

Antibiotic Resistance: A Tragedy of the Common

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Abstract

Antibiotics due to their resistance to bacteria, fail to act and therefore, millions of human lives can gravely suffer. Human's tendency and dependency to overuse the antibiotics can be the main reason for drug resistance. This literature used advanced search of literatures to find out the evidence of people's attitude to antibiotics. Non-compliance with the recommended antibiotic course, patient's request to prescribe antibiotic, misperception, and ignorance in overusing the antibiotic are the prominent attitude among the patients. Health education and strategic implementation of different programs addressing on antibiotic use are necessary. Integrated global initiatives are demanded to solve this public health hazard.

Keywords: Public Attitudes, Antibiotic resistance

1. Introduction

Alexander Fleming invented penicillin almost 90 years ago to save human lives from inimitable fatality. In combat against infection or microbes; undoubtedly antibiotics are blessing to the human civilization [1]. However, antibiotics are experiencing resistance to the microbes over the year, and almost every antibiotic has been reported to get the resistance. Life-threatening resistant bacteria can cause long-term global burden of disease irrespective of age and place [2]. Study reports that human's tendency to overuse antibiotic for suspected infections can be the main reason for developing the drug resistance. Therefore, human's attitude in using proper antibiotics need to be properly addressed to ensure the rational use of drugs and the appropriate use of healthcare [3]. This article aims to find out public's attitude to use antibiotics and potential solutions to get rid of antibiotic resistance.

Source of getting the antibiotic resistance

According to the research finding, use of antibiotic is proportional to develop antibiotic resistance in a community i.e. the more antibiotics are used, the higher the resistance can be observed [4]. There are several underlying reasons for antimicrobial resistance [5]. Overuse of antimicrobial use is the key driving force of resistance. Misuse of antibiotics and failure to complete treatment courses are the contributing factors which have increased the

antimicrobial use. Inherent microbial characteristics also play a role. For example, *Streptococcus aureus* resistance to penicillin is highly prevalent. However, *Streptococcus pyrogens* strains are uniformly susceptible to penicillin, and therefore, it remains the drug of choice to treat infections caused by this organism [6]. Social and technological characteristics also attribute to the spread of antibiotic resistance among the carriers due to increased availability and ease of travel across the globe [7].

Public's attitudes to and compliance with antibiotics

Easy availability of antibiotics is worsening the scenario as there is lack of regulations to get antibiotics. No prescription is needed to buy antibiotics even in most of the developing countries where it is required. Physicians often feel pressure and sometimes economic incentives are offered by the patient to prescribe a course of antibiotic [4, 8].

- According to a study finding, 11.3% of the participated respondents reported that they did not complete their prescribed antibiotic course. When asked about the reason for not completing the course, 65% stated that they felt better or forgot to take the antibiotics [9].
- Most of the patients believe that antibiotics can help them in earlier recovery of the disease. Therefore, they intend to use the same antibiotic in the case of the appearance of same type of symptoms [10].

- Another study reported that clinicians want to prescribe antibiotics because they felt that most of the patients love to have antibiotics. Most of the patient tends to request the clinicians to prescribe antibiotics for their early recovery [10].
- Respondents were found to have few knowledge regarding the action of antibiotics. In a study, about 43% incorrectly agreed that 'antibiotics can kill viruses.' There are widespread misperceptions like antibiotic acts better against cough and cold, and therefore people urge to get the antibiotics when they attend their physician for a cure [11].
- There is evidence that even health care professionals does not adequately follow hand washing practices in developing countries which may indicate their suboptimal level of knowledge to get rid of antibiotic resistance [12, 13].
- According to a study finding, the improper practice of medical personnel maintaining hand hygiene is responsible for increasing dissemination of resistant organisms, [14]. Conversely, increased hand washing compliance could results in decreased rates of antimicrobial resistance [15].
- Healthcare professionals need to be encouraged to prescribe antibiotics when there is an indication to give antibiotics.
- Prescribed antibiotics should target the offending pathogens responsible for infection
- An appropriate dose of the antibiotic should be prescribed
- Physician needs to advise patients to complete the course of antibiotic, even if the patient feels better after taking few doses. In case of incomplete treatment of antibiotic, bacteria develops the better survival chances to cause re-infection.
- One patient should not share the prescribed antibiotics of others. In spite of the same types of sign symptoms, the disease can be different.
- Proper hygiene is an essential to prevent the spread of infection in community and at home. Thus, appropriate hand washing practices need to be initiated.

