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An overview of self-medication: a major cause of antibiotic resistance and a threat to global public health

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Abstract

Self-medication is the use of medicines by people on the basis of their own experience without consulting a doctor. People use medicines for pain management or to cure a disease and sometime this may be unnecessary. There are a lot of public and professional health concerns about misuse of medicines and globally physicians agree upon this rising issue that leads to antibiotic resistance. In developing countries, medicines without prescription are easily available which results in many adverse outcomes, especially bacterial resistance. Insufficient healthcare services and socioeconomic factors result in increased proportion of self-medication compared to drugs prescribed by physicians. The current narrative review was planned to focus on indicating prevalence rate of self-medication in different developed and under-developed countries, major risk factors and control of self-medication due to which antibiotic resistance rate can be minimised. The issue needs urgent attention of representative authorities for taking serious actions. Furthermore, arranging awareness seminars and implementing new policies/regulations to prevent the sale of any drug/antibiotic without prescription could play a vital role in bringing this alarming issue under control.

Key Words: Antibiotics, Bacterial resistance, Prevalence, Self-medication.

Introduction

Self-medication is globally a noteworthy general medical issue and can be defined as “the use of a drug by a patient on his own experience without proper consultation of medical practitioner”(1) or “utilising drugs without consulting medical specialist either for diagnosis or treatment”(2). Due to self-medication practices, the use of antibiotics is on the rise. These antibiotics are usually advised by either lay-persons amongst family or by patients themselves based on information available on the internet or friends of the patient(3) or using leftover from the stock of medicines at home or lack of time or reusing old prescriptions to buy medicine(4).

If a self-medicating person chooses irrelevant antibiotics of not the recommended dose or therapy, it may be harmful. The major cause of antibiotic resistance is inadequate use of antibiotics(5). Promiscuous use of antibiotics may lead to a variety of complications, including nosocomial, waterborne and food-borne infections by the bacteria that are antibiotic-resistant, enteropathy or short-tempered bowel syndrome, diarrhoea etc., drug sensitivity, environment modification and devastation of flimsy competition occurring in different species of the microbial ecosystem(6,7).

A study conducted in Europe demonstrated that there is a significant difference in public point of view and their level of education about self-medication and antibiotic resistance. About 50% of respondent knew about antibiotic resistance and consciousness was minimal in nations with a higher prevalence of resistance(8). Another study, conducted in Spain, demonstrated that regulations and its implementation also differ for the prescription of antibiotics. For example, in Spain, because of poor implementation and control over the rules and regulations, self-medication with antibioticsis noted(9).

There are myriad of public and professional problems regarding unreasonable use of medicine(4). The prevalence rate of self-medication is high and alarming all over the world, particularly among university students of developing

countries as well as in the developed countries. In Asia, the highest prevalence rate of self-medication was recorded in Pakistan (95.5%)(10), followed by Kuwait (92%)(11), India (87%)(12), Nepal (59%)(13), Dubai (56%)(14), Saudi Arabia (34%)(15), while the lowest rate was found in southern China (47.8%) university students(16). In Europe the highest prevalence rate was recorded in Croatia (88%)(17), followed by Greece (75%)(18), other European countries (68%)(19) and Turkey (45%)(20). In Africa, the highest prevalence rate was recorded in Ethiopia (51.4%)(21), followed by northern Nigeria (38.8%)(22). In the United States, 54% of young children were reported to be self-medicated(23), while in Australia 55% respondents were found to be self-medicated in a survey(24).

Studies have revealed that the prevalence rate is high in women living alone, people with low socioeconomic status (SES), patients suffering from chronic diseases, in teenagers and students(18, 25, 26). In Pakistan and many other developing countries, pharmacies mostly sells drugs without any prescription(27). The reasons behind high prevalence of self-medication are easy availability of medicine over the counter (OTC) and unawareness of harmful effects of different drugs. Due to sub-standard basic healthcare units and affordability problems, people usually prefer self-medication instead of following proper diagnosis and treatment protocols(28).

