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Research Paper

Role of Community Pharmacist in Antimicrobial Stewardship Program

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ABSTRACT
Antibiotic resistance is emerging as a global public health problem and remains a major obstacle in the efficient management of infectious diseases. Stewardship initiatives will help minimize the unnecessary prescribing and wide-spectrum usage of antimicrobials, increase healthcare outcomes for the community as a whole, slow down the production of antimicrobial resistance, and preserve health services. Pharmacists are the perfect personnel to perform the antibiotic stewardship program. This review details about the role of community pharmacist in antibiotic stewardship programs and steps to enhance the stewardship program.

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I. INTRODUCTION

Stewardship, as a general term, is defined as the "careful and conscientious management of something entrusted to one's care." Health care professionals are tasked with using these agents responsibly when applied to antimicrobials, including antibiotics, antivirals, and antifungals, and finding the balance between optimum effectiveness and resistance and toxicity development.[1]

Antibiotic resistance in human pathogens has drawn worldwide interest and the effectiveness of available antibiotics tends to decline.[2] Antimicrobial stewardship strategies used by pharmacists differ according to available tools and standard of service, but can include intravenous to oral conversions of antibiotics, prospective action and feedback audit, pharmacokinetics and pharmacodynamics dose optimization, implementation of quick diagnostic testing, and antibiotic preauthorization.[1]

Pharmacists often work in a number of contexts, from inpatient, outpatient, and long term care environments. When antimicrobials are prescribed in both of these environments, as the drug professional on the patient care staff, pharmacists have the potential to refine these regimens. Under Antimicrobial Stewardship (AMS) systems, pharmacists play an important function, including: designing and managing antimicrobial guidelines; evaluating specific patient regimens to improve therapy; informing healthcare workers on the rational use of antimicrobials; and monitoring and auditing outcomes of antimicrobial usage.[3]

IMPORTANCE OF ANTIBIOTIC STEWARDSHIP PROGRAMS

Antibiotic stewardship is the systemic effort to educate and induce prescribers of antimicrobials to follow evidence based prescribing in order to reduce the misuse and resistance of antibiotics which is a global challenge nowadays. The shortage of new antimicrobial product production places strain on current therapies and highlights the need for preservation and adequate usage. Recommendations were presented at the 2016 United Nations General Assembly High level Meeting on Antimicrobial Resistance (AMR)[4] and the 2016 Final conclusion of the Antimicrobial Resistance Review[5] to resolve AMR and maintain the potency of existing antimicrobials. Owing to the production of tolerance any time they are ingested, antibiotics are vulnerable to a communicable loss of effectiveness. Any lack of effectiveness in a person has detrimental effects for public health and reduces the efficacy of these drugs for all.[6] However, recent statistics show that 30 percent of prescribing is needless and approximately 50 percent of the time is chosen for non-first line agents.[7]

There are numerous factors contributing to the suboptimal prescription of antibiotics, including uncertainty about the presence of infection, delayed test result, time constraints for clinicians, limited potential for patient follow-up, knowledge of current guidelines for treatment, free or discounted antibiotic programs, and fear of retaliation if a treatable infection is missed. These findings point out the need for antibiotic stewardship programs.[8] Estimates suggest that in the US, drug-resistant microbes are responsible for more than 2 million infections and nearly 23,000 annual death.[9] Existing estimates predict that by 2050, the infection mortality rate

associated with antimicrobial resistant organisms would surpass that of cancer.[10] In addition, antimicrobial resistance generates up to $20 billion in excess direct health care costs and up to $35 billion (2008 U.S. dollars) in lost productivity costs annually.[9]

The increase in the occurrence of methicillin resistant Staphylococcus aureus now demands that this pathogen be taken into account when considering an empirical regimen for the treatment of mild to serious purulent skin infections.[11] In a study conducted by Mendes et al on drug resistance expression in Streptococcus pneumonia, a primary pathogen in infections of the respiratory tract, has found to be approximately 40% to macrolides and approximately 10% to ceftriaxone.[12]

Consumption of antibiotics has been described in the outpatient setting as a significant contributor to the increase in S. Pneumoniae tolerance.[13] A large improvement in the resistance rate of E. coli to agents widely used in the treatment of urinary tract infections (UTIs) has recently been identified. Moreover the spread of E. Coli producing CTX-M extended-spectrum beta lactamase has been isolated from outpatients with no typical risk factors, resulting in resistance to all penicillin, cephalosporins and a number of alternative agents that are frequently used to treat outpatient UTIs.[14]

This tells us that antibiotic overuse and misuse, especially for the excessive treatment of asymptomatic bacterinuria, contributes to an increase in E. coli resistance rates. Antibiotic stewardship systems are most important in order to slow the spread of antibiotic resistant bacteria and to mitigate insufficient care for infections caused by antibiotic resistant bacteria. Health recommendations about serious adverse effects of fluoroquinolone antibiotics have recently been revised by the U.S. Food and Drug Administration, recommending that the use of these agents for acute respiratory infections and uncomplicated UTI is reserved for those who do not have alternative treatment options.[15]

Research suggests that antibiotic induced changes to the human microbiome can lead to the development of obesity, asthma, allergies, and autoimmune diabetes.[16] Research also suggests that antibiotic induced changes to the human microbiome can contribute to the development of obesity, asthma, allergies, and autoimmune diabetes.[17] This implies that antibiotic usage may have a significant effect on patient protection across all purposes.