Antibiotic resistance spread when people ignore the issue and pay less seriousness. Sometimes patient demand for antibiotics without having the proper indication [16].

Global Initiative to prevent antibiotic resistance

The World Health Assembly supported a global action plan on antibiotic resistance in 2015. According to the global action plan "five strategic objectives" have been derived which seeks support to ensure the prevention and treatment of infectious disease. They are as follows: improving the awareness and understanding of antimicrobial resistance among the people; strengthening the surveillance and research; optimizing the use of antimicrobial medicines; reducing the incidence of infection, and ensuring sustainable investment in taking the initiative against antimicrobial resistance [17].

World health organization recommends some preventative approach against antibiotic resistance [17]:

- Antibiotics should not be recommended for a viral and fungal infection, i.e. fever, cough, and cold.

Plausible solution to overcome antibiotic resistance

Many proposals have been developed so far by the antibiotic experts over the years which reiterate the importance of human's attitude in stopping the non-judicial use of antibiotics. There are absolute indications to control antibiotic use in animal husbandry and agriculture to prevent antibiotic-resistant specimen [4]. Scandinavian countries have established the regulation of antimicrobials utilization which resulted in decreased use [18]. These countries were able to stop antibiotic use in food animal production successfully. However, it was time-consuming and took a lot of combined effort, and consequently, it makes us realize that restriction of antibiotic use is tough to implement on a global scale [19]. The success of Scandinavians in throttling the use of growth-promoting antibiotics was encouraging for other EU countries. Hence, the EU countries have been trying to implement similar strategies to limit the antibiotic use in agricultural sources [20]. Moreover, combination therapy of drugs can inhibit the emergence of drug resistance, but it needs expert opinion in choosing the appropriate remedy [21]. Simple measures of handwashing and antiseptic use can be useful intervention in reducing bacterial transmission to encounter nosocomial infection [22]. Therefore, active role of public health leaders for ensuring rational use of drugs is important [23].

2. Conclusion

According to the Nobel laureate Joshua Lederberg (1994), "We are running out of bullets for dealing

with some (bacterial) infections. Patients are dying because we no longer in many cases have antibiotics that work.” Antibiotic resistance is arduous to encounter; thus seems to be inevitable to prevent the current global practices. Therefore, antibiotic resistance is known as the tragedy of the commons: one person no impact, when everyone is misusing antibiotics we encounter far-reaching detrimental global effect. Health education and strategic implementation of different programs are necessary to reduce the cases of antibiotic resistance.

