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A Review on "Superbugs" – A Rundown Crisis

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ABSTRACT

Antibiotics that are either bactericidal or bacteriostatic can be defined as the wonder drugs that acts on the human body against various disease states. The term "SUPERBUGS" refers to multidrug resistant bacteria and other microorganisms. Various types of superbugs are present in the community with varying mechanism leading to their development. Being superbugs on the rise morbidity and mortality in hospital and community setting is increasing. Multidisciplinary approaches are undertaken in order to combat them where antibiotic stewardship is one of them.

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INTRODUCTION`

Antibiotics that are either bactericidal or bacteriostatic can be defined as the wonder drugs that acts on the human body against various disease states. To defence the infections or infectious organisms inside the human body, we can say without any doubt that antibiotics are a blessing to the humans that has saved and saving millions of lives. These blessings were started showering by the name of two scientists: Paul Ehrlich and Alexander Flemming, those who made great contribution to the "Antibiotic Era". Paul Ehrlich named it as a "Magic Bullet" which target disease causing microbes but not the host cells. Alexander Flemming introduced Penicillin antibiotics in 1928 and this paved the way to Modern Antibiotic Era.

In 1940's Penicillin antibiotics were successfully treating bacterial infections, but by the 1950's, there developed resistance to these antibiotics in humans. This led to the development of Beta-lactam antibiotics which successfully treated bacterial infections. The progress in use of these antibiotics subsequently leads to the emergence of resistance to these antibiotics.

Early in 1945 itself, Sir Alexander Flemming warned about the resistance to antibiotics due to antibiotic overuse. Antibiotic resistance develops due several reasons such as irrational use of antibiotics, wrong prescribing pattern, overuse and may also occurs due to mutations.

The term "SUPERBUGS" was introduced by media in 1970 to describe the multidrug resistant bacteria which leads to dangerous infectious diseases.

Dr. Martin Blaser, a professor at New York University School of Medicine and Former President of Infectious Diseases Society of America clearly stated that the term superbugs is an entirely media term to refer the bacteria that resist antibiotics.

There are several types of organisms which cause antibiotic resistance. Mainly in developing countries there exists the development of antibiotic resistance. Because almost all the antibiotics can be bought from drug stores without the prescription of a medical practitioner. In such a situation, the present scenario of these developing countries is also purely presenting the Era of Superbugs. In order to control or prevent this situation, we need to educate the patient population and society.

We present this review as education or awareness to the public along with certain other facts about superbugs.

EPIDEMIOLOGY

Nowadays the Antimicrobial Resistance (AMR) has found to increase the mortality and morbidity rate. The origin and spread of Multidrug resistant bacteria's greatly affect our current healthcare system. Lack of development of new antimicrobials is a threat to current medication system. Multidrug resistance is affected by bacterial, host and environmental factors including exposure to antimicrobials in clinical medicine, environmental water contamination etc.

In 2014, a synthesis of evidence and economic review says that about 700000 deaths were globally occurred due to antibiotic resistant organisms and is expected to reach 10 million/year by a year about 2050. The cost associated with multidrug resistance found to increase as resistance develops to 2nd and 3rd generation antibiotics leading to scenarios when critically ill patients need medical and supportive care.

CLASSIFICATION OF MULTI DRUG RESISTANCE

Drug resistance is the reduction in the effectiveness of antimicrobials. Drug resistance is the capacity of a bacteria or any other microorganisms to hold out against a drug that once impeded them or killed them. When the organism is resistant to more than one drug, it is said to be multidrug resistance. Administration of applicable doses of medicine for a selected period of your time, survival for varied microorganism strains represents the high levels of resistance. Persistence of microbes once treatments refers differing types of antimicrobial drug resistance.

Multidrug resistance is classified into two types primary secondary and clinical resistance. Primary resistance means patients do not respond at all to treatment. Secondary resistance means patients respond to treatment at the beginning but develop resistance later on.

Primary resistance- It happens once the organism has never encountered the drug of interest in an exceedingly specific host.

Secondary resistance- It is also known as acquired resistance. Resistance forms in the organism only after the exposure to the drug.

Intrinsic resistance- It is the insensitivity of all microorganisms to first line drugs. It is used to treat diseases on the basis of clinical evidence and symptoms. It is also called as MDR. Example is mycobacterium tuberculosis to rifampicin and isoniazid.

