

Review Article

Poverty and corruption affecting antimicrobial resistance: a silent pandemic

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ABSTRACT

Antimicrobial resistance (AMR) occurs when microorganisms like bacteria, viruses, fungi, and parasites become able to adapt and grow even with medications that once killed them. AMR is a growing global problem. The causes for AMR in countries with poverty and corruption are complex and may be rooted in the practices of health care professionals and behaviour of patients towards the use of antimicrobials as well as supply chains of antimicrobials in the public. The factors like inappropriate prescription practices, insufficient patient education, limited diagnostic facilities, unauthorized sale of antimicrobials, absence of appropriate functioning drug regulatory mechanisms, and non-human use of antimicrobials such as animal production. This can lead to serious infections and cause difficulty in treatment of the infections. Poverty and corruption are two important parameters which strongly accelerate AMR by weakening drug regulation and forcing reliance on cheap or fake medicine. Poor infection control, poor water sanitation and poor hygiene all increase the spread of resistant bacteria from person to person. The appropriate use of antibiotic is related to economic development of countries. According to the World Health Organization (WHO), poverty is very crucial for development of AMR. This review discusses the importance of governmental, social, and economic factors related to antibiotic resistance including poverty and corruption.

Keywords: Antimicrobial resistance, Micro-organism, Poverty, Corruption, Developing countries

INTRODUCTION

When bacteria, fungi, viruses, and parasites change over time and become resistant to antimicrobial treatments, this is known as AMR.¹ In case of AMR, common infections of body become life-threatening by increasing risk of disease spread, and even death. AMR is becoming a major threat to global health security.² The discovery of penicillin about a century back revolutionized healthcare, with antibiotics now very important for treatment of infectious disease.³ However, currently, AMR has become a major threat to this breakthrough, unevenly affecting global health security.⁴ Beyond a lack of awareness, the high

mortality and disproportionate distribution of AMR in low- and middle-income countries are caused by a variety of systemic factors across political and economic contexts that have an adverse effect on purchasing power and standard of living, which in turn affects the population's health-seeking and infection-prevention behaviors.⁵ Despite this, diverse programs for AMS, infection prevention and control strategies, risk communication, and community participation are being used to address AMR. Certain systemic elements that contribute to AMR are overlooked, including governance, corruption, poverty, inflation, culture, and setting.⁶

METHODS OF LITERATURE SEARCH

To identify the research articles on the poverty and corruption affecting AMR, a comprehensive and methodical search of the literature was conducted. Using a variety of techniques, we searched for studies on the risk factors for congenital hearing loss. The first step in this process was to search internet databases including Scopus, PubMed, Medline, and Google Scholar using a structured approach that included free text keywords and medical topic headings (MeSH) related to poverty and corruption affecting AMR. Key terms included “antimicrobial resistance”, “poverty affecting antimicrobial resistance”, “corruption affecting antimicrobial resistance”, “antimicrobial resistance in developing countries” linked using Boolean operators to increase search precision. The PRISMA (Preferred reporting items for systematic reviews and meta-analysis) standards served as the foundation for the development of a search strategy. Citations were employed to manually locate further research articles after the search strategy turned up published article abstracts. It was determined if observational studies, comparative studies, case series, case reports, and randomized controlled trials were appropriate for inclusion in this review. There were 39 out of the 68 papers (20 case reports, 17 case series, and 31 original articles) identified in different databases were included in this evaluation. (Figure 1). This article discusses the global burden of antimicrobial resistance, poverty and corruption affecting the antimicrobial resistance.

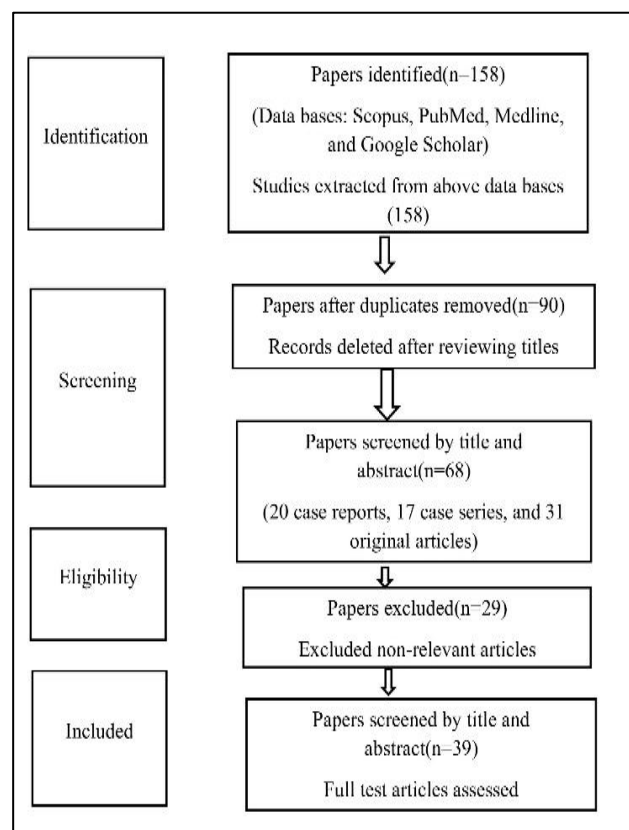


Figure 1: Methods of literature search.

