

Pharmacy Technicians, Pharmacists, Nurses, and Microbiologists in Tackling Antimicrobial Resistance: Current Strategies and Future Directions

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ABSTRACT

Introduction: Antimicrobial resistance (AMR) is a significant issue, leading to increased morbidity, mortality, and expenses, with sub-Saharan Africa exhibiting the highest rates worldwide. Concerns over the escalation of AMR have prompted worldwide, Pan-African, and national initiatives, including the formulation of national action plans (NAPs).

Aim of work: To explore the alarming rise of AMR in critical care settings and investigate the role of pharmacy technicians, pharmacists, nurses, and microbiologists in tackling AMR

Methods: The keywords "Pharmacy Technicians, Pharmacists, Nurses, and Microbiologists, Tackling Antimicrobial Resistance" were used to conduct a thorough literature search in the MEDLINE database in order to find relevant publications published between 2017 and 2024. Using the proper search terms, Google Scholar was utilized to find and access pertinent scientific publications. Various inclusion criteria were used to choose which articles to select.

Results: The research included in this study was published from 2017 to 2024. The research included a discussion segment that was broken into many specific elements. Topics covered include the Pharmacy contributions in combating AMR, Nursing role in tackling AMR, Microbiology Laboratory role in AMR.

Conclusion: Integrating pharmacists into healthcare systems can reduce antibiotic misuse in underdeveloped nations. This can be achieved through improved positions, university curricula, and professional development. Hospitals should implement antimicrobial stewardship to ensure responsible use. Nurses play a crucial role in AMS and patient safety, but their knowledge and reluctance to speak up limit their contribution. Pre- and post-registration education, voicing concerns, and strong hospital leadership can maximize their contribution. The Microbiology Laboratory is essential for infection control, and new techniques can transform prevention and control tactics.

Keywords: Pharmacy Technicians, Pharmacists, Nurses, and Microbiologists, Tackling Antimicrobial Resistance

INTRODUCTION

The World Health Organization (WHO) characterizes antimicrobial resistance (AMR) as 'the resistance of bacterial, viral, parasitic, and fungal pathogens to antimicrobial agents that were formerly successful in treating infections' (WHO, 2022). AMR is a naturally occurring phenomena; nevertheless, it is well acknowledged that the excessive usage and improper use of antimicrobials have expedited this process (Jones-Berry, 2018). It is estimated that 30%–50% of antibiotic prescriptions are inappropriate, resulting in around 700,000 global

fatalities each year due to illnesses caused by multidrug-resistant organisms, which have gained resistance to previously effective treatments (Frieri et al., 2017). This number is projected to increase to 10 million worldwide by 2050 (WHO, 2022).

The problem of AMR is complicated by the fact that no new antibiotics have been developed since the 1980s. AMR is now recognised as a threat to lives worldwide, and is defined by the WHO, NICE, and PHE as being a global public health issue that could majorly worsen patient outcomes in medical procedures including routine surgery and chemotherapy if left uncontrolled (Jones-Berry, 2018).

First coined in the scientific literature in 1996, antimicrobial stewardship (AMS) describes an organised and coordinated effort to optimise the use of antibiotics in the present day in order to ensure that these remain effective in the future (NICE, 2015). In 2015, WHO developed the Global Action Plan on AMR and asked countries to act as a part of the solution to the AMR challenge. This included the goal for developing strategies to lower incidences of sickness, to optimise the consumption of antibiotics on the right infected individuals, and raising awareness of AMR. The ex-UK government launched five-year strategic plan in 2019 to cover the programs to decrease necessity for the antibiotics due to infections, using antibiotics rationally in case of necessity, and lack of the new antimicrobials' developments (Bennani et al., 2024).

For a purposeful AMS, real improvements in clinical practice, educational endeavors with healthcare and the general populace, antimicrobial stewardship surveys, and the implementation of governmental health policies are required (Castro-Sánchez et al., 2019). For its part, AMS has the potential to help contain AMR should it be practiced and adopted appropriately; this can contribute to the decrease of infections, drop patient mortality and ultimately put a dent on healthcare cost globally (D'Agata et al., 2018).