3. References

- [1] Levy SB. From tragedy the antibiotic age is born. *The Antibiotic Paradox*: Springer; 1992. p. 1-12.
- [2] Organization WH, editor WHO’S first global report on antibiotic resistance reveals serious, worldwide threat to public health. *Antimicrobial resistance–global surveillance report 2014*: Virtual Press Conference.
- [3] Zaman SB, Hossain N. Universal Health Coverage: A burning need for developing countries. *Journal of Medical Research and Innovation*. 2017;1(1):18-20.
- [4] Davies J, Davies D. Origins and evolution of antibiotic resistance. *Microbiology and molecular biology reviews*. 2010;74(3):417-33.
- [5] Levy SB. *The antimicrobial paradox. How miracle drugs are destroying the miracle*. New York: Plenum Press; 1992.
- [6] Marchese A, Balistreri G, Tonoli E, Debbia E, Schito G. Heterogeneous Vancomycin Resistance in Methicillin-Resistant *Staphylococcus aureus* Strains Isolated in a Large Italian Hospital. *Journal of clinical microbiology*. 2000;38(2):866-9.
- [7] Lowy FD. Antimicrobial resistance: the example of *Staphylococcus aureus*. *The Journal of clinical investigation*. 2003;111(9):1265-73.
- [8] Rahman AE, Iqbal A, Hoque DE, Moinuddin M, Zaman SB, Rahman QS-u, et al. Managing Neonatal and Early Childhood Syndromic Sepsis in Sub-District Hospitals in Resource Poor Settings: Improvement in Quality of Care through Introduction of a Package of Interventions in Rural Bangladesh. *PloS one*. 2017;12(1):e0170267.
- [9] Woodhead M, Finch R. Public education—a progress report. *Journal of Antimicrobial Chemotherapy*. 2007;60(suppl 1):i53-i5.
- [10] Coenen S, Michiels B, Renard D, Denekens J, Van Royen P. Antibiotic prescribing for acute cough: the effect of perceived patient demand. *Br J Gen Pract*. 2006;56(524):183-90.
- [11] McNulty CA, Boyle P, Nichols T, Clappison P, Davey P. The public’s attitudes to and compliance with antibiotics. *Journal of Antimicrobial Chemotherapy*. 2007;60(suppl 1):i63-i8.
- [12] Pittet D. Improving adherence to hand hygiene practice: a multidisciplinary approach. *Emerging infectious diseases*. 2001;7(2):234.
- [13] Zaman SB, Hossain N, Yasir Arafat SM, Sharmin S. Management of Newborn Infection: Knowledge and attitude among health care providers of selected sub-district hospitals in Bangladesh. *International Journal of Perceptions in Public Health*. 2017;1(2):127-32.
- [14] Girou E, Legrand P, Soing-Altrach S, Lemire A, Poulain C, Allaire A, et al. Association between hand hygiene compliance and methicillin-resistant *Staphylococcus aureus* prevalence in a French rehabilitation hospital. *Infection Control and Hospital Epidemiology*. 2006;27(10):1128-30.
- [15] Swoboda SM, Earsing K, Strauss K, Lane S, Lipsett PA. Electronic monitoring and voice prompts improve hand hygiene and decrease nosocomial infections in an intermediate care unit. *Critical care medicine*. 2004;32(2):358-63.
- [16] Grigoryan L, Burgerhof JG, Haaijer-Ruskamp FM, Degener JE, Deschepper R, Monnet DL, et al. Is self-medication with antibiotics in Europe driven by prescribed use? *Journal of antimicrobial chemotherapy*. 2007;59(1):152-6.
- [17] WHO G. Antibiotic resistance; Fact sheet 2016 [Available from: <http://www.who.int/mediacentre/factsheets/antibiotic-resistance/en/>].
- [18] Bengtsson B, Wierup M. Antimicrobial resistance in Scandinavia after a ban of antimicrobial growth promoters. *Animal biotechnology*. 2006;17(2):147-56.
- [19] Acar J, Davies J, Buckley M. Antibiotic resistance: an ecological perspective on an old problem. 2009.
- [20] Kotilainen P, Routamaa M, Peltonen R, Oksi J, Rintala E, Meurman O, et al. Elimination of epidemic methicillin-resistant *Staphylococcus aureus* from a university hospital and district institutions, Finland. *Emerging infectious diseases*. 2003;9(2):169-75.
- [21] Kim S, Lieberman TD, Kishony R. Alternating antibiotic treatments constrain evolutionary paths to multidrug resistance. *Proceedings of the National Academy of Sciences*. 2014;111(40):14494-9.
- [22] Gaynes RP, Weinstein RA, Smith J, Carman M, Kabins SA. Control of aminoglycoside resistance by barrier precautions. *Infection Control*. 1983;4(04):221-5.
- [23] Zaman SB. Importance of Learning the Public Health Leadership. *Public Health of Indonesia*. 2017;3(1):1-3.