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Review Article

Antibiogram and Antimicrobial Stewardship Program: Fighting Global Antimicrobial Resistance and Rationalizing the Antibiotic Treatment

Manoj S. Dikkatwar[1], Jitendra Vaghasiya[2,*]

[1]Department of Pharmacy Practice, Parul Institute of Pharmacy, Faculty of Pharmacy, Parul University, Vadodara, Gujarat, INDIA.
[2]Department of Pharmacology, Parul Institute of Pharmacy, Parul University, Vadodara, Gujarat, INDIA.

ABSTRACT

Global public health is threatened by the emergence of antimicrobial resistance. There is an increased risk of illness, complication, increased hospital stays and death as well as an increase in the amount of money spent on medical treatment. This has a significant impact on the clinical aspects of infections with the emergence of multidrug-resistant bacteria. The main aim of this review is to highlight the use of antibiogram in hospital and impact of antimicrobial stewardship program in fighting antimicrobial resistance. In addition, the study also focuses on the need of antibiogram and its development by creating the roadmap for antimicrobial susceptibility testing systems. The study also highlights policy documents on antimicrobial stewardship practices in India as well as at global level. In addition to this, the also highlights the process of antibiogram development and the need for an antibiogram in the current situation. Lastly, the study points out the role of hospital antibiogram in reducing antibiotic resistance.

Keywords: Antibiotics, Antimicrobial resistance, Antimicrobial stewardship program, Multidrug-resistant, One Health, Global health.

Correspondence:
Dr. Jitendra Vaghasiya
Associate Professor, Department of Pharmacology, Parul Institute of Pharmacy, Faculty of Pharmacy, Parul University, Vadodara, Gujarat, INDIA.
Email id: j_vaghasiya@yahoo.com

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INTRODUCTION

For institutions, an antibiogram is a vital tool for monitoring antimicrobial resistance and guiding the use of empirical antimicrobials. In this viewpoint, facts and examples from the literature are provided to show that institutions have not fully implemented the standardized methodology in creating antibiograms, notwithstanding CLSI's consensus standards. As a result, we stress the need of adhering to the M39 criteria when creating antibiograms. We also stress how important it is to understand the limits of antibiogram data to make appropriate interpretations and applications in clinical decision-making processes. The establishment of a shortened antibiogram for frontline users is also recommended, as is making antibiograms more readily available to prescribers so they may choose the best empirical treatment regimens. Antimicrobial stewardship programs involving several disciplines are essential if these objectives are to be met.[1,2]

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IMPORTANCE OF ANTIBIOGRAM DEVELOPMENT IN CURRENT SITUATIONS

An antibiogram is a useful tool for clinicians and pharmacists to use whilst awaiting findings from microbiology and susceptibility testing. Antimicrobial resistance trends may also be tracked using these technologies. Trends in antibiotic susceptibility testing data may be discovered and explored if they are summarised for a hospital or healthcare system regularly (e.g., annually, or quarterly). Antibiotic stewardship and the discovery of novel antibiotics are essential components of society's strategy to tackle resistance. Antibiotic resistance and the breakdown of the research-and-development pipeline continue to deteriorate, despite our efforts on all these fronts, according to the World Economic Forum (WEF). We must come up with fresh concepts that complement our current countermeasures if we are to achieve long-term results.

Old facts are frequently the foundation of new concepts. Antibiotics were "created" by prokaryotes (bacteria) billions of years ago, and resistance is essentially a product of bacterial adaptation to aeons of exposure. Exactly what are the most important ramifications of this situation? First, the usage of antibiotics promotes the evolution of naturally resistant bacterial populations in addition to their therapeutic effects. Second, the selection for resistance is not limited to "inappropriate" antibiotic usage. Instead, microbial exposure to all antibiotics, whether

treated effectively or not, drives the rate at which resistance spreads. That is why antibiotic-resistant diseases might still emerge even if improper drug usage was completely eradicated (albeit at a lower frequency). An Antimicrobial stewardship (AMS) program may only be launched if the practice is fully dedicated to the purpose. As part of this, management must commit resources (people, time, and money). All employees will get training and direction from the program's development and implementation team. Identifying co-champions to lead the team is a solid practice in building an AMS program.