Research shows that antimicrobial stewardship has in the past been the sole mandate of physicians and pharmacists (Ladenheim, 2018). As proponents of stewardship stress that intervention must be advertised and coordinated with the help of multiple related disciplines, it is worth mentioning that the specific work of nurses is described in guidelines produced by authorities such as NICE only fragmentarily, if at all (Ladenheim, 2018). Olans et al. (2016) and Ladenheim (2018) highlight that as nurses sit across the continuum of the patient care they are in a prime location to play a role in the AMS. Nurses constitute a significant portion of the healthcare workforce, and enhancing their involvement in AMS could substantially improve patient outcomes (Castro-Sánchez et al., 2019). Consequently, it is essential to understand nurses' perceptions of their involvement in AMS to tailor AMS programs for optimal nurse contributions.

Aim Of Work

To explore the alarming rise of AMR in critical care settings and investigate the role of pharmacy technicians, pharmacists, nurses, and microbiologists in tackling AMR

METHODS

Scientific researches involved in this review were obtained through scientific websites (Google scholar and Pubmed) using various keywords (Pharmacy Technicians, Pharmacists, Nurses, and Microbiologists, Tackling Antimicrobial Resistance) to obtain all possible articles related to the current subject. The articles were chosen based on a set of criteria for selection. First, each article's main titles and abstracts were reviewed, and then we excluded duplicate articles, non-full text articles, irrelevant articles, and case reports. The publications examined in this review were published between 2015 and 2024.

RESULTS

The current study included research on the role of pharmacy technicians, pharmacists, nurses, and microbiologists in tackling AMR. The publications considered were published throughout the timeframe of 2015 to 2024. Hence, in the discussion part, the review was organized according to several topics such as Pharmacy contributions in combating AMR, Nursing role in tackling AMR, Microbiology Laboratory role in AMR.

DISCUSSION

AMR constitutes a significant worldwide health challenge (Marston et al., 2016). By 2050, it is anticipated that over ten million deaths annually will be ascribed to AMR. Moreover, it is anticipated that the highest incidence of these fatalities will occur in underdeveloped nations (Tillotson&Zinner, 2017). Consequently, there is an immediate necessity to implement measures to reduce the spread of antimicrobial-resistant bacteria in underdeveloped nations (Laxminarayan&Chaudhury, 2016). Addressing the development and dissemination of antimicrobial resistance necessitates a comprehensive strategy, involving the engagement of all healthcare professionals. The initial objective of the WHO global action plan on AMR emphasizes that preventing the overuse and misuse of antibiotics necessitates healthcare professionals' awareness and comprehension of AMR, alongside effective communication, education, and training (Khouja et al., 2022). In this setting, healthcare providers play a crucial role in optimizing antibiotic utilization within the population.

Pharmacy contributions in combating AMR

The role of pharmacists in ensuring effective antibiotic utilization is a crucial element in combating the increasing issue of AMR. Numerous developed nations have attained success through the introduction of AMS programs that incorporate pharmacists (Hwang & Kwon, 2021). Strategies of the AMS focus on ensuring that antibiotics are used wisely, appropriate, and safely. The clinical and economic implications of pharmaceutical services related to antibiotics are overtly described by Al-Tawfiq et al. This review outlines how pharmacists can play a positive role in countering the development and spread of AMR. The role of pharmacists about the rational use of prophylactic antimicrobial agents is well understood and embedded in the healthcare systems of some potentates (Al-Tawfiq et al., 2022). One example of this function is the care for the patients with infectious diseases in Intensive Care Units (ICU), which resulted in improvement of the clinical and economic efficiency (Muñoz-Pichuante & Villa-Zapata, 2020).

On the other hand, LSM countries have not embraced pharmacist-led ventures such as the use of pharmacist-led ASPs. In these nations, pharmacists could also play an important role in decreasing unnecessary antibiotic prescription as well as developing national prescribing practices according to some diagnosis and antibiotic resistance profiles of the respective regions (Sharma et al., 2015). Another important element of pharmacists' activity in the context of educating patients about preserving their health is their participation in explaining the use of protective measures to prevent infections. Due to their public accessibility, community pharmacists ought to proactively educate the public on essential infection-control behaviors, including general hygiene, hand cleanliness, cough etiquette, vaccines, and the importance of remaining at home while ill. Despite appearing to be common sense, one should not overestimate patients' comprehension of fundamental infection-control techniques. Competently qualified pharmacists can instruct patients on the management of viral, bacterial, and prevalent fungal illnesses.

Therefore, it is essential to guarantee adequately qualified pharmacists in emerging nations by providing high-quality and comprehensive pharmacy education. Increased emphasis should be placed on education on infectious illnesses, their management, and AMR within the pharmacy curriculum. The acquired knowledge, behaviors, and skills must be assessed before qualification, and ongoing professional development in this therapeutic domain should be sustained to prevent the adverse effects of improper antibiotic use and antimicrobial resistance projected in developing countries in the near future (Johora et al., 2020).

