

## Emergence of Antimicrobial Drug Resistant Bacteria in Nepal: A Current Scenario

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### ABSTRACT

Emergence of antimicrobial resistance (AMR) among bacteria is a global threat to the existence of human civilization as well as for diversities of animals and plants. The burden of AMR bacteria is continually increasing in under developed countries and developed countries as well, Nepal is not an exception. Irrational antibiotics use in communities and uncontrolled use in poultry farms are the major contributors besides improper and inadequate disinfection at health care facilities and other causes. Because of the lack of proper control measures, Multi Drug Resistant (MDR) and Extensively Drug Resistant bacterial isolates have also emerged. Being an under developed nation, Nepal lacks basic infrastructure for healthy living. The low socioeconomic status, lack of quality education, very low doctors to patient ratio and lack of awareness on health and irrational drug use, has attributed to emergence of AMR bacterial pathogens. Thus, this review aims at bringing into light the current scenario of AMR emergence in Nepal and its possible control measures.

**Keywords:** Emergence of antimicrobial resistance, Bacterial pathogens, Poultry meat, Nepal

**Abbreviations:** AMR: Antimicrobial Resistance; WHO: World Health Organization; CDC: Center of Disease Control and Prevention; MDR: Multi-Drug Resistant

### INTRODUCTION

Globally, antimicrobial resistance (AMR) is becoming a core political, social and economic problem as it is a critical public health threat. In recent times, despite numerous intensive researches being carried out worldwide on development of newer antibiotics and lots of money involved, very less success has been achieved. It takes no less than 12-15 years for a new antibiotic to be cleared for being taken by humans. But, the emergence of AMR is so rapid that we can imagine the day when most of the prevailing antibiotics will be ineffective before newer antibiotics are developed. Thus, search for new antibiotics and control of AMR should be carried out in parallel. Causes of antibiotic resistance include selective pressure, mutation, gene transfer, inappropriate and inadequate use, extensive use in hospitalized patients and massive use in animal feed and poultry industry [1].

According to World Health Organization (WHO), infectious diseases caused by AMR bacteria accounts for high premature mortality in Nepal. These include diarrhea, lower respiratory tract infection, tuberculosis, blood stream infection, urinary tract infection and sexually transmitted diseases [2]. Majority of the people in Nepal are living

below the line of poverty lacking proper sanitation and adequate nutrition. A significant proportion of population in rural Nepal is devoid of toilets and open air defecation is still practiced. Sewage system is not managed and pure drinking water is always in scarce. Majority of the rural population is engaged in agriculture and farming (traditional farming methods without protective measures). All these factors have contributed to the higher rates of transmission of infectious parasites and bacteria to the healthy individuals in communities.

Different hospital based studies done in Nepal show alarming results. A study done by Shakya et al. [3] found 52.3% of the total isolates that were studied to be MDR

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strains; *Escherichia coli* 79.7%, *Providencia* species 5.1%, *Klebsiella pneumoniae* 3.4% were the most common MDR isolates. They also found 91.7% of *Escherichia coli* and 8.3% of *Klebsiella* species to be extended spectrum beta-lactamase (ESBL) producers [3]. Another study done by Chaudhary et al. [4] found 39.2% of the total isolates to be MDR bacteria in surgical site infection specimen, *Staphylococcus aureus* and *Escherichia coli* were the major isolates. According to another cross-sectional study done in Chitwan Medical College Teaching Hospital, Chitwan, Methicillin resistance among *Staphylococcus aureus* in blood culture specimen from neonates with septicemia was 44.4%, gram-positive showed resistance to ampicillin, erythromycin, cotrimoxazole and  $\beta$ -lactam antibiotics, similar results were found for gram negative specimen [5]. A study done on chicken meat samples collected from different butcher houses isolated *Citrobacter* species 44.7%, *Salmonella* species 26.2%, *Proteus* species 18.4%, *Escherichia coli* 4.8%, *Shigella* species 3.9%. Of the total isolates MDR isolates were 79.6% and 36.9% were ESBL producers [6].

