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Factors Influencing Increased Anti-Microbial Resistance and Mitigation Strategies Used Among People Living with HIV Aids Visiting Rwanda Military Hospital

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Abstract

Antimicrobial resistance globally, regionally, and locally in Rwanda has caused hospital resistance, more-acquired infections, and increased morbidity and mortality from tuberculosis, cholera, and dysentery epidemics. Determine the prevalence of biomedical factors and mitigation strategies used against antimicrobial resistance in PLWHs, determine social cultural and beliefs influencing AMR, determine social economic and accessibility factors to comprehensive care clinic (CCC), and evaluate how KAP affects AMR and mitigation strategies in PLWHs visiting RMH. The results of this study inform the government, especially the health sector, about the main causes of anti-microbial resistance and how to mitigate them, especially in HIV/AIDS patients. Research alerts policymakers to make effective supervision of anti-microbial use to minimise drug misuse using mixed research approaches survey (quantitative) and interviews (qualitative) with descriptive study designs, purposive sampling on PLWHs, SPSS Version 27.0 data management, cross-tabulation of descriptive and inferential statistics, and pie charts. MKU School of Postgraduate Studies approved the research project, which will seek ethical clearance from MKU and RMH ethical committees to reduce AMR in Rwandan PLWHS. Antimicrobials were used by 88.2% of respondents for biomedical factors and mitigation strategies to reduce HIV/AIDS-related AMR. Social-cultural and belief factors that increase HIV/AIDS-related antimicrobial resistance Cultural beliefs or practices were reported by 62.6% of Rwanda Military Hospital visitors. Among HIV/AIDS patients visiting Rwanda Military Hospital, 73.6% cited antimicrobial cost as a factor. Lastly, KAP increased HIV/AIDS patients' antimicrobial resistance. Rwanda Military Hospital reported 62.6% unprescribed antimicrobial use. The study found that biomedical, social-cultural, socioeconomic, and knowledge-based factors increase AMR in Rwanda Military Hospital PLWHs. To optimise PLWH opportunistic infection management, the study recommended monitoring and updating treatment guidelines based on local resistance patterns.

Keywords: *Anti-Microbial Resistance, Mitigation Strategies, People Living with HIV Aids, Rwanda Military Hospital*

1.0 Background of the Study

Regarding the distribution of antimicrobial resistance in humans, animals, the environment, and wildlife, as well as the associated contributing factors and preventive strategies, recent research findings, insights, and recommendations have been made available (Berkowitz, 2021). Consequently, a comprehensive analysis that considers the collective impact of humans, animals, the environment, and wildlife on the dissemination of antibiotic resistance, as well as the imperative for preventive measures within the framework of one health, is necessary. According to Bruno (2023), the problem of antibiotic resistance among HIV/AIDS patients at Rwanda Military Hospital in Kicukiro, has predominantly been attributed to the excessive and inappropriate use of antibiotics. Based on the currently available research, it is evident that the extensive utilization of antibiotics, coupled with the interconnectedness of animal husbandry, human health, and animal health, has resulted in the emergence and dissemination of drug-resistant bacteria and other species. According to Uwimana et al. (2020), limited access to healthcare services leads to self-medication with antibiotics obtained without prescriptions, exacerbating the misuse and resistance.

Mbonigaba et al. (2019) indicated that patients often lack understanding about the importance of completing antibiotic courses and the risks of resistance, resulting in improper use. Examining the KAP of people with HIV/AIDS visiting Rwanda Military Hospital can provide insights into areas requiring targeted education and training program to prevent or minimize the spreading of antimicrobial resistance among people living with HIV/AIDS. The study done by Bonaventure (2021) indicated that communities' Social norms, beliefs, and practices related to use of medicals and healthcare contribute to antibiotic usage patterns and contribute to the emergence of resistance. Furthermore, even if researches have been done to assess the factors influencing increased anti-microbial resistance and mitigation strategies used in people living with HIV/AIDS by different researchers. There is still gap to indicate clearly the factors influencing increased anti-microbial resistance and mitigation strategies used in people living with HIV/AIDS especially patients visiting Rwanda Military Hospital, Kigali. Further, lack of strong evidence on antimicrobial usage level and resistance profiles, it is difficult to develop targeted strategies to prevent and minimize factors influencing increased anti-microbial resistance and mitigation strategies used in people living with HIV/AIDS in Rwanda Military Hospital.

