International Journal of Management, IT & Engineering
Vol. 13 Issue 06, June 2023
ISSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

Antibiotic Resistance and its Implications on Public Health

Dr.S.Thenmozhi, Assistant professor
Department of Microbiology
Valliammal college for women, Chennai

Abstract

The global problem of antibiotic resistance has high rates of morbidity and mortality. Gram-positive and Gram-negative bacteria have both evolved medication resistance, making it challenging to treat illnesses. The spread of resistant bacteria is facilitated by the overuse of broad-spectrum antibiotics in conjunction with inadequate infection management. There are few methods for prevention, and the discovery of novel antibiotics is constrained. Researchers are investigating anti-resistance therapies that target bacterial virulence factors and biological pathways. Researchers are looking into methods include modifying antibiotic uptake, avoiding biofilm development, creating novel antibiotics, combination therapy, employing organic antibacterial agents, and nanoparticulate systems. To safeguard human health, antibiotic resistance must be addressed immediately.The researcher had considered experts to conduct the study survey and know their opinion regarding Antibiotic Resistance and its Implications on Public Health and concludes that due to exposure to antimicrobials and colonisation by resistant bacteria, resistance might develop at the individual leveland Corrective actions should prioritise to reduce antibiotics use to enhance international awareness.

Key Words: -Antibiotic Resistance, Bacterial Pathogens, Multidrug Resistance, Morbidity, Mortality, Overuse, Antibacterial

Introduction: -

Antibiotic resistance in pathogenic bacteria is a significant problem that is associated with high rates of morbidity and mortality worldwide. Multidrug resistant patterns have been seen in both Gram-positive and Gram-negative bacteria, leading to diseases that are either incurable or difficult to treat. Due to the lack of early diagnosis of pathogenic germs and their antibiotic resistance, broad-spectrum antibiotic use is excessive in many clinical settings. This helps the spread of resistant germs, combined with subpar infection control procedures. To combat the problems of resistance, various treatments that target bacterial virulence factors and molecular pathways are now being explored.Controlling the spread of antibiotic resistance genes requires an understanding of the resistome and horizontal gene transfer. Altering antibiotic uptake, preventing biofilm development, creating new antibiotics, combination therapy, using natural antibacterial agents, and nanoparticulate systems are some methods which are being currently looked at. It is urgently necessary to address the rising incidence of multidrug-resistant bacteria and the detrimental effects it has on human health by finding ways to combat bacterial resistance.(Frieri et al., 2017)

Antibiotics are substances that can prevent germs from growing and surviving. They are frequently employed in the treatment of infectious diseases in humans as well as in the aquaculture and cattle industries. They are released into the environment in a number of ways, including sewage discharge, industrial manufacture, animal husbandry, and agricultural runoff. Because of how frequently and extensively they are used, antibiotic residues can linger in the environment. Genetic changes brought about by the presence of antibiotics in microbial systems may result in the evolution of an antibiotic-resistant bacterial strain (ARB) with antibiotic-resistant genes (ARGs). Horizontal gene transfer (HGT) and mobile genetic elements facilitate the propagation and recombination of ARGs. ARGs are increasingly recognized as new environmental pollutants. The emergence of ARG and ARB reservoirs that are in the environment (environmental antibiotic resistance), their possible impact on the microbiome of human beings, and the propagation of the selection of resistant bacteria in humans are all problems related to antibiotic resistance in the environment. Risk evaluations of human exposure to environmental antibiotic resistance are now essential for estimating the potential health effects linked to ARB infections. (Ben et al., 2019). Figure 1 shows the consequences of Antibiotic Resistance.

