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Review Article

The role of pharmacists in antimicrobial stewardship: a scoping review

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ABSTRACT

Antimicrobial stewardship programs optimize antimicrobial use and combat antimicrobial resistance (AMR). This scoping review examines the roles of pharmacists in antimicrobial stewardship, pharmacist-led interventions, barriers to participation, and recognition mechanisms to enhance pharmacist engagement. The study followed PRISMA methodology, searching databases for literature published between 2010 and 2023. Twenty-four studies met the inclusion criteria. The review reveals that pharmacists undertake a range of functions, including administering pharmacotherapy, monitoring therapeutic drugs, and assessing patients for optimal treatment. Effective pharmacist-led interventions include audit and feedback systems, prior authorization protocols with educational components, real-time alert technologies, and the implementation of evidence-based guidelines. However, key barriers to participation include limited access to resources, ineffective inter-professional communication, and organizational constraints. The review further reveals that recognition mechanisms identified to enhance pharmacist engagement include administrative support, increased involvement in decision-making, enhanced education, and streamlined processes. The review emphasizes the importance of individualizing antimicrobial strategies through interprofessional collaboration, expanding education, implementing clinical decision support systems, fostering an antimicrobial stewardship culture, and supporting research innovations. Addressing the identified barriers and enhancing support mechanisms will maximize pharmacists' contributions to antimicrobial stewardship, ultimately improving patient outcomes.

Keywords: Antimicrobial stewardship, Pharmacists, Barriers, Interventions, Recognition

INTRODUCTION

The inappropriate use of antimicrobial agents is a primary driver of antimicrobial resistance (AMR), the development of multidrug-resistant organisms (MDROs), and the diminishing effectiveness of antimicrobials.[1] Consequently, antimicrobial stewardship programs (ASPs) have become critical to optimizing antimicrobial efficacy and countering AMR. Pharmacists are in a unique position to ensure the safety, effectiveness, and appropriate utilization of antimicrobial agents.[2]

Current literature emphasizes the vital contributions of pharmacists to antimicrobial stewardship.

Pharmacists' unique skill set, which enables them to optimize antimicrobial use and reduce AMR, was highlighted.[3] Their expertise in pharmacokinetics, drug interactions, and adverse effects, combined with practical

communication abilities, renders them indispensable in ASPs. Additionally, pharmacists are well-positioned to monitor antimicrobial use, provide education, and promote adherence to infection prevention and control measures.[4]

Moreover, extant studies have illuminated the effectiveness of pharmacist-led interventions in reducing AMR reported substantial reductions in antimicrobial use and cost savings following the implementation of a pharmacist-led ASP in a Korean hospital.[5] Similarly, found that clinical pharmacist involvement in antimicrobial stewardship led to a shorter duration of antimicrobial therapy and improved patient outcomes.[6] Furthermore, emphasized the importance of training future pharmacists as antimicrobial stewards to ensure their continued contributions to ASPs.[7]

Despite these established benefits, several challenges impede pharmacists' full participation. A primary barrier is the lack of recognition and support for their contributions, which hampers motivation and engagement.[8] Furthermore, pharmacists may encounter resistance from healthcare providers who perceive their ASP involvement as encroaching on their practice. Limited access to antimicrobial usage data further hinders pharmacists' ability to monitor antimicrobial use effectively.[9] This review aims to examine pharmacists' roles in ASPs, identify barriers and facilitators to participation, and explore strategies to enhance recognition and support.

The objectives of this study were: (1) to examine and understand the role of pharmacists in antimicrobial stewardship and its contribution to reducing AMR, (2) to identify effective pharmacist-led interventions in ASPs and assess their impact on patient outcomes and healthcare costs, (3) to explore barriers and facilitators affecting pharmacists' full participation in ASPs and develop strategies to address these challenges, and (4) to investigate ways to improve recognition and support of pharmacists' contributions to ASPs, focusing on enhancing their engagement and motivation in antimicrobial stewardship efforts.

METHODS

This scoping review utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to identify and assess relevant studies. We formulated inclusion criteria using the Population, Intervention, Comparison, and Outcome (PICO) framework. The population comprised adult patients receiving antimicrobial therapy; the intervention involved any antimicrobial agent, and the outcome encompassed adverse events associated with this therapy.

