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Antibiotic Stewardship: Improving Clinical Outcomes by Optimization of Antibiotic Use

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ABSTRACT

For decades microbial such as particular bacteria have become increasingly resistant to various antimicrobials. The world Health Assembly's endorsement of the Global Action Plan on Antimicrobial Resistance in May 2015, and the Political Declaration of the High level Meeting of the General assembly on Antibiotic Resistance in September 2017, both recognize AMR as a global threat to public health. Expert has declared that we are close to the age of no effective antibiotics as the crest of the AMR challenge appears. In the late 1990s, the discovery and development of new antibiotics have slowed dramatically, where only 3 antibiotics received FDA approval in the last 30 years. These policy initiatives acknowledge over use and misuse of antimicrobial as a main driver for development of resistance as well as need for optimization of antimicrobial use. The global action plan on AMR sets out five strategic objectives as a blueprint for countries in developing national action plan (NAPs) on AMR. Antibiotic stewardship program mainly aim aims to support countries in optimization of use of antimicrobial medicines in human and animal health. According to the Organization for Economic Co-operation and Development (OECD) report Stemming the superbug tide: just a few dollars more implementing AMS program together with other policies to reduce overuse of antibiotics and promote hospitals hygiene could save up to 1.6 million lives by 2050 and 4.8 US dollar per year in 33 OECD countries.

INTRODUCTION

Stewardship is defined as “the careful and responsible management of something entrusted to one’s care”. It was originally applied in the health care setting as a tool for optimizing antimicrobial use termed “antimicrobial stewardship” (AMS). Stewardship has since been applied in the context of governance of the health sector as a whole and taking responsibility for the health and well-being of the population and guiding health systems at the national and global level.

Today AMS is one of three “pillars” of an integrated approach to health systems strengthening. The other two are infection prevention and control (IPC) and medicine and patient safety. When applied in conjunction with antimicrobial use surveillance and the WHO essential medicines list (EML) AWaRe classification (ACCESS, WATCH, RESERVE) AMS helps to control AMS by optimizing the use of antimicrobials. Linking all three pillars to other key components of infection management and health system strengthening, such as AMR surveillance and adequate supply of quality assured medicines, promotes equitable and quality health care towards the goal of achieving universal health care toward the goal of achieving universal health coverage.

These principles also apply to the use of antimicrobials in the animal and agriculture sectors, typically with an emphasis on the responsible and prudent use of these agents. Although increasing levels of viral, fungal and parasite resistance to antimicrobials are of concern. This document will focus on the public health challenges of bacterial resistance to antibiotics. The specific aim of the toolkit is to enable AMS in healthcare facilities.

Antibiotic stewardship program:

Microorganisms are the major cause of food borne diseases in human that occur by consuming unhealthy products from poultry and other sources. Among all microbes, bacteria are the most common organism to cause illness. Campylobacter is most commonly found bacteria in poultry products like eggs and meat. It is the main cause of gastroenteritis in humans. It is horizontally transmitted through infected livestock and free living animals. Microbes depreciate the quality of eggs, impair growth and decrease the performance of birds. Egg containing Salmonella can cause food poisoning although it appears normal. In this way, egg is used as a vector by these microbes in causing illness to humans.

Immunity is the capacity of the body to resist the invading organisms. Immunity works by the immunoglobulins and white blood cells. Immunity of chicks may be modified by active or passive immunity. In poultry industries, different kind of vaccines and antibiotics are being given to animals to increase growth and food production. These drugs may reside in their body for a prolonged time. Thus, the present study was designed to investigate chicken egg samples obtained from different areas of district. Faisalabad to isolate and identify the bacteria through morphological and biochemical tests and then through antibiotic sensitivity evaluation to sort out which bacterial species are resistant to commonly used drugs including penicillin, cefotaxim, tetracycline, gentamicin and levofloxacin in the poultry sector.

The use of plants as a source of drugs has for a long time been recognized and appreciated, thus has resulted in the discovery of plants with the tendency of strong potency to cure illnesses. Nonetheless, WHO survey report show that about 80 percent of persons living in developing countries depend on traditional medicines, most of which are obtained from plants. In Africa specifically, interests in plant exploration as source of medicine have increased geometrically, over the recent years when compared with the past or Dark Ages. This interest stems from the fact that microorganisms are developing resistance t most drugs, as such most of the cheap and broad-spectrum antimicrobial drugs have become less, or non-effective against a good number off fastidious and emerging pathogens of medical importance.

The ineffectiveness of these drugs could probably stem from the frequent use of drugs by self-medication, consumption of under dose or overuse, as well as the acquisition of resistant genes by these microorganisms probably, through their frequent contact and interaction with the contaminated environment, even as the increasing upsurge of climate change variation index , cannot be left out as one of the seemingly promoter of high prevalence cases of antibiotic resistance issues across the globe.

In Nigeria especially in the rural areas, most families rely on the different parts of bitter leaf, scent leaf and sour soup not only as spices or in cooking but also in the treatment off different illnesses such as gastroenteritis and fever. Spices and herbs have been useful in treating pathological infections. Wounds and chronic skin ulcers have been treated using herbs prepared locally and other substances that occur naturally in the environment for many years now. Even in the failure of antibiotics, these plants such as Vernonia amygdalina has been studied and found to be able to inhibit the growth of Staphylococcus aureus,

Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumonia and Candida albicans respectively.