AMR AND GLOBAL BURDEN

AMR is one of the urgent health challenges for the next decade. AMR is a global threat affecting low- and middle-income countries.⁴ Misuse of antimicrobials in low-income countries are in accelerating the evolution of AMR.⁷ Global inequities in the burden of AMR in the population are severely influenced by social and structural determinants of health. AMR was responsible for approximately five million deaths in 2021, well on the way to a projected ten million deaths annually by 2025.⁸ Beyond low awareness, the high mortality and disproportionate distribution of AMR in low- and middle-income countries are caused by a variety of systemic factors across political and economic contexts that negatively impact people's ability to prevent infections and seek medical attention.⁹ Studies at Brazil, Kenya, and Guinea-Bissau have shown that sex workers are at high risk of drug-resistant sexually transmitted infections like gonorrhoea, syphilis, and HIV which highlight their occupational exposure to resistant infections.^{10,11} One of the main causes of death in nations with low socioeconomic status is infectious diseases brought on by drug-resistant bacteria. All nations are impacted by AMR, although middle- and lower-income nations are disproportionately more affected due to a number of poverty-related issues.¹¹ These causes include the lack of quality control in antimicrobial production facilities, the absence of healthcare regulations regarding the use of antimicrobials, the insufficient supply of high-quality medications, the inability to pay for suitable treatment, and the administration of antimicrobials without a prescription.⁴

USE OF ANTIMICROBIAL DRUGS

In many underdeveloped and developing countries, the antimicrobial drugs are used for treatment of infections among people and animals in unregulated way.¹² In poor countries, the antibiotics are often purchased in pharmacies, general stores, and even market stalls.¹² On study at Bangladesh showed that a clinician with average 11 years of experience showed that they each saw on average 380 patients per month and prescribed antibiotics to 60% of these patients on the basis of only symptoms.¹³ A total of 291500 doses of antibiotics were prescribed to 14950 individuals in a single month. Pharmacies only dispensed 109500 doses, but an additional 100,000 tablets were given out without a prescription.¹³ So, there is widespread and uncontrolled use of antibiotics, and patients usually do not take a full course of antibiotics if they are unable to afford it. The effectiveness and quality of antibiotics is another issue in developing and impoverished nations. Numerous antimicrobial medications are made locally in several nations. More than 80 distinct brands of fluoroquinolones, such as ciprofloxacin, are available in India. AMR can result from self-medication due to improper administration of antibiotics for illnesses, improper medicine selection for a particular microorganism, and improper dosage or

duration of treatment. These practices are more widespread in the underdeveloped or developing countries due to poverty.¹⁴ The microbial population that is resistant to antimicrobial agents that they are supposed to treat as the consequence is likely to be very dangerous.

ASSOCIATION BETWEEN AMR AND POVERTY

The association between AMR and poverty is usually underestimated, leading to interventions that fail to address the present conditions in developing countries with poverty, corruption, and inflation.² One study shows that corporate governance and corruption drive AMR in developing countries which is more than antimicrobial use.¹⁵ How society is empowered to participate meaningfully in AMR responses is significantly impacted by structural challenges of governance and the economy. No matter how much awareness or education is provided, community-level efforts to address AMR will remain limited when healthcare dollars are used for poor governance. Therefore, poverty and corruption create an environment that encourages the abuse of antibiotics. According to one study, AMR is more influenced by corporate governance and corruption than by the usage of antibiotics. No matter how much awareness or education is provided, community-level efforts to address AMR will remain limited when healthcare funds are allocated under weak governance.² This is because corruption and poverty foster an environment that encourages the abuse of antibiotics. Economic survival frequently takes precedent over appropriate use for individuals and companies that depend on the selling of antibiotics for revenue, particularly in unregulated markets. Patients in poverty may choose to self-medicate rather than pay for a clinician's session.¹⁶ Assuming they are all bioequivalent, people are likely to buy the least costly (and probably least effective) drug. Additionally, because they are unable to pay for the entire course of medication, these patients may finish a shortened course of therapy.¹⁷ These kinds of improper antibiotic use for insufficient amounts of time might put microorganisms under intense selective pressure and lead to resistance.