Nursing role in tackling AMR

Nurses recognize their responsibility in antimicrobial stewardship (AMS). This position is supported by more healthcare professionals in the broader literature (Firouzabadi & Mahmoudi, 2020). Historically, AMS education has focused on physicians and pharmacists (McGregor, 2015). There is an increasing acknowledgment that for nurses to be empowered to participate effectively, including confidently addressing concerns regarding antibiotic management methods, they must first acquire a deeper understanding of the subject matter (Jones-Berry, 2018). A study indicated that over 75% of surveyed nurses agreed that education on AMS should commence prior to registration, with supplementary training for certified nurses (Davey & Aveyard, 2022). Research indicates that deficiencies are present in both undergraduate and postgraduate education (Castro-Sánchez et al., 2019), a concern highlighted in this review. The NMC's revised educational requirements incorporate efforts to address this issue, explicitly stating the necessity for preregistration education to encompass both antimicrobial stewardship and resistance. This is encouraging as findings on this topic suggest that there exists a direct relationship between nurses' AMS knowledge and their competence in managing antibiotics as well as their confidence in dealing with prescribers on these matters (Monsees et al., 2019) In support of the idea by McCotter et al. (2017a) that education can alleviate some of the barriers identified in this systematic review of the literature.

From this analysis it has been seen that nurses understand their role in stewardship and are willing to be a part of this worldwide issue. This is positive finding and points to the fact that the nurses are willing to participate in a collaboration to achieve such an aim. In order for such engagement to occur, nurses need to feel empowered to speak out. Communicating concerns is well understood to be part of ensuring patient safety and a core duty of a nurse, the patient's advocate (Tarrant et al., 2017). It can be described as reporting a new situation to an authority in order to prevent the harm of a patient.

Research has indicated the possibility of the following as the reason why nurses may lack assertiveness, fear of their concerns being ignored or need to uphold unity within the ward team by not embarrassing another member of the team (Mansour & Mattukoyya, 2019). Sumner et al. (2018) note that nurses are hesitant to question antibiotic prescribers and that they have established poor attitudes to general practitioners and suggested that challenging prescribers' practice would be unwelcome; they also found that contesting prescribing decisions was considered one of the most difficult tasks of ward work (Broom et al., 2017). As a result the nurses are put in a position where they have to consider their personal psychosocial needs against those of the patients.

Compelling evidence is available that suggests that the culture in the hospital plays a crucial role in determining prescribing behaviour and antibiotics are known to be influenced by a variety of psychological factors. The traditional organizational structure of the ward environment assumes that some people are knowledgeable while others are ignorant; it accords the status to healthcare workers. The view that more or less nurses' inputs to antibiotic processes are inconsequential is reinforced by mundane practices such as their exclusion from ward rounds or scarce assertiveness about seeking their opinion (Monsees et al., 2019). These variables can create culture where people of lower perceived power feel helpless to speak out about their concerns (Best & Sim, 2019). Such a culture might explain why nurses rarely raise questions regarding AMS because some of them did not want to cross a perceived divide between nursing and medical practice in this regard (Broom et al., 2017). Mawuena et al. (2024) argue that it is required to bring about a change in the hospital culture that makes communication possible and guarantees the freedom of all the health professionals to express their challenges and opportunities; leadership should encourage and support it. It has been established that there is higher likelihood of the nurses to challenge their colleagues when they work under legally safe conditions with management endorsing and modelling need to raise the concerns to improve patient safety (Alingh et al., 2019). One example of how leadership within the United States has amplified the import of nurses speaking for themselves is by exemplification of what 'Agency for Healthcare Research and Quality Safety Program for Improving Antibiotic Use' states, where it compels prescribers to recognize and appreciate the role of nurses in the stewardship of antimicrobials.

Some interventions have recommended that learning on how to report concerns, especially on AMS, might be more effective if delivered via an interprofessional approach (Merrill et al., 2019). Besides passing knowledge, this method also helps to deconstruct a traditional power structure, to encourage teamwork between professionals (Broom et al., 2017), as well as providing understanding of others' view (Merrill et al., 2019).

