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REVIEW

Behavioral and Socio-Economic Determinants of Antimicrobial Resistance in Sub-Saharan Africa: A Systematic Review

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Introduction: Antimicrobial resistance (AMR) is currently one of the twenty-first century's biggest threats to public health. Addressing AMR is often operationalized as requiring 'behavior change' of clinicians and patients and improving the drug development pipeline. Few studies and interventions have approached AMR as a challenge fundamentally embedded within the cultural fabric of modern societies and their varied economic, social and political organizations. This systematic review aimed to gather and review the available data on the behavioral and socio-economic determinants of AMR in sub-Saharan Africa (SSA).

Methods: Articles were sourced from PubMed using search terms across five domains: "Antimicrobial resistance", "Sub-Saharan Africa", "Behavioral", "Socio-economic", and specific SSA country names. References were also reviewed for relevant data. This systematic review included original studies published in English between 2015 and 2023, focusing on behavioral and socio-economic factors influencing AMR in human populations in SSA, with AMR as a key outcome.

Results: This systematic review identified 30 studies, with 83% (n=25) focusing on self-medication and antibiotic use practices, 67% (n=20) on healthcare providers' practices and knowledge, and 60% (n=18) on community knowledge and perceptions of AMR while 50% (n=15) of studies explored various socio-economic factors. The common themes that emerged from these studies included inadequate evidence-based prescription practices (63%, n=19), financial barriers to accessing antibiotics (50%, n=15), poor community awareness of AMR (53%, n=16), regulatory challenges in antibiotic sales and distribution (47%, n=14), and healthcare infrastructure limitations, including deficient diagnostic capabilities and antimicrobial stewardship programs (40%, n=12).

Conclusion: This review's findings provide crucial insights into the behavioral and socioeconomic patterns influencing AMR in sub-Saharan African populations. For AMR interventions to be effective, there is a need for a thorough understanding of people's behaviors and practices about AMR knowledge and antimicrobial use which will help in developing more targeted interventions and policies to address inappropriate antimicrobial use and the spread of AMR.

Keywords: antimicrobial resistance, behavioral determinants, socio-economic determinants, sub-Saharan Africa

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Background

Antimicrobial resistance (AMR) is defined as the resistance of microorganisms to an antimicrobial agent to which they were initially sensitive.[1] These microorganisms become resistant through different mechanisms which may be native to the microorganisms, or acquired from other microorganisms. These mechanisms include limiting uptake of a drug, modification of a drug target, inactivation of a drug, and active efflux of a drug.[2] The emergence and spread of AMR is accelerated by human activity, mainly the misuse and overuse of antimicrobials to treat, prevent or control infections in humans, animals and plants.[3] AMR is currently one of the biggest threats to public health in the twenty-first century as antimicrobial-resistant infection has been ranked third in the leading causes of death after cardiovascular diseases.[4] The impact of AMR extends further into healthcare systems, economies, and societies at large. Resistant infections lead to prolonged hospital stays, higher medical costs, and increased burden on already strained healthcare resource.[5] Economically, AMR poses a threat to global health and poverty mitigation efforts by driving up treatment costs and reducing productivity due to illness and disability. According to recent estimates, in 2019, 1.27 million deaths were directly attributed to drug-resistant infections globally.[4] This number is predicted to reach up to 10 million deaths yearly by 2050, with South Asia and Africa having the highest death tolls.[4]

In 2019, sub-Saharan Africa (SSA) registered the highest mortality rate of 23.5 deaths per 100,000 attributable to AMR compared to other regions.[6] The SSA region faces unique AMR challenges influenced by various elements, including the region's inadequate healthcare infrastructure, cultural customs such as traditional healing practices and socioeconomic dynamics. These elements can influence treatment-seeking behaviors, adherence to prescribed regimens, and the acceptance or rejection of antimicrobial interventions.[7] In SSA, public awareness of AMR remains significantly lower compared to regions like Asia, where targeted campaigns and educational initiatives have been successfully implemented to address the issue.[8] This gap in awareness underscores the urgent need for community-level education and awareness initiatives in SSA as such programs play a pivotal role in preventing antimicrobial abuse by empowering individuals with knowledge and promote responsible behavior with antibiotic use.[9] These initiatives also help in challenging misconceptions such as the belief that antimicrobials are effective against viral infections like colds and flu and promoting preventive measures like vaccination, hygiene, and sanitation. The lack of these initiatives in SSA contributes to the region's unique challenges in controlling AMR, which are further exacerbated by the availability of substandard or falsified antibiotics arising from weak regulatory systems, limited local manufacturing, and inadequate quality assurance testing. Combined with the high burden of communicable diseases, widespread poverty, and insufficient healthcare infrastructure, these factors make AMR control in SSA particularly difficult.

Some countries in the sub-Saharan African region lack adequate controls for monitoring antibiotic distribution.[10] In Tanzania for instance, although antibiotics are considered prescription-only medicines, dispensers often abandon correct dispensing practices for financial reasons.[10] Even with regular reminders and continuing education provided to the dispensers by regulatory bodies, little has changed.[11] The lack of antibiotic-use regulation in safe doses has also been escalated through the unregulated use of these antibiotics in livestock farming among SSA countries where they are used for treating animal diseases, and using sub-therapeutic levels of the antibiotics in concentrated animal feed for growth promotion, improved feed conversion efficiency, and for the prevention of diseases.[12]

The majority of AMR-related studies in the SSA have focused on urban areas, whereas 60% of the human population lives in the countryside,[13] making the results unrepresentative of the wider population. There is also a lack of high-quality data on communicable diseases, infectious agents, and AMR in several low- and middle income African countries.[14] For example, a study published in *The Lancet Infectious Diseases* in 2019 reported that the prevalence of antimicrobial resistance among *Escherichia coli* and *Klebsiella pneumoniae* in sub-Saharan Africa ranged from 40% to 90%, but many countries lack comprehensive data on local resistance patterns to inform and update clinical guidelines for better treatment outcomes.[15] Additionally, implementing surveillance programmes in low- and middle-income countries is challenging because of inadequate human and financial resources and microbiology expertise.[16] The scarcity of AMR data in SSA has also been associated with the lack of real-time data recording and surveillance and poor antimicrobial use regulations. The actual impact of AMR on society, animals, the environment, and hospitals is among the significant data gaps on the subject of AMR in SSA.[17]

Surveillance data from 2022 showed that many countries in SSA are "flying blind" when it comes to the surveillance of antibiotic-resistant pathogens. Data, collected and analyzed by the Mapping Antimicrobial Resistance and Antimicrobial Use Partnership (MAAP) showed that in 14 sub-Saharan countries, only 5 of 15 antibiotic-resistant pathogens that have been designated by the World Health Organization (WHO) as "priority" pathogens are being consistently tested for resistance to antibiotics[18] and inadequate AMR surveillance in SSA impedes AMR prevention because only a few countries conduct drug resistance surveillance in the region[17] and among the few countries that do, it is usually based on local hospital data, small cohort studies in neonatal and adult wards, and routine laboratory samples taken from patients with suspected infection and healthcare-associated infections.[17]

Addressing AMR is necessary for achieving global priorities such as the Sustainable Development Goals (SDGs) and ensuring global health security as stipulated by the International Health Regulations (IHR (2005)).[19] Addressing AMR is often operationalized as requiring "behavior change" of clinicians and patients, in combination with improving the drug development pipeline. Few studies and interventions have approached AMR as a challenge fundamentally embedded within the cultural fabric of modern societies and the varied ways they are organized economically, socially and politically.[20] This highlights the need for a people-centered approach that focuses on examining people's behaviors in relation to antibiotic resistance. In addition to behavioral change, there is need to understand and address the factors that drive these behaviors.

