

**Antibiotic utilization in community—A literature review****Anil Kumar Sah<sup>1\*</sup>, D.S Rathore<sup>2</sup>, Kadir Alam<sup>3</sup>, Anup Pradhan<sup>4</sup>**<sup>1</sup>Lecturer, Department of Pharmacy, Purbanchal University College of Medical and Allied Sciences, Gothgaun, Nepal<sup>2</sup>Professor, Department of Pharmacy, Goenka College of Pharmacy, Bikaner road, Laxmangarh, Rajasthan, India<sup>3</sup>Associate Professor, Department of Clinical Pharmacology and Therapeutics, B.P. Koirala Institute of Health Sciences, Dharan, Nepal<sup>4</sup>Research Director, SunRise University, Alwar, Rajasthan, India

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**ABSTRACT**

Antibiotic is major health problem in the developing and developed countries. Appropriate use of antibiotic provides the benefit of cost-effective, clinical therapeutic effect, decreased drug-related toxicity and the development of antibiotic resistance. In Mongolia, around 80% of antimicrobial drugs are purchased without a prescription from retail pharmacies. In Asian countries, 50-90% of pharmaceutical medicines transactions are occur in private retail pharmacy mostly in community. The literature review was conducted to study the antibiotic utilization in community. Literature review is conducted with the variety of literature from 1994 to 2018. The search was done in Hinari, Google, Google Scholar, PubMed for articles published in English using the keywords “use of antibiotic in community, Antibiotic AND resistance AND community AND developing country AND developed country, Pattern of antibiotic use AND community AND developing AND developed country, survey study on antibiotic use and antibiotic resistances in community, and self-medication antibiotic use. Antibiotic utilization in Latin America from 1997-2007 revealed that use of antibiotic was increased in Peru (70.6%), Venezuela (43.0%). Study on irrational use of antibiotic in an urban slum community in Lagos, Nigeria suggested that 63.4% slum community was found to be non-adherence to the antibiotic therapy. Study from Peshawar, Pakistan on self-medication with antibiotic suggested most commonly used of antibiotics were amoxicillin/clavulanic acid (45%), ciprofloxacin (31%), sulfamethoxazole/ trimethoprim (18%), and clarithromycin (5%). Self-medication with antibiotic among dental students in Kathmandu suggested most frequently use of antibiotics were amoxicillin, metronidazole, azithromycin, ciprofloxacin and amoxicillin and clavulanic respectively. Antibiotic resistance patterns of common Gram negative pathogens isolate from urinary tract infection in Ethiopia noted that the resistance rate of E. coli pathogens was high with common antibiotics like tetracycline, ampicillin, amoxicillin and nalidixic acid. Similarly, these pathogens were low resistance with nitrofurantoin, gentamycin and trimethoprim-sulfamethoxazole. Conclusively, there were high antibiotic use and resistance which is huge global problem and require special attention.

**Key word:** Antibiotic utilization, Antibiotic resistance, Community, Self-medication

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**INTRODUCTION**

Rational use of medicines has been defined by World health organization as patient get medication correct to

their clinical requirements, in doses that meet their individual needs, for right period of time, and at the lowest price to them and their community.[1]When it comes to irrational use of antibiotics, it adds another risk of antibacterial resistance.

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As per WHO define appropriate use of antibiotic as “the cost-effective use of antibiotics, which maximizes clinical therapeutic effect while minimizing both drug-related toxicity and the development of antibiotic resistance.[2] In developed countries, half of the

antibiotics consumed in community are considered to be based on incorrect indications and most common indications are viral infections.[3]As per World Health Organization (WHO) definition of drug utilization as the marketing, distribution, prescription and use of drugs in a society, considering its consequences. Either medical, social and economic. [4]Studies suggested self-medication with antibiotic practices is a huge problem.[5, 6] In context of a developing country, this type of practice can lead to developing antibiotic resistance[7,8,9,] and similarly in other contexts of developed countries.[10,11, 12,13, 14] Further, in European countries this type of practice also has a high rate.[15]Study suggested community pharmacies dispensing antibiotics without prescription can lead to antimicrobial resistance.[16] Antibiotic is a major health problem in the developing and developed countries. Hence, the antibiotic is commonly available as over-the-counter, the over and under uses of antibiotics can lead to antibiotic resistance, drug adverse effects and unnecessary increase in health cost. Irrational uses of antibiotics in the community to develop resistance to antibiotics, increase in health cost, morbidity and mortality in the community. In Mongolia, around 80% of antimicrobial drugs are purchased without a prescription from retail pharmacies. [16]In Asian countries, 50-90% of pharmaceutical medicine transactions are prepared in private retail pharmacies.[17,18,19]The literature review was conducted with the objective to identify common antibiotic utilization, antibiotic resistance and problems related to antibiotics. Literature review is conducted with the variety of literature from AD 1994 to AD 2018. The search was done in Hinari, Google, Google Scholar and PubMed published articles in English. Using the keywords “use of antibiotic in community, Antibiotic AND resistance AND community AND developing country AND developed country, Pattern of antibiotic use AND community AND developing AND developed country, Simulated clients survey antibiotic use in community, survey study on antibiotic use and antibiotic resistances in community, and self-medication antibiotic use”.

