

Antimicrobial Resistance in Nepal: The Next Invisible Pandemic

Saugat Pratap KC¹, Aney Rijal², Sampurna Kakchapati^{1*}

¹HERD International, Thapathali, Kathmandu, Nepal

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*Corresponding author

sampurna.kakchapati@
herdint.com

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Introduction

Antimicrobial resistance (AMR) is a serious threat to current and future medical advances and requires immediate action. It is an important public health issue that threatens to undo the remarkable achievements of modern medicine [1]. Owing to interconnected ecosystems and the constant exchange of bacteria among humans, animals, and the environment, this is not just a challenge for humanity but also the planet [2]. It is estimated that, currently, at least 700,000 people die each year due to drug-resistant diseases, with most of the direct and indirect impact falling on low and middle-income countries [1]. The World Bank report 2017 approximates that by 2030 AMR could cost the world economy estimating more than \$1.0–3.4 trillion annually, relatively worse than the 2008-09 great recession [3]. By 2030, AMR could force up to 24 million people into extreme poverty, due to its combined effects on human health as well as food systems [3]. The economic losses are projected to be worse in low-income countries, thereby increasing global economic inequality and vulnerability to infectious diseases [3]. Unless countries act now, the economic effects of AMR will be felt by the poor, deprived and vulnerable sections of society, jeopardising the achievements of the Sustainable Development Goals 2030 for ending poverty, ending hunger, ensuring healthy living, reducing inequality, and revitalising global development partnerships [3].

The World Health Organization (WHO) has declared AMR among the top 10 global health threats [4]; it can no longer be addressed by single, isolated interventions with limited impact [3]. In low- and middle-income countries like Nepal, AMR is less prioritized compared to other public health agendas and there is an inadequate implementation of the law. Nepal is considered a major contributor to the growing burden of AMR. The regular irrational consumption of antimicrobials in individuals and animals causing the resistance is an alert for a worse public health situation [5]. Moreover, comprehensive study findings on antimicrobial resistance in Nepal are limited. There is limited information on total production, importation, and use of different categories of antimicrobials in the country. Although the Department of Drug Administration (DDA) has some information on production licensing amounts of antimicrobials within the country [5].

Components such as antibiotic use as growth promoters in livestock, overuse, long-term use, self-medication practices, and lack of well-equipped health facilities were driving forces behind the development of AMR in humans [5]. On the other hand, factors such as inadequate infection prevention, poor husbandry practices, and prudent use of antibiotics have contributed to AMR in animals [5]. Even though the country has taken necessary actions to endorse policies, acts, and regulations to tackle the rise of AMR, there is the urgent need for overall commitment to fighting against AMR using one health strategy [5].

Use of Antimicrobial in Humans, Animal and Environment

Antimicrobial resistance is driven by antimicrobial use and abuse in human, animal, and environmental sectors and the spread of resistant bacteria within and between these sectors (human, animal and environment) and around the globe [6-10].

Human health sector:

Most of the patients are prescribed more than one antibiotic unnecessarily, without bacterial confirmation or susceptibility testing by the pharmacies [5]. Antimicrobials are commonly prescribed for conditions that do not require antibiotics, such as fever, colds, coughs and diarrhoea [6]. Self-medication is common in Nepal, and most people do not comply with the physician-directed duration of antibiotics treatment [4]. Pharmaceutical companies with vested interests offer incentives to physicians/clinicians to prescribe “their” brand of drugs [7]. Recently, antibiotics such as amoxicillin-clavulanate and doxycycline are less effective due to the development of partial resistance/resistance by bacteria [7]. There is the high

prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) in tertiary care hospitals in Kathmandu [8]. Penicillin-resistant *Neisseria gonorrhoea* infection is also on the rise in hospitals [9].

Animal health sector:

Retailers and distributors lack adequate knowledge on the effective dosage and possible side effects of veterinary drugs [8]. Farmers use antibiotics to compensate for poor farm sanitation and hygiene [5]. Resistant microbes from animals are transmitted to humans either through the food chain or via direct or indirect contact with animals [10]. Antibiotics are used inappropriately in cattle, pigs, and poultry as growth promoters [5]. Safe and judicious use of antibiotics is not practiced in dairy farms, and the risk to public health due to residues in meat and milk is comparatively high [11].