AMR IN DEVELOPING COUNTRIES

The World Health Organization states that one of the main factors contributing to the emergence of antibiotic resistance is poverty and limited access to medications.¹⁸ The emergence of multidrug resistant bacteria has been linked to a number of poverty-driven causes, some of which may have a direct impact on resistance in rich nations like the United States.¹⁶ Research conducted in low-, middle-, and high-income nations demonstrates how antibiotic use and resistance affect AMR. Bribery during the hiring process is a form of corruption in Bangladesh that affects the distribution of clinicians and jeopardizes access to healthcare.¹⁹ Corruption poses a serious threat to the healthcare system in Africa, where poor management costs billions of dollars.²⁰ Millions of people have little or no access to healthcare as a result, and

healthcare facilities fail. Corruption exposes society to the risks of improper usage by reducing the resources available for antimicrobial stewardship and regulation.²¹ Additionally, access to healthcare is restricted by inflation. Patients are put in danger when they look for less priced alternatives from unlicensed drug vendors due to unchecked increases in medicine and healthcare expenditures.²² The relationship between AMR, poverty, corruption, and inflation is frequently overlooked, which results in actions that don't address these fundamental causes. How communities are empowered to participate actively in AMR responses is significantly impacted by concerns of governance and the economics. No matter how much awareness or education is given, community-level efforts to address AMR will remain limited when healthcare funds are allocated under bad governance. This is due to the fact that poverty and corruption foster environments that encourage the abuse of antibiotics. Economic survival frequently takes precedent over appropriate use for people and companies that depend on the selling of antibiotics for revenue, especially in unregulated markets. Regulatory deficiencies that permit unrestricted antibiotic distribution exacerbate this. Transparent funding distribution and utilization, bolstered by robust institutional structures that thwart corruption, are necessary for achieving long-term progress in combating AMR. These include investing in job creation and economic opportunities to support local production and encourage financial empowerment among the populace, addressing corruption in pharmaceutical supply chains to reduce incentives for inappropriate antimicrobial marketing and distribution, strengthening regulatory oversight, and providing economic protection for vulnerable groups.²³ In the end, the fight against AMR must be people-centered, based on providing communities with resources for healthy lives, information to fight AMR, and necessary access to basic amenities and services for infection prevention and control.

POOR GOVERNANCE AND AMR

When quality of Governance is poor, then there are high chance to be fewer effective controls of antibiotics.¹⁵ As a result, microorganism that are resistant to antibiotics would not only proliferate but also spread more easily. Another crucial element is private health spending. The degree of antibiotic resistance increases with a nation's percentage of private health spending.¹⁵ The reason for this is not clear. When healthcare is being delivered predominantly in the private sector, there are less controls and supervision of what is being done. Many impoverished and emerging nations are unable to offer the funding required for drug research, development, and manufacture due to their weak economies.² These factors increase the risk of AMR as developing and improved antimicrobials is the most effective way of counteracting drug resistance.¹⁵ Reduction of new drug production leads to availability of more expensive antimicrobials and unaffordable to poverty affected people. Such conditions force public to buy medications from unregulated drug dispensaries,

mostly selling substandard medicines for profit making. All these factors can lead to risk of AMR.²⁴

CORRUPTION AND AMR

Poor governance and corruption increase the chance of AMR by weakening regulatory oversight, enabling the over-the-counter selling of the unprescribed antibiotics, and degrade the public health infrastructure.²⁵ Corruption diverts money away from public health systems. This leads to broken sanitation works, poor waste management in hospitals, and lack of clean drinking water which increase the resistant superbugs spread. Countries with higher corruption often fail to enforce laws governing the sale of prescription of medications. This allows pharmacies and informal vendors to sell antibiotics without prescription.²⁵

HEALTH PROFESSIONALS AND AMR

Health professionals play an essential role in the treatment and prevention of disease.²⁶ However, it may jeopardize this if their practice is not evidenced base. In some cases, the antimicrobial prescriptions are inappropriate (like wrong drug, wrong doses, or antimicrobial not needed at all).²⁷ Due to high patient-doctor ratio in most developing countries, doctors are overwhelmed and there is often inadequate time for meaningful education and communication with patient on drug use guidelines. The treatment sometimes includes administration of broad-spectrum antibiotics without definitive diagnosis and indication for antimicrobial treatment. One study showed that in 52% of cases, the prescription dose was inappropriate while 63.7% of clinicians prescribed antibiotics with wrong duration of treatment.²⁸