Figure 1 Consequences of Antibiotic Resistance

Literature Review:

Antimicrobial resistance (AMR) is accelerating due in large part to the misuse and overuse of antibiotics. Patients frequently think that antibiotics may treat viral infections like the flu or the common cold, which results in overuse of antibiotics. Antibiotics are frequently provided without the correct justification in many underdeveloped nations where there aren't enough diagnostic tools. In some nations, low-quality antibiotics are also sold over the counter, allowing patients to self-treat ailments for which antibiotics are not necessary. Due to financial incentives or patient expectations, doctors may mistakenly recommend extended antibiotic treatments.The use of antibiotics in agriculture is a substantial factor to AMR. Animals get large doses of antibiotics, including essential medicines used in humans, for disease prevention and growth enhancement. Higher antibiotic consumption has been seen in developing nations, and the spread of resistant diseases around the globe is facilitated by convenient transit routes. Antibiotic resistance is spread by biological agents such bacterial mutation, plasmid transfer, and horizontal gene transfer.(Dadgostar, 2019).

With high rates of infectious illness mortality as compared to other nations, India has a serious problem with antibiotic resistance. Poor public health systems, hospital infections, a high burden of infectious diseases, widespread accessibility to low-cost antibiotics, and rising wealth are among the factors causing this catastrophe. Since over-the-counter antibiotics, including carbapenems, are widely available, India has been the world's largest user of antibiotics for human health. This has resulted in an increase in resistant diseases. Priorities include regulating physician compensation, encouraging behaviour change among physicians and patients, and improving regulation of drug manufacture and sales. The elderly and other vulnerable groups are primarily impacted by the burden of antibiotic resistance.(Laxminarayan & Chaudhury, 2016).

Through a process called Darwinian selection, microorganisms have developed defences against antimicrobial medications. This can be done by blocking drug entry, exporting pharmaceuticals, creating enzymes that break down or alter antimicrobials, or altering the antimicrobial target. Antimicrobial compounds produced by microorganisms naturally compete with them, which is how antimicrobial resistance can be understood. Antimicrobial resistance, however, is largely caused by the use of antibiotics in agriculture, human medicine, and animals. Due to exposure to antimicrobials and colonisation by resistant bacteria, resistance might develop at the individual level. Antimicrobial misuse, abuse, and overprescription all lead to resistance at the community level. Resistance development is also influenced by the usage of antibiotics in agriculture, food production, and veterinary care. In general, combating antimicrobial resistance necessitates a thorough and integrated strategy spanning numerous sectors.(Holmes et al., 2016)

Over the past ten years, the prevalence of several bacterial illnesses that are resistant to numerous antibiotics has increased. The incorrect and excessive application of antibiotics in both clinical and farm settings has contributed to the development and spread of bacteria that are resistant to antibiotics. The corrective actions should prioritise reducing the use of antibiotics in livestock and the food chain, enhancing international awareness and collaboration, and promoting ethical antibiotic use in society. In low-income countries, problems including poverty, access to over-the-counter drugs, a lack of diagnostic tools, and poor sanitation make the battle against antibiotic resistance even more difficult.(Roca et al., 2015).

Numerous lives have been saved because to the development of antibacterial therapy, which efficiently treats bacterial infections. Prior to the development of antibiotics, conditions like endocarditis, pneumonia, and Staphylococcus aureus bacteraemia all had significant fatality rates. Amputations from wound infections were common. Antibiotics have completely changed how these infections are treated and cured, making sophisticated operations, organ transplants, and chemotherapy possible. The development of antibiotic therapy, however, is seriously threatened by the growing prevalence of antibiotic resistance in the community and in clinical settings. (Friedman et al., 2016)

Although antibiotics have been an exceptionally successful kind of therapy in medicine, their effectiveness is being eroded by the incidence of infections that are resistant to them. Global public health is seriously threatened by antibiotic resistance, which raises sickness, mortality, and medical costs. Emphasis is placed on efflux systems and -lactamases as the primary causes of resistance. It is essential to find innovative antimicrobials that concentrate on quorum sensing, intrinsic resistance, as well as specific resistance mechanisms in different organisms. Additionally, it examines the various environmental triggers of antibiotic resistance genes and emphasises the significance of understanding horizontal gene transfer in halting the spread of resistance. (Lin et al., 2015).