#### **Antibiotic use in community in developed country**

A study on antibiotic utilization in Latin America from 1997-2007 suggested that use of antibiotics were increased in Peru (70.6%), Venezuela (43.0%) while decreased use of antibiotics in Mexico (-2.43 DID; -15.5%) and Colombia (-4.10; -33.7%). [20] Another survey study on antimicrobial resistance correlated with use of beta-lactam and macrolides in Europe showed that the beta-lactam and macrolide antibiotics used in highest in the three countries like France 24 DDD/1000 inhabitants/day, Spain 21 DDD/1000

inhabitants/day, Portugal 16 DDD/1000 inhabitants/day for beta lactam and France 6 DDD/1000 inhabitants/day, Spain 5.9 DDD/1000 inhabitants/day, Italy 5.1 DDD/1000 inhabitants/day for macrolides in the Europe. [21] Similarly, another study on antibiotic use in 13 non-EU countries and areas of the WHO European region suggested that increase of inappropriate use of antibiotics ranged from 15.3 DID in Armenia to 42.3 DID for Turkey. Co-amoxiclav was mainly used in Georgia (42.9% of total antibiotic use) and Turkey (30.7%) in the eastern Europe. [22]

#### **Antibiotic use in community in developing country other than Asian country**

Study on pattern and consumption of antibacterial drugs in Jordanian population revealed that less than one half of all antibacterial drugs were dispensed without prescription (46%) through self-medication (46%) and pharmacist recommendation (23%). The study also suggested that the prescribed and non-prescribed (over-the-counter) antibacterial drug was used improperly. [23] Another study on irrational use of antibiotics in an urban slum community in Lagos, Nigeria suggested that 63.4% of the slum community was found to be non-adherent to the antibiotic therapy. [24] Study on utilization pattern of antibiotics in Benin adult populations revealed that the most commonly used antibiotics were ampicillin, chloramphenicol, streptomycin, and tetracycline. [25] Studies from Hanoi, Vietnam [26], Benin, Nigeria [25] suggested that commonly used antibiotics were ampicillin, amoxycillin, co-trimoxazole, cephalexin in Vietnam and erythromycin, gentamicin, and cloxacillin in Nigeria respectively. A survey study on patterns of antibiotic use in a rural community in the Philippines suggested that most frequently used antibiotics were aminopenicillins (29.3%), anti-tuberculosis agents (15.5%), natural penicillins (13.9%). [27] Another study on use and knowledge of antibiotics in three countries Yemen, Saudi Arabia and Uzbekistan suggested that the prevalence of non-prescription use of antibiotics were 48% in Saudi Arabia and 78% in Yemen and Uzbekistan. The study also suggested that most common indications of antibiotics were in cough (40%) and influenza (34%). [28]

#### **Antibiotic use in community in Asian country**

A study on patterns of prescribing, consumption and dispensing of antibiotics in Chittagong city in Bangladesh revealed that commonly prescribed drugs were azithromycin (30.49%), cefixim (19.51%) and ciprofloxacin (15.85%). However, azithromycin (22.65%), ciprofloxacin (20.01%) and cefixime

(15.71%) were sold without prescription from local pharmacy shop. [29] Likewise, the study on prevalence of non-prescription sale of antimicrobial drugs by pharmacies in Bangalore, India suggested that most frequently prescribed drugs were amoxicillin (51.2%), azithromycin and ciprofloxacin (12.2% of each). [30] A survey study on use of antibiotic trends in the public and outpatient sectors in New Delhi, India suggested frequently prescribed antibiotic were fluoroquinolone group and extended spectrum penicillin group of drugs at private retailer pharmacy and private clinics. [31]