The WHO People-centered approach to addressing antimicrobial resistance in human health consists of four levels of implementation including the community, primary care, secondary and tertiary care.[21] Since the community implementation level is the foundation of the four implementation levels, it follows that all components at this level ought to be addressed in the fight against AMR, with beneficial effects also extending to the subsequent levels of implementation.

The community level of implementation factors in socioeconomic and behavioral characteristics that are influenced by a variety of elements, such as employment status, educational attainment, and access to healthcare which affect a community's behaviors in several aspects from social interactions to health-related decisions.[21]

To the best of our knowledge, few reviews have focused on the socio-economic determinants of AMR in Sub-Saharan Africa. Other review studies have either focused on a certain sub-region, specific age group, class of antibiotics or clinical syndrome with regards to AMR.[22] Analyzing the behavioral and socioeconomic factors influencing AMR in the SSA region is crucial to provide valuable insights and a broader outlook on the progress made since the global action plan against AMR was established in 2015.[22]

This systematic review aimed to comprehensively analyze the available data on the behavioral and socioeconomic determinants of antimicrobial resistance in Sub-Saharan Africa, with the goal of identifying evidence-based interventions to mitigate the growing threat of AMR in the region.

Objectives

Main Objective

- To identify the behavioral and socio-economic factors that affect antimicrobial resistance in sub-Saharan Africa.

Specific Objectives

- To identify the most common behavioral and socio-economic factors affecting AMR in sub-Saharan Africa.
- To assess antibiotic use practices across Sub-Saharan African communities that may contribute to AMR.
- To identify knowledge and awareness gaps that might affect behaviors that contribute to AMR.

Scope of the Review

The research question was structured using the PICO framework shown in Table 1 to ensure a systematic and comprehensive exploration of the topic.[23]

Table 1 Research Question PICO Framework Breakdown

Question Component	Component Explanation
Population	Human populations across diverse demographic characteristics in sub-Saharan Africa, including age, gender, occupation, and residence areas.
Intervention	Behavioral and socio-economic factors that may contribute to AMR, eg antibiotic usage trends, hygienic practices, socioeconomic status, healthcare access and educational levels.
Comparison	Comparisons between different demographic groups, socioeconomic strata, or behavioral patterns and the impact of different levels or variations within the identified behavioral and socio-economic factors on AMR.
Outcome	The primary outcome was the emergence and spread of AMR which may be measured by the prevalence of resistant strains or other relevant indicators. The review also explores the interplay between behavioral and socio-economic determinants to understand how these factors interact and contribute to AMR in human populations.

Research Question

What are the key behavioral and socio-economic determinants contributing to the spread of AMR in human populations across diverse demographic characteristics in sub-Saharan Africa, and how do these factors interact with each other, influencing the emergence and spread of AMR?

Methodology

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA 2020) reporting checklist to ensure a thorough and transparent presentation of the research process and findings. This checklist additionally allowed the systematic addressing of all key aspects of the review, including the research question, search strategy and results synthesis.

Search Strategy

Relevant articles in line with the behavioral and socio-economic determinants of antimicrobial resistance in Sub-Saharan Africa were sourced from PubMed in line with the PRISMA guidelines. Literature search strategies were constructed using medical subject headings (MeSH) and text words related to the study's outcomes. Search terms were developed along five domains: "Antimicrobial resistance", "Sub-Saharan Africa", "Behavioral", "Socio-economic", and specific names of African countries in the Sub-Saharan African region. References of the data sources were also reviewed to identify relevant information. PubMed was chosen as the primary database due to its reliability in offering access to high-quality, peer-reviewed literature covering a wide range of biomedical and public health research, making it an ideal source for studies related to this review.

Inclusion Criteria

This systematic review included original research studies published in English between January 2015 and December 2023 to ensures that the systematic review captured the most recent research studies on the behavioral and socio-economic determinants of AMR in SSA. This period also corresponds with the increased global interest in AMR research and policymaking triggered by establishment of the Global Action Plan on Antimicrobial Resistance, launched in 2015 by the World Health Organization.

Relevant studies included observational and intervention studies focusing on behavioral and socio-economic determinants of antimicrobial resistance. Studies involving human populations residing in various geographic areas from various socio-economic strata in sub-Saharan Africa were also included. Relevant to this systematic review, the included studies examined a range of behavioral factors and socioeconomic determinants of antimicrobial resistance as well as studies that directly addressed antimicrobial resistance as a significant outcome, either as a primary endpoint or as a key component of the study.

Exclusion Criteria

Non-research articles, duplicates, editorials, commentaries, non-English publications, case reports, opinion pieces lacking original data or empirical evidence and studies published before 2015 were excluded from this systematic review. This review also excluded studies focusing on animal populations or laboratory settings without direct relevance to human populations or human behavioral and socio-economic factors related to antimicrobial resistance. Studies comprising human populations outside sub-Saharan Africa were excluded.

Data Extraction

Following the search, the resulting literature was screened for relevance. Relevant data that met the inclusion criteria including study type, demographic characteristics, behavioral and socioeconomic factors and outcomes related to antibiotic resistance was included in the data extraction process. The comprehensiveness of the included studies was assessed using quality assessment tools. After the data had been obtained, a thorough summary of the behavioral and socioeconomic aspects affecting antibiotic resistance in sub-Saharan Africa was produced.