According to the United Arab Emirates Ministry of Economy's national antibiotics policy and manual of antimicrobial treatment, antimicrobials should only be sold or provided by prescription from an approved therapeutic expert or dental specialist. For sensible usage, antimicrobials are characterised into three groups. Group I: Basic use; all physicians may recommend them; they are safe, effective and relatively cheap. Group II: For confined use; prescription by doctors only; they are expensive, toxic and new agents. Group III: Use in essential human services; they share the characteristics of Group I with a few oversights(29).

There are different reasons for self-medication, like occasional pain(30), sore throat, diarrhoea, fever, cough, vomiting, headache, allergy, inability to sleep, gastric pain, constipation, and eye diseases and other common infections(10).

The current narrative review was planned to focus on the comparison of self-medication problem in developing and the developed countries while putting together the basic reasons behind self-medication. It also planned to take a look as the consequences of self-medication, its relation with antibiotic resistance, and steps to control this problem.

Why people self-medicate?

Studies indicated that top two factors for self-medication are prior familiarity and non-seriousness of illness. People preferering to maintain their own health with non-expert advices also contribute towards high prevalence of problems originating due to self-medication(21,31-33). Other factors accountable for the rising drift of self-medication are feeling sympathy towards members of the family when they are ill, shortage of time, absence of health facilities, low SES, unawareness, misbelief, widespread advertisments, remaining stock of medicines at home and reusing old prescriptions to buy medicine(34,35).

Though OTC medicines are planned for self-medication and can be useful if used properly while having enough information about usage, in unique groups, particularly in kids, elderly patients, pregnant and lactating mothers, irrational use of drugs can cause severe damage if the user lacks knowledge regarding side-effects, efficacy as well as their antagonistic effects(36).

Role of Self-Medication in Antibiotics Resistance

Two factors need to be focussed on while understanding the resistance phenomena: the antibiotics and resistance gene(37). To conventional antibiotics, bacteria show progressive resistance at both clinical and non-clinical sites. About a decade ago, the main concern was toward gram-positive bacteria, especially methicillin-resistant staphylococcus aureus (MRSA) and vancomycin-resistant enterococcus spp. But currently, microbiologists strongly

agree that multi-drug ressitant (MDR) gram-negative bacteria are highly fatal to public health. Not only gram-negative bacteria resistance is increasing more rapidly(38, 39), but along with it there are insufficient development of new antibiotics against gram-positive bacteria(40-42).

The leading cause for development of resistance to antibiotic and human pathogens is self-medication(43,44). Amoxicillin has the highest percentage of self-medication usage among antibiotics (22.4%) and Ampiclox has the lowest percentage (3.3%) (Table 1) (45). Some of the common antibiotic-resistant pathogens are toxin producing clostridium difficile, MRSA, glycopeptides-resistant staphylococcus aureus, and β-lactamase- and carbapenemase-producing coliforms(46,47). In 2008 a database listed bacterial genome sequences in which more than 20,000 potential resistant genes (r genes) of 400 different sorts were predicted(48).

The potential reasons behind the development of microbial resistance include regular and irrational use of antibiotics, and ignorance of patient regarding adequate dosage limit, their side-effects and overdose(43). Common reasons for self-medication evaluated by different studies are chill and upper respiratory tract symptoms usually caused by viruses(49,50). Many patients use antibiotics to treat viral infections although antibiotics don't work against them since many developing countries have poor antibiotic administering rule which ultimately results in the emergence of antibiotic resistance(51,52). The phenomenon of antibiotic resistance, its development and the transfer of drug resistance to other bacteria have been studied (Figure 1).

Antibiotic resistance has transformed into serious worldwide health problem and people are still not aware of the risks or damages that occur at the personal as well as at public/community level. According to the Centers for Disease Control and Prevention (CDC)(53), in developed countries like the United States, annually many patients admitted in hospitals are infected by antibiotic-resistant pathogens and approximately 23,000 die due to the absence of

therapeutic choices available along with vague and fatal effects resulting in troubled diagnosis. For example, in children suffering from meningitis who may suffer neurological damage, antibiotic as a firstline of therapy is not of much significance. An infection of antibiotic-resistant pathogen can slow the healing process and persuade more therapeutic expenses(54). In under-developed countries where the healthcare system is not as much advanced, the costs become comparatively higher. A study estimated that in India more than 58,000 infants died in 2013 because of antibiotic-resistant bacterial infections, although it produces over 40% of world's antibiotics(55). A report presented at a medical conference in Pakistan said antibiotic resistance will possibly kill 10 million people per annum up to 2050 which is an alarming condition for the country. Another study reported that 95% of the infections in hospitalised patients are detected as resistant against a wide range of antibiotics(56).