Find out what you're dealing with first! Identify the bacterial species present and rule out non-bacterial pathogens by performing the relevant tests. As part of an AMS program, clinicians are taught how to appropriately analyse C&S data and determine whether they match the clinical presentation. As part of determining the objectives of your AMS program, you need to keep an eye on antibiotic usage, the incidence of antibiotic-resistant diseases, and infection-control methods. Antibiograms may be created by working with your reference laboratory to understand how to appropriately interpret this data. Be sure to keep an eye on your progress and adjust as necessary.

ANTIBIOTICS - IS THERE A NEED FOR ANTIBIOGRAM?

Antimicrobial resistance has become a serious public health issue due to its fast rise in prevalence in recent years. Antibiotic resistance has led to a rise in both morbidity and death because of inadequate treatment of illnesses. As a worldwide problem, antibiotic resistance can only be addressed locally. To put it another way, a Clinical and Laboratory Standards Institute (CLSI) antibiogram is a summary of an organism's antibiotic sensitivity to a variety of antimicrobial drugs. "Antibiogram charts" are issued by most hospitals once a year to summarise the most notable antibiotic resistance patterns of the year . There has been an alarming rise in antibiotic-resistant, Methicillin-resistant Staph aureus, and other resistant bacteria in several Hospitals, according to anti-microbiological statistics. Using an antibiogram to pick an empiric antibiotic for a particular bacterium might be helpful. It is important for epidemiologists and healthcare practitioners to track trends, set recommendations for optimum empiric treatment, and assess educational activities advocating judicious antibiotic use since antimicrobial resistance is not consistent.[6,7]

An infection may be successfully cured, but it can also offer physicians and health care providers confidence in their therapeutic prescription and capacity to treat. It is possible to misunderstand data and provide empiric antimicrobial treatment incorrectly if there is no uniformity in antibiogram creation. Many hospitals have guidelines on how to conduct antimicrobial susceptibility testing and how to report the results in an antibiogram. Antibiograms, when properly generated, are critical for antimicrobial resistance monitoring and management. As a result of this alarming reality, the antibiotic policy has been framed and infection control in hospitals has been improved. Using an existing hospital antibiogram to estimate the percentage of specific, drug-resistant bacteria across multiple sites in a medical college with a super specialty hospital in a developing country, this collaborative study aims to find solutions to emerging problems and their implications for other places that might be relevant. Antibiograms are regularly generated in most hospitals and labs, therefore getting them is not difficult. Using an antibiogram to conduct drug-resistant surveillance may be an appropriate method, demonstrating the comparability of aggregated antibiograms and providing site-specific point estimates of antibiotic resistance like the studies of antimicrobial susceptibility testing conducted in various sites to detect resistance trends over time.[7-11]

In terms of antimicrobial resistance, Antibiogram may be able to keep up with the times. People are unable to document the antibiogram's capacity to identify trends currently. As a result of these limitations, it is not possible to assess the level of medication resistance. There are just a few medications that can be tested for susceptibility because of laboratory variances in the antibiotics used. Consequently, hospital labs may be encouraged to standardize their susceptibility panels to pool their findings. Additional antibiotic plate cultures for broad antimicrobial susceptibility testing should be carefully considered by experts from the fields of microbiology and pharmacy.[9,12,13]

Hospital-acquired infections may benefit from aggregating antibiograms. Communication between hospitals and clinics must be improved when it comes to the evaluation of antibiograms. Always up-to-date and accessible Resistance patterns and infections may be reduced by educating and enlightening treating physicians via medical education. Doctors and researchers are finally realizing the significance of avoiding antibiotic-resistant illnesses by using medications properly. Antimicrobial susceptibility testing should be standardized by microbiologists and pharmacists in hospital labs so that clinicians have an easier time selecting the optimal medications and preventing antibiotic resistance from being abused and overused. For successful antimicrobial resistance prevention, People must educate themselves on the usage of antibiotics in both hospitals and the community. The incidence of nosocomial infections may be reduced by increasing the monitoring, surveillance, and education of hospital infection control concepts and procedures. The time has come for us to learn. "The war must begin now."