Results

A comprehensive screening process of 666 papers obtained from PubMed, was conducted as illustrated in Figure 1, resulting in 30 studies that were included in this systematic review comprising of 25 cross-sectional studies, 3 qualitative

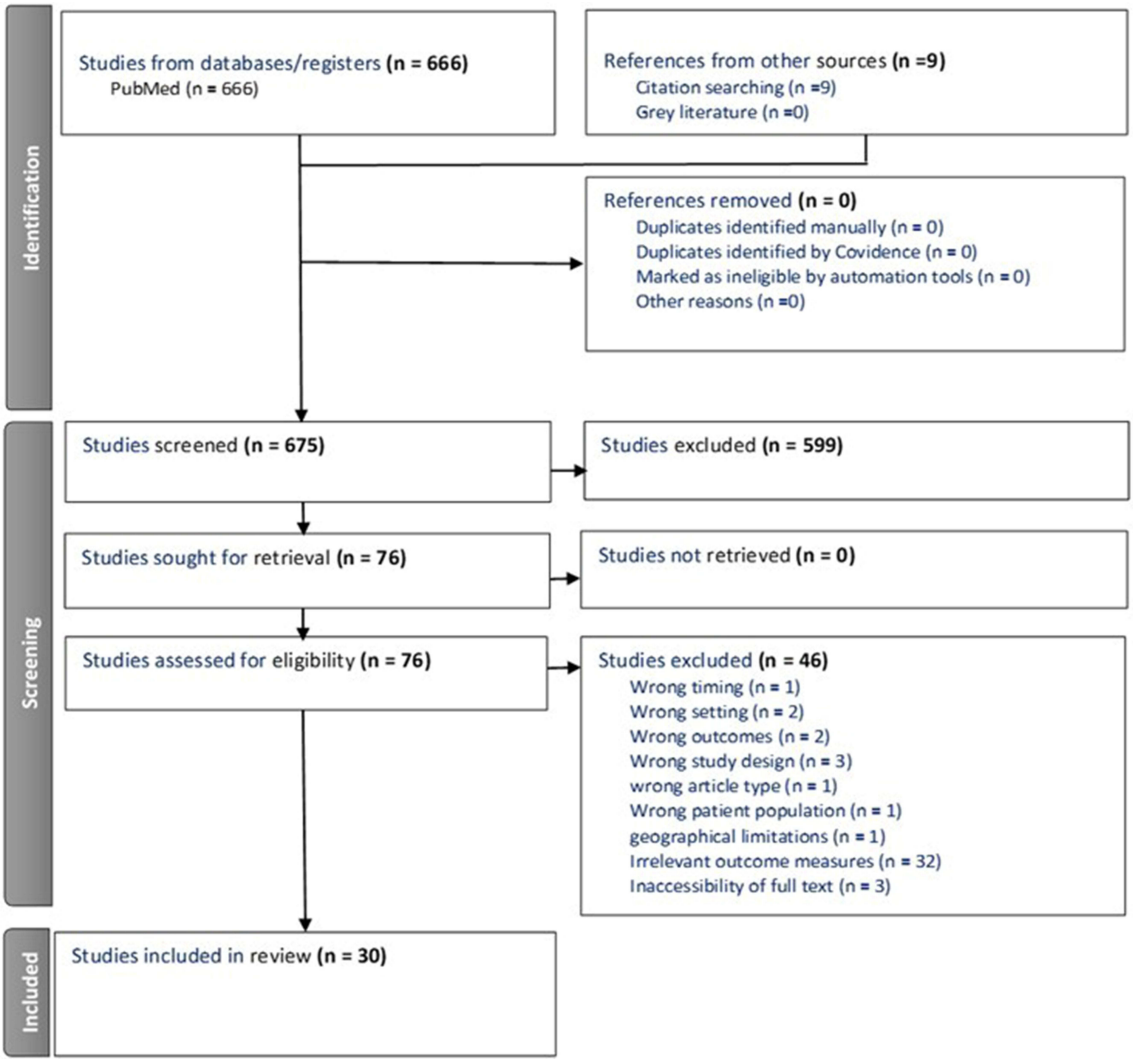

Figure 1 PRISMA flowchart showing the study selection process. Generated using Covidence software.

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studies, 1 case-control study, and 1 mixed-methods study. The characteristics of the included studies are summarized in Table 2. Study selection was performed using previously established inclusion and exclusion criteria. The studies included those conducted in hospital and community settings among healthcare workers and community members to determine their knowledge and perceptions of AMR and antimicrobial use. Most of the studies were cross-sectional with volunteer participants representing a range of socio-demographic characteristics, including age, sex, occupation, level of education, and marital status among others.

Common Behaviors Associated with AMR Spread

The review identified several behavioral and socio-economic factors contributing to AMR in Sub-Saharan Africa. One common behaviour was self-medication where participants viewed certain symptoms such as headache, cold or flu and stomachache as not requiring hospital assistance and suitable for home treatment. Sharing of antibiotics —medications specifically used to treat bacterial infections—among family members was a prevalent practice as observed in one study, where 18 out of 26 participants reported giving their previously prescribed antibiotics to family members who exhibited similar symptoms. This behavior was also noted in another study, among 63 out of 244 participants. Poor adherence to treatment regimens also emerged as a common behavior in most of the included studies. Four studies specifically explored this issue, with one reporting that 40% of participants discontinued their prescribed antibiotics as soon as they felt better, opting to save the remaining doses for future use. Similarly, 19.3% of participants in another study shared this sentiment and stopped taking antibiotics once they felt better. In a separate study, poor consultation practices, which failed to emphasize the importance of completing the full treatment regimen, was identified as a contributing factor to non-adherence.

Socio-Economic Characteristics and AMR

The studies identified various socioeconomic characteristics among the participants that were considered relevant to contributing to AMR in some manner. It was observed that antibiotic misuse was more common among low socio-economic status populations than among high socio-economic status populations. Antibiotic purchases were seen to be higher in low-income households where they purchased fewer antibiotics than required, intending to complete the course later due to financial difficulties, as seen among 52% of respondents. Participants with lower educational levels were about 4 times more likely to use unregulated antibiotics compared to those with higher education levels. Some studies found self-medication more common among individuals in urban settings and with higher education. In contrast, other studies found self-medication more common among rural and less educated communities.

Common Antibiotic Use Practices Contributing to AMR

Several patterns of antibiotic use were identified among the included studies. Contrary to medical recommendations, healthcare professionals admitted to prescribing antibiotics for viral infections such as flu. Furthermore, 85% of healthcare providers among the included studies prescribed antibiotics based on their previous experience or consulted senior colleagues with only 21% requesting laboratory testing prior to prescribing antibiotics. Among the patients, their inappropriate antibiotic use practices included the discontinuation of their prescribed treatment regimen in nearly 40% of the respondents, purchasing antibiotics without seeking medical advice and sharing left-over antibiotics with their relatives or friends.

Knowledge and AMR Awareness Gaps

These study identified some knowledge and awareness gaps among both healthcare providers and community members characterized by misconceptions about the efficacy of antibiotics for viral infections, contributing to inappropriate prescribing and use. Patients often lacked awareness of the importance of completing prescribed antibiotic regimens, which played a role in poor adherence to treatment regimens. Limited understanding of AMR and its consequences was particularly common in rural areas, where self-medication and the sharing of antibiotics were more prevalent due to mis-information and lack of access to healthcare education.