1.1 Objective of the Study

To determine the factors influencing increased anti-microbial resistance and mitigation strategies used in people living with HIV/AIDS visiting Rwanda Military Hospital.

1.1.1 Specific Objectives

i. To determine prevalence of the Biomedical factors and mitigation strategies used to reduce factors influencing increased AMR in people living with HIV/AIDS visiting Rwanda Military Hospital
ii. To assess social-cultural and beliefs factors that influence increased antimicrobial resistance among people living with HIV/AIDS visiting Rwanda Military Hospital
iii. To determine Social economic factors and accessibility influence antimicrobial resistance among people living with HIV/AIDS visiting Rwanda Military Hospital
iv. To evaluate how KAP influences increased of antimicrobial resistance among people living with HIV/AIDS visiting Rwanda Military Hospital

1.2 Research Questions

i. What is prevalence of the biomedical factors and mitigation strategies used to reduce factors influencing increased AMR in people living with HIV/AIDS visiting Rwanda Military Hospital?
ii. What are the main social-cultural and belief factors that influence increased of antimicrobial resistance among people living with HIV/AIDS visiting Rwanda Military Hospital?
iii. How does social economic factors and accessibility influence antimicrobial resistance among people living with HIV/AIDS visiting Rwanda Military Hospital?
iv. How do KAP influence increased of antimicrobial resistance among people living with HIV/AIDS visiting Rwanda Military Hospital?

2.0 Literature Review

This section details the specific objectives based on various researchers and scholars' writings about biomedical factors and mitigation strategies used to reduce causes of AMR in HIV/AIDS patients, social-cultural and beliefs factors that cause antimicrobial resistance, Social economic factors and accessibility affect HIV/AIDS patients' antimicrobial resistance, while KAP increases it.

2.1 Factors Influencing Antimicrobial Resistance

Numerous researches were conducted all over the world, to indicate the factors arising antimicrobial resistance, for instance, Boneventure et al, (2021). It has been stated that the overuse and misuse of antimicrobial agents is one of the primary factors contributing to antimicrobial resistance. The excessive utilization of antibiotics in agricultural practices, veterinary care, and human healthcare promotes the development of resistant strains of bacteria, viruses, fungi, and parasites. Moreover, incomplete antibiotic therapies can lead to the survival of microorganisms that develop resistance to the specific drug being administered, thereby complicating the treatment of subsequent infections. Prescribing antimicrobial drugs when they are not necessary or using broad-spectrum antibiotics instead of targeted therapy can contribute to the emergence of resistance. Inadequate infection prevention and control measures in healthcare settings lead to the spread of resistant pathogens among patients. Poor WASH infrastructure increases the risk of infectious diseases and can lead to the overuse of antimicrobials as a means of compensating for inadequate sanitation practices (Nugent, et al., 2019). Given the ability of resistant bacteria to be transmitted to humans via the food chain, the utilization of antibiotics in livestock with the intention of stimulating growth and preventing illnesses serves as a significant catalyst in the progression of antimicrobial resistance. The discharge of antimicrobial agents and resistant microbes into the environment, such as through wastewater, agricultural runoff, and pharmaceutical manufacturing waste, can contribute to the spread of resistance genes in natural ecosystems (Bruno, 2023).

The pipeline for the development of new antimicrobial drugs has slowed, leading to a limited arsenal of effective treatments against resistant infections. Trends in AMR drivers vary across geographical regions. In low-income countries, the burden of AMR is high due to factors such as poor sanitation, lack of access to laboratory diagnostics, insufficient healthcare resources, limited choice of drugs, and unavailability of standard drugs (Iskandar et al., 2021). Antimicrobial resistance (AMR) has a universal impact, irrespective of a nation's economic status. Its prevalence transcends geographical boundaries. Factors contributing to AMR include limited access to

