipulations. Measures to curtail

industry influences should also promote declaration in conflict of interests among health professionals (Ezeome, 2021; Rönnerstrand & Lapuente, 2017).

The findings in this research agreed with the position of the TPB that intention is the best predictor whether a system actor will actually perform a behavior. However, the strength of the attitude, the significance that others attach to the behavior in question and the individual perception about availability of opportunity or resources to perform the behavior strengthens the intention to perform the behavior of concern (see Figure 5). The lack of AMS program and guidelines, imbalance of power, lack of modern equipment and incorrect diagnosis, lack of continuing medical education, lack of access to quality and affordable medicines, substandard and falsified products and pervasive external influence diminish the resources and opportunities to achieve rational use of antimicrobials.

Figure 5

Theoretical Framework of Antimicrobial Prescription Behavior

Attitude of system actors toward AMS such as usefulness, appropriateness, responsiveness of antimicrobials prescription (Knowledge, Pervasive Influence/Corruption)

Subjective norms of system actors such as degree of pressure arising from patients, colleagues and society on AMS (Functioning AMS Committee, Professional Hierarchy/Power

Perceived behavioural control of system actors such as ease in making rational decisions on AMS
(Active AMS Program, Diagnostic Stewardship, Functional Guidelines, SOPs, Continuous

Intention of system actors at the health facility on AMS

Desired behavior which is AMS

Limitation of the Study

This study focused on the experiences of the system actors regarding the lack of or the implementation processes, best practices, and challenges of functioning AMS program in public health care facilities in Nigeria. The study provided data sets from two federating states and three levels of public health facilities with different cultural and institutional settings. Therefore, the results of this study may not be generalizable to other settings, like the private health sector. The second limitation is the use of purposeful sampling, which recruited participants from a group of actors that are supposedly information-rich on the phenomenon of interest using pre-determined selection criteria. The participants are assumed to be information-rich on the role they perform in their respective organizations; however, some other participants that are information-rich in some other aspects of the phenomenon of interest may have been omitted.

Despite the limitations, the research methodology is reliable and can be applied in similar studies and environments to get similar results.

Recommendations

This study focused on the presence of the AMS program at the health facility level, its functionality and factors hindering its effective performance in Nigeria. My findings potentially contribute to understanding the factors promoting rational antimicrobial use, resulting in improved quality of care and potential reduction in the spread of AMR. Specifically, the findings would be helpful to key stakeholders like the National AMR Coordinating Committee (AMRCC), health facility administrators, health professionals, partners and donor agencies supporting AMS and policy makers.

This study may be replicated in the other health facilities in other zones to promote the understanding of the factors affecting the effective performance of the AMS program at the facility level by the Federal and State Ministries of Health. Effective performance is predicated on good governance. The quality of AMS governance at the health facility should be explored. The poor quality of governance with attendant poor process management within the AMS program will potentially result in the irrational use of antimicrobials at the facility level. Stepwise implementation of the AMS program as well as the alignment of the objectives, processes and monitoring and evaluation would improve and sustain performance, improve patient care, and ultimately reduce spread of AMR in the long run.

The social and behavioral factors influencing the performance of the AMS program has not been well explored in Nigeria. The hierarchy and power asymmetry with the health facilities deserve attention. Understanding the role of other stakeholders, apart from physicians, in the hospital environment will promote the performance of the AMS program and the effective control of antimicrobial use at that level.

Although the physician-pharmaceutical industry interactions could be beneficial, this study revealed that it has negative influences across the facilities where this study was conducted. It is therefore recommended that the Federal and State Ministries of Health as well as the Medical and Dental Council of Nigeria and the Nursing and Midwifery Council of Nigeria intensify education of health professionals to raise awareness on how to handle conflict of interest. Curtailing the negative influence of pharmaceutical industries would contribute to rational use of antimicrobials.

Implications

AMR is a global challenge threatening the most recent advances made in the field of medicine. AMS program, if effectively managed, will contribute to reducing the spread of AMR. This research explored the perception of system actors on the functionality of the AMS program and factors hindering its effective performance at the facility level. The AMS program is a set of coordinated actions designed to achieve responsible antimicrobial use. Therefore, a functioning AMS program will create benefits that can be felt at individual, institutional, community, and national levels.

The findings from this study revealed that good governance of the AMS program would contribute to the effective control of antimicrobial use at the facility level resulting in potential improvement in the quality of patient care. Making correct diagnoses and prescribing the right medication and dosage for the right duration reduces the duration of hospitalization and the cost of treatment in individuals. AMS program would also create universal and equitable access to old but effective and cheaper antibiotics. The use of these antibiotics may be preserved through inclusion in local treatment guidelines and the national essential drug list. Universal access to effective, quality-assured, and affordable medicines is an issue of basic human right.

Additionally, improving the process governance of the AMS program is very important. Good governance would align all processes, including resources, training, monitoring and evaluation, to achieve responsible antimicrobial use at all levels and contribute to the slowdown of the spread of AMR.

The physician-pharmaceutical industry interactions negatively affect prescription habits, increases prescription costs, patient care and scientific integrity. The Federal and State Ministries of Health should promote measures curtailing the negative influences of this interaction at all levels. Health professional should be educated on possible conflict of interest in their work.

In 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development and 17 SDGs. These goals target ending poverty, zero hunger, improving health and education, reducing inequality and promoting economic growth, amongst others. However, AMR threatens the achievement of a significant number of goals. Tackling AMR through effective AMS program governance would contribute to achieving goals 1, 2, 3, 8 and 10, amongst others. Universal Health Coverage, in particular, would not be possible if AMR is not tackled successfully.

Conclusion

AMR is a global threat associated with grave health, social and economic consequences. Tackling AMR requires multisectoral coordination and collaboration at the global, national, local, institutional, and individual levels. There is limited literature on the state of AMS programs across sub–Saharan Africa. This study sought to elucidate the functionality of the hospital AMS program and the factors hindering its efficient performance in Nigeria. Through in-depth interviews, system actors at the primary, secondary, and tertiary health care facilities shared their experiences on AMS within their respective environments. The findings from this qualitative case study revealed limited leadership commitment to AMS at all levels of care. Most of the facilities did not have an

institutionalized AMS program. The study also found that the AMS program, where it existed, performed sub-optimally due to low quality of governance. Furthermore, the health care workers at the primary level do follow guidelines for treatment as in the standing order guidelines. However, supervision and monitoring of compliance with treatment, specifically concerning antibiotic prescription, is not systematic.

Premised on the findings of this study, it is suggested that Nigeria strengthens the AMR response by creating a policy and legal framework mandating all health care facilities to establish an AMS program with effective governance structures. Attention should focus on process management aligning the AMS objectives, processes, and resources, monitoring and evaluation in such a way to achieve high performance leading to responsible antimicrobial use while preserving universal access to effective ones.

The selection of correct diagnostic tool, quality and correct laboratory result that is reported promptly to the clinician for action is crucial and contributes to the success of the AMS program. Therefore, this study also recommends that stakeholders recognize diagnostic stewardship as an integral part of the AMS program, which must be pursued vigorously. Future research should focus on improving and sustaining the quality of AMS program governance at all levels of healthcare in Nigeria.

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