#### Self-medication with antibiotic in community in developing country

A survey study conducted in United Arab Emirates on the incidence of self-medication with antibiotic found 485 (56%) participants used antibiotic in the period the last one years. Most commonly used antibiotic was amoxicillin (46.3%). [14] Another study conducted in Peshawar in the urban population on self-medication with antibiotic noted that most commonly used of antibiotics were amoxicillin/clavulanic acid (45%), ciprofloxacin (31%), sulfamethoxazole/ trimethoprim (18%), and clarithromycin (5%). [32] Similarly, study on self-medication with antibiotics in urban population in Indonesia revealed that amoxicillin, ampicillin, fradiomisin- gramisidin, tetracycline, and ciprofloxacin drugs were commonly used as self-medication for treating the condition like cough, sore throat, headache, and other minor condition. [33]

#### Self-medication with antibiotic use in community in developed country

Study on self-medication with antibiotic in Latino communities in the united states revealed that the use of antibiotic was increased in the intervention community. The intervention community was aware about the availability of antibiotic without prescription and consequently influence higher usage of antibiotic.[34] Study on self-medicated in adult Latin American immigrants in Seville suggested that consumption of anti-inflammatory, non-prescription

analgesics and antibiotic were found higher in Seville city. [35] Another study of self-medication with antibiotic in Lithuania revealed that most common condition for antibiotic use were tonsillitis, bronchitis, and upper respiratory infections. [36] Study on self-medication with antibiotics in northern Israel suggested that most frequently use of drugs were penicillin, cephalosporin and macrolide. [37] Another study of self-medication with antibiotics in Cameroon revealed that most commonly use of antibiotic for respiratory tract infections was cotrimoxazole and amoxicillin. [38] Similarly, study on self-medication practices among university students in Turkey suggested most common drugs used by university students were analgesic 39%, antibiotic 36.9% and cold remedies (24%) respectively. [39] Likewise, a survey study on self-medication with antibiotic for respiratory tract infection in Poland suggested that most common belief of antibiotic used in majority of infection was influenza and influenza-like illnesses. [40]

#### Self-medication with antibiotic use in community in Nepal

A study on self-medication with antibiotic among dental students in Kathmandu suggested that more than two thirds (81.5%) of dental students gave history of antibiotic use in the period one year and among them 35.1% students gave history for self-medication. The study also suggested that most common antibiotics used were amoxicillin, metronidazole, azithromycin, ciprofloxacin and amoxicillin and clavulanic respectively. [41] Similarly, another study of self-medication with antibiotics among nursing students suggested that amoxicillin, azithromycin and ciprofloxacin antibiotics were frequently used in self-medication practice for treating in fever, sore throat and rhinitis. [42] Another study of self-medication and non-doctor prescription practice in the western region of Nepal revealed that most common use of drugs were paracetamol, NSAIDs, herbal remedies along with other antimicrobial drugs. [43]

#### Studies on Antibiotic use in community

Author's	Country	Main Obj	Categorization of antibiotic	Main Finding
Zawahi.S .[44]	Sri Lanka	To evaluate the response of community pharmacy staff to an antibiotic product request without a prescription  To explore possible	Ciprofloxacin  Amoxicillin	<ul style="list-style-type: none"> <li>• Only 16 (7%) pharmacy staff recommended the simulated clients to see a doctor.</li> <li>• Overall, 61% of pharmacies dispensed antibiotics without a prescription.</li> <li>• The highest dispensed antibiotic was ciprofloxacin (44/63 requests; 70%) and the least was amoxicillin (32/62; 52%)</li> </ul>

		factors influencing such practice		
Chang.J et al.[45]	China	To quantify sales of antibiotics without amedical prescription and to assess the quality of pharmacy services in relation to the antibiotics sold in community pharmacies in urban China.		<ul style="list-style-type: none"> <li>• Of 256 pharmacies, antibiotics were obtained without a prescription from 55.9% (95% CI: 49.5%–62.0%) when paediatricdiarrhoea was simulated and from 77.7% (95% CI: 72.1%–82.7%) when adult respiratory infection was simulated.</li> <li>• About 83.9% and 66.3% antibiotic dispensed from pharmacy after the simulated clients requested or insisted in the case of paediatricdiarrhoea and adult respiratory infection, respectively.</li> <li>• The performance of pharmacy staff regarding the provision of information and advice was unsatisfactory</li> </ul>
Ansari. M.[46]	Nepal	To determine the most commonly dispensed antibiotic among the pharmacies located in and around National Medical College Teaching Hospital	Penicillins, Cephalosporins, Macrolides, Fluoroquinolone	<ul style="list-style-type: none"> <li>• The top 15 selling antibiotics belonged to four different groups including Penicillins, Cephalosporins, Macrolides and Fluoroquinolones.</li> <li>• Beta lactam antibiotics were the most selling antibiotics followed by Macrolides and Fluoroquinolones.</li> </ul>