Mortality and the cost of public health are significantly impacted by antibiotic resistance. Intensive care for newborns, cancer treatment, organ transplantation, and other medical specialties are also impacted by antibiotic resistance. Quantifying the financial burden is difficult, but it involves higher prices for pricy antibiotics, longer hospital stays, and lost productivity. Antibiotic overuse and inappropriate use in human medicine, public ignorance, and abuse in agriculture and animal husbandry are all factors that contribute to antibiotic resistance. The spread of resistance is also influenced by the environment. Infections are become harder to cure because common bacteria including Staphylococcus aureus, non-typhoidal Salmonella, Klebsiella pneumoniae, and tuberculosis are getting more resistant.(Prestinaci et al., 2015).

Antibiotics are released into the environment through human and animal waste, and their enduring presence in water sources raises worries about the spread of ARB and ARG (antibiotic-resistant genes). Risks to human health and ecological health arise from the presence of ARB and ARG in aquatic habitats as well as from their potential spread to natural settings and drinking water resources. To deal with ARB and ARG in water, various treatment methods have been investigated, including chemical disinfection, engineered wetlands, and nanotechnology.(Sharma et al., 2016).

Today, fungi infections pose a severe threat to human health, food security, and biodiversity. Opportunistic fungal diseases such the Candida, Aspergillus, and Cryptococcus species are currently the main causes of human fatality. Aspergillus fumigatus and Cryptococcus species cause invasive aspergillosis and infestations of the brain and spinal cord, respectively. Fungal diseases also affect food security by killing crops and contaminating food supplies. They also aid in the demise of wild species brought on by climate change. The scarcity of antifungal drugs and the rise of resistance mechanisms make the issue more challenging. To tackle this global health catastrophe, it is essential to learn about these pathways and consider novel therapeutic approaches.(Revie et al., 2018)

Antimicrobial resistance (AMR) poses a serious risk to public health; estimates indicate that by 2050, it may be responsible for 10 million annual deaths. It can be difficult to gauge the full cost of resistance, particularly in places with scant data and surveillance. It's critical to evaluate the burden when considering both illnesses that are susceptible and drug-resistant in order to successfully combat AMR. To determine the priority diseases in various regions and devise targeted therapies, a thorough global investigation is required. (Murray et al., 2022)

The discovery of antibiotics by Sir Alexander Fleming revolutionised medicine and greatly extended life expectancy, especially in industrialised nations. To the contrary, Fleming cautioned against the development of drug-resistant microorganisms in his acceptance speech for the Nobel Prize. Sadly, his advice was disregarded, which resulted in the current crisis in the fight against infectious illnesses. Numerous infections that were once curable have become incurable and are now among the leading causes of morbidity and mortality. Although other antibiotics were discovered after Fleming's discovery, their excessive and improper usage, both as a form of prophylaxis and a means of treatment, contributed to the development of antibiotic resistance. In developing nations where infectious diseases continue to be a major cause of death, antibiotic resistance has decreased the efficacy of treatment against infectious organisms.The growth and spread of resistant bacteria have been facilitated by lax infection control and overuse of antibiotics in hospitals and communities. Practical solutions and prompt attention are needed for this worldwide catastrophe. To address this pressing public health concern, international cooperation and coordination are crucial. Also identified are crucial microorganisms with high rates of antibiotic resistance that demand rapid attention and the creation of fresh antibiotic therapies.(Talebi Bezmin Abadi et al., 2019)