Prevention of bacterial resistance

To handle the problem of antibiotic resistance, it is essential to discuss the misuse of antibiotics(57) and to make strict strategies to curb the resistance percentage. Restraining the misuse of antibiotics at the local level can diminish the number of resistant bacterial strains and ultimately prevent the whole world from such a crisis(58).

Medical specialists can play an important role in this regard by providing awareness to the people about the potential risks of antibiotics misuse. Physicians ought to likewise instruct their patients and parental figures about the psychosomatic factors that can help them in increasing adherence to medicine, for example, improving inspiration, patient education, defining wellbeing objectives and expanding social help and support. When a patient has a disease that should be treated with antibiotics, the physician ought to give appropriate guidelines on its utilisation, like dose, frequency of dosage, duration of treatment and harmful effects of its misuse(59).

Better information and awareness among the non-medical population regarding allopathic medicines, particularly an understanding of the dosage of antibiotics, can help in reducing microbial resistance issues worldwide(59). Medical specialists and pharmacists can also play an important role in reducing antibiotic resistance rate if enough information is provided to patients during checkup and sale of medicines(51).

Trends of Self-Medication Around the World

Different studies reveal that self-medication is a common practice, especially in the developing countries or in communities having low SES. Self-medication also has some advantages, but many disadvantages which can cause severe damages and can even be lethal(60,61). In under-developed countries where healthcare services are not readily available, the preferable choice for people become self-medication(62). Self-medication is highly prevalent worldwide and its rate is alarming, especially among university students (Figure 2) (11, 63).

Self-Medication in Pakistan

The prevalence rate of self-medication is significantly high in Pakistan, especially among university students; 76% in Karachi University students(28) and 95.5% in COMSATS Institute of Information Technology, Abbottabad(10) which was significantly ($p<0.0001$) higher from that of Karachi, although the subjects knew the harmful effects better(28). The common factors which were the main cause of self-medication were previous experiences (50.10%) with similar symptoms and trivial nature of the problem (48.30%)(28, 64). Here is a need to teach the juveniles to move towards safe practices by adopting strict strategies that may help control the issue(28). In Pakistan, the government spends very less percentage of its GDP on health which is the key reason behind the high prevalence rate of self-medication. According to one report, Pakistan is only spending $36.2 per capita on health which is against the World Health Organisation (WHO)'s low-income countries standard ($86) (65).

Headache, fever and flu-like symptoms were the most common symptoms that led to self-medication (Figure 3) and, hence, painkillers, antipyretics, anti-allergies and antibiotics were among the most commonly used drugs. These drugs are usually obtained from medical stores or from friends(28).

Advantages and Disadvantage of Self-Medication

Self-medication can only be beneficial if it is used for minor health problems, such as headache, mouth ulcers, cough etc., and the users have enough knowledge about disease condition, drug efficacy, side-effects etc. At the community level, it can reduce the workload on healthcare centres where facilities or healthcare personnel are insufficient(66-68). Besides, self-medication has many potential risks. Regular user usually has no or limited knowledge of principles of therapy, or of specific usage of medicinal product. This results in certain potential risk at individual and community levels, like inappropriate selection of drug may lead to progression of disease, organ failure and, most importantly, bacterial resistance. Delay in diagnosis and treatment of a serious medical condition can cause health and financial loss and sometime even death(66,69). Unwillingly, repeated use of similar drugs with different trade names, incorrect route of administration and failure to recognise contraindications, interactions, warnings and precautions can cause severe damages and some infections can even be lethal(66).

Controlling Potential Risks Related with Self-Medication

Role of medical specialist

Doctors should give enough time to patients, comprehensively guide them about the pros and cons of prescribed drug and its usage along with detailed information about the illnesses they have(70). Minimum information that should be provided to the patients must be given (Table 2).

Medical specialists have an important role in preventing the risks of self-medication. Information, therapeutic advice and education are the three main aspects on which medical specialists must work on daily basis(70,71).