Extensive resistance- Organisms have the capability to withstand the inhibitory effects of minimum one or two antimicrobial agents. It is also referred as XDR. It should be arising in patients after the treatment with first line drugs. Example is XDR tuberculosis resistance against fluoroquinolones.

Clinical resistance- organisms usually treated with a concentration of antimicrobial agents is higher, it usually causes therapeutic failure or reappearance of infections within in organism due to impaired host immune function. It is also explained as, when the microorganisms are inhibited by antimicrobial agent in higher concentration it is not clinically effective. Clinically more effective method is microorganisms are inhibited by a normal dose.

TYPES OF SUPERBUGS

Superbugs are bacteria that are impervious to antibiotics. Since the institution of antibiotics, the bacteria they treat have been adapting and changing in order to build up resistance.

Antibiotic resistant bacterial infections include: -

Methicillin resistant *Staphylococcus aureus*

MRSA is resistant against antibiotic drug like beta lactam antibiotics. Variety of medication still retain activity against MRSA, together with glycopeptides, linezolid, tigecycline, daptomycin, and even some new beta lactams, like ceftaroline and ceftobiprole. The resistance to anti MRSA agents sometimes happens through microorganism mutation, there are reports for transfer of resistance to linezolid and glycopeptide antibiotics that is the reason for major concern.

Vancomycin resistant *Enterococci*

VRE presents a significant therapeutic challenge Enterococci cause a large variety of sickness, largely among patients in hospitals or alternative health care settings, together with blood, surgical site and urinary tract infections. Few antimicrobial choices for treat VRE. Antibiotics used against VRE embrace linezolid and quinupristin or dalfopristin, whereas the

role of daptomycin and tigecycline must additional outlined. VRE remains a significant threat, consequently, there's tremendous interest in developing novel medication that might have bactericidal activity against VRE, like Oritavancin.

Drug resistant *Streptococcus pneumoniae*

S. pneumoniae will cause serious and generally dangerous infections. It's a significant reason behind microorganism respiratory illness and infectious disease, in addition as blood, ear and sinus infections. *S. pneumoniae* has developed resistance to medicine within the antibiotic category and erythromycin, amoxicillin and azithromycin. Pneumococcal conjugate vaccine introduced in 2010. This vaccine prevented pneumococcal infections and it also reduced antibiotic resistance by interference the transmission of resistant *S. pneumoniae* strains.

Drug resistant *Mycobacterium tuberculosis*

The microorganism *M. tuberculosis* is usually spreading via air. The infections caused by this bacterium occurs in any part of body, mostly occurs in lungs. It is airborne infection. It spreads through infected person sneeze and cough if the patient has pulmonary tuberculosis. Extrapulmonary tuberculosis are non-contagious. Tuberculosis are treated with first line tuberculosis drugs like isoniazid and rifampicin. In some cases, bacteria develop resistance to one or two of first line drugs. Drug resistant tuberculosis requires longer treatment periods and more costly drugs and it also have more side effects. Widely drug resistant tuberculosis is usually impervious to isoniazid, rifampicin, any fluoroquinolones and injectable drugs like amikacin, kanamycin and capreomycin. For extensively drug resistant tuberculosis lesser treatment option and it is much less effective.

Carbapenem resistant Enterobacteriaceae

CRE is resistant to all or almost all available antibiotics including carbapenem, it is usually considered as last treatment option for most drug resistant pathogens. Metallo beta lactamase (NDM-1) is present in gram negative Enterobacteriaceae bacteria like *E. coli* and *K. pneumoniae* this causes resistance to all beta lactams and including carbapenem.

Multi drug resistant *Pseudomonas aeruginosa*

Microorganism *P. aeruginosa* is the cause of hospital associated infections like pneumonia and bloodstream, urinary tract, surgical site infections. Multidrug resistant *P. aeruginosa* are

usually resistant to almost all antibiotics including aminoglycosides, cephalosporins, fluoroquinolones, and carbapenems.

Multi drug resistant Acinetobacter

Acinetobacter species cause resistant to all or almost all antibiotics including carbapenems, it is usually considered as last treatment option for most drug resistant pathogens.

ESBL- producing Enterobacteriaceae

Extended spectrum beta lactamase (ESBL) producing Enterobacteriaceae that cause broad spectrum beta lactamase enzyme and it causes resistant's to penicillin and cephalosporins antibiotics. ESBL- producing Enterobacteriaceae are usually resistant to most of the antibiotics in the penicillin and cephalosporins classes. In this case, last treatment option is drug from carbapenem class but it this drug is used caution to avoid development of resistance.