Table 2 Characteristics of the Included Studies Generated from Covidence Software

Title	Citation Number	Authors	Country	Aim of Study	Study design	Setting	Inclusion Criteria	Intervention	Comparison
Knowledge and perception on antimicrobial resistance and antibiotics prescribing attitude among physicians and nurses in Lambaréné region, Gabon: a call for setting-up an antimicrobial stewardship program	[24]	Adegbite et al 2020	Gabon	To examine knowledge and perceptions of AMR and antibiotics prescription practices of HCW (healthcare workers) in Lambaréné, Gabon	Cross-sectional	Hospital	Health care workers at Lambaréné referral hospital that were prescribers of antibiotics	Assessing the knowledge and perception on antimicrobial resistance and antibiotics prescribing attitude among physicians and nurses	Comparison of knowledge and perceptions on antimicrobial resistance and infection control among different categories of health care workers ie physicians and nurses
Determinants of Inappropriate Antibiotics Use in Rural Central Ghana Using a Mixed Methods	[25]	Asiedu et al 2020	Ghana	To examine determinants of inappropriate antibiotic use at the community level in rural Ghana	A mixed methods observational study involving qualitative and quantitative methods	Rural community	Household members who lived in Kintampo north and south −18 years or older - Those that were willing to participate	Exploring inappropriate antibiotic use from 1100 households in Kintampo, through survey questions.	Comparison across different socio-demographic characteristics including age, sex, level of education, occupation, and marital status to explore how they influence participants' inappropriate antibiotic use, health care characteristics and the type of health providers they attend
Knowledge and perceptions about antibiotic resistance and prudent antibiotic prescribing among final year medical students in two African countries	[26]	Augie et al 2021	South Africa and Nigeria	To assess the knowledge and perceptions of final year medical students about antibiotic resistance and antibiotic use	Case control study	Universities	Final year medical students	Assessing perceptions and knowledge about antibiotics, antibiotic resistance, and the perceived quality of education regarding preparedness to prescribe antibiotics.	The results from the survey enabled comparison of perceptions and knowledge levels on antibiotics and antibiotic use among the final year medical students from Nigeria and South Africa
Addressing antimicrobial resistance in Nigerian hospitals: Exploring physicians prescribing behavior, knowledge and perception of antimicrobial resistance and stewardship programs	[27]	Babatola et al 2020	Nigeria	To assess knowledge of AMR, attitude and practice of AMS among physicians practicing at tertiary health institutions in Nigeria	Cross sectional study	Hospital	All consenting physicians at the selected health care facilities were possible candidates for inclusion	Assessing the knowledge of Nigerian physicians in selected health care facilities, their attitude towards AMR and practice of antimicrobial stewardship to provide future guidance to the Nigerian National Action Plan for AMR.	The association between physician cadre, sex, practice duration, and AMR knowledge

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Table 2 (Continued).

Title	Citation Number	Authors	Country	Aim of Study	Study design	Setting	Inclusion Criteria	Intervention	Comparison
Community knowledge and practices regarding antibiotic use in rural Mozambique: where is the starting point for prevention of antibiotic resistance?	[28]	Cambaco et al 2020	Mozambique	To describe different dimensions of community knowledge of antibiotics and practices regarding antibiotic use in Mozambique from the perspective of community members	Cross sectional study	Rural community	Community members that lived in Manhiça district and registered in the Health and Demographic Surveillance System	Assessing community knowledge and practices regarding antibiotic use in rural Mozambique using in-depth interviews and focus group discussions	Comparison of knowledge and practices relating to antibiotics among different age groups, level of education, literacy, occupation, sex and place of residence
Antimicrobial resistance awareness and antibiotic prescribing behavior among healthcare workers in Nigeria: a national survey	[29]	Chukwu et al 2021	Nigeria	To provide an up-to-date estimate of the knowledge, attitude and antibiotic prescribing behavior of Health Care Workers in Nigeria	Cross sectional study	Hospital	All healthcare workers who were either permanent staff or visiting consultants at the time of survey.	Administering a questionnaire to estimate the knowledge, attitude and antibiotic prescribing behavior of HCWs in Nigeria	Comparison of knowledge levels on AMR among healthcare workers from tertiary health centers, secondary health centers and primary health centers from different states in Nigeria
Potency of commonly retailed antibiotics in pharmacies found in Adama, Oromia regional state, Ethiopia	[30]	Demissie et al 2021	Ethiopia	To determine the potency and associated factors of commonly retailed antibiotics	Cross sectional study	Pharmacies	All pharmacies in Adama		Comparison antibiotics potency among the 42 pharmacies from were the antibiotics were gotten from.
Tanzanian primary healthcare workers' experiences of antibiotic prescription and understanding of antibiotic resistance in common childhood infections: a qualitative phenomenographic study	[31]	Emgard et al 2021	Tanzania	To describe primary healthcare workers' experiences of antibiotic prescription for children under 5 years of age and their conceptions of antibiotic resistance in Northern Tanzania	Qualitative research	Hospital	All healthcare workers prescribing antibiotics at five health centers and seven dispensaries, chosen to represent different geographical and socioeconomic parts of Moshi urban and rural district.	Using a phenomenographic approach to explore the experiences of Tanzanian health care workers on their experiences of antibiotic prescription and understanding of antibiotic resistance in common childhood infections	Using different participant characteristics like age, sex, educational background, years of experience, health facility level and geographical location to compare antibiotic experiences and AMR understanding among healthcare workers
Inappropriate Use of Antibiotics and Its Associated Factors among Urban and Rural Communities of Bahir Dar City Administration, Northwest Ethiopia	[32]	Gebeyehu et al 2015	Ethiopia	To determine inappropriate use of antibiotics and its associated factors among urban and rural communities of Bahir Dar city administration	Cross sectional study	Communities	Households lived in the past six months were included	Determining the extent of inappropriate use of antibiotics and its associated factors by administering a Pre-tested and structured questionnaire to capture participants knowledge and use of antibiotics	Comparing knowledge and use of antibiotics between participants from rural and urban areas and other demographic characteristics eg family monthly income, education status, sex and occupation
Knowledge of Antimicrobial Drug Resistance (AMR) Among Patients in a General Outpatient Clinic in Abuja Municipal Area Council (AMAC), Federal Capital Territory	[33]	Idoko et al 2023	Nigeria	To assess the knowledge of Antimicrobial Drug Resistance (AMR) among patients in a General Outpatient Clinic in Abuja, Nigeria	Cross sectional study	Hospital	Adults (18 years and above) patients found in the waiting area of the outpatient clinic before the commencement of consultation who were medically stable and willing to participate	Using a questionnaire to assess the knowledge of AMR Among Patients in a General Outpatient Clinic in Abuja, Nigeria	Comparing the level of knowledge about AMR between males and females among the study participants