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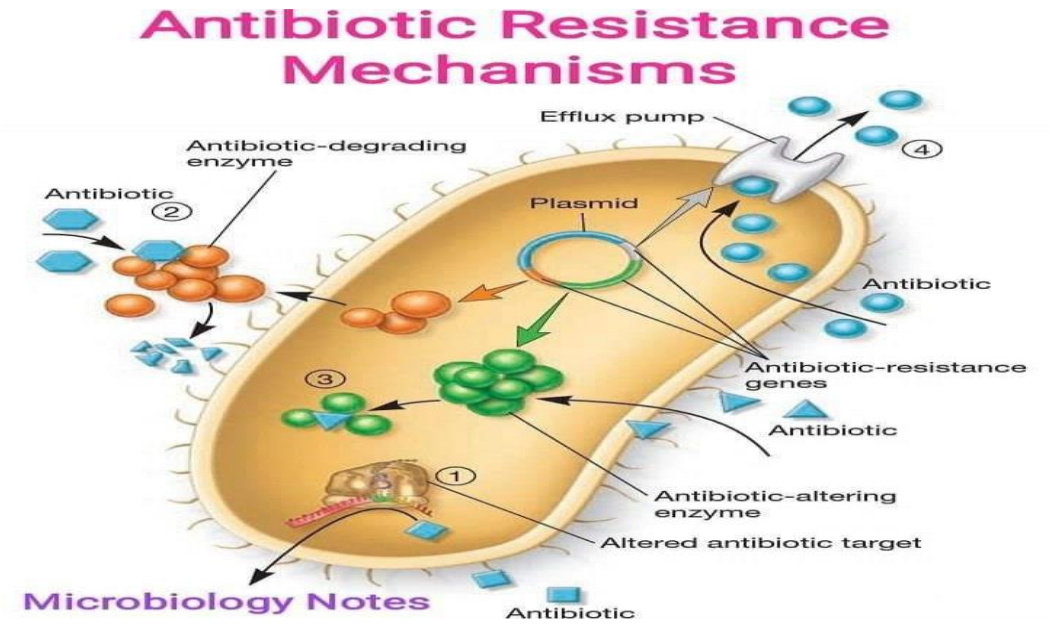
WASH (clean water, sanitation, and hygiene) facilities for both humans and animals, inadequate infection and disease prevention and control measures in households, hospitals, and farms, insufficient availability of affordable and high-quality vaccines, diagnostics, and medications, lack of awareness and knowledge, and inadequate enforcement of relevant legislations (Pillay et al., 2017). The causes and consequences of AMR disproportionately affect vulnerable populations and individuals residing in resource-limited settings. Changes in the HIV genome that hinder the efficacy of antiretroviral (ARV) drugs in halting the replication of the virus are the fundamental cause of HIV drug resistance (HIVDR). HIVDR can be transmitted during the initial stages of infection or arise due to drug interactions or inadequate adherence to treatment (WHO/AFRO, 2015). The prevalence of HIV infections, as well as HIV-related morbidity and mortality, may increase as a consequence of HIVDR.

2.2 Antimicrobial Resistance

Antimicrobial resistance (AMR), also known as microbial resistance, refers to the ability of microorganisms, such as bacteria, viruses, fungi, and parasites, to survive and multiply despite exposure to antimicrobial treatments that were previously effective in eliminating them. The development of this resistance is accelerated by the misuse and overuse of antimicrobial medications in humans, animals, and agriculture, although it can also occur naturally over time (Callixte, 2019). As stated by Kharismayekti (2017), resistance is the ability of bacteria to withstand the inhibitory effects on reproduction or the bactericidal effects of antibacterial agents. Juliet (2021) also noted that the excessive and inappropriate utilization of antibiotics often results in the emergence of antibiotic resistance in bacteria. Over the years, resistant microorganisms have emerged due to the extensive usage of antibiotics, presenting difficulties for managing diseases caused by these resistant strains (Oliver, 2022). Despite attempts to develop novel medications, treatment challenges arise due to the rapid development of drug resistance.



Source: KIHO, 2021

Mayer (2020) stated that when microbes become resistant to antimicrobial drugs, infections caused by these resistant organisms are more difficult to treat, leading to prolonged illness, increased risk

of complications, higher healthcare costs, and in some cases, death. Microbial resistance is a significant global health threat and can render many previously effective treatments ineffective, making it harder to control infectious diseases.