Drug resistant *Neisseria gonorrhoeae*

Gonorrhoea causes the symptoms like discharge and inflammation of the urethra, cervix, pharynx or rectum. One of the treatment options for gonorrhoea is cephalosporins. Cephalosporin resistant *N. gonorrhoeae* is resistant to almost all antibiotics like fluoroquinolones, tetracyclines and penicillins.

Mechanism of Multi Drug Resistance

Resistance is that the term referred to because the insensitiveness of a microorganism to associate in nursing antimicrobial drug compared with different isolates of an equivalent species. The development of resistance among infectious microorganisms is increasing particularly in patients below prolonged drug exposure. Antimicrobial medication typically acts on the microbes either by inhibiting a metabolic pathway like ester synthesis that successively ends up in the inhibition of polymer or ribonucleic acid synthesis and additional supermolecules synthesis and disruption of the plasma membrane or by competing with the substrate of any catalyst concerned in cytomembrane synthesis. Microorganisms have evolved a mess of mechanisms to beat the effectiveness of medication, thereby extent exposure to the medication. Medicine inhibit cell wall synthesis by binding with the peptidoglycan layer in microorganisms or moving ergosterol in fungi, thus, interference the

cell growth and division. These organisms bear bound body mutations or exchange of extrachromosomal. DNA parts through conjugation or transformation like K. pneumoniae, which can cause alteration within the cytomembrane composition leading to decreased permeability and uptake of medicine into the cell. Mutations within the genes coding for the target cause modifications at the molecular level and retain cellular perform by reducing susceptibility to inhibition. Other mechanisms of MDR was found to be associate degree overexpression of drug target enzymes resulting in target bypass thanks to modification in bound metabolic pathways that causes production of auxiliary goal molecules and intrusion in some protein synthesis. This could influence the access of medicine to the target sites. Inactivation or catalyst degradation of antimicrobials by chemical reaction of organic compound or organic compound bonds and chemical transformation of those compounds by acetylation, phosphorylation, adenylation, glycosylation, and hydroxylation have additionally become progressively apparent as reason behind MDR. MDR mediate by drug effluence pumps remains the predominant mechanism of MDR. The overexpression of genes secret writing for ATP binding cassette transporter membrane proteins additionally called the multidrug effluence pumps that area unit chargeable for the export or expulsion of medicine out of the cell, typically generates MDR and continues cellular functions with none interference.

CORRELATION BETWEEN ANTIBIOTIC CONSUMPTION AND ITS ASSOCIATION WITH ANTIBIOTIC RESISTANCE

In the absence of the development of latest generations of antibiotic drugs, suitable use of current antibiotics is wanted to make sure the long-term availability of effective treatment for bacterial infections. If antibiotics emerge as ineffective, then mounted and newly emerging infectious diseases, which are turning into a growing threat, may result in extended morbidity, fitness care utilisation and untimely mortality. Unfortunately, extra use of antibiotics all through the past 50 years has exerted selective pressure on prone bacteria and can have favoured the survival of resistant strains, some of which are resistant to more than one antibiotic. If immoderate antibiotic use may be reduced, the expectancy is that resistant microorganism can be replaced by susceptible bacteria due to the fact resistant bacteria can be much less 'fit' than inclined microorganism. Antimicrobial resistance is a main threat to fitness and human development, affecting our capacity to treat a selection of infections. Treatments for a developing range of infections

have end up less effective in many parts of the world because of resistance. The link between antimicrobial resistance and use of antimicrobials is properly documented. However, little information is available on antimicrobial use in low-earnings countries.

The development of AMR is a normal evolutionary technique for microorganisms however it is accelerated through the selective stress exerted by using considerable use of antimicrobials. The association among antimicrobial use and resistance has been well documented in man or woman fitness care facilities, groups and nations. There is a robust affiliation among AMR and stages of antimicrobial use, implying that a discount in unnecessary intake of antimicrobials could affect resistance. The available evidence shows that the global intake of antibiotics in people has risen in the past two decades, often driven through a multiplied use in low- and middle-profits countries.