ANTIBIOTIC RESISTANCE-THE NEED FOR GLOBAL SOLUTIONS

Human and veterinary medicine are feeling the full brunt of AMR's worldwide toll. AMR, like global warming, is an unstoppable ecological catastrophe from which there seems to be no escape. Scientists and physicians were not aware of AMR until the first decade of the twenty-first century, even though resistant bacteria had been discovered long before the discovery of penicillin. As a result, the World Health Organization (WHO) declared and promoted AMR as a worldwide health issue. For example, a book titled "The increasing challenge of antimicrobial resistance - alternatives for action" is a great contribution to the collection in terms of global health issues.[11-14] Few nations throughout the world have claimed complete eradication of MRSA and other resistant infections, however, the causes for this drop in resistance are debated. Several other reasons may have contributed to the US's apparent MRSA containment success, including the broad national drop in the prevalence of MRSA, which may have been overlooked. At the national level in Europe, the same acts are rather common as well. Because people have yet to identify the primary treatments required to reduce AMR, the scientific community should value these points. AMR's elimination may be impossible, but its spread may be slowed. Several international organizations, including the WHO's Global Antimicrobial Resistance Surveillance System, the FAO, the CDC, and the Office International des Epizooties, should cooperate to combat antibiotic resistance. The Worldwide Health Security Agenda and the Antimicrobial Resistance Action Package (ARAP) are two more projects aimed at addressing the global problem of antibiotic resistance.[11,15,16]

Small, 2018 analysed the present outbreak was generated by a misunderstanding about the magnitude and threat of AMR. In addition, research revealing the financial impact of AMR prompted the think tanks to take the matter more seriously. Controlling AMR has been a success for countries that devised inclusive national policies. The "One Health Approach" may be used to monitor antibiotic usage, as well as the establishment of health care systems, health insurance policies, limited drug promotion, and disease control methods in the community. These tactics, on the other hand, need patience and organization. In addition, they demand the full support of the government, as well as a large amount of money. AMR development is slow in underdeveloped nations, although certain Asian governments, such as India, have taken daring moves in recent times, such as the Chennai Declaration, to combat AMR, for example. Antibiotic resistance (AMR) may be caused by diagnostics that encourage doctors to prescribe unnecessary antibiotics. Diagnostics is a major problem in underdeveloped nations, as traditional microbiological instruments are still used to diagnose germs. By using innovative and efficient molecular diagnostic methods to assist identify patients who genuinely need antibiotic medication, people can close these gaps in customized medicine. Using a One Health Approach to examine the human-animal interaction and lead researchers in the development of innovative screening tools might be very beneficial. Because AMR has been shown to spread across humans, animals, and the environment, this is a very important issue that must be tackled head-on.[17-21]

Alternate treatments for infectious disorders might potentially be a viable way to counteract AMR. Medicines for bacterial infections include anti-virulence methods, biological therapies (such as monoclonal antibodies), vaccinations, and immunotherapy (vaccines against MRSA, MDR *M. tuberculosis*). There is a significant belief that herbal medications might be a viable alternative to conventional treatments. People need to learn more about how widespread the AMR problem is. AMR control relies on comprehensive and unremitting data collecting. Anxiety about this topic stems from a lack of knowledge. At this point, it's impossible to know what the future holds, but the lack of new medicines makes battling AMR all but impossible. This problem requires a multifaceted approach. Medical students, doctors, and pharmacists must be constantly re-educated. Antibiotic usage should be strictly monitored under regulations, as part of a comprehensive approach. The development of novel screening and diagnostic technologies requires a worldwide and multidisciplinary approach. Control policies should include all aspects of "one health," including ecological and environmental considerations.