According to Tomas (2016), combating microbial resistance necessitates a multipronged strategy that includes the creation of novel antimicrobial agents, enhanced surveillance and stewardship activities, responsible use of antimicrobial medications, and public education campaigns. Leontine elaborated that microbial resistance in HIV patients is the phenomenon where the human immunodeficiency virus (HIV) develops resistance to antiretroviral drugs (ARVs), which are medications used to treat HIV infection. HIV can mutate rapidly, leading to the emergence of strains that are no longer susceptible to the effects of certain antiretroviral drugs.

2.3 Social-Economic Factors Attributed to Self-Medication of Antibiotics

Eulade (2019) explained self-medication as a way of individuals to use medications without professional medical advice or supervision that contributes to antimicrobial resistance (AMR). Jonas (2021) revealed that limited access to healthcare services, particularly in low-income or rural areas, influences individuals to self-medicate as a means of managing health issues when professional medical care is not readily available. This can result in inappropriate use of antimicrobial drugs, including taking antibiotics without a prescription or using leftover medication from previous treatments. Didas (2016) stated socioeconomic factors contribute to self-medication due to high healthcare costs or lack of health insurance coverage may deter individuals from seeking medical attention when they are ill. Consequently, individuals resort to self-medication, thereby contributing to the emergence of antimicrobial resistance (AMR). This includes the utilization of antimicrobial medicines acquired without a prescription.

On the point of view of Fredaric (2018) revealed that limited understanding of health issues and the appropriate use of medications among individuals with lower levels of education or health literacy lead to self-medication practices that include the unnecessary or incorrect use of antimicrobial drugs. He added that cultural norms and beliefs regarding illness and treatment influence self-medication behaviors. In some cultures, there may be a preference for self-medication or the use of traditional remedies, which may include antimicrobial agents obtained without a prescription. The research done by Virgine (2021) noted that the availability of antimicrobial drugs over the counter in some countries or regions promote self-medication practices, as individuals can easily access these medications without a prescription or professional medical advice. According to Maphalala, et al (2019), busy work schedules or lack of time for medical appointments lead individuals to self-diagnose and self-medicate instead of seeking professional medical care. This leads in the inappropriate use of antimicrobial drugs, contributing to AMR.

2.4 Social Culture and Health Awareness Factors Associated with Anti-Microbial Resistance

Jackline (2018) found that socioeconomic factors such as poverty, lack of health insurance, and geographic barriers limit access to healthcare services for HIV/AIDS patients. She added that this factor may result in delays in diagnosis and treatment, as well as inadequate monitoring of HIV/AIDS patients receiving antimicrobial therapy, increasing the risk of AMR. Another study done by Karake (2015) showed that limited health literacy among HIV/AIDS patients affect their understanding of the importance of adherence to treatment regimens, including antimicrobial therapy. Poor understanding of medication instructions and the consequences of non-adherence contribute to the development of AMR. On the other hand, Cultural beliefs and practices regarding

illness and healthcare influence the healthcare-seeking behavior of HIV/AIDS patients (Cecile, 2017). Misconceptions about HIV/AIDS treatment leads to self-medication or reliance on traditional healers, potentially leading to AMR if antimicrobial drugs are used inappropriately. The discrimination of HIV/AIDS patients within their communities create barriers in accessing healthcare services. This may result in delays in seeking medical care, leading to the inappropriate use of antimicrobial drugs and potentially contributing to AMR. Cultural beliefs about medication and illness influence adherence to treatment among HIV/AIDS patients. Fear of side effects or concerns about the long-term effects of antimicrobial drugs lead to treatment interruptions or non-adherence, potentially contributing to AMR. Awareness of AMR among HIV/AIDS patients, their families, and healthcare providers is crucial for promoting responsible antimicrobial use and minimizing the risk of resistance development (Wanjuk, 2023). Lack of awareness about AMR and its implications may result in inappropriate prescribing practices and poor medication adherence, contributing to AMR.