At the equal time, there has been a shift toward using broad-spectrum and last-inn antibiotics. These traits are partly an end result of stepped forward get entry to medicines because of monetary improvement in some elements of the world, but also because antibiotics are used inappropriately. The styles of beside the point use of antimicrobials encompass the use of antibiotics to treat conditions that are no longer resulting from a bacterial infection, the use of the wrong form of antibiotic, the usage of the incorrect dosage or direction of administration, and use for the incorrect duration.

Detailed global estimates are lacking but in nations of the Organization for Economic Co-operation and Development (OECD), as many as half of all antimicrobials used in human health care can be taken into consideration beside the point. Drug-resistant infections can also be a result of poor gets entry to antimicrobials. Inequities in get admission to medicines persist and many low- and middle-profits nations (or their sub regions) nonetheless have excessive mortality charges from infectious diseases however low charges of use of antibiotics. In low- and middle-earnings international locations where humans have limited get right of entry to antimicrobials, individuals may not be capable of find the money for a full path of remedy or may only be capable of obtain substandard or falsified drugs or ones to which the organism is already resistant. In these international locations and circumstances, growing get admission to appropriate antimicrobials can lessen choice stress. Historically, the development and use of each new antibiotic have been observed through the emergence of resistance. Until the 1970s, many new antibiotics have been evolved to which most, not unusual pathogens have been initially fully susceptible.

Unfortunately, their introduction in clinical exercise has been accompanied by the speedy look of resistant strains in maximum components of the world. Since the 1980s, only a few new lessons of antibiotics have been correctly added onto the market and most of them target Gram-tremendous bacteria.

It has been a major venture to locate new antibiotics energetic towards resistant M. Tuberculosis strains and Gram-negative bacteria, which have been diagnosed as priorities for studies and development on new antibiotics by means of WHO. This complicated image of an nearly empty antibiotic research and development pipeline, the diminishing effectiveness of existing antibiotics, the big misuse of these antibiotics, and insufficient get admission to adequate drugs in lots of resource-confined settings shows that even as new remedies for infections want to be advanced to counteract emerging AMR, antibiotics need to also be used appropriately, made available to the ones who want them, and meet international standards of quality.

The time period consumption refers to estimates of aggregated records, specifically derived from import, sales or compensation databases. Aggregated facts on antimicrobial consumption, often amassed for administrative purposes, are usually effortlessly accessible and can serve as a proxy for actual use of antibiotics, for which information series is often greater laborious. The time period antibiotic use refers to records on antibiotics taken with the aid of the character patients. Data are amassed at the patient level, which lets in an extra complete set of facts to be gathered, such as facts on indication, remedy schemes and patient characteristics. In general, the collection of statistics on antibiotic use requires greater resources however gives additional statistics on prescribing practices, which is important for guiding antimicrobial stewardship activities. Data on intake and use every serve specific functions and supplement rather than replace every other.

Antimicrobials monitored

The WHO global program on surveillance of antimicrobial consumption monitors antimicrobials for systemic use and includes a middle set of antimicrobial training to be monitored in all countrywide surveillance program. Additional records describing the broader socioeconomic and health context in the regions which are of relevance to interpretation of antimicrobial consumption data has also been included.

In addition, information on the popularity of implementation of countrywide action plans on AMR and the development of surveillance efforts on AMR and antibiotic consumption in each vicinity are reported. Results from this report showed extensive intra and interregional variation in the amount and styles of antibiotics consumed. This version probably reflects real variations in antibiotic consumption, but may additionally be partially attributed to variations in facts coverage.

The WHO technique on antimicrobial consumption monitoring allows for records to be gathered on an aggregated stage and does now not rely on the provisions of person-degree records.

There is likewise flexibility within the choice of facts sources, starting from import- and production statistics to prescription information, enabling countries with limited sources to apply pre-existing data assets to build sustainable programs for surveillance of antimicrobial consumption. However, the choice of facts assets has implications for the translation of results, as different data sources have inherent benefits and limitations. Depending at the source(s) selected, statistics insurance or population coverage may additionally be incomplete in some countries, thus not showing the full photo of antibiotic consumption. It is crucial to take into consideration when deciphering the results, and consequently, it is satisfactory to refrain from cross-nearby and cross U.S.A. comparisons.

More importantly, the information on antibiotic intake must be interpreted inside the context of the specific countries, considering other aspects such as the weight of infectious diseases, national or local remedy recommendations and broader health structures issues.