Information

Whenever medical specialists are recommending medicine, they should give admissible advices and clearly identify the purpose for which it is suggested so that the given instructions and advices are helpful for better understanding. The advices, facts and figures which are given to the patient should be brief, so that the patient may easily understand the administration of medicine(71).

Therapeutic advice

In both acute and chronic treatments, absence of proper therapeutic advice is a significant issue and reflects an inadequately understandable or deficient explanation of the treatment purpose. If the patients are not well instructed, they struggle to take medication properly(70). However, if limitation and way of using drugs are well explained, like dosage, time difference between first and second dosage, time period of the entire course, how to use it, etc., then the patients feel more inclined towards taking medicines accurately. Wrong and irrational self-medication as well as with non-compliance might be decreased if patients are educated, well aware and know why these advices and supervision have been provided by medical specialists(71).

Education

Suitable and proper health education must be provided to patients. By acquiring a professional attitude, people may subsequenlt encourage their friends, family and relatives(71).

Role of Pharmacist

Pharmacists play a crucial part in educating people indulging in self-medication. Tey may guide customers regarding the proper use of medicine as well as indicating, solving and avoiding drug-related problems for acquiring maximum patient outcomes and quality of life(68, 72, 73).

A pharmacist should be a good communicator and must communicate straightforward and briefly with patient(74). Pharmacist must ask key questions

from patients and provide an appropriate information, like efficacy, how to take medicine, how to keep medicine and how to deal with safety issues(71, 75).

To obtain essential information, the pharmacist must take necessary detail regarding patient age, gender, allergies, diseases etc., and about medicine that is either prescribed or not. This will help pharmacist decide whether to prescribe a drug or refer the patient to some specialist(74).

There must be a referral protocol for the pharmacologist. Protocol for public health workers is required for circulation of drugs(71,75,76) and a pharmacist should be selective in providing information and drugs to patient(74).

To identify health problems and risks in the community, a pharmacist must participate in health screening programmes. He should attend and arrange seminars to raise awareness of issues related to health and disease prevention. Pharmacists should also provide advices to individuals regarding health, which can help them in maintaining their health on their own (71,75).

Finally, a pharmacist essentially certifies that the items the custormer is purchasing are of excellent quality (71,75).

Suggestions and Recommendations

Self-medication in Pakistan and in other under-developed countries has not been studied extensively and it is essential for researchers to report more data. Health regulatory authorities must take serious actions against medical stores selling drugs without doctor's prescription. Furthermore, it is recommended for the patients to avoid using any medicines without prescription of a medical specialist. There is also a need to explore new strategies to combat antibiotic resistance by adopting alternative strategies like phage therapy as well as by immunotherapy.

Strategies to augment the existing policies for prevention of antimicrobial resistance may include improving the self hygiene and immunisation which ultimately reduce the need for antibiotics; nosocomial infection control and antibiotic stewardship must also be improved; modifying the inducements that

encourage the overuse and miss-use of antibiotic and reassuring antibiotic stewardship; decreasing and ultimately phasing out the use of sub-therapeutic antibiotic in agriculture; encouraging health professionals, policy-makers, and the community at large about the proper use of antibiotics; and to ensure political commitment to encounter the threat generated by antibiotic resistance.

Conclusion

Self-medication being a serious issue would be safe if a person has proper and adequate familiarity with its dosage, efficacy and side-effects However, due to limited knowledge, it can cause serious side-effects, such as allergic reactions, skin problems and bacterial resistance. In less advanced countries, such as Pakistan and India, people have very limited knowledge regarding risks associated with self-medication, which leads to a high prevalence rate and the emergence of new cases of antibiotic resistance frequently. Many studies have reported self-medication as the root cause of antibiotic resistance. To curb the menace, multidimensional approaches need to be adopted, like proper awareness, education, and strictness regarding pharmaceutical advertising. Healthcare commission should implement protocols and strict legislation related to sale of drugs without prescription, and the government should spend higher percentage of its GDP on the health sector.

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Table 1: Frequency of antibiotics used as self-medication (45).