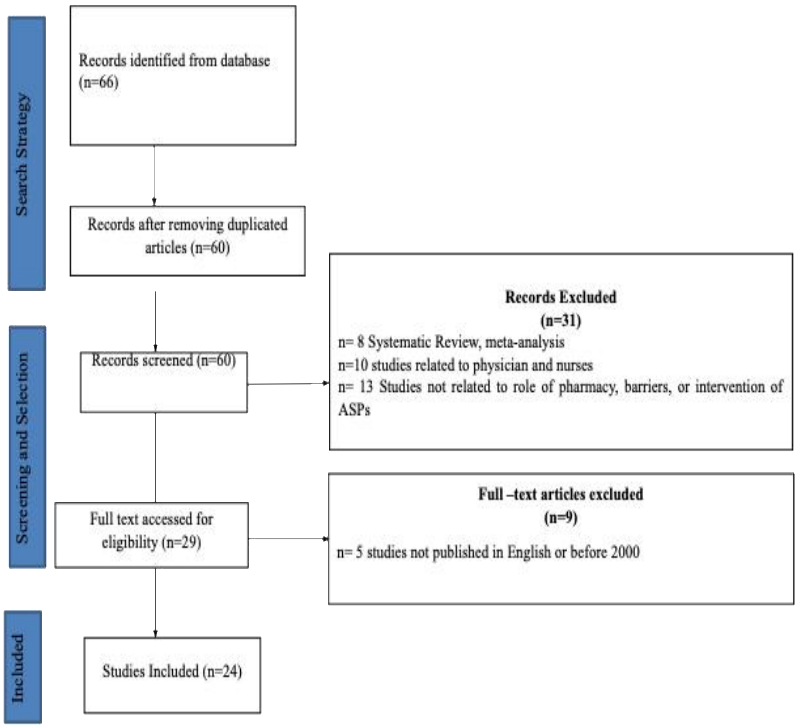

Figure 1: PRISMA flowchart.

Studies were included if they: (1) examined pharmacists' role in antimicrobial stewardship programs (ASPs) in any healthcare setting (hospital, community, long-term care), (2) described the impact of pharmacist-led interventions on antimicrobial use and ASP, (3) explored barriers and facilitators to pharmacists' ASP participation and strategies to address them, or (4) described recognition and support mechanisms for pharmacists' contributions to ASPs.

Studies were excluded if they: (1) did not focus on pharmacists' roles in ASPs, (2) concentrated on other healthcare providers' roles in ASPs, (3) failed to report outcomes related to antimicrobial use, patient outcomes, or healthcare costs, or (4) were not published in English. The search encompassed electronic database searches in PubMed, Embase, and Scopus, as well as manual searches of reference lists. We developed a search strategy combining keywords and medical subject headings (MeSH) related to the research questions: support mechanisms, pharmacy facilitators, interventions, barriers, facilitators, stewardship, antimicrobial antibiotic stewardship, antibiotics, pharmacists, and pharmacies. The search included studies published in English from January 2010 to March 2023.

Two independent reviewers screened the titles and abstracts of identified studies for relevance to the research questions and adherence to the inclusion/exclusion criteria. Full-text articles of potentially relevant studies were obtained and reviewed independently. Discrepancies between reviewers were resolved through discussion with a third reviewer. The study selection process was documented using a PRISMA flowchart (Figure 1).

Data extraction was conducted using a standardized form that captured: (1) study characteristics (author, year, methodology), (2) pharmacist-led interventions (description, duration, outcome measures), (3) pharmacists' role in antimicrobial stewardship (description, impact), (4) barriers and facilitators to participation, and (5) recognition and support mechanisms.

A pilot test of the data extraction form ensured all relevant information was captured efficiently. Quality assurance processes included independent data extraction by a second reviewer for a sample of included studies.

We employed a narrative synthesis approach to analyze the data, which enables the synthesis of evidence from diverse study designs. Thematic analysis identified patterns and themes related to the research questions. The themes were organized into categories based on their relevance to the research questions, summarized, and narratively synthesized to address the key objectives.

RESULTS

Summary of study methodology

Of the 24 analyzed articles, 10 employed qualitative methods, highlighting the importance of capturing pharmacists' subjective experiences and perceptions in antimicrobial stewardship. Quantitative methods were employed in seven articles, while mixed methods were used in two articles, combining the strengths of both approaches.

Figure 2 shows a gradual increase in the number of articles published over time, indicating growing interest in pharmacists' roles in antimicrobial stewardship. Beginning with a single publication in 2009, the number steadily increased, peaking in 2021 with five published articles and totalling 24 by the end of the observed period in 2023.