Alternative approaches, particularly in underdeveloped nations, may be very effective. A growing amount of attention is being paid to antimicrobial resistance (AMR) all around the world. The attention paid to AMR isn't enough, but a worldwide code of behaviour including all of the methods for combating AMR might eradicate the disease in the future.[2,15] By minimizing the need for antibiotics, new technologies like lytic bacteriophages and probiotics may help minimize AMR's global toll on the environment. Antibiotic use, infection management, immunization, healthy food supply practices, and control of person-to-person transmission via screening, treatment, awareness, and education may be utilized to reduce the spread and spreading of AMR. Antimicrobial resistance (AMR) and multidrug-resistant diseases (MDR) monitoring, bio-surveillance, response, and preventive measures might assist to regulate the "global resistance".

DEVELOPMENTAL ROADMAP FOR ANTIMICROBIAL SUSCEPTIBILITY TESTING SYSTEMS

At least 25,000 individuals are killed each year by drug-resistant bacteria in the European Union alone due to antimicrobial resistance (AMR). The use of antibiotics that are resistant to antibiotics, especially if the empirical prescription of antibiotics is necessary, is no longer useful in treating infections. 30–50

percent of all antimicrobials prescribed to human patients are unnecessary, according to the European Centre for Disease Prevention and Control. Over prescription of antimicrobials increases the development and spread of resistance. It is the goal of antimicrobial susceptibility testing, or AST, to monitor the selection and growth of resistant bacteria in ill patients to ensure that the proper treatments are supplied. Current data on local resistance trends may be utilized to acquire information on antimicrobial susceptibility patterns in the area to make educated treatment choices for a certain patient (also known as the local or institutional antibiogram). With the use of AST, it is possible to identify bacteria with known resistance mechanisms, such as those that produce extended-spectrum -lactamases and carbapenems, MRSA, and vancomycin-resistant enterococci. As a result, epidemiological studies looking at the emergence and transmission of resistance, as well as research examining the efficacy of countermeasures, rely on AST as a critical tool.

Clinical microbiology labs now conduct AST following culturing and species-level identification of a bacterial infectious agent. To perform an AST, bacteria must be allowed to grow in the lack and presence of antibiotics, which adds additional time to the process. The availability of qualified laboratory scientists who are adept in the use of AST may vary from shift to shift. Sometimes, data are not accessible until a full test run or final data set validation has been completed. To achieve accurate testing, the clinical laboratory must enhance its laboratory protocols and personnel hours. Additionally, turnaround times for modern ASTs are typically between 12 and 48 hr. To support antimicrobial stewardship programs, quick testing, which is defined as being possible during an 8-hr working shift, is essential. Clinical diagnostic microbiology laboratories may benefit from AST platforms, but their primary drawback is the lengthy time to result (TTR) and the absence of complete automation, which may lead to inaccurate antibiotic prescriptions. Basic microbiological knowledge of existing antibiotic resistance mechanisms, the discovery of novel mechanisms, epidemiological issues as well as variance in the growth-associated lag time and variability of resistance may all present significant challenges when utilizing AST.

Rapid AST platform advancements have slowed significantly during the last decade. This may be due to inaccuracies in sensitivity and specificity, expensive purchasing and testing expenses, and a lack of timely results reporting for the care-giving doctors. Apart from these issues, new AST platforms may be delayed by factors like the number of antibiotic targets to include post-development validation in the laboratory and clinical settings, geographical and institutional differences in optimal antibiotic target menus, IP/legal aspects, cost-effectiveness, and acceptability. It's very uncommon for doctors to be concerned about "false antibiotic susceptibility" and "false resistance." EUCAST and the Clinical and Laboratory Standards Institute (CLSI) are continually keeping an eye out for these kinds of concerns. Food safety authorities in Europe are also aiming to standardize all advances in the field of rapid AST, which is backed by EU policymakers. The European Medicines Agency and the European Centre for Disease Control and Prevention (ECDC). When used in conjunction with other infection control methods, such as an antibiotic prescription for specific bacteria such as those that cause bacterial infections, AST aids in combating and preventing the spread of antimicrobial resistance. In the meanwhile, clinicians and healthcare authorities aren't always aware of the urgent need for better and quicker AST diagnosis. In the case of an infectious illness pandemic, it seems sensible to investigate the best AST approaches. Yet, even the most up-to-date studies tend to miss the significance of AST in limiting and avoiding epidemics. Public, academic, patient organizations, governmental leaders, and industry will benefit from increased communication about the importance of AST.