COMMUNITY PHARMACISTS IN ANTIBIOTIC STEWARDSHIP PROGRAMS

AMS's overarching endpoints can be broken into main and secondary targets. Optimization of health outcomes, avoidance of antimicrobial resistance, and minimization of antimicrobial adverse effects should be called key stewardship priorities as they are aimed at optimizing the patient and society. Focusing on costs alone can lead to the use of sub-optimal or more dangerous antimicrobials, which can increase the time of hospitalization and the risk of adverse reactions, reduce resolution of infection and reduce the risk of adverse events. Through reviewing antimicrobial regimens on a regular basis, pharmacists can achieve both primary and secondary effects. The diagnosis, medication, dosage, and length are four main areas of focus during the study. Patient results may be increased and cost savings may be achieved by tailored antimicrobial regimens, shorter durations, and avoidance of antimicrobials where they are not needed.[1]

Pharmacists are an important part of the AMS staff and are regularly engaged with antimicrobial management.[18] AMS programs with a committed ID pharmacist have been found to be consistent with better alignment with prescribed antimicrobial therapy procedures relative to AMS programs focused on ward pharmacists.[19] The most commonly known teaching approach is specialist internship and/or fellowship training in ID, but the Society of Infectious Disease Pharmacists and Having a Difference in Infectious Diseases Pharmacotherapy qualification programs and professional development programs are other approaches. The lack of ID-trained pharmacists, however has hindered the widespread introduction of comprehensive systems.[20]

The role of non-ID pharmacists in driving an AMS program should not be overlooked due to the lack of ID-trained pharmacists.[21] One study found that including an elective AMS at the introductory level that uses active learning with human patient simulation technology in a Pharm D curriculum gave AMS understanding, knowledge and skills to students.[22] It was expected that Pharm D students participating in the elective AMS will identify the concepts and functions of AMS services, pick, review and refine or redesign patient-specific treatment plans for complex ID scenarios and apply AMS information, skills and resources to compare and contrast related antimicrobial agents to define and recommend requirements and appropriate AMS strategies.[23]

Antibiotic Stewardship Program Statergy[3]

1. Patient Evaluation:

Facility- specific clinical practice guidelines

Prescriber education

Educating healthcare staffs on Antibiotic stewardship programs

2. Choice of Antibiotic to Prescribe

Computerized clinical decision support system

Formulary/ restriction strategies

Assess prescriptions in accordance with local policies

Counsel on restricted antimicrobials
Monitor and feedback of trends in antimicrobial prescribing, formulary and guidance adherence
3. Prescription ordering and dispensing of antimicrobials
Counsel on the use of restricted antimicrobials
Guidance on dosage, preparation and administration of antimicrobials
Review antimicrobial duration
4. Patient monitoring
IV to Oral conversion and early discharge
Pharmacokinetic monitoring and adjustment programme
Monitor antimicrobial use
Prospective audit and feedback
Advise patient on proper use of antimicrobials

PRESCRIPTION OPTIMIZATION AND ANTIBIOTIC USE MONITORING

In comparison, electronic, pharmacist-driven interventions have seen substantial changes in the percentage of hospital patients seeking an ID appointment, antimicrobial drug monitoring systems that monitor a patient's health records and ensure that the current care remains acceptable can result in a significant positive financial and clinical effect for the hospital.[24] In addition, automated, pharmacist-driven interventions have demonstrated significant improvements in the number of hospital patients receiving an ID consult, including targeted antimicrobial therapy and adherence to quality-of-care measures.[25] Prospective audit and reviews by an ID doctor and an ID pharmacist has the ability to dramatically enhance antimicrobial usage and performance. Implementation of prospective audit and feedback in two intensive care units resulted in a substantial reduction in average antimicrobial use.[26] This resulted in a shift towards reduced length of stay in a teaching hospital, the use of broad-spectrum antimicrobials, the cost of antimicrobials and adverse events.[27] For inpatients, it could be necessary to promote early discharge and treat the patient with effective oral antimicrobial therapy or outpatient parenteral antimicrobial therapy (OPAT) after the infection has been controlled.[28] A systematic analysis of five research, reviewing pharmacist-led strategies on prescribing medicine in older adults seeking primary treatment, showed that pharmacist-led interventions have been performed including access to medical notes and medication reviews, in conjunction with feedback to physicians and computer alerts identifying potentially inappropriate medications—can improve prescribing appropriateness.[29]