Environment health sector:

In environments affected by anthropogenic activities, antimicrobial residues and antimicrobial-resistant bacteria are found in surface waters, soils, animal and human waste streams, and foods of plant origin [12]. Overall, the main sources of this environmental contamination are human waste from homes and hospitals, animal waste from farms, pharmaceutical manufacturing waste, and antimicrobial pesticides used in agriculture [13]. To control the AMR in the environmental sector, the country lacks the mitigation strategy to cope up with the AMR.

Country response to tackle AMR

Nepal's actions on antimicrobial resistance, including those addressing antimicrobial use, are followed based on international guidelines and commitments [14]. There is intersectoral coordination between the Government of Nepal, Ministries, organizations, civil societies including private sectors in reducing public health risks and impacts of antimicrobial resistance using one health strategy [6]. One Health is the collaborative effort of multiple health science professions to attain optimal health for people, domestic animals, wildlife, plants, and our environment [4]. Given the important and interdependent human, animal, and environmental dimensions of antimicrobial resistance, the country has endorsed one health strategy to address the problem that includes taking steps to preserve the continued effectiveness of existing antimicrobials by eliminating their inappropriate use and by limiting the spread of infection [4]. Necessary actions include improvements in antimicrobial use regulation and policy, surveillance, stewardship, infection control, sanitation, animal husbandry, and alternatives to antimicrobials [4].

The Ministry of Health and Population (MoHP) formulated the 2014 National Antibiotic Treatment Guidelines [15] and the National Antimicrobial Resistance Containment Action Plan Nepal 2016 to promote rational use of antibiotics, good surveillance systems, and antibiotic stewardship [8]. Similarly, the Department of Livestock Services (DLS) introduced a policy of zero tolerance to antibiotics [3,14] to stop the use of antibiotics in animal feed. The cooperation of the United Nations Food and Agriculture Organization (FAO), WHO, and other government agencies involves coordinating and undertaking an AMR National Action Plan including various sectors that is in the process of being executed [14]. To address the gap in AMR surveillance in the country, the surveillance system and laboratory capacity for AMR surveillance were developed [8]. Under this program, 12 participating laboratories, 8 from human health and 4 from animal health sectors, are working on active and passive surveillance of AMR through the One Health approach [8]. The program led by NPHL extended to an organization of 26 laboratories with WHO support. The representation is limited with KIST clinical school, Kathmandu Model Hospital, Manipal showing Hospital, and Bayalpata Hospital, and some semi-government foundations (TUTH and Patan Hospital) [8]. The multisectoral committee is responsible for involving stakeholders from the animal and human health sectors [16]. Staff members from participating laboratories were trained in active surveillance and culture and identification of bacteria according to the developed protocol and Standard Operating Procedures (SOPs) [16]. The ongoing National-level workshops on AMR surveillance are training the field-level care providers on rational and prudent use of antibiotics [17].

The country recently observed and celebrated World Antimicrobial Awareness Week (WAAW) during the week (18th to 24 November) of 2021, to increase awareness of global antimicrobial resistance. This year's theme was "Spread Awareness, Stop Resistance" and the overarching slogan continued with 'Antimicrobials: Handle with care. This campaign aims to increase awareness of global antimicrobial resistance at the community level and to encourage best practices among the general public, health workers, and policymakers to avoid further emergence and spread of drug-resistant infections.

The recent COVID pandemic has already highlighted how fragile the health system of Nepal is. COVID-19 pandemic has physically, mentally, economically, and socially damaged the lives of many people and put immense stress on the health systems of Nepal. Nepal faced unprecedented challenges when dealing with COVID-19 with enormous implications at three tiers of government. This invisible pandemic could affect our lives and economies. If we do not act against the alarming AMR on time, the foundations of modern medicine will crumble.

Conclusion

The country has already endorsed and committed to one health strategy integrated actions in the areas of human, animal, and environmental health to combat AMR. It is of utmost importance that government and non-government organizations along with civil societies promote and take one health initiative forward to tackle antimicrobial resistance. It is important to understand that AMR can be a lasting feature in society causing significant public health crises with associated social and economic costs.

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