Microbiology Laboratory role in AMR

Healthcare-associated infection (HAIs) are known to be a significant source of morbidity and mortality, with 37,000 deaths reported in Europe, and 75,000 in the USA, by 2011 (Ketata et al., 2021). HAIs affect the economy since they amount to approximately 9.8 billion dollars annually in the USA, for the five most common diseases. Antibiotic resistance constitutes a significant issue linked to healthcare-associated infections (Wozniak et al., 2022): The Centers for Disease Control and Prevention (CDC) approximates that over two million people get some type of antibiotic-resistant infection each year and die from the same at ages 23,000. European countries lose 25000 people to drug-resistant diseases each year (ChinemeremNwobodo et al., 2022).

Education is the most common approach of preventing HAIs and the potential healthcare saving amounts may reach 5.5 billion US dollars (Poudel et al., 2023). Measures at international level to compare control HAIs consist of hand washing, staff training, environmental cleanliness, ASM, and improved communication systems. To address HAIs, doctors need to be proactive, which means that all the data that is related to this infection has to be obtained as quickly as possible. Since the Microbiology Laboratory participates in detecting infections promptly, understanding the antibiotic resistance profile and identifying outbreaks, it is essential in the prevention and control of HAIs (Manias et al., 2021). The general roles of the Microbiology Laboratory have been previously described as involving the identification and characterisation of microbial agents and determination of their antibiotic resistance patterns (Leber et al., 2022). However, it includes other related domains necessary for Infection Control Programs and ASPs – staff member of Microbiology Laboratory should be involved in it ideally (Peiffer-Smadja et al., 2020). The effectiveness of such programs mainly depends on the active involvement of the Microbiology Laboratory in actions that go beyond routine microbiological testing, result reporting, surveillance, communication and the other miscellaneous tasks of the Infection Control Teams (Voidazan et al., 2020).

Due to increasing emergence and spread of antibiotic resistant organisms, antimicrobial resistance surveillance becomes a core mandate of the Microbiology Laboratory. Surveillance of antimicrobial resistance therefore comprises systematic data gathering which, when analyzed and reported, generates useful information for functional antibiotic therapy (Diallo et al., 2015).

However, good surveillance entails a lot of human capital and time hence it needs dedicated personnel. However, there are other challenges that are closely related to data gathering, storage, processing, analysis, interpretation, and presentation. For instance, the call for improvement of operational efficiency with an efficiency and cost cutting gadget such as appropriate technology in the laboratory; call for surveillance of important bacterial strains are goals that needs to be addressed (Okolie et al., 2023).

Uniformity in interpretation is required: currently, conflicting recommendations and breakpoint for determination of antimicrobial susceptibility patterns are used in the United States and some European countries (Turner et al 2021). Clinicians must be able to assimilate data in formats that aid their understanding of the larger information sets (Diallo et al., 2020).

A way of achieving operation efficiency is communicated by information systems (Kaplan, 2020). Because surveillance information systems enable the gathering and storage of antibiotic resistance information, it

becomes easier to later submit reports. Furthermore, surveillance information systems help in better functioning of antibiotic resistance and lend support to empirical data, which can be used to develop controlling programs (Baudet et al., 2022). The general roles of the Microbiology Laboratory have been previously described as involving the identification and characterisation of microbial agents and determination of their antibiotic resistance patterns (Leber et al., 2022). However, it includes other related domains necessary for Infection Control Programs and ASPs – staff member of Microbiology Laboratory should be involved in it ideally (Peiffer-Smadja et al., 2020). The effectiveness of such programs mainly depends on the active involvement of the Microbiology Laboratory in actions that go beyond routine microbiological testing, result reporting, surveillance, communication and the other miscellaneous tasks of the Infection Control Teams (Voidazan et al., 2020).

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CONCLUSION

The incorrect use of antibiotics in underdeveloped nations can be considerably reduced by integrating pharmacists with training into healthcare systems. Improved positions, acceptance as a member of the healthcare team, university curricula, and ongoing professional development all contribute to this. Hospitals should implement antimicrobial stewardship to guarantee responsible and prudent use. By implementing these tactics, developing nations will be able to combat their heightened susceptibility to the spread of AMR. Antimicrobial stewardship involves several nurses participating in prescription decisions, following protocols, and educating patients and the public. Nonetheless, their lack of knowledge and reluctance to speak up limit their ability to contribute. The contribution of nurses to AMS and patient safety can be maximized by implementing pre- and post-registration education in antimicrobial stewardship, voicing concerns, and having strong hospital leadership. The Microbiology Laboratory, which handles every facet of infection control, is essential to the prevention and management of HAI. Novel techniques for identification and central information systems have the potential to transform HAI prevention and control tactics, facilitate decision-making, and address challenges encountered by microbiologists.

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