POLICY DOCUMENT ON ANTIMICROBIAL STEWARDSHIP PRACTICES IN INDIA

The phrase "antimicrobial drug, dosage, duration of treatment, and route of administration with least toxicity" is referred to as AMSP. To make the most of the benefits offered by antimicrobial agents, several strategies colloquially referred to as "all-encompassing approaches" have been developed (AMAs). The AMSP makes use of a wide variety of initiatives, including the creation of stewardship task capacity, amongst others. Establishing laws and regulations, putting in place processes, educating medical workers, and providing beneficial therapies that are specially customized to the local context are all other choices. Nevertheless, the programs that are sometimes the most successful are the ones that blend the two strategies into a single operational approach. Both important supplementary approaches might be regarded as potential components of the primary approaches. The front-end or pre-prescription strategy of antibiotic stewardship requires prior consent before the use of limited specific antibiotics. This technique makes use of restricted prescriptive authority. There is an exemption to this rule for doctors and other medical professionals who have completed specialized training in the treatment and administration of antibiotics like these. Both pre-and post-assessment, as well as feedback, are included in the stewardship technique which is also referred to as the back-end method or the post-prescription plan. After conducting analysis and soliciting feedback from physicians, the AMSP team has proposed to those physicians that they modify the method in which they use certain antibiotics or completely discontinue their usage of antibiotics. The findings of the research as well as the perspectives of the participants informed this proposition.

Consultations with clinical microbiologists on regional resistance patterns (hospital antibiograms) should be used to select the

best treatment options. These treatments should use the fewest formulary drugs possible, exhibit the fewest adverse effects possible, and maintain the optimal dose and treatment duration. It is important to take these steps to provide patients with the best care that is currently available. Without the participation of infectious disease (ID) specialists, clinical pharmacists, and nurses who have undergone specialized training in infection control procedures and protocols, AMSP programs will not be able to function as effectively as they should. Because the AMSP is an intervention that requires a significant number of resources, it is necessary to provide administrative support in the form of sufficient personnel, financial resources, and information technology infrastructure. Because of this, the AMSP is seen as an intervention that requires a significant number of resources. As a direct consequence of this fact, the deployment of AMSP in healthcare facilities is financially self-sufficient opinion that an investigation on the AMSP's components, implementation, and outcomes was carried out in 2013 by the Indian Council of Medical Research (ICMR) at 20 tertiary health care institutions located in India.[8] The capabilities of AMSP in Indian Healthcare Institutions (HCIs) are either very restricted or non-existent. More than seventy-five percent of healthcare organizations are compliant with HIC criteria, however, only sixty-five percent of healthcare organizations are compliant with AMA prescription guidelines. In addition, only thirty percent of health care organizations (HCIs) presently have active AMSP implementation strategies in place. Because the commercial HCIs followed the accreditation method in their assessment process, they fared better in the AMSP than the government HCIs did. According to the findings of the research, clinical pharmacists and ID experts are not generally available at institutions. This demonstrates that there is an immediate need to give AMSP implementation in India a higher priority, as well as that there is a hole in AMSP. In addition, AMSP implementation must be given the highest priority.[22-27]

The antimicrobial resistance (AMR) prevention strategy was given a high priority in India's National Health Policy 2017, which was released in March 2017 by the Ministry of Health and Family Welfare, an institution under the administration of the Indian government. In April of 2017, Indian authorities gave a response to the demand made by the 71st United Nations General Assembly for a national action plan on antimicrobial resistance (2017-2021). The demand was made in response to the threat that antimicrobial resistance posed at the meeting of global leaders. The office of the World Health Organization in India assisted in the introduction of the National Action Plan on Antimicrobial Resistance (2017-2021), which was directed by the Ministry of Health and Family Welfare at the time. Specifically, it outlined the responsibilities of the three organizations, which included a core AMR working group, an intersectoral coordination committee, and a technical advisory group.