Antimicrobial resistance (AMR) describes a microorganism's capacity to resist the effects of antimicrobial medications, rendering them useless. The abuse and overuse of antimicrobial medications is the primary cause of AMR, which is a hazard to world health. It contributes to greater rates of morbidity and mortality, lengthens hospital stays, and raises healthcare expenses. With high rates of resistance found in bacteria including Escherichia coli, Staphylococcus aureus, Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aeruginosa, and Enterobacter spp., developing nations are severely afflicted.These bacteria, collectively referred to as ESKAPE, have the capacity to acquire antibiotic resistance, reducing the number of available treatments and escalating the severity of infections. Inadequate antimicrobial stewardship programmes, poor surveillance, and subpar cleanliness in developing nations present further problems. Targeted treatments, such as antibiotic stewardship and infection prevention strategies, are needed to address the urgent clinical and financial consequences of AMR in these nations.(Founou et al., 2017)Antimicrobial resistance is bad for your health because it makes antimicrobial therapy less effective and makes infections costlier and more severe. Antimicrobial use in both humans and animals helps diseases including Salmonella, Campylobacter, Enterococcus, and E.coli become resistant to treatment. These bacteria's propensity for resistance can restrict treatment options and lead to more serious infections. Resistance in Campylobacter is linked to animal misuse of antimicrobials, including as fluoroquinolones and macrolides. E. coli infections are also getting more difficult to treat in both humans and animals, which is a serious health issue. Methicillin-resistant Staphylococcus aureus (MRSA) is a major health problem since it can infect both humans and animals with different illnesses. Antimicrobial usage, inadequate biosecurity, and interaction with carrier animals all contribute to the spread of MRSA.(McEwen & Collignon, 2018)

Objective: To know expert's opinion regarding Antibiotic Resistance and its Implications on Public Health.

Methodology: The researcher had considered experts to conduct the study survey and know their opinion regarding Antibiotic Resistance and its Implications on Public Health. The survey was conducted with the help of a questionnaire. The researcher had collected the primary data through random sampling method and was analysed by statistical tool called mean.

Findings

Table 1 Antibiotic Resistance and its Implications on Public Health

S. No.	Statements	Mean Value
1.	Antimicrobial resistance (AMR) is accelerating due to misuse and overuse of antibiotics	3.93
2.	Antibiotics are frequently provided without the correct reason in many underdeveloped nations	3.59
3.	Antibiotic consumption and spread of resistant diseases around the globe are facilitated by convenient transit routes	3.81
4.	Due to exposure to antimicrobials and colonisation by resistant bacteria, resistance might develop at the individual level	3.74
5.	Resistance development is also influenced by the usage of antibiotics in agriculture, food production, and veterinary care	3.76
6.	Corrective actions should prioritise to reduce antibiotics use to enhance international awareness	3.69
7.	Use of antibiotics aided in the emergence and spread of bacteria that are multidrug resistant	3.80
8.	Overuse of antibiotics contributes to greater rates of morbidity and mortality, lengthens hospital stays, and raises healthcare expenses	3.91

International Journal of Management, IT & Engineering
Vol. 13 Issue 06, June 2023
ISSN: 2249-0558 Impact Factor: 7.119
Journal Homepage: http://www.ijmra.us, Email: editorijmie@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal - Included in the International Serial Directories Indexed & Listed at: Ulrich's Periodicals Directory ©, U.S.A., Open J-Gate as well as in Cabell's Directories of Publishing Opportunities, U.S.A