INFECTION PREVENTION

Pharmacists can work to either avoid or mitigate the spread of diseases within the healthcare system.[30] Pharmacists can also be involved in encouraging vaccinations that will directly eliminate the use of antibiotics by preventing primary infection and indirectly by avoiding superinfection of bacteria.[31]

EDUCATION AND TRAINING

Education and preparation are vital to improving prescribing and AMS, and pharmacists are important to supplying healthcare providers, consumers and members of the public with stewardship education.[30] Pharmacists are often critical community health leaders, since they are always the public's first point of touch and are responsible for providing awareness and instruction.[31]

TRACKING OUTPATIENT ANTIBIOTIC USE

Population and prescriber concentrations may be national or for a particular geographic region (i.e. county) and may provide a benchmark for the use of antibiotics to drive major outpatient efforts.[32] The assessment of antibiotic intake may be carried out in a hospital or other closed environment by monitoring pharmaceutical purchasing data or doses dispensed by the pharmacy, usually recorded as the amount of specified regular doses (DDD) or days of care per unit of patient days or admissions. Although in the outpatient environment, these methods to monitoring antibiotic usage have been tested.[33] The use of medical reports as a way of tracking antibiotic use makes it easier to connect data on prescribing antibiotics to specific prescribers and patients; it also enables data analysis to take place without the need to reconcile data with external systems.[34] Antibiotics prescribed for various uses can be matched with agents recommended for use in published and institutional recommendations for care.[35]

PROSPECTIVE AUDIT WITH INTERVENTION AND FEEDBACK

As a central policy of AMS programs (ASPs), the Infectious Diseases Society of America, the Society for Healthcare Epidemiology of America, and the Centers for Disease Control and Prevention (CDC) have established prospective action and feedback audit (PAIF).[1] The goal of PAIF is to increase antibiotic use while minimizing unintended consequences (e.g., adverse effects, bacterial resistance).

This central approach requires a study of patients undergoing antimicrobial therapy in order to determine their suitability for indication, medication range, dosage, path, and length. The signs and symptoms of infection should be compatible with the condition indicated.[36] After the patient has been fully examined, the proposed improvements to the antimicrobial regimens and suggestions are then communicated to the treating physician by a medical report or direct verbal contact notification of the patient. Intervention and feedback audits are normally performed by a clinical pharmacist, preferably with advanced experience in ID or AMS. There are a range of methods used by pharmacists to classify patients for a prospective audit. There are a variety of strategies pharmacists use to identify patients to prospectively audit. Relevant infections such as respiratory tract infections or urinary tract infections, patient position (medical or intensive care unit) where antimicrobial usage might be especially large, specific antibiotics detected by use data e.g. restricted, broad-spectrum, high-use, expensive, or possibly harmful antibiotics), or by culture outcomes may be targeted for patient selection for PAIF. Pharmacists' interventions may involve antimicrobial de-escalation or extension of the antimicrobial range, discontinuation, enhancement of the medication, dosage or length, intravenous oral conversion, ID consulting, medicinal drug surveillance, including ordering of specific laboratory samples, detection of drug-drug associations, and excessive duplication of antimicrobial coverage.[1]

PHARMACY-DRIVEN INTERVENTIONS

Automatic IV to oral replacement of selected antimicrobials with excellent oral bioavailability is an intervention widely referred to in the stewardship literature as having a positive effect not only on the use of antimicrobials, but also on the harm and cost savings associated with intravenous antimicrobial administration. Not only is an oral choice safe and successful for many disease states, but it's highly acceptable. Antimicrobials such as fluoroquinolones, linezolid, and fluconazole are excellent targets for a pharmacist's automatic replacement protocol.[37] In the literature, protocols incorporating these and other drugs are well defined and are associated with decreased duration of stay, reduced complications of treatment, and increased cost savings. Additional pharmacist-driven initiatives include individualized dosage changes for patients with organ dysfunction (e.g. renal or hepatic adjustment), dose optimization based on monitoring of therapeutic medications, and identification and avoidance of drug-drug interactions related to antibiotics.[38] Pharmacists can also assist with drug selection to avoid excessive duplication of therapy in patients at the same time.[39] The use of automatic warnings to highlight circumstances such as duplicate overlapping spectra therapies can be checked and triggered by a qualified pharmacist, enabling the infectious diseases physician to determine higher acuity interventions.[39] Time-sensitive indications, especially antibiotics prescribed for surgical prophylaxis, can be monitored by pharmacists for discontinuation.