### Access Health Care and Antibiotic in the Community

Health care system in Nepal: Treatment of disease in Nepal is mainly traditional medicine (Ayurveda, unani, homeopathy etc) and modern medical health care system. Usually, there is at least one health facility in each village development committee (VDC), one primary health care center in each electoral constituency, and one hospital at the district level to provide curative services. According to the public health system, services are classified into three i.e. primary, secondary and tertiary level.

**Primary level:** This level covers female community health volunteers, primary health care outreach clinics, community health units. Service delivery at this level is largely the responsibility of medical officers, health assistants, staff nurses, auxiliary health workers, auxiliary nurse midwives, and female community health volunteers, who provide a range of mostly promotive and preventable services in addition to some curative services.

**Secondary level:** Secondary-level services are delivered by district hospitals. These are first referral points from the primary-level health facilities and provide inpatient,

outpatient, emergency, and comprehensive emergency obstetric and neonatal care services for their target populations.

**Tertiary level:** Tertiary-level services are provided by zonal, sub regional, regional, and central hospitals. These institutions are second-level referral points for districts and also provide other services in their catchment areas. Central hospitals offer professional training, conduct research, and provide support to the districts.[47]

### Common disease in the community

Common disease accounting in Nepalese community. Among of the common disease, the first rank of disease was Pyrexia of Unknown origin and Headache, second one was Gastritis (APD), Acute Respiratory Infection (Lower Respiratory Tract Infection) and third one was Upper Respiratory Tract Infection.[48]

### Access to the antibiotic in the community

In Nepal, no special mechanism for accessing of antibiotic in community. These antibiotics are supplied and procure as same as of other drugs. There are three mechanisms for accessing of medicine in the

community i.e Central push system, District level procurement and community drug programmes.

*Central push system:* Antibiotics have supplied by the logistic management division (LMD) to the government hospital and primary health care facilities. These managements are responsible for purchasing, supplying to the health units over the country. It has also responsible for distributing antibiotic through push system to all health units.[49]

*District level procurement:* The district office is also responsible for the procurement and purchase of these antibiotic drugs through tender. All the drugs for the health posts pass through the district office.[49]

*Community drug programmes:* Community drug programmes CDPs are supported by groupings of organizations, including UNICEF and the Swiss development corporation (SDC). Other partners include GTZ, and others, making this national programme a complex of institutional assemblages. Some financial assistance comes from the World Bank "pool fund".

Procurement is done at the district level. At each district, they identify wholesalers, and this list is given to all the village development committees.[49]

In Nepal, Antibiotic is illegal to buy and sale antibiotic without prescription or over the counter. However, the community pharmacists have to treat patients with these medicine. Several countries is restricted antibiotic to sale as OTC. However in a few countries, antibiotics are legally available as OTC drug such as erythromycin gel 3% (30gram) (Albania), fusafungin (Czech Republic), bacomycin (Norway), 24-hour dosage of any antibiotic medicines in emergency situations (Romania), antibiotics with local effect (eye and topical preparations) (Serbia and Slovakia), and chloramphenicol eye drops for the treatment of conjunctivitis and azithromycin for the treatment of chlamydia (United Kingdom).[50]