Drug Name	Used only for one time (n=127)	Used only for two time (n=51)	Used more than two times (n=54)
Ciprofloxacin	16(7.6%)	6(2.9%)	5(2.4%)
Cotrimoxazole	12(5.7%)	3(1.4%)	5(2.4%)
Amoxicillin	47(22.4%)	19(9%)	21(10%)
Ampiclox	7(3.3%)	3(1.4%)	3(1.4%)
Ampicillin	4(1.9%)	1(0.5%)	2(1.0%)
Erythromycin	8(3.8%)	3(1.4%)	3(1.4%)
Metronidazole	33(15.7%)	16(7.6%)	15(7.1%)

Table 2: Summary of the minimum information that should be given to the patients

1. Medication effects • Why the medication is required? • By using these medicines which symptoms will dissolve and which symptoms will not? • When will be the effect of this medication is estimated to begin? • What happen when you take these medicines?	**2. Side effects** • What are the side effects that might occur? • By what means you can identify them? • For how much time will these remain? • How much severe these side effects are and which actions should be taken when you notice these side effects?
3. Advices • How to take the medicine? • When to take these medicines? • Time period of treatment? • How to keep medicine? • If medicines are left then what to do with them?	**4. Cautions** • When the medicine should not be taken? • Maximum dose? • Why it is necessary to complete the treatment course?
5. Future consultations • Whether the patient needs a review consultation? • When to come earlier? • What sort of information's are required to the doctor on next checkup?	**6. Everything clear?** • Enquire from the patient. • Enquire that everything is understood? • Review the most significant info? • Ask whether if you have any additional questions?

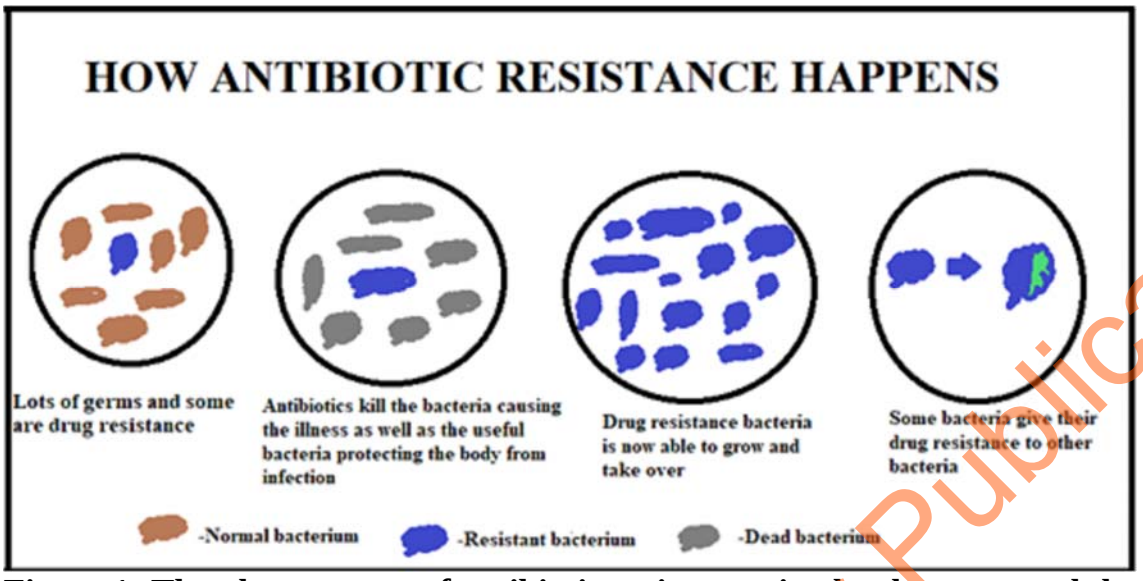

Figure 1: The phenomenon of antibiotic resistance, its development and the transfer of drug resistance to other bacteria.