2.5 Prevalence of biomedical Factors and Mitigation Strategies

The study done by Maina et al. (2016) about influence of over prescription and Misuse on the microbial resistance in Kenya. The study's goal was to determine the influence of misuse of medical on the antibiotics resistance in people living with HIV/AIDS, 679 participants from a sample of six hospitals were included in the study using purposive sampling procedures. Both nurses' surveys and doctors' interview guides were used to get the needed data. The findings indicated that antibiotics are frequently prescribed without proper diagnostic confirmation, leading to misuse and the development of resistance. Rukundo et al. (2022) evaluate the biomedical factors influence antimicrobial resistance in South Africa. The research methodology applied was quantitative and qualitative research design, data were obtained using questionnaire and interview guide for sample size of 189. The findings 53% agreed and 28% strongly agreed that poor adherence to antiretroviral therapy while 78% revealed that limited access to healthcare contribute to antimicrobial resistance, 42% agreed and 32% strongly agreed that delayed identification of infections. The study has revealed that the irregular adherence to antiretroviral therapy (ART) contributes significantly to the emergence of drug-resistant strains of HIV. This, in turn, poses greater challenges in terms of treatment and necessitates the use of additional antibiotics to combat opportunistic infections. The phenomenon of antimicrobial resistance is known to be influenced by a multitude of biological factors. The study recommended that establishing robust surveillance systems to monitor infection rates, antibiotic use, and resistance patterns, which can inform treatment guidelines and policies.

2.6 Social -Cultural and Beliefs Factors

The study done by Liberatore and Pollack (2017) assesses the contribution of social culture and beliefs on the anti-microbial resistance in HIV/AIDS in Malawi. Purposive sampling procedures were employed to obtain a sample size of 63 respondents for the study, which utilized a descriptive and case study approach. Both quantitative and qualitative techniques were employed to analyze the data. The researchers discussed the findings of a questionnaire survey administered to patients in four hospitals, revealing that 97% of the respondents indicated that patients' mishandling of medications contributed to the emergence of antimicrobial resistance. However, the study recommended pharmacists to educate patients the use of medical as measure of preventing anti-microbial resistance. Thomsen (2020) assessed the impact of use medications without professional medical advice or supervision in Uganda. The objective of the study was to investigate impact of

use medications without professional medical advice or supervision on the antimicrobial resistance. The study adopted descriptive design; the target population was 370 while sample size was 79 respondents drawn using convenience sampling techniques. The results showed that use medications without professional medical advice or supervision contributes to antimicrobial resistance in Uganda at Positive correlation of .81. He recommended that effective use of medications play great in preventing antimicrobial resistance significantly. Yaser & associates (2014). Poor Knowledge of Medication Instructions on the Antimicrobial Resistance in Senegal was the name of the study that was conducted. Descriptive research approach was used in the study to examine the association between the variables. The target population was 363 HIV/AIDS selected from six hospitals. Using stratified sampling techniques 148 respondents will be selected. Questionnaires were used in data collection while quantitative, qualitative methods were used to analyze collected data, and tables were used to present data. Where Cronbach coefficient was 0.8. The findings reveal poor usage of medications contributes to antibiotic resistance. The study encouraged patients to use medicals as instructed by physicians.

2.7 Influence of KAP to Increase Antimicrobial Resistance among People Living with HIV/AIDS

Weerakkody et al. (2017) study examines the relationship between knowledge and antibiotic resistance among HIV/AIDS patients in Cameroun. This study employed a descriptive research design to investigate how knowledge influences antibiotic resistance in Cameroun. The researchers utilized purposive sampling to select a sample of 275 patients across 8 hospitals, and online data collection methods were employed to gather the necessary data. The findings of the study indicate that the lack of awareness among individuals with HIV/AIDS is the primary driver of antimicrobial resistance. Research was done in 2016 by Obeidat and Aldulaimi regarding the effect of drug abuse on antimicrobial resistance in England. To get sufficient data, the study used both quantitative and qualitative research designs. 56 respondents' questionnaires were used to collect data while stratified random sampling chose respondents. The study revealed negligence of medical instructions lead to microbial resistance for patients living with diseases. Caldwell (2018) conducted the study about the influence of patient's attitude on the antimicrobial resistance in Nepal. The study employed a descriptive research design, with a sample of 120 participants selected through convenience sampling. Questionnaires were utilized as the primary tool for data collection. The collected data was then analyzed using SPSS. The study indicated that poor usage of medications contributes to antimicrobial resistance. Researcher added that Addressing AMR for patients requires a comprehensive approach that includes improving access to healthcare services, addressing discrimination, promoting health literacy and awareness about AMR, and ensuring culturally sensitive care that takes into account patients' beliefs and practices.