In healthcare settings, a team dedicated to antimicrobial stewardship should be established. Although it is not required, ideally, this team would include a physician or surgeon specializing in ID, a pharmacist, a clinical microbiologist, and someone with training in infection control. However, this is not required. Because of this, these obligations do not necessarily conflict with one another. This group will oversee putting the AMS ideas into action and keeping track of their progress. This panel will receive reports from the pharmaceutical committee, the infection control committee, and the governance committee. Additionally, they will be responsible for supervising the activities and operations of the hospital pharmacy. As a committee, they have the responsibility of ensuring that a separate budget is developed for the operations of the hospital. Investing in technology and information systems, such as tools for monitoring, reporting, and auditing is an absolute need if one wants to maintain track of developments and come up with innovative ideas. It is necessary to provide a comprehensive outline of the goals and objectives.

Antibiograms should be prepared periodically in hospitals, and recommendations for the use of antibiotics should be based on the antibiograms of the hospitals themselves. It is important to have a conversation about alternative treatment techniques as well as factors to consider for the location of the condition (such as skin or soft tissue infections, intra-abdominal infections such as urosepsis or pneumonia, head-and-neck infections, and joint and bone infections). Instructions and mathematical expressions: Medication that does not need a prescription should only be marketed if it has been given the green light to be prescribed and supplied. Guidelines for the treatment and prevention of antibiotic resistance should be available to medical professionals. Certain drugs, both prescription and over the counter, should be required to go through additional regulatory processes before they may be distributed or prescribed. At least once per year, hospital employees and prescribers are required to get training on AMSP and "Therapeutic guidelines for antimicrobial use" and receive certification in either topic. Monitoring for and reporting any cases of inappropriate or excessive use of antibiotics It is of the utmost importance to get knowledge on the most recent facts regarding the use of antibiotics and prescription drugs in the community. The use of antibiotics and other types of prescription medication needs to be monitored via the use of electronic patient records. It is crucial to monitor the cost of antibiotics over an extended period.

ANTIBIOGRAM DEVELOPMENT, NEED FOR ANTIBIOGRAM IN THE CURRENT SITUATION

A cumulative antibiogram is a periodic profile of the antimicrobial susceptibilities of many organisms that have been researched and isolated from patients. This profile is kept at an institution. Alternatively, a "cumulative antibiogram" might be constructed to track patterns of resistance throughout a larger geographic

area by using data from many institutions. This would be done in place of the traditional approach. It is often used to keep track of current trends in antimicrobial sensitivity, which serves the purpose of assisting in the selection of empirical antimicrobial treatment. The organism names, the number of isolates tested, the antimicrobial agents used to test them, and the percentage of each organism that was interpreted as being susceptible to listed antimicrobial agents based on the CLSI recommended breakpoints are among the most important components of the cumulative antibiogram. This is because the cumulative antibiogram is used to determine which antimicrobial agents are effective against which organisms. Institutions have made widespread use of antibiograms throughout the last several decades; despite this, there are a variety of development approaches for cumulative antibiograms. Antibiograms are a kind of genetic information that is used to identify bacteria. There is also the possibility that the methods of computation that were used to ascertain the susceptibility rates had errors. Estimations of susceptibility have the potential to be impacted if there are any delays in the implementation of the most recent CLSI breakpoints, as well as the application of FDA or EUCAST breaks. It has been shown that increasing the frequency of CLSI updates to lower breakpoints would increase the prevalence of resistance in some species. All of the labs had difficulties when the new breakpoints were introduced, particularly since not all automated susceptibility testing systems received FDA approval for the updated breakpoints that are presently in effect.