DRUG DISPENSE AND QUALITY

Antimicrobial overuse and misuse, poor sanitation and hygiene, unregulated antimicrobial production, lack of awareness and knowledge, and early discontinuation of antimicrobial therapy due to cost are the primary causes of AMR (Table 1).²⁹ Absence of proper regulations in sales of antimicrobials is an important factor in access and misuse of antimicrobials. Most of developing countries, antimicrobials are purchased without medical prescription and often dispensed on streets by untrained persons.³⁰ These untrained salesmen sell medications just to make a sale and accommodate patients' ability to pay.³¹ Some pharmacies even operate without a licence, appear to be more accessible to public as they have lesser waiting period, do not charge consultation fees and above all are willing to negotiate treatment options to adjust to financial ability of patients.³² In developing and poor countries, retail pharmacies have emerged as primary level of outpatient care rendering unauthorized services from consultation, diagnosis, prescription and dispensing of medications.³³

SANITATION AND HYGIENE

Environmental conditions like crowding and poor sanitation may contribute in spread of resistant micro-organisms.³⁴ Transmission of resistant micro-organism is also facilitated by person-to-person contact, contaminated water, food or by vectors. The improvement of basic hygiene and sanitation are helpful to reduce the spread of resistant organisms (Table 2).³⁵ Improvement of hospital infection prevention and control usually reduce nosocomial spread of bacteria with acquired resistance such as *S. aureus* amongst others.^{36,37}

Table 1: Factors contributing to development of AMR.

Factors	Contribution	Example
Prescribers	Excessive clinical use and misuse is partially responsible for development of resistance	Variations of prescription practice among health care providers. Sometimes there is prescription of wrong medicine, wrong doses, or antimicrobial not needed at all
Dispensers	Drug vendors usually have little or no knowledge of the required dosage regimen, indication, or contraindications	Medications are often sold in small aliquots from roadside shop and storage and distribution is often done under inadequate conditions
Poor quality of drug	Sales of counterfeit, adulterated and poor quality of antibiotics	These poor-quality antibiotics can cause sub-inhibitory concentration in vivo, which increases the selection of resistant strains
Regulators	Most of developed countries have developed AMR action plans, this is still absent in developing countries	Many countries lack the resources to enforce policies regarding the manufacturer and distribution of substandard drugs
Users/patients	Self-medication and lack of treatment compliance	Patients fail to adhere to dosage regimens and discontinue treatment when symptoms subside before microorganism are eliminated
Animal industry	The use of antimicrobial drugs in agriculture or industry settings, exerts selection pressure which can favour the survival resistant strains (or genes) over susceptible ones, resulting in increased resistant bacteria within microbial communities	Resistant bacteria in animals can be transferred to humans by consumption of food through direct contact with food-producing animals or by environmental spread

Table 2: Strategies to minimize the development of AMR.

Control strategies	Contribution
Education	Patients, medicine dispensers, and health care providers should be educated on how to use and misuse of antimicrobials that can develop AMR
Hygiene and sanitation	Improve basic sanitation and hygiene that will reduce spread of resistant organisms
Alternative treatment	The reluctance of pharmaceutical companies to invest in research and development of novel antibiotics necessitate the exploration of alternative treatment such as bacteriophage, probiotics and Quorum Sensing inhibitors
Infection prevention and control	Proper control of hospital infection may prevent the spread of nosocomial pathogens and resistant microbes that may easily been spread to the community if these measures are not in place

SOCIAL AND CULTURAL IMPACT

People who are affected by poverty may be forced to maintain their confidence in customs and popular myths due to low levels of education and public ignorance.³⁸ People with poverty often ignore important laboratory tests and never depend on doctors to get antibiotics even for mild to severe illnesses in order to lower long-term treatment costs.³⁹ The risk of AMR is greatly increased by each of these variables.³⁸

CONCLUSION

The poor governance and corruption contribute to levels of AMR and correlate better than antibiotic usage volumes with resistance rates. Addressing corruption and improvement of governance can lead to reduction of antibiotic resistance. The irrational use of antibiotics is certainly a complex and multifactorial problem in developing countries. Proper understanding of this problem is important for effective control of AMR. Without effective antimicrobials, many medical procedures such as surgery, the care of premature infants, cancer chemotherapy, care of critically ill patients, invasive diagnostic and treatment procedures, and transplantation medicine will be severely hampered along with increase of morbidity and mortality by secondary microbial infections. The challenge of global AMR is comparable to climate change and global warming. So, as we seek to protect the climate for the future generation, it is our responsibility not to pass over to the next generation.

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