### COMMON PRACTICES

When one becomes ill of some infectious disease, the common practice among rural population is to go to some nearby pharmacy and ask for drugs that could treat them at the earliest possible. There are no tight regulations regarding antibiotics use. People have easy access to antibiotics and prescription from doctors is not mandatory. Even, most doctors do not prefer laboratory testing before prescribing antibiotics in rural areas. Most of the time, people are not aware of the drawbacks of irrational antibiotics use and even if told, remain reluctant. Because the difference between production cost and market price of antibiotics is more than 100-400% in most of the cases, this makes it nearly impossible for the poor to have economic access to complete dose of antibiotics. In rural communities people usually ask for antibiotics for 2-3 days thinking it was enough and if the disease does not get cured completely (to them being cured is limited to the subsiding of the clinical signs) they would ask for more antibiotics later. The obvious reason behind this kind of compromise is poverty and in few cases lack of knowledge on the adversities of the practice. In most of the cases needing antibiotics, disease begins to subside after 2-3 days of taking the antibiotics. This makes them feel relieved of the economic burden of purchasing more antibiotics and also, they can return to work quickly (lower pay, hard labor and poor nutrition). Drug retailers do not comply with government regulations and sell inappropriate and under dose of antibiotics for economic benefit even without physician's prescription [7,8]. The increasing number of relapses in cases of infectious diseases is due to lack of compliance to antibiotics.

Meanwhile, meat producing animal farms and poultry are also major contributing factors. Massive doses of antibiotics

are used in animal feeds, injected to poultry and animals in commercial meat producing farms to reduce their business risk. Antibiotic resistance determinants of bacteria present in contaminated food can be transduced into human pathogenic bacteria leading to development to AMR [9]. Checking of vets for possible illness is badly monitored before sending them to the market and slaughter houses. On the other hand, there are no slaughter houses in rural Nepal and those in urban area are not properly managed and lack basic sanitation and infection control facilities. In terms of environmental sanitation Maharjan et al. [10] have shown that only 14.35% of slaughtering places in Kathmandu were good. Slaughter houses have no proper storage facilities and unhygienic meat product handling is a common practice. This is also contributing to the spread of zoonotic multidrug resistant bacteria in community.

### POSSIBLE FACTORS CONTRIBUTING TO THE EMERGENCE AND SPREAD OF AMR IN NEPAL

- Lack of trained staff and well-equipped facilities for identification of bacteria and their antibiogram.
- Lack of facilities for the surveillance of emergence of antibiotics resistance.
- Lack of implementation of policies for control of microorganisms in health care facilities.
- Lack of compliance to antibiotics use among communities due to low purchase capacity.
- Lack of awareness about the adversities of incomplete antibiotics use.
- Absence of practice for use of antibiotics according to age and weight of patient in the community.
- Prescription of multiple antibiotics without knowing the causative agent for the disease and without laboratory testing in rural areas.
- Easy access to antibiotics in local pharmacies requiring no prescription from clinicians.
- Massive use of antibiotics in poultry industry and unhygienic slaughter houses and improper handling of meat products [11].

### CONCLUSION AND RECOMMENDATION

Until recently, the study on the emergence of antimicrobial resistance was limited to healthcare facilities. It has been observed that not only healthcare facilities but also, communities are equally responsible for it [12]. Poultry farms, animal feed industry and improper handling of meat products at slaughter house and butcher shop are also contributing to the emergence and spread of AMR bacteria. The government must design and implement policies to address irrational drug use including control of easy access to antibiotics and social awareness for compliance to treatment, lifting up economic status and control of market

price of commonly used antibiotics. Tight regulations on the use of antibiotics in poultry farms and in animal feed industry should be made and regular surveillance and monitoring should be done. Pharmacists should be made responsible and the concerned council should strongly monitor drug dispensing practices in pharmacies, and take harsh action if found guilty. Center for Disease control and Prevention (CDC) [13] and WHO [14] have suggested measures to control emergence of AMR including rationalization of antibiotic use which if implemented can decrease the burden of AMR bacteria emergence.

#### CONFLICT OF INTEREST

None

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