Prevalence and antimicrobial susceptibility patterns of methicillin-resistant Staphylococcus aureus among janitors of Mekelle University, North Ethiopia	[34]	Kahsay et al 2018	Ethiopia	To determine the prevalence of methicillin-resistant Staphylococcus aureus and antimicrobial susceptibility patterns among janitors working at Mekelle University, Tigray, Northern Ethiopia.	Cross sectional study	University	Janitors working at Mekelle University that were willing to participate and did not have nose bleeding	Nasal swab analysis and antimicrobial susceptibility testing to assess the prevalence and antimicrobial susceptibility patterns of methicillin-resistant Staphylococcus aureus among janitors of Mekelle University	Comparing the prevalence and antimicrobial susceptibility patterns of methicillin-resistant Staphylococcus aureus among janitors of Mekelle University using demographic characteristics like age, marital status, years of service and health conditions
Knowledge, attitude and perception on antimicrobial use and antimicrobial resistance among final year medical students in the College of Medicine, Malawi	[35]	Kamoto et al 2020	Malawi	To determine knowledge, attitude and perception on antimicrobial use and AMR among final year medical students in Malawi.	Cross sectional study	University	All final year medical students at the college of medicine	Administering a questionnaire to assess the students' knowledge levels, attitude and perception on antimicrobial use and antimicrobial resistance	Comparing knowledge levels among the final year students
Antimicrobial resistance and rational use of medicine: knowledge, perceptions, and training of clinical health professions students in Uganda	[36]	Kanyike et al 2022	Uganda	To determine the knowledge, perceptions of clinical health professions students towards antimicrobial resistance and rational use of medicine and confidence level to prescribe	Cross sectional study	Hospital	Students in the selected universities pursuing MBChB, BDS, BNS, BNA, BPharm courses in their clinical years who had consented to participate	Administration of questionnaire to assess knowledge of AMR among medical students in their final year	Comparison of AMR knowledge among students based on gender, year of study and program of study
Physicians' knowledge, attitudes, and perceptions concerning antibiotic resistance: a survey in a Ghanaian tertiary care hospital	[37]	Labi et al 2018	Ghana	To investigate physicians' knowledge and attitudes towards antibiotic resistance in a tertiary-care hospital setting in Ghana	Cross sectional study	Hospital	Physicians of all levels of expertise at the Departments of Medicine, Surgery, Paediatrics and Obstetrics and Gynaecology	Using a self-administered questionnaire get a picture of the knowledge and attitudes towards antibiotic resistance in a tertiary-care hospital	Comparing knowledge of AMR among the physicians based on age, sex, years of practice, position and level of training
Antimicrobial resistance among farming communities in Wakiso District, Central Uganda: A knowledge, awareness and practice study	[38]	Muleme et al 2023	Uganda	To assess the knowledge, attitudes and practices on AMR among subsistence and commercial farmers in Wakiso district, central Uganda	Cross sectional study	Community	All farmers (male or female), above 18 years, who had provided consent and had used or experienced antimicrobials during their routine livestock production and crop farming	Assessing knowledge, attitudes and practices on AMR among subsistence and commercial farmers	Marital status, education, farming, ethnic group, keeping poultry, age, and income
Predictors of antibiotic prescriptions: a knowledge, attitude and practice survey among physicians in tertiary hospitals in Nigeria	[39]	Ogoina et al 2021	Nigeria	To evaluate the knowledge, attitude, and practice (KAP) regarding antibiotic prescriptions (APR) and AMR among physicians in tertiary hospitals in Nigeria, and to determine predictors of KAP of APR and AMR	Cross sectional study	Hospital	Physicians working in public tertiary hospitals	Using a questionnaire to collect data on the knowledge, attitude, and practice regarding antibiotic prescriptions and AMR among physicians in tertiary hospitals and determining their predictors	Gender, age group, professional rank, prior AMR training and department with regard to knowledge of AMR and prescription practices

(*Continued*)

Table 2 (Continued).

Title	Citation Number	Authors	Country	Aim of Study	Study design	Setting	Inclusion Criteria	Intervention	Comparison
Determinants of Antibiotics Prescribing among Doctors in a Nigerian Urban Tertiary Hospital	[40]	Ogunleye et al 2018	Nigeria	To investigate the patterns and determinants of antibiotics prescription among doctors in a tertiary hospital in Nigeria as the first step to improve future antibiotic use in hospitals.	Cross sectional study	Hospital	Doctors who attended the grand round on the rational use of antibiotics at the Lagos state University teaching hospital	Using a questionnaire to gather information about the doctors' prescription habits and factors determining these patterns	Clinical specialty, professional status, gender and years of experience with regards to patterns of antibiotic prescribing
Carriage of antimicrobial-resistant bacteria in a high-density informal settlement in Kenya is associated with environmental risk-factors	[41]	Omulo et al 2021	Kenya	To assess the environmental risk-factors associated with the carriage of antimicrobial-resistant bacteria in Kibera, Kenya	Cross-sectional study	Community	Households with at least one adult (≥18 years) and one child (≤5 years) in Soweto and Gatwekera villages in Kibera, Kenya	Household interviews to assess the sanitation practices and antibiotic use and their possible influence on Carriage of antimicrobial-resistant bacteria	Comparing different households' sanitation practices and how that contributes to AMR
Self-Medication and Antimicrobial Resistance: A Survey of Students Studying Healthcare Programmes at a Tertiary Institution in Ghana	[42]	Ofori et al 2021	Ghana	To determine students of healthcare programmes self-medication practices and attitudes in relation to AMR	Cross-sectional	University	First-year health students reading programs in nursing, midwifery and medical imaging participated	Using a questionnaire to determine the self medication practices among students in healthcare programmes	Knowledge of antibiotics and antibiotic resistance among the students
A community survey of antibiotic consumption among children in Madagascar and Senegal: the importance of healthcare access and care quality	[43]	Padget et al 2016	Madagascar and Senegal	Estimating the proportion of children under 2 in the study population with at least one episode of consumption in the last 3 months, determining factors associated with antibiotic consumption, and comparing consumption patterns across countries	Cross-sectional	Community	Children under 2 living in Antananarivo and those living in the semi-rural city of Moramanga (Madagascar)- children under 2, living in Guediawaye (Senegal)- consent obtained from an adult family member or caregiver who had knowledge of the child's medical history	Undertaking a community survey to measure antibiotic consumption and related factors	Comparison of antibiotic consumption among Antananarivo and Moramanga in Madagascar and Guediawaye in Senegal
Barriers to implementing antimicrobial stewardship programs in three low and middle-income country tertiary care settings: findings from a multi-site qualitative study	[44]	Rolfe et al 2021	Sri Lanka, Kenya and Tanzania	To determine perceived barriers to implementing antimicrobial stewardship programs in three low and middle-income country tertiary care settings	Qualitative study	Hospital	Physicians from tertiary care facilities in Sri Lanka, Kenya and Tanzania	Conducting a qualitative study through interviews to gather information barriers to implementing antimicrobial stewardship programs in three low and middle-income country tertiary care settings	Comparing barriers to implementing antimicrobial stewardship among Sri Lanka, Kenya and Tanzania