2.8 Conceptual Framework

The conceptual framework section outlines the theoretical structure guiding the study on antimicrobial resistance (AMR) among people living with HIV/AIDS. It illustrates the interrelationships between various factors influencing AMR, including biomedical elements, social-cultural beliefs, socioeconomic conditions, and knowledge, attitudes, and practices (KAP). This framework serves as a foundation for understanding how these interconnected variables contribute to AMR and informs the development of targeted interventions aimed at mitigating its impact.

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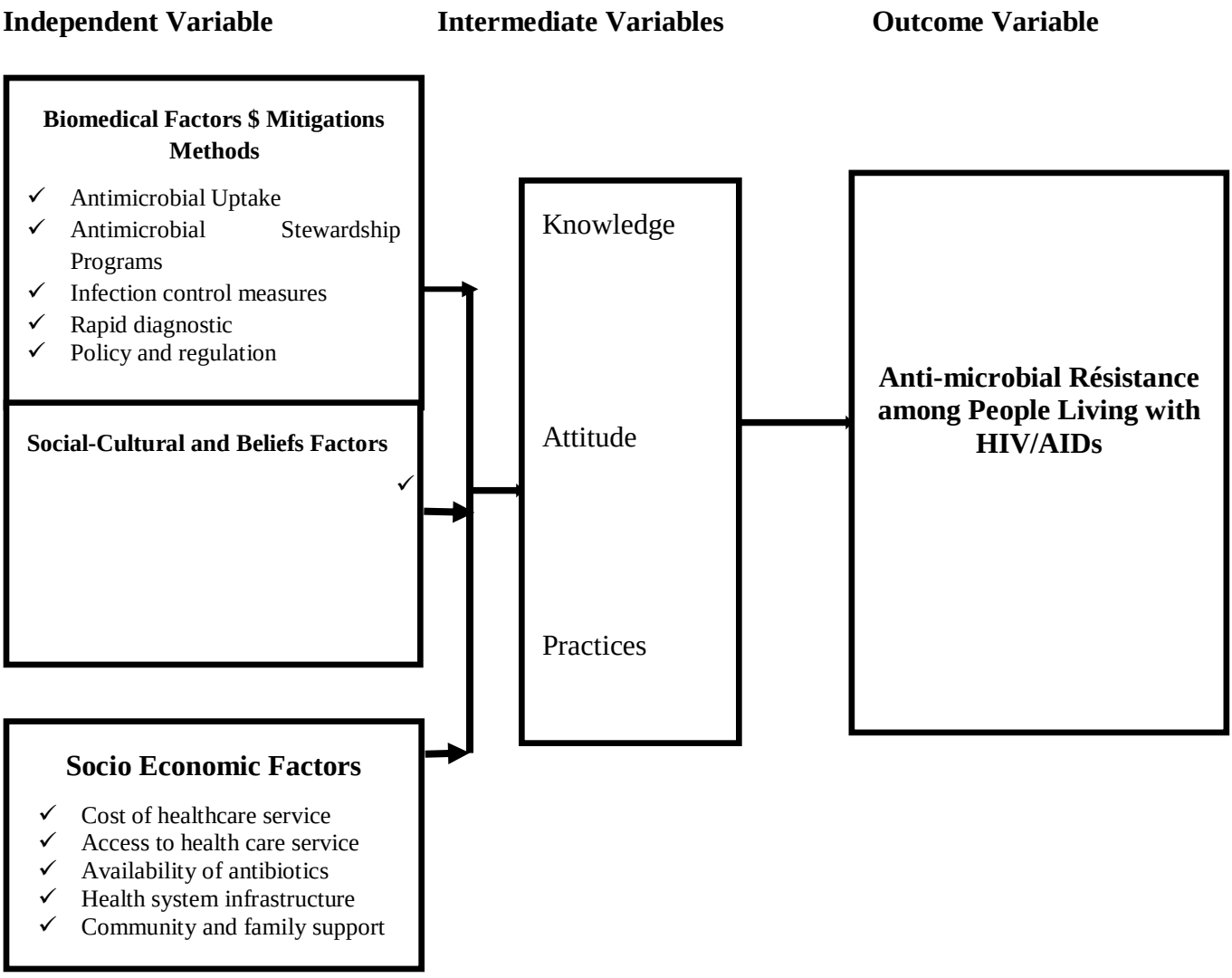