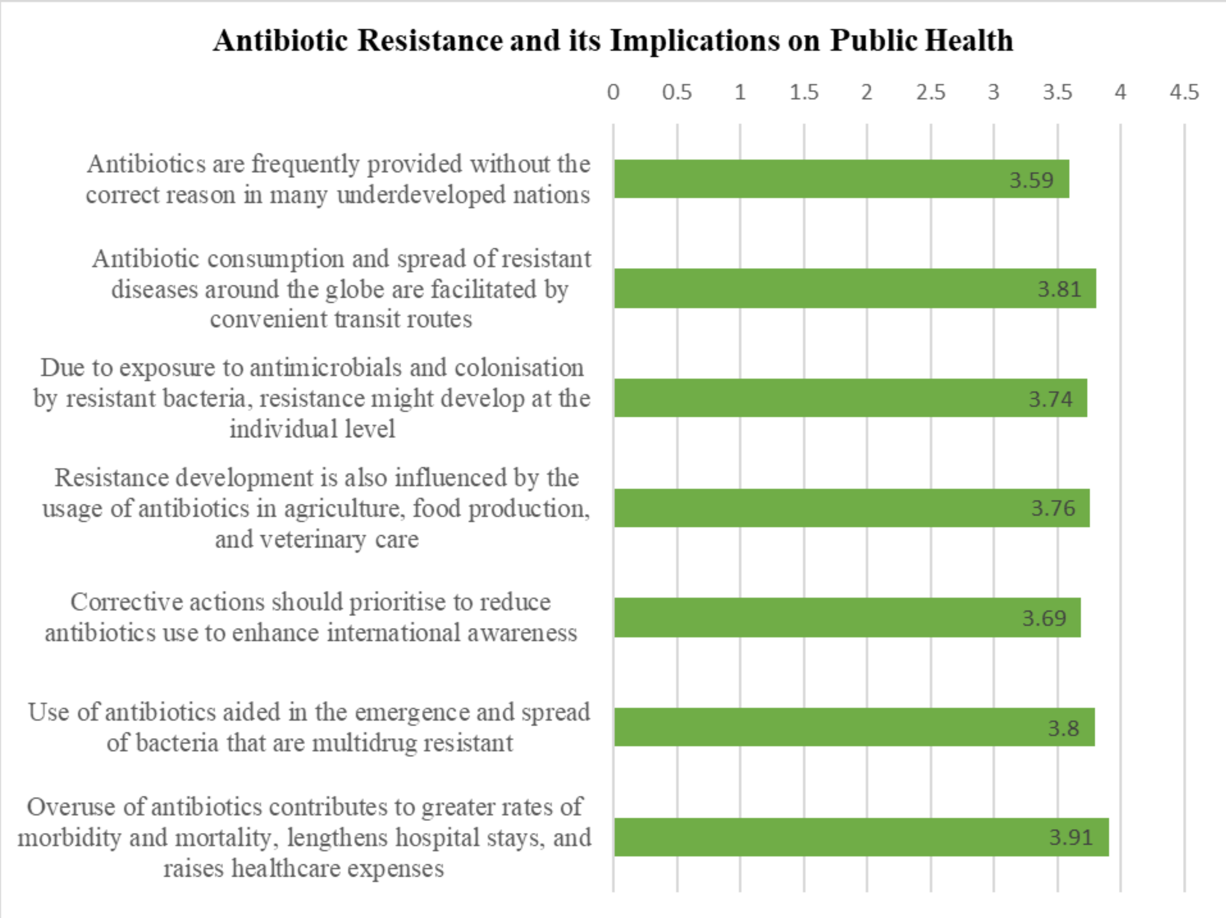

Figure 1 Antibiotic Resistance and its Implications on Public Health

Table and figure above are showing expert's opinion regarding Antibiotic Resistance and its Implications on Public Health. The respondent says that Antimicrobial resistance (AMR) is accelerating due to misuse and overuse of antibiotics with mean value 3.93, Overuse of antibiotics contributes to greater rates of morbidity and mortality, lengthens hospital stays, and raises healthcare expenses with mean value 3.91, Antibiotic consumption and spread of resistant diseases around the globe are facilitated by convenient transit routes with mean value 3.81 and Use of antibiotics aided in the emergence and spread of bacteria that are multidrug resistant with mean value 3.80. The respondent also says that Resistance development is also influenced by the usage of antibiotics in agriculture, food production, and veterinary care with mean value 3.76. Due to exposure to antimicrobials and colonisation by resistant bacteria, resistance might develop at the individual level with mean value 3.74, Corrective actions should prioritise to reduce antibiotics use to enhance international awareness with mean value

3.69 and Antibiotics are frequently provided without the correct reason in many underdeveloped nations with mean value 3.59.

Conclusion: -

Antibiotic resistance poses a serious threat to world health, increasing the likelihood of morbidity and mortality. Antibiotic abuse and misuse, both in medical settings and in agricultural practises, have aided in the emergence and spread of bacteria that are multidrug resistant. The situation is made worse by a shortage of new antibiotics and a lack of effective prophylactic measures. Innovative antibacterial therapies that target virulence factors and molecular pathways are being investigated to overcome bacterial resistance. Controlling the spread of resistance genes requires an understanding of the resistome and horizontal gene transfer. Promising initiatives include those to modify antibiotic uptake, inhibit biofilm development, create novel antibiotics, use combination therapy, and apply natural antibacterial agents. To address the increasing prevalence of multidrug-resistant microorganisms and safeguard human health, immediate action is required.