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A two-month follow-up evaluation testing interventions to limit the emergence and spread of antimicrobial resistant bacteria among Maasai of northern Tanzania	[45]	Roulette et al 2017	Tanzania	To determine retention of the health information to limit the emergence and spread of antimicrobial resistant bacteria among Maasai of northern Tanzania	Qualitative research	Community	Maasai agropastoralists of northern Tanzania who were provided with health knowledge and technological innovations to facilitate: 1) the prudent use of veterinary antibiotics and the pasteurization of milk	Assessing the knowledge retention of Maasai agropastoralists who were provided with health knowledge and technological innovations to facilitate the prudent use of veterinary antibiotics and the pasteurization of milk	Demographic factors like age, sex, educational level, marital status, number of children, amount of cattle
Knowledge, attitudes and practices regarding antimicrobial use and resistance among communities of Ilala, Kilosa and Kibaha districts of Tanzania	[46]	Sindato et al 2020	Tanzania	To determine knowledge, attitudes and practices (KAP) regarding antimicrobial use (AMU) and AMR among communities of Ilala, Kilosa and Kibaha in Tanzania	Cross-sectional study	Community	Participants who were willing to participate from Ilala, Kilosa and Kibaha	Assessing AMR knowledge and awareness among participants from 3 districts in Tanzania	Demographic factors including sex, age, marital status, educational level and source of income and how this correlates to AMR knowledge among the participants
Knowledge and attitude towards antimicrobial resistance among final year undergraduate paramedical students at University of Gondar, Ethiopia	[47]	Seid et al 2018	Ethiopia	To assess knowledge and attitude of paramedical students regarding antimicrobial resistance, which helps to rationalize the use of antimicrobials	Cross-sectional	University	All first-degree paramedical graduate students of each department were eligible for participation	Conducting a cross-sectional survey to assess the knowledge and attitude towards antimicrobial resistance among final year undergraduate paramedical students at University of Gondar	Department of study and AMR knowledge
Knowledge of Antimicrobial Resistance and Associated Factors Among Health Professionals at the University of Gondar Specialized Hospital: Institution-Based Cross-Sectional Study	[48]	Simegn et al 2020	Ethiopia	To determine the antimicrobial resistance knowledge and examined the associated factors among the University of Gondar Hospital health professionals	Cross-sectional	University	All health professionals (in department of nursing, pharmacy, medicine, laboratory, and midwifery) working at the University of Gondar Comprehensive and Specialized Hospital	Assessing the relationship of different some Sociodemographic characteristics of study participants and how they influence their knowledge of AMR	Sex, work experience, working hours per week, work stress, knowledge of over the counter drugs, use of antibiotics, and self-medication practice
Paramedical staffs knowledge and attitudes towards antimicrobial resistance in Dire Dawa, Ethiopia: a cross sectional study	[49]	Tafa et al 2017	Ethiopia	To assess paramedical staffs' knowledge and attitudes towards antimicrobial resistance and their antibiotics prescription practices in Dire Dawa, Ethiopia.	Cross-sectional	University	All paramedical staffs holding bachelor degree (Nurses, Health Officers, Midwives, Medical Laboratory Technologists, and Pharmacists) working in hospitals (private and governmental) and health centers in Dire Dawa Administration	Conducting a cross-sectional study among paramedical staff to assess their knowledge and attitudes towards antimicrobial resistance and their antibiotics prescription practices	Age group, sex, location of institution, facility working at, whether government or private facility, profession, working experience, attendance of AMR training, use of antimicrobial sensitivity test result for treating patients, source of AMR information and whether they get up to date information on antimicrobial resistance

(*Continued*)

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Table 2 (Continued).

Title	Citation Number	Authors	Country	Aim of Study	Study design	Setting	Inclusion Criteria	Intervention	Comparison
Antibiotic use in Moshi Urban: A cross-sectional Study of Knowledge and Practices among Caretakers of Children in Kilimanjaro Tanzania	[50]	Petro et al 2021	Tanzania	Investigating the caretaker's knowledge and practices on antibiotics and antibiotics use to their children	Cross-sectional	Hospital	All caretakers (parents/guardians) present at the health facility who were seeking care and treatment for their children	Assessing caretakers knowledge of AMR and antibiotic use	Comparison among several demographic characteristics including age, sex, educational level, occupation, monthly income, number of children and residence area
Antimicrobial storage and antibiotic knowledge in the community: a cross-sectional pilot study in north-western Angola	[51]	Cortez et al 2017	Angola	To describe the first prevalence estimates for antimicrobial storage in the community, explore factors associated with storage, and to assess basic knowledge on antimicrobials among the general public in Bengo Province in the north of Angola	Cross-sectional	Community	–	Conducting household surveys to determine antimicrobial storage and antibiotic knowledge in north-western Angola	Age, sex, area of residence, literacy levels and distance to health facilities
Knowledge, attitudes and practices regarding antibiotic use in Maputo City, Mozambique	[52]	Mate et al 2019	Mozambique	To determine knowledge, attitudes and practices regarding antibiotic use in Maputo City, Mozambique	Cross-sectional	Community	Individuals aged 18 years and over, with permanent residence (> 1 year) in the selected household, who accepted to participate in the study	Using household interviews to determine the knowledge, attitudes and practices regarding antibiotic use in Maputo	Age, sex, marital status, education, monthly income and residence area
Self-medication practices and predictors for self-medication with antibiotics and antimalarials among community in Mbeya City, Tanzania	[53]	Kajeguka et al 2017	Tanzania	To determine self-medication practices with antimalarials and antibiotics, and as well as predictors for self-medication among urban communities of Mbeya in Tanzania.	Cross-sectional	Community	Adults 18 years and above, residing in Mbeya City for the period of at least 12 months before data collection	Conducting a cross-sectional study to determine the predictors of self medication with antibiotics and antimalarials in Mbeya City	Age, sex, marital status, occupation, income per month and their association with self-medication practices

Discussion

This systematic review aimed to assess the behavioral and socio-economic determinants of antimicrobial resistance in sub-Saharan Africa. Primarily, the review set out to identify the most common behavioral and socio-economic factors affecting the spread of AMR in sub-Saharan Africa, assess antibiotic use practices across sub-Saharan African communities that may contribute to the progression AMR and identify knowledge and awareness gaps that might affect behaviors that contribute to AMR. This review identified several themes regarding the roles played by behavioral and socio-economic factors in AMR in the sub-Saharan region.

Empiric Antibiotic Prescription

Empiric antibiotic prescription was a common trend among several healthcare providers in these studies, where they relied on clinical suspicion or experience to begin treatment without waiting for laboratory results.[40] This is evidenced in a study by Adegbite et al (2020) where only 21% of the healthcare workers requested microbiological culture and antimicrobial susceptibility testing before prescribing antibiotics.[24] In a study by Babatola et al (2020), 77% of respondents had clinical microbiologists in their facilities; however, only 55.5% of respondents sent samples to the laboratory before commencing antibiotic treatment. Interestingly, some prescribers mentioned distrust in the microbiology laboratory when cultures were negative, even when infections were highly suspected[44] hence pushing them to prescribe antibiotics regardless. Empirical prescribing is often viewed as a pragmatic approach to providing immediate relief and preventing complications in the absence of diagnostic support. Contributing to this trend, the top reasons for prescribing antibiotics without clear indication in one study included a desire to 'be on the safe side, the high cost of further diagnostic tests for patients, difficulty in predicting the disease cause, patient demands for antibiotics, and helping patients return to work quickly.[29] Similarly, a study in South Africa found that general prescribers often used antibiotics empirically to provide symptom relief for conditions like urinary tract infections and acute sinusitis.[54]

Similar trends are also seen in regions outside SSA in an Irish study where 78% of antibiotic prescriptions were not strictly in accordance to guidelines, posing a major threat on increasing resistance. The study also highlighted that majority of tonsillitis presentations were not being treated with narrow-spectrum antibiotics as considered appropriate.[55]

Empiric antibiotic prescribing is necessary in certain cases requiring immediate treatment interventions where laboratory results may delay. This approach however carries the risk that healthcare providers may not adjust or discontinue antibiotics once laboratory results confirm the causative agent or drug susceptibility patterns. Failing to switch to more targeted therapy in such cases can lead to the overuse or misuse of antibiotics, contributing to the spread of antibiotic resistance.