CORE ELEMENTS FOR HOSPITAL ANTIBIOTIC STEWARDSHIP PROGRAMS 2019 - CDC

It is important to improve the use of antibiotics to treat infections efficiently, protect patients from harm caused by excessive use of antibiotics, and fight antibiotic resistance. Antibiotic stewardship initiatives can help physicians maximize health outcomes and reduce harms by enhancing prescription of antibiotics.[40] In 2019, CDC upgraded the hospital Core Elements to reflect both lessons learned from five years of experience and new research from the field of antibiotic stewardship. Significant updates to Key Elements Hospital include:
Hospital Leadership Commitment: Dedicate necessary human, financial and information technology resources.[41]
• The 2019 update has additional hospital leadership examples, and "priority" and other" stratify the examples.

Priority examples of hospital leadership commitment highlight the need for leadership of antibiotic stewardship programs to devote time and energy to running the program effectively, as well as ensuring that program leadership has regularly scheduled platforms for senior executives and hospital board to report stewardship activities and resources.[42]

Accountability: Name a leader or co-leaders responsible for program management and results, such as a physician and pharmacist.

The 2019 update highlights the efficacy of the co-leadership of physicians and pharmacies, recorded by 59% of hospitals responding to the 2019 NHSN Annual Hospital Survey.[43]

Pharmacy Experience (previously 'Drug Expertise'): Nominate a pharmacist to lead implementation efforts to increase antibiotic use, preferably as the co-leader of the stewardship program.

This core element has been called "Pharmacy Expertise" to reflect the importance of pharmacy intervention in leading efforts to promote the use of antibiotics.[44]

Action: To promote antibiotic use, incorporate measures, such as prospective audit and feedback or pre-authorization. Further examples of approaches stratified to "priority" and other are available in the 2019 update. "The other" measures are categorized as treatments based on infection, provider-based, pharmacy-based, microbiology-based, and nursing.[45]

Priority strategies include prospective audit and feedback, preauthorization, and guidelines for facility-specific care. Evidence suggests that prospective audit and input and pre-authorization enhance the use of antibiotics and are recommended as "core components of any stewardship program" in the guidelines. In enhancing the

effectiveness of prospective audit and feedback and pre-authorization, facility-specific treatment guidelines may be essential.[46]

• The 2019 update highlights the importance of interventions focusing on the most common indications for hospital antibiotic use: infection of the lower respiratory tract (e.g., community-acquired pneumonia), infection of the urinary tract, and infection of the skin and soft tissue. The antibiotic timeout was reframed as a valuable supplementary measure, but should not be a replacement for prospective audit and feedback.[47] In order to represent the important role that nurses can play in the efforts to control antibiotics in hospitals, a new category of nursing-based activities was introduced.

Tracking: Track the prescription of antibiotics, the effect of treatments, and other essential outcomes, such as complicated pattern of C. difficile infection and resistance. It is necessary for hospitals to send data on antibiotic use electronically to the National Healthcare Safety Network (NHSN) Antimicrobial Use (AU) Choice for inpatient antibiotic use tracking and optimization.[48]

System measures of antibiotic stewardship were extended and stratified into "priority" and other."

Priority process steps emphasize the assessment of the effect of key procedures, including prospective audit and feedback, pre-authorization, and guidelines for facility-specific care.[49]

Reporting: Report periodically to prescribers, pharmacists, nurses, and hospital leadership on antibiotic use and resistance details. The 2019 update emphasizes the efficacy of data reporting at the provider level, while understanding that this has not been well studied for the use of antibiotics in hospitals.[50] Education: Inform prescribers, pharmacists, and nurses about antibiotic adverse reactions, antibiotic tolerance, and optimum prescribing.

The 2019 update highlights that case-based education through prospective audit and feedback and pre-authorization are successful strategies for delivering antibiotic use education. This can be more emphasized when the case-based education is provided in person (e.g., handshake stewardship). The 2019 update also pointed out in engaging nurses in patient education efforts.[51]

II. CONCLUSION

Rates of antibiotic resistance continue to rise at an alarming rate and are not limited to only pathogens occurring within a hospital setting. Pharmacists have a significant role in optimising prescribing behavior, monitoring antimicrobial use, infection control and education. However, there is a need for more AMS-trained pharmacists within the hospital and community settings. Antimicrobial stewardship involving pharmacists should be established in hospitals to ensure judicious and appropriate antimicrobial use. Adoption of these strategies will assist developing countries overcome their increased vulnerability to growing AMR. In the future, antibiotic stewardship education should be better integrated into pharmacy curricula to ensure that all Pharm D graduates are prepared to serve as antibiotic stewards.

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