Figure 1: Conceptual Framework

3.0 Methodology

The study utilized a cross-sectional and descriptive research design, focusing on a target population of 696 individuals, which included 661 people living with HIV/AIDS, 10 pharmacists, 20 nurses, and 5 clinicians visiting the Rwanda Military Hospital. A purposive sampling technique was employed to select participants, resulting in a sample size of 254 individuals determined using Slovin's formula. Data collection instruments comprised semi-structured questionnaires for quantitative data and interviews for qualitative insights, including Key Informant Interviews (KII) and Focus Group Discussions (FGDs). The data collection procedure involved obtaining authorization letters, directly engaging with respondents to distribute questionnaires, and following up to ensure feedback. Data analysis was conducted using SPSS version 27.0, employing cross-tabulation of descriptive and inferential statistics to interpret the findings.

4.0 Findings and Discussion

The data were analyzed based on research objectives, focusing on demographic characteristics and specific objectives using descriptive and inferential statistics. The majority of respondents, aged 31-40 years (37.8%), were male (59%) compared to female (41%), highlighting a trend in healthcare-seeking behaviors that could influence AMR risk. Education levels showed that most participants had secondary education (42.1%), with a significant impact on treatment adherence and healthcare behaviors. In addition, religious beliefs varied, with 29.5% identifying as Catholic, which affects attitudes toward modern medicine and treatment adherence, ultimately influencing AMR dynamics. The prevalence stated that 91.3% affirmed that used antibiotics. The findings were in line of Kharismayekti (2017) who indicated that appropriate use antibiotics reduce increased of AMR in people living with HIV/AIDS. Further, 75.6% stated that they completed full course of antibiotics as prescribed. Misuse of antibiotics raise significantly the microbial resistance. The improvement of ART adherence, promoting rational antibiotic use through stewardship programs, strengthening infection prevention and control measures, advancing the development of new treatment options, increasing patient awareness of antibiotic misuse, and enhancing AMR surveillance in HIV populations mitigate the increased of Microbial resistance.

The results revealed that 75% revealed that cultural beliefs or practice influence the use of antimicrobials for people living with HIV/AIDS. On the other hand, 93.7% of people living with HIV/AIDS visit health care facility or clinic. The results were concurred with Jonas (2021) revealed that limited access to healthcare services, particularly in low-income or rural areas, influences individuals to self-medicate as a means of managing health issues when professional medical care is not readily available. Cultural beliefs around illness and traditional healing often lead to delayed medical care and reliance on alternative treatments, resulting in inconsistent or improper use of prescribed antibiotics. Some individuals stop antibiotic regimens prematurely due to a belief in symptom-based recovery rather than completing the course, which fosters resistance. Mistrust in healthcare systems and preference for self-medication or traditional remedies can lead to inappropriate antibiotic use. Further, stigma-surrounding HIV results in patients seeking care from informal providers, where antibiotic misuse is common. To address these issues, research suggests integrating culturally sensitive education programs that promote adherence to treatment regimens, raising awareness about the dangers of AMR, and working with community leaders to reshape beliefs that contribute to antibiotic misuse.