DRUGS FOR MULTI DRUG RESISTANT BACTERIA

COLISTIN

Colistin may be a cationic antimicrobial peptide which is found in 2 forms:
1) Colistin sulphate

2) Sodium colistin Methane Sulphonate (CMS)

CMS is usually used one because it's less toxic than others. It had been recently reported that CMS was an inactive prodrug of Colistin which is more efficient. Colistin shows potent

bacterial killing effect in comparison with others. The concentration below the MIC breakpoint of 2mg/L within the first few doses found to possess effectively delaying appropriate therapy.

FUSIDIC ACID

This is more commonly used for uncomplicated skin and skin structure infections mostly in Europe and Australia since 1960s. The most commonly using drug dosage regimen was 500mg 12 or 8 hourly. It's now currently undergoing redevelopment in US regarding the activity against Methicillin Resistant Staphylococcus aureus. There's a decrease in clearance with increasing dose and with multiple doses compared to single doses just in case of Fusidic acid. Administration of Fusidic acid delays the absorption and bioavailability of medicine. It's non renally eliminated and located to be highly protien bound. The time required to succeed in steady state at a dose above 500mg 12 hourly was found to be approximately 3 weeks. It had been found that monotherapy of Fusidic acid produce resistance in S.aureus thanks to mutation in FusA gene and plasmid resistance. The mixture of Fusidic acid with Colistin was found to be simpler.

FOSFOMYCIN

It is a broad-spectrum bactericidal antibiotic which has been used quite 40 yrs. It mainly acts by inhibiting an early step in bacterial cell membrane synthesis and makes cross resistance. It allows the drug to retain invitro activity against many pathogens like Multidrug Resistant Strains (MDR) including Gram positive and Gram Negative.

It is a standard drug of choice for UTI. Fosfomycin - Tromethamin is sooner absorbing drug formulation which reach a serum concentration of 22-32mg/L following the quality 3g single dose. a variety about 1053-4415 mg/L, a really high concentration attained in urine after 3 hours and remains elevated for several days. Glomerular filtration is found to be the main route of elimination. For systemic infections Fosfomycin is typically given via IV.

STRATEGIES TO TACKLE MDR BACTERIA

Nanomaterials against bacteria

NPs offer an encouraging solution as they will not only fight bacteria themselves but also can act as carriers for antibiotics and natural antimicrobial compounds. Nanomaterials have a

minimum of one dimension within the nanometer scale range (1–100 nm) that convey particular physical and chemical properties considerably different from those of bulk materials. NPs have variety of features, which make them favourable as vectors for drugs to combat disease-causing pathogens. Amplification of drug solubility and stability; their simple synthesis; their biocompatibility with target agents; and their modulated release, which may be controlled by stimuli, like light, pH and warmth. Their capability in drug delivery is achieved by their ultra-small size and vast surface to volume ratios. This is often a key competitive advantage over conventional therapies within the treatment of infections caused by intracellular pathogens and MDR strains. AgNPs are considered the foremost effective nanomaterial against bacteria.

Antibacterial mechanism of NPs

NPs antibacterial activity depends on their intactness with electrostatic attraction, van der walls forces or hydrophobic interactions; on the nanoparticle size and stability; alongside the drug concentration. The interaction of NPs with bacteria generally triggers oxidative stress mechanisms, enzymatic inhibition, protein deactivation and changes in organic phenomenon. Still, the foremost common antibacterial mechanisms are associated with oxidative stress, metal ion release, and non-oxidative mechanisms.

Given their vast therapeutic potential, it's becoming increasingly important to know the mechanisms by which NPs complexes can impact bacterial viability. While one among the beneficial aspects of NPs drug carriers involve “macrotargeting,” i.e., specific delivery to the location of infection, understanding the “micro-targeting” of bacterial mechanisms is imperative for the widespread future use of those vectors. Their impact of cell functions like cell membrane permeability efflux activity, formation of reactive species, and inhibition of essential cellular metabolism and reproduction is of utmost importance.

CALL FOR ACTION ON SUPERBUGS

The global threat of AMR involves collaborative action for developing effective strategies in combating AMR. CDC recommends several steps to stop antimicrobial resistance during a healthcare setting.

1. International Measures

For combating antimicrobial resistance WHO came up with a strategy in 2011 which had been one among the main attempts to draw international attention and wish of combined efforts to alleviate the matter of AMR. a number of the WHO recommended approaches are listed below:

* Increased collaboration between governments, nongovernmental organizations, professional groups and international agencies

* New strategies for the surveillance of antimicrobial use and AMR

* Counterfeit antimicrobials combated by International approach

* Incentives for the research and development of latest drugs and vaccines

* New and strengthening existing programs to contain AMR.