Poverty and Economic Constraints

Poverty is a significant socio-economic factor contributing to antimicrobial resistance particularly in Sub-Saharan Africa and beyond. A retrospective study in the United States found that the incidence of invasive infections caused by community-associated methicillin-resistant Staphylococcus aureus (MRSA) was higher among individuals living under the national poverty line, in neighborhoods with lower socioeconomic status, and in medically underserved areas.[56] Poverty-stricken patients are more likely to purchase less expensive and potentially less effective medications, and at times shorten their antibiotic regimens to save money.[25] The high cost of healthcare, especially for those without health insurance, often leads impoverished individuals to delay seeking medical attention, self-medicate, or resort to alternative, possibly inappropriate, treatments.[57]

In a study by Asiedu et al (2020), clients with low socioeconomic status tended to buy fewer antibiotics than expected with the understanding that, they would come back and buy the remaining antibiotics when they had money available and often buy antibiotics from unapproved sources for reasons such as distance to health facilities and pharmacies.[30] These substandard medications often lack the necessary potency and purity, further exacerbating the AMR crisis as evidenced in a study by Demissie et al (2021), where 52% of all antibiotics from private pharmacies were not potent.[30] Substandard antimicrobials containing suboptimal levels of the required active ingredient may not efficiently clear infections. Such antibiotic misuse and subsequent AMR infections can be dangerous and even fatal.[57] In addition to healthcare settings,

the effects of economic constraints on AMR also extend to the agricultural sector, exemplified in a study by Muleme et al 2023, where farmers used human antibiotics on animals because they were cheaper and easily available among other reasons.[38] The economic barriers faced by communities in the SSA underscore the urgent need for affordable healthcare and regulated access to quality antibiotics.

Poor AMR Knowledge Among Community Members and Healthcare Providers

A significant lack of awareness of AMR among community members was noted among the included studies. For instance, about 73% participants wrongly believed that antimicrobial resistance is only a problem for people who take antibiotics regularly but that is not the case.[33] This lack of understanding extended to health professionals as well, with 28% believing that antibiotics could cure both viral and bacterial infections[39,48] and alarmingly prescribed antibiotics to treat malaria. Participants were also reported to use antibiotics to combat flu body muscle pain, signs and symptoms typical of viral diseases.[51]

Additionally, there was a misconception among certain healthcare providers that regular hand-washing does not help reduce AMR[39] when in fact, sanitation and hygiene play a key role in the spread of AMR as seen in a study by Omulo et al 2021, where despite widespread antibiotic use, the prevalence of resistance in the community was more strongly correlated to poor hygienic conditions and practices.[41] Furthermore, while most physicians perceived antibiotic resistance as a global issue, only a minority regarded it as a problem within their own department.[37] There is an urgent need for more antimicrobial stewardship programs among the public and healthcare workers in sub-Saharan Africa. Observations and studies have revealed Poor AMR surveillance and lack of coordination to be among the contributors of AMR in the region.[4] For instance, in one study, only 28.2% of participants had ever heard of Antimicrobial Stewardship Programs, and only 16.6% had attended any educational programs on AMS.[27] In another study, nearly 90% of interviewed health workers had not received any training on antimicrobial resistance.[49] These results highlight the necessity of putting in place thorough AMS programs to improve knowledge and appropriate use of antibiotics, which will ultimately minimize the spread of AMR.

Easy Access to Antibiotics from Pharmacies Without a Prescription

Multiple studies in this review highlighted the ease of access to antibiotics without a prescription from pharmacies, with participants citing pharmacies as the primary source of antibiotics in various situations without even needing to visit medical facilities for a prescription. A recent review on the pooled prevalence of community pharmacy non-prescription antibiotic dispensing among 52 countries was 63·4%.[58] These findings are similar to a study by Ofori et al 2021 where the Pharmacy recorded the highest source of procurement of antibiotics for self-medication.[42] Non-prescribed dispensing of antibiotics is a common practice among community drug retail outlets in several SSA countries.[59] In Uganda, there was a high proportion of antibiotics dispensing occurring even though this practice was illegal. The study authors speculated that the high rate of dispensing of non-prescribed antibiotics was due to weak enforcement of the regulations unlike in Zimbabwe where the lowest prevalence of non-prescription antibiotic sale was recorded possibly due to efforts commenced in 2000 to regulate for-profit healthcare providers in the country. Hence, the country undertook strict enforcement of laws prohibiting the supply of antibiotics without prescription by establishing collaboration between the central and local regulatory authorities.[59] In the absence of stringent regulations, private entities tend to prioritize financial gain over patient safety, leading to the over-prescription and inappropriate use of antibiotics as seen in a study by Emgard et al (2021) which stated that private facilities are more likely to prescribe antibiotics because they are driven by the profit of selling them and not for the benefit of the patients.[31] To mitigate this risk, it is imperative to implement and enforce robust regulatory frameworks that ensure that antibiotics are prescribed and dispensed responsibly, prioritizing public health over profit. Despite being a high-income country, Chile presents a successful model for implementing antibiotic use regulations that could be adapted for LMICs. In Chile, strict enforcement of antibiotic use regulations, accompanied by a public awareness campaign and pharmacy support, led to a significant reduction in antibiotic sales.[60]

Inadequate Health Literacy

The study revealed a concerning lack of health literacy among participants, characterized by their inability to provide an elaborate and consistent definition of antibiotics that does not contradict biomedical knowledge. Participants were also noted to misuse certain specific medical terms as they used "Paracetamol" and "antibiotics" interchangeably.[28] There were also widespread misconceptions over which symptoms necessitate hospital attention versus those manageable through self-medication. A study among caretakers in Tanzania revealed several reasons warranting self-medication in cases where the condition of the child did not seem alarming (98/244), they lacked time to visit the doctor (86/244), they had knowledge of antibiotics for the same symptom (83/244), a friend or relative recommended the antibiotic for the child (45/244), while with a few caretakers, (16/224) an unprescribed antibiotic was given to the child because the health facility was too far from home.[50] Other reasons of self-medication included Someone else's advice, poor quality of care in health facilities, the inconvenience of a long waiting, emergency of the illness, proximity to the private pharmacy, distance to the health facility, health facility charges and unavailability of drugs in the health facility.[52,53]