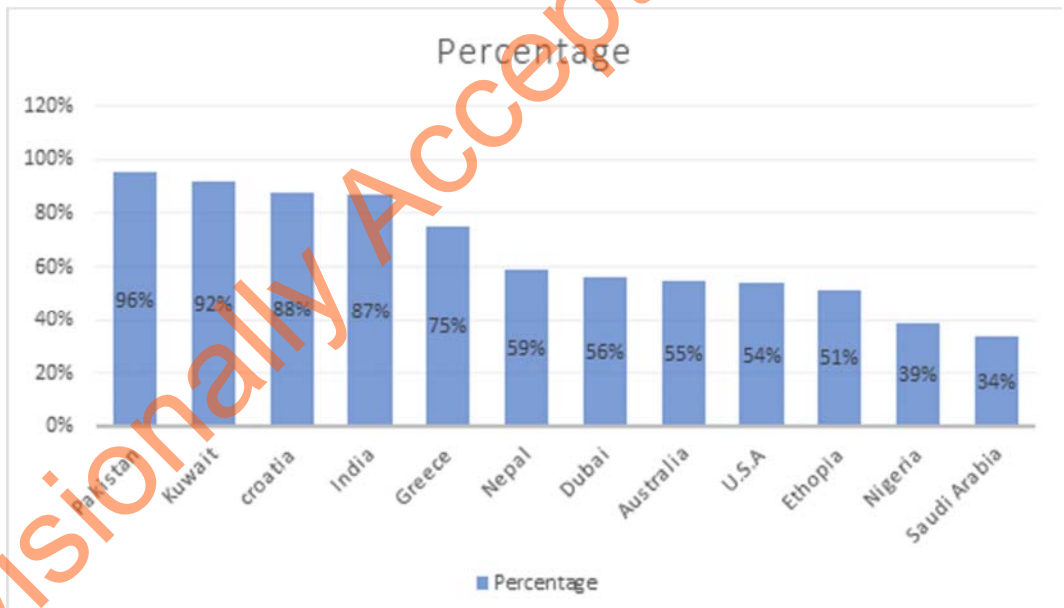

Figure 2: The prevalence rate of self-medication worldwide.

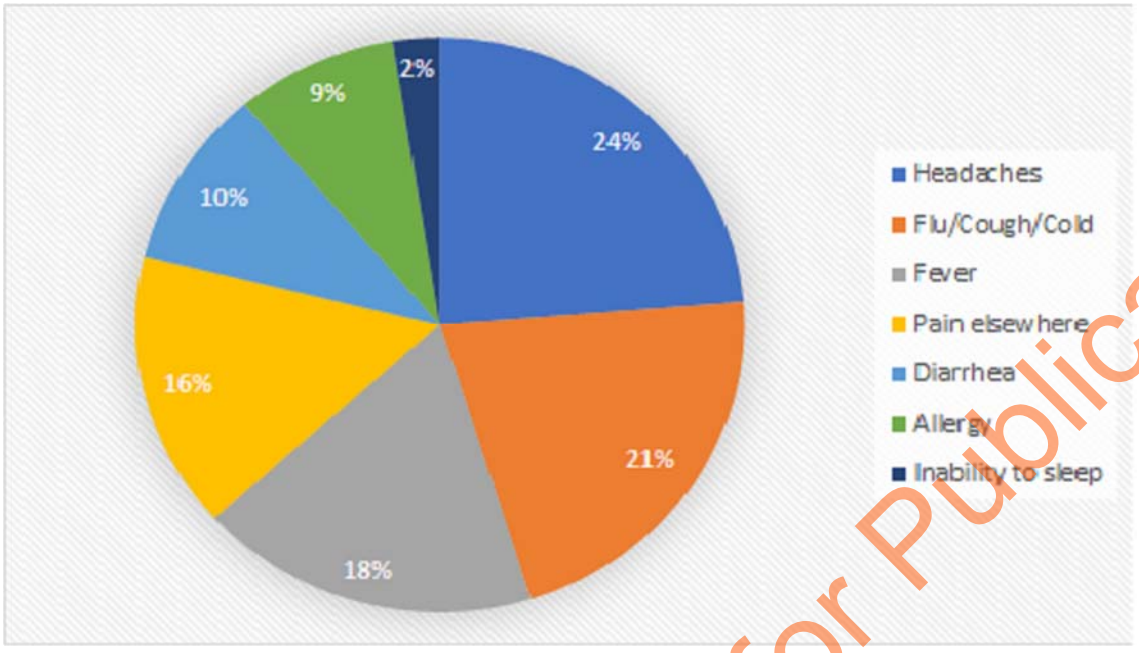

Figure 3: Factors leading to self-medication.