Ethanol, distilled water and methylated spirit were used as solvents in obtain the leaf, root and stem bark extracts of Allanblackia floribunda. The antimicrobial activity of the extracts was thereafter tested against of the various extracts on the test isolates. Ethanol extract of the bark showed no activity against S. Aureus and Bacillus species and Escherichia coli but the other parts showed activity against them.

It is essential that before implementing the antimicrobial stewardship program to create an effective team with a given budget and personnel constraints. Core members of a multidisciplinary antimicrobial stewardship team include an infectious diseases physician and a clinical pharmacist with infectious diseases training who should be compensated for their time with the inclusion of a clinical microbiologist, an information system specialist, an infection control professional and hospital epidemiologist being optimal. There are two major approaches to antimicrobial stewardship strategies with the most successful programs generally implementing a combination of both. First approach is front-end or pre-prescription approach which means that uses restrictive prescriptive authority. Certain antimicrobials are considered restricted and require prior authorization for use by all except a select group of clinicians. Second approach is the back-end or post-prescription approach, use prospective review and feedback.

Introduction of the ‘Antibiotic Justification Form’ has the potential of restricting the use as well as de-escalation of high-end antimicrobial agents. As both the groups were comparable in terms of demographic profile and disease spectrum and severity, the reduction in the initial usage and later de-escalation of these antimicrobials can be attributed to the intervention. There was a more stream lined approach to check antibiotic usage at multiple levels at the same time creating more accountability, responsibility and awareness among the clinicians.

We have restricted only to sepsis because antimicrobial usage is directly related to this condition and hence would give us a clear picture on antibiotic overuse or abuse. As a unit we do not routinely start antibiotic overuse or abuse. As a unit we do not routinely start antibiotics in respiratory, neurological morbidities, instead only when there is a clinical or laboratory evidence of sepsis. We dot deal with oncology cases and post-operative babies are still on first line antibiotics unless any complications.

A study by McCarthy et al involved a prospective audit to assess the compliance with antimicrobial guidelines. The intervention included an electronic prescribing unlike ours which was a manual filling form. There was a significant overall reduction in the primary outcome of DOT days of antibiotic therapy per 1000 patient days from 572 to 417 DOT. This represents a 27 percent reduction in total antibiotic use as compared to 8.81 percent reduction in our study. Treatment courses greater than 5 days for culture negative sepsis were reduced from 46.5 DOT to 7 DOT. We did not measure the outcome in terms of DOT.

The Coronavirus disease, COVID-19 is a new threat to global public health. Many patients with mild disease without pneumonia or moderate disease with pneumonia take antibiotics such as azithromycin. Which are not recommended by health authorities. WHO has already warned that ‘increased use of antibiotics to combat the COVID-19 pandemic will strengthen bacterial resistance and will lead to more death during the crisis and beyond. While reviewing antimicrobial prescribing in COVID-19 patients, it was found that 72 percent of 2,010 COVID-19 patients received broad-spectrum antimicrobial therapy in the hospital, although only 8 percent suffered bacterial and fungal co-infection.

Due to the drought of new antibiotics and the withdrawal of some major pharmaceutical companies from the field of antimicrobials, WHO recently issued a fresh warning regarding the global threat of AMR. Recent literature suggest that initial antibiotic therapy with broad spectrum is associated with poor outcomes. A recent meta-analysis of the import of appropriate antibiotic therapy in a range of infectious nicely summarizes how the value of appropriate therapy increased in parallel with the severity of illness. The majority of 50 antibiotics in clinical studies in the drug development pipeline have limited benefits and 252 products in the preclinical phase of the drug development are in the very early stages of testing and might be available in about ten years.

To exacerbate the AMR threat major pharmaceutical companies involved in AMR research have left the market due to a ‘lack of incentives’ and dwindling funding. Two recent WHO reports confirmed that clinical and preclinical drug development is predominantly driven by the small or medium-sized enterprises as large pharmaceutical companies continue to leave the business. Furthermore, the level of research and development investment in clinical development is insufficient to meet global health needs in contrast to the more robust and vibrant preclinical biotechnology pipeline. Hence there is a paucity of new drugs in the research and development pipeline of the pharmaceutical industry.

CONCLUSION:

The study demonstrated that the ASP positively reduced costs and antimicrobial consumption with no statistically significant effect on the mortality rate. Two recent WHO reports on clinical and preclinical drug development highlighted a weak pipeline for antibiotic agents, which may threaten global efforts to contain drug-resistant infections. However a long-term evaluation of the ASP's impact is needed to ascertain its enduring influence on antimicrobial susceptibility patterns and infection-related mortality. Antibiotic stewardship in the real world is very different from what is published in medical journals.This discrepancy will be hard to resolve because the use of cephalosporins, carbapenem, and quinolones is part of daily clinical practice, despite their improper use being the main cause of multidrug-resistance. For implementation of antibiotic stewardship in clinical practice, first identify possible barriers and facilitators and tailor the program based on the specific setting. As we gather more evidence, we see more clearly and more worrying that how fast we are losing critically important antimicrobial medicines all over the world.

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