The need that labs to carry out validation studies is another issue that contributes to the complexity of the situation. There is a possibility that antibiotic susceptibility percentages will be overestimated if delays are made in upgrading to the most current CLSI breakpoint guidelines. The CLSI consensus standards were developed as a direct result of the disparities that were found during the procedure of developing cumulative antibiograms. Since then, an antibiogram guideline that is accurate, trustworthy, and statistically valid has been constructed expressly for the requirements of institutional laboratories. This development was recorded in the M39 guideline article that was published in 2006. Even though M39 is very pertinent currently of antibiotic resistance, institutions are not required to apply it. The M39 guideline offers detailed instructions as well as sample documents that illustrate the prerequisites for the gathering, storing, analysing, and presenting of data. The CLSI completed a revision of the M39 standard in 2014. This update provides updated instructions on how to generate and understand antibiogram reports, as well as how to comply with the clinical laboratory's guidelines for the handling of susceptibility data. To maximize the value of the antibiogram, CLSI has offered the idea of stratifying susceptibility data according to body location (for example, urine and non-urine isolates), hospital unit (for example, ICU, ED), and/or patient demographics. The antibiogram has been augmented to incorporate information on the costs of medications, recommended dosages, and several other elements of drug use. Because of this, the antibiogram of each institution may be altered to conform to the specific necessities of that facility.

A decade after the first release of M39, there is a significant amount of variety in the ways that cumulative AST data are analysed and presented from one institution to the next. Studies conducted on a nationwide scale indicate that the M39 suggestions have acceptance rates that vary from 47 percent to 61 percent. The National Committee for Clinical Laboratory Standards (also formerly known as CLSI) published a standard in 2002 about acute care hospitals. According to this standard, forty percent of acute care hospitals are teaching hospitals, and most of these hospitals have more than two hundred beds. According to Ernst and his colleagues12, these institutions considered the proposal and implemented it.

These criteria called for antibiograms to be sent to specialists in infection control and medical care on an annual basis, and the compliance rate for these antibiograms was only around 60 percent. According to a study that was carried out in 2006, the process of creating and reporting institutional antibiograms was quite diverse across the United States. Larger universities and hospitals produced antibiograms that were significantly more complex and advanced than those produced by smaller institutions. The purpose of this study is to investigate the creation, reporting, and use of antibiograms in 47 different hospitals. Even though 98 percent of labs produce yearly antibiograms, only 47 percent of laboratories claimed that they have completely implemented all the CLSI requirements. According to the findings of the research, only 64 percent of the labs that were examined corresponded to the M39 requirements, which required at least 30 isolates for each reported species. There was only 26 percent of labs reported fewer than 30 isolates, and only 3 percent of those laboratories provided footnotes that stressed the lower statistical validity of such low isolate numbers. For an antibiogram to be considered statistically reliable, it must include information on more than 30 different species and their susceptibilities. If a smaller sample size is chosen, the 95 percent confidence interval will be bigger. The confidence interval for 95 percent, which ranges from 0.623 to 0.909, for an 80 percent susceptibility rate is between 0.479 and 0.954 for a sample size of 30, whereas it is between 0.479 and 0.954 for a sample size of 10.

ROLE OF HOSPITAL ANTIBIOGRAM IN REDUCING ANTIBIOTIC RESISTANCE

Since quite some time ago, hospital pharmacists have known inappropriate use of antibiotics seems to be associated with reduced bacterial susceptibility, as shown by antibiograms, and the development of nosocomial infections caused by pathogens resistant to antibiotics. Since quite some time ago, this has been confirmed beyond a reasonable doubt. Both clinical practitioners