The findings revealed that cost of antimicrobials contributes to the increase of antimicrobial resistance at 73.6%. The results agreed with Ahleman (2017) who affirmed that high cost of antimicrobial resistance influence self-medication leading to the microbial resistance. Limited financial resources often force patients to ration medications or discontinue antibiotics prematurely, fostering resistance. High costs of healthcare services, including transportation and medication prevent consistent access to professional medical care, leading to self-medication or reliance on cheaper, informal healthcare providers where antibiotic misuse is common. Socio-economic disparities also influence health literacy, with less-educated individuals being more prone to misunderstand antibiotic guidelines. These factors were compounded by inconsistent availability of medications at healthcare facilities.

The findings revealed that 72.4% confirmed that they received education or information about antimicrobial resistance. In addition, the findings showed that 31.6% strongly agreed and 49.1% agreed that lack of awareness about antimicrobial resistance influence antimicrobial resistance.

Limited knowledge about proper antibiotic use, such as the need to complete prescribed courses, contributes to misuse, which fosters resistance. Attitudes, including trust in traditional medicine and a belief in discontinuing antibiotics once symptoms improve, further exacerbate non-adherence to medical advice. Practices such as self-medication, sharing antibiotics, or using leftover drugs without professional guidance are prevalent and amplify the risk of AMR. Improving KAP through targeted educational interventions and promoting behavior change among the population is essential for combating AMR. By enhancing patients' understanding of antimicrobial use and correcting misconceptions, healthcare systems can reduce the improper use of antibiotics and, in turn, curb resistance.

5.0 Conclusions

The study concluded that biomedical factors such as the frequent need for antibiotics due to opportunistic infections, improper prescription practices, and the long-term use of antimicrobial therapies significantly contribute to the increased AMR among PLWHS. Effective mitigation strategies, including strict antibiotic stewardship, regular monitoring of drug resistance patterns, and personalized treatment plans, are essential in reducing the impact of these biomedical factors. In addition to that, the study affirmed that social-cultural beliefs and practices, such as the preference for traditional medicine or the misuse of antibiotics based on cultural misconceptions, are key contributors to the rise in AMR among PLWHS. Addressing these factors requires culturally sensitive education programs that promote the responsible use of antibiotics and the importance of adhering to medical prescriptions. The findings confirmed that Socioeconomic factors, including limited financial resources, poor access to healthcare services, and the availability of antibiotics without prescriptions, exacerbate AMR among PLWHS. Enhancing healthcare accessibility, subsidizing treatment costs, and enforcing regulations on antibiotic sales are critical strategies for mitigating these influences. The study found that gaps in knowledge, negative attitudes, and harmful practices related to antibiotic use significantly contribute to the increase in AMR among PLWHS. Improving KAP through targeted educational interventions and continuous professional training for healthcare providers is crucial in combating the spread of resistance. In overall conclusion, the factors influencing increased AMR among PLWHS at Rwanda Military Hospital are multifaceted, encompassing biomedical, social-cultural, socioeconomic, and knowledge-based elements. To effectively mitigate AMR, a comprehensive approach is required that includes enhancing antibiotic stewardship, improving patient and community education, addressing socioeconomic barriers, and strengthening healthcare policies and practices.

6.0 Recommendations

The study recommends the Rwanda Military Hospital to implement comprehensive antibiotic stewardship protocols at the household level to enhance the appropriate use of antimicrobials and boost immune function among affected households. It suggests regular updates to treatment guidelines based on local resistance patterns and the development of targeted educational programs addressing cultural beliefs related to antimicrobial resistance (AMR). Additionally, it emphasizes the importance of conducting Knowledge, Attitude, and Practice (KAP) assessments for continuous education of healthcare providers and patients, along with providing socioeconomic support to improve access to medical care. For the Ministry of Health, the recommendations include enforcing national antibiotic stewardship policies, launching public health campaigns on the risks of AMR, and enhancing access to subsidized healthcare services for people living with

HIV/AIDS (PLWHS). It also suggests strengthening regulations on antibiotic sales and investing in ongoing education regarding responsible antibiotic use. Public-private partnerships (PPP) are encouraged to promote joint antibiotic stewardship initiatives, share monitoring data, and conduct widespread awareness campaigns addressing the social-cultural factors contributing to AMR. Lastly, the study advocates for further research into factors influencing food supplement management among PLWHS with a focus on those at risk of antimicrobial resistance and heart disease.

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