2. National Strategies

2.1 National committee with intersectoral coordination and regulatory actions Establishment of national committee to watch impact of antibiotic resistance and supply intersectoral coordination is required. WHO recommends providing guidance on standards, regulations, training and awareness on antibiotic use and AMR. Developing indicators to watch and evaluate the impact of AMR prevention and control strategies would be amongst priority objectives at national level. Further WHO advises that having a registration scheme for all dispensing outlets, making prescription-only availability of antimicrobials, legal binding on all manufacturers to report data on antimicrobial distribution and payment for rational use of antimicrobials can help contain AMR.

2.2 National Antimicrobial Resistance Policy, India

In 2011, a national policy for containment of AMR was introduced. The policy was set as a plan to know emergence, spread and factors influencing AMR, to setup antimicrobial program, to rationalize the utilization of antimicrobials and to encourage the innovation of newer effective antimicrobials. Additionally, some major action points identified in national policy were; establishing AMR closed-circuit television, strengthening infection prevention

and control measures and educate, train and motivate all stakeholders in rational use of antimicrobials.

3. Action at Community Level

Globally, infectious diseases still be significant explanation for morbidity and mortality, affecting more the countries where health services aren't sufficiently accessible. Kardas et al., during a review of antibiotic misuse within the community reported that at community level, quite one third of patients were non-compliant to the antibiotic regimen and one quarter kept the unused antibiotics to be used in future. This means a poor antibiotic-taking behavior. Review on population perspective of AMR by Lipsitch et al., suggests that prevention of AMR in a private affected by infection is one among the essential methods to stop further spread of resistance to the broader community. The increasing rate of resistance among community acquired infections like upper and lower tract infections, bacterial diarrhea, typhoid isn't matched by development of newer antibiotics. Thus, there's urgent need for reforms at community level for curtailing AMR. Different measures directed to regulate and stop AMR at community levels are the necessity of an hour.

4. At Hospital or health care setting

A person or a patient during a health care facility is at higher risk of infection with common pathogens. For control and containment of AMR, experts recommend a number of measures as discussed herein.

4.1 Infection prevention and control within health-care facilities.

Infection prevention and control measures are designed to scale back the spread of pathogens including resistant ones within healthcare facilities and to the broader community. This will prevent further infections and AMR spread. Recommended measures to stop and control infection during a health-care facility: -

* Implementing an infection prevention and control committee (IPC).

* Good hand hygiene practices.

* Effective diagnosis and treatment of infection.

* Rational antimicrobial use.

* Monitoring of antibiotic resistance and antibiotic use.

* Improving the antimicrobial quality and provide chain.

* Good Microbiology Practices

ANTIMICROBIAL STEWARDSHIP

In 2001, WHO began to require measures to combat the spread of AMR and strongly recommended governments to implement antimicrobial stewardship (AMS). Studies have reported that AMS had beneficial effects on managing antibiotic-resistant pathogens, rational use of antibiotics and economical purchase, highlighting the importance of AMS. The term antimicrobial stewardships programs point out many strategical methods which may be: antibiotic usage, antibiotic management programs, antibiotic management programs, and other terms could also be used more or less interchangeably. These terms generally point to an extensive program to vary and direct antimicrobial use at a health care institution, which can employ variety of individual strategies.

The goal of antimicrobial stewardship is 3-fold. The foremost goal is to figure with health care practitioners to assist each patient receive the foremost appropriate antimicrobial with the right dose and duration. The optimal care of infected patient means treating with the right, properly dosed antibiotic and one that has the smallest amount likelihood of causing fatal accident (i.e., resulting in resistance within the patient or his or her contacts). Another advantage of programs that aim to optimize antibiotic use is that they typically experience cost savings because fewer doses of antibiotic are used and fewer expensive antibiotics are chosen.

CONCLUSION

Antimicrobial resistance being a global burden is on the rise and is associated with increased morbidity and mortality in clinical and community setting. Understanding the optimal use, the antimicrobial resistance leading to the rise of Superbugs can be prevented. A multidisciplinary approach is to be taken in order to fight these superbugs. Strategical approaches and guidelines along with global surveillance system is mandatory.

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