and academic researchers have, in recent years, placed a greater emphasis on antibiotic resistance and the factors that contribute to its development, as well as the strategies that have proven to be the most successful when it comes to either managing it or preventing it. Antibiotic resistance is becoming more prevalent, which is hurting public health. A Joint Committee on Antibiotic Resistance in Hospitals was established in 1997 by the Infectious Diseases Society of America and the Society for Health Care Epidemiology of America. This group was charged with examining antibiotic resistance in healthcare institutions and producing suggestions based on its results. Antibiotic resistance in healthcare facilities was the primary focus of this group. According to one proposal, medical institutions should establish interdisciplinary teams to formulate methods for lowering the incidence of antibiotic resistance. The most significant proposals were the enhancement of microbiological and nosocomial infection data monitoring, as well as the creation of instruments to increase the effectiveness of antibiotic use. Population-based monitoring of antibiotic usage overtime was one of the functions associated with the process of optimizing antibiotic use. Detection and management of incorrect antibiotic use as well as resistance are two more aspects of optimizing antibiotic use. Optimal antibiotic use has several features. Researchers concluded that more study was necessary to find the most reliable and effective strategies for antibiotic monitoring and intervention to cut down on antibiotic resistance. [-30]

Investigative research into the World has been hypothesized that more than one technique exists for monitoring the use of antibiotics at the community level; nevertheless, it seems that the approaches taken by various establishments are somewhat unlike one another. The records of antibiotic purchases are likely the method that is the least complicated to utilize when attempting to quantify antibiotic usage. These records may be provided either in terms of the monetary amount or the number of antibiotics that were purchased. This strategy is less straightforward and places a significant emphasis on changes in the purchasing patterns of institutional buyers, prices from manufacturers, and discounts provided by suppliers. Comparisons of the usage of antibiotics are made impossible since there is a lack of standardization in the information associated with procurement. This prohibits comparisons from being made across different institutions. It may be as easy as determining how many grams of antibiotics have been offered or given to calculate the appropriate dosage for medicine that has been consumed. One advantage it has over information about prices is that it makes it simple to compare levels of consumption without considering those prices. On the other hand, it is challenging to make direct comparisons between the use of antibiotics of varying potencies.[29-33]

DISCUSSION

To limit and mitigate AMR, AMS's practices, principles, and actions are crucial. To preserve antimicrobial efficacy and protect public health in mind, these programs are meant to support and enhance the sensible use of antimicrobials. Implementing evidence-based treatments has proved to be extremely effective in encouraging the sensible use of antimicrobials. The WHO Global Action Plan on Antimicrobial Resistance (AMR) includes its principles and essential aspects, which all countries should include in their anti-AMR programs. Taking on AMR will need a multisectoral "One Health" approach. According to the World Health Organization, this is a worldwide problem that must be addressed at the national and global levels. Some of the measures to prevent the AMR are rational prescription of antibiotics based on the C&S reports, educating the patients on the importance and proper uses of antibiotic therapy, avoiding the selling of drugs as over the counter drugs, complying with the local, national and international guidelines on antibiotics, implementing the AMSP in the primary, secondary and tertiary level healthcare institutions, etc. However, the factors are not in the control of the authority. Although there is need of multidisciplinary approach to tackle the antibiotic resistance and to deliver the quality healthcare, pharmacist is often neglected from the team. There are several premier roles played by the pharmacist in ensuring the optimal care and the expert knowledge and skills of the pharmacist can be effectively utilized in the formulation of antibiogram and related policies.[34,35] Thus, the sure need of antibiogram in the healthcare institution is warranted and the same has been discussed in this review study.

CONCLUSION AND RECOMMENDATION

Antimicrobial-resistant bacteria are a growing burden on human health and a significant economic liability because of the harm they represent to public health. The reckless use of antibiotics and the subsequent trajectory of global health catastrophe it has set is generally recognized as a contributing cause to the fast emergence of antimicrobial resistance. Antimicrobial resistance has also been blamed on poor training and education of health care professional students, who have been unable to properly treat illnesses and prevent and control them. Many studies regularly show that students have poor levels of confidence and competence when it comes to prescription antibiotics, despite the necessity and ramifications of this knowledge.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

AMR: Antimicrobial Resistance; **WEF:** World Economic Forum; **ASP:** Antibiotic Stewardship Program; **AMR:** Antimicrobial Stewardship; **AST:** Antibiotic sensitivity testing; **HCI:** Healthcare

Institution; **C/S:** Culture and Sensitivity; **CLSI:** Clinical and Laboratory Standards Institute; **ICMR:** Indian Council of Medical Research

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