The study was conducted to know expert's opinion regarding Antibiotic Resistance and its Implications on Public Health and found that antimicrobial resistance (AMR) is accelerating due to misuse and overuse of antibiotics,Overuse of antibiotics contributes to greater rates of morbidity and mortality, lengthens hospital stays, and raises healthcare expensesand Antibiotic consumption and spread of resistant diseases around the globe are facilitated by convenient transit routes.

References: -

- Ben, Y., Fu, C., Hu, M., Liu, L., Wong, M. H., & Zheng, C. (2019). Human health risk assessment of antibiotic resistance associated with antibiotic residues in the environment: A review. *Environmental Research*, *169*, 483–493.
- Dadgostar, P. (2019). Antimicrobial Resistance: Implications and Costs. *Infection and Drug Resistance*, *12*(12), 3903–3910.
- Founou, R. C., Founou, L. L., & Essack, S. Y. (2017). Clinical and economic impact of antibiotic resistance in developing countries: A systematic review and meta-analysis. *PLOS ONE*, *12*(12), e0189621.
- Friedman, N. D., Temkin, E., & Carmeli, Y. (2016). The negative impact of antibiotic resistance. *Clinical Microbiology and Infection*, *22*(5), 416–422.

- Frieri, M., Kumar, K., & Boutin, A. (2017). Antibiotic resistance. *Journal of Infection and Public Health*, *10*(4), 369–378.
- Holmes, A. H., Moore, L. S. P., Sundsfjord, A., Steinbakk, M., Regmi, S., Karkey, A., Guerin, P. J., & Piddock, L. J. V. (2016). Understanding the mechanisms and drivers of antimicrobial resistance. *The Lancet*, *387*(10014), 176–187.
- Laxminarayan, R., & Chaudhury, R. R. (2016). Antibiotic Resistance in India: Drivers and Opportunities for Action. *PLOS Medicine*, *13*(3), e1001974.
- Lin, J., Nishino, K., Roberts, M. C., Tolmasky, M., Aminov, R. I., & Zhang, L. (2015). Mechanisms of antibiotic resistance. *Frontiers in microbiology*, *6*, 34.
- McEwen, S. A., & Collignon, P. J. (2018). Antimicrobial Resistance: a One Health Perspective. *Antimicrobial Resistance in Bacteria from Livestock and Companion Animals*, 521–547.
- Murray, C. J., Ikuta, K. S., Sharara, F., Swetschinski, L., Aguilar, G. R., Gray, A., ... & Tasak, N. (2022). Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *The Lancet*, *399*(10325), 629-655.
- Prestinaci, F., Pezzotti, P., &Pantosti, A. (2015). Antimicrobial resistance: a global multifaceted phenomenon. *Pathogens and Global Health*, *109*(7), 309–318.
- Revie, N. M., Iyer, K. R., Robbins, N., & Cowen, L. E. (2018). Antifungal drug resistance: evolution, mechanisms and impact. *Current Opinion in Microbiology*, *45*, 70–76.
- Roca, I., Akova, M., Baquero, F., Carlet, J., Cavaleri, M., Coenen, S., Cohen, J., Findlay, D., Gyssens, I., Heure, O. E., Kahlmeter, G., Kruse, H., Laxminarayan, R., Liébana, E., López-Cerero, L., MacGowan, A., Martins, M., Rodríguez-Baño, J., Rolain, J.-M. ., & Segovia, C. (2015). The global threat of antimicrobial resistance: science for intervention. *New Microbes and New Infections*, *6*, 22–29.
- Sharma, V. K., Johnson, N., Cizmas, L., McDonald, T. J., & Kim, H. (2016). A review of the influence of treatment strategies on antibiotic resistant bacteria and antibiotic resistance genes. *Chemosphere*, *150*, 702–714.
- Talebi Bezmin Abadi, A., Rizvanov, A. A., Haertlé, T., & Blatt, N. L. (2019). World Health Organization Report: Current Crisis of Antibiotic Resistance. *BioNanoScience*, *9*(4), 778–788.