### Antimicrobial Resistance in Community

Studies from India, Pakistan and Bhutan suggested that common antibiotics like ciprofloxacin (94%), penicillin G (68%), erythromycin (62%), tetracycline (55%), and azithromycin (7.7%) were highly resistance with *Neisseria gonorrhoeae* pathogens.[51] Another study on antibiotic resistance patterns of common gram negative pathogens isolate from urinary tract infection (UTI) in E St. Paul's Hospital Millennium Medical College in Ethiopia revealed that the resistance rate of *E.coli* pathogens was high with common antibiotics

like tetracycline, ampicillin, amoxicillin and nalidixic acid. Similarly, these pathogens were low resistance with Nitrofurantoin, Gentamycin and Trimethoprim-Sulfamethoxazole.[52] Study on nasopharynx/throat specimens isolate from 145 children under age 1-5 years in Vietnam suggested that *S.pneumoniae* and *H. influenza* pathogens resistant to tetracycline (88% and 32% respectively), trimethoprim/sulphonamide (32% and 44%), and chloramphenicol (25% and 24%). *S. pneumoniae* pathogen was resistant to erythromycin 23% and *H. influenza* isolate pathogen was resistant to ampicillin 18%. [53] Study on antibiotic resistance pattern of common pathogens isolates from single episode urinary tract infection (UTI) from 175 children below 14 years in Oman revealed that *E. coli* and *Klebsiellapneumoniae* was resistant with cotrimoxazole, amoxicillin + Clavulanic acid, Cefuroxime and nitrofurantoin. [54]

### Situation of Antimicrobial Resistance in Nepalese Community

In the context of Nepalese community studies suggested 64% *E. coli* were resistant to fluoroquinolones and 38% were resistant to third-generation cephalosporins however *K. pneumonia* exhibited resistance to third-generation cephalosporins of 48%, while no resistance to carbapenems. [55]

Co-trimoxazole was highly resistance to *S. pneumoniae* in 2002 and slightly decrease the resistance rate in 2008. Similarly, the increasing trend of resistance to penicillin with highest in 2007, followed by ampicillin, erythromycin, ciprofloxacin and ceftriaxone. [56] Study on bacterial etiology of septicaemia among children in a tertiary care center of central Nepal revealed that coagulase negative staphylococcus and staphylococcus aureus pathogens were resistant with methicillin whereas amikacin was found to be very good alternative antibiotic for gram positive as well as gram negative with very minor resistance to it.[57] Amoxicillin-clavulanic acid and ciprofloxacin were resistance with *E. coli* however few percentage rate of imipenem antibiotic was resistance with *E. coli*. [58] and Amikacin was found to be most sensitive antimicrobial followed by nitrofurantoin and gentamicin. ampicillin showed the higher percentage of resistant, compared to other antimicrobials. [59] Another study suggested individual's overall exposure to antibiotics and antibiotic-resistant bacteria has an equal or greater impact on an individual's carriage of antibiotic-resistant bacteria than does direct consumption of antibiotic. [60]

### Problems of Antibiotic Uses

In inappropriate or over use of any antibiotics may contribute to

*Adverse drug reaction:* Any noxious and unintended response to medicine when given at normal dose in course of treatment of disease. [61] Infant and child have a high risk of adverse drug reaction because their organism is not matured Therefore they are unable to metabolize some drugs. For example, newborn cannot metabolize and eliminate chloramphenicol antibiotic that can lead to development of gray baby syndrome  
*Antibiotic resistance,* use of antibiotic in low dose may result in treatment failures. More prescribing, administrating and misuse of antibiotics can lead to increase in the health cost, antibiotic resistance and poor health outcome. e.g. Use of antibiotic in viral infection. Use of antibiotic in common cold, runny nose etc.

### Initiative to combat antibiotic resistance in Nepal

In appropriate and irrational use of antibiotic can lead as antibiotic resistance. It is also one of the another region to develop resistance i.e patient do not adherence with therapy or poor quality of antibiotic are use. Hence, Nepal government seeks to reduce the health risk due to antibiotic resistance by collaborating with partners. These five pillars have been preferred on the basis of WHO resolution and Nepal's commitments in different forums. Improve awareness and understanding of AMR through effective communication, education and training. Strengthen the knowledge and evidence base through research and surveillance. Reduce the incidence of infection through effective hygiene and infection prevention measures. Optimize the use of antimicrobial medicines in human and animal health. Develop the economic case for sustainable investment that takes account of the needs of all countries, as well as the need for investment in new medicines, diagnostic tools, vaccines and other interventions. [62,63,64]

### CONCLUSION

Studies from developed and developing countries suggested the increase in antibiotic utilization. Antibiotics were frequently dispensed without prescription in developing countries. Studies from developing countries also indicate the use of antibiotic as self-medication. Likewise, studies from developed and developing countries suggested high rate of antibiotic resistance. Hence it is high time for action against misused of antibiotic.

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