Participants in several studies perceived certain symptoms such as headache, cold or flu and stomachache as conditions not requiring hospital assistance and suitable for home treatment or traditional medical treatment which common in many communities, with traditional healers often serving as the first point of contact for health concerns due to their cultural alignment and easy accessibility compared to health facilities. This was the case one particular study where 11% of the antibiotics were prescribed by traditional healers.[43] These traditional healers may however lack adequate knowledge of antibiotic use, leading to inappropriate prescriptions or recommendations.[32] It is evident that addressing these health-damaging practices is crucial to mitigating the spread of AMR. It is equally vital to highlight and leverage health-enhancing cultural values among these communities as pointed out in a study among Maasai communities that revealed some positive health practices including dietary preferences for unboiled milk and a strong concern for child and livestock health that can be integrated into health promotion efforts, offering opportunities to design interventions that respect local values while fostering responsible antibiotic use.[45]

In addition, there was misinformation that sharing medicine is acceptable in the case of compatible symptoms with relatives, neighbors or friends and when the conditions are non-threatening.[47] Among others, educational level is associated with health literacy.[61] This was also the case in a study by Gebeyehu et al 2015 where those who were unable to read and write were significantly more likely to misuse antibiotics than those who completed college and above.[32] While in a study by Seid et al 2018 The majority of those with no formal education reported a lower level of AMR awareness than those with primary, secondary and college/university level of education.[46] This trend is not limited to low-income countries; a recent study in high-income countries highlighted that individuals with 9 years or less of formal education were more prone to antibiotic misuse.[62] Furthermore, a study conducted in the UAE revealed that inadequate health literacy was strongly associated with increased antibiotic misuse.[63] The effects of lacking health literacy may also extend beyond antibiotic misuse to workplace settings. A study by Kahsay et al 2020 revealed a high prevalence of MRSA (62.5%, P=0.038) among janitors who were unable to read and write, likely due to a lack of awareness regarding the use of safety measures in medical environments.[34] This gap in health literacy underscores the urgent need for comprehensive educational initiatives aimed at empowering individuals with accurate health information and guiding them in making informed decisions regarding their healthcare needs.

Knowledge and Awareness Gaps

The review revealed significant gaps in the knowledge and awareness of AMR across sub-Saharan Africa. A significant knowledge gap of note is the overall lack of knowledge regarding AMR, including its mechanisms and effects. Additionally, there is a notable deficiency in prescription knowledge among healthcare professionals, resulting in poor prescription practices that may pose a risk to patients from over-prescription to under-prescription of antimicrobials, leading to inefficient patient care in health facilities. Furthermore, there is limited awareness of what constitutes inappropriate antimicrobial use and the severe consequences that can arise from such practices, including the acceleration of AMR and adverse patient outcomes. These disparities show how urgently targeted training and education programs are needed to enhance knowledge and control over the use of antibiotics. Supporting this, studies by Augie et al 2021,

Kanyike et.AL 2022 and Kamoto et al 2020 expressed a need among medical students for more training during their medical courses on managing common infections, antimicrobial selection and interpreting antibiograms respectively. This emphasizes that such initiatives could better equip newly qualified doctors to prescribe antibiotics appropriately, reducing the risks of misuse.[26,35,36]

Study Limitations

This systematic review had a number of limitations including sourcing papers exclusively from PubMed which may have led to selection bias by excluding relevant studies available in other databases or unpublished literature, resulting in the incomplete representation of available data on the behavioral and socio-economic determinants of AMR in sub-Saharan Africa. Additionally, restricting the included studies to English, could have omitted significant studies published in other local languages.

Recommendations

To combat AMR effectively, it is imperative to adopt a stepwise strategy involving among other things, increased availability of affordable healthcare services to reduce reliance on over-the-counter antibiotics as a cheaper healthcare alternative compared to seeking help from Healthcare facilities and providing training and support for informal healthcare providers to ensure safer dispensing practices to help curb antimicrobial. This will play a significant role in reducing ease of access to antibiotics and antimicrobial misuse exacerbated by increased over the counter antibiotics sales in pharmacies.

To enhance AMR awareness campaigns, local authorities and traditional leaders should be engaged to boost the effectiveness of these campaigns as they hold significant influence over community norms, beliefs, and community engagement in Sub-Saharan Africa, with their endorsement and active participation potentially enhancing the acceptance and effectiveness of AMR campaigns. Educational programs should also be tailored to specific cultural and socio-economic contexts to resonate more deeply with the target populations and therefore have a greater impact. AMR surveillance systems should integrate behavioral and socio-economic factors to gain a more comprehensive understanding of the relationship between these phenomena. Community-based antimicrobial stewardship programs should also be initiated, emphasizing training healthcare workers and engaging local leaders. AMS should also be strengthened among Healthcare workers by incorporating it in the Healthcare curricula as well as conducting regular workshops or webinars for healthcare providers. Cross-country comparisons of the roles played by behavioral and socio-economic factors in AMR within sub-Saharan Africa should also be adopted as this will help identify regional differences and the best ways to mitigate them.

Future Research Directions

Future studies should focus on assessing health literacy among community members to understand their awareness and knowledge levels of AMR and appropriate antimicrobial use. Investigations on antibiotic prescription practices among healthcare professionals should also be conducted to identify areas needing improvement, particularly regarding adherence to guidelines and awareness of AMR consequences. Further studies should assess the effectiveness of antimicrobial stewardship programs in various settings to provide insights into best practices and strategies for optimizing antimicrobial use. Research should also explore the socio-economic barriers influencing community behaviors and healthcare practices related to AMR. In addition, future research should prioritize investigating the interplay between cultural beliefs, traditional medicine practices, and AMR-related behaviors like self-medication to provide insights for designing culturally sensitive interventions that address both traditional medicine and other health-seeking behaviors. Addressing these areas will help in developing more targeted interventions aimed at mitigating AMR and promote sustainable healthcare practices in sub-Saharan Africa.

Conclusion

This systematic review highlights the multifaceted nature of AMR in sub-Saharan Africa, driven by a combination of behavioral and socio-economic factors that are embedded in the day-to-day lives of the communities and its members.

The review identifies key determinants, including self-medication, widespread practices of antibiotic sharing, inconsistent adherence to treatment regimens, and socio-economic barriers such as poverty, inadequate access to healthcare, and limited awareness about appropriate antibiotic use. This review highlights the necessity for interventions enhancing public education on antibiotic use, improving healthcare accessibility, and addressing socio-economic disparities, along with policies promoting rational antibiotic prescribing practices. To ensure the effective implementation of these interventions, multidisciplinary collaboration and further AMR research focusing on context specific behavioral and socio-economic factors, antibiotic use patterns, drivers of resistance, and evaluating the impact of AMR interventions. Such efforts will help achieve sustainable improvements in antibiotic use and resistance management. By addressing these interconnected factors, meaningful strides toward mitigating the adverse effects of AMR and promoting public health in sub-Saharan Africa can be made.

Data Sharing Statement

All the papers included in this systematic review are available and can be made available upon request.

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