Figure 3 also shows the methodological approaches used across the included studies. Qualitative methods predominated (10 studies), followed by quantitative (7) and mixed methods (2). This distribution reflects the importance of capturing both descriptive data and measurable outcomes related to pharmacists' involvement in antimicrobial stewardship.

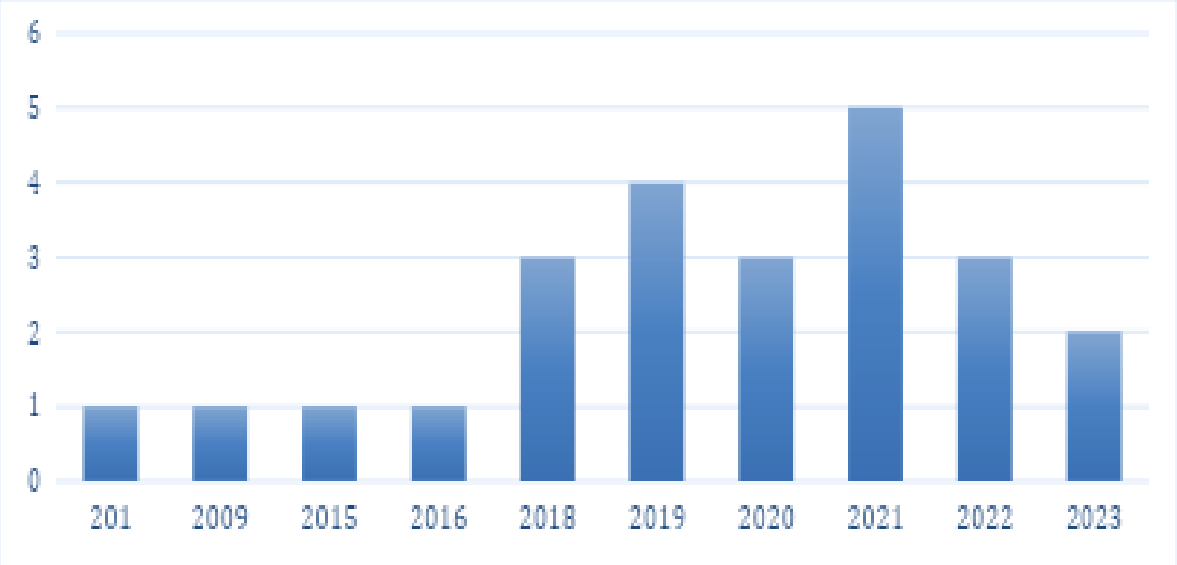

Figure 2: Trends in publications on studies.

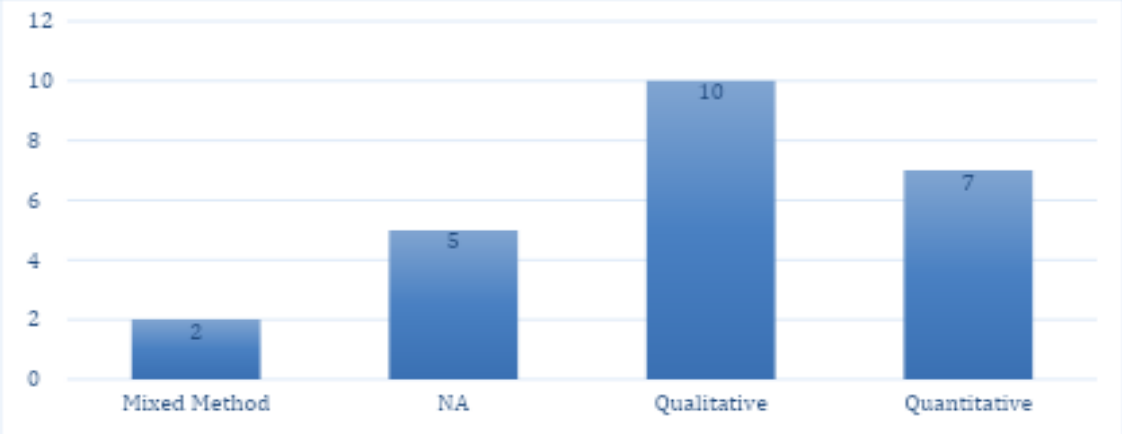

Figure 3: Methodological approaches.

Thematic analysis

The role of pharmacists in antimicrobial stewardship

The role of pharmacists in antimicrobial stewardship (AS) and their contribution to reducing antimicrobial resistance (AMR) were explored in 13 studies.[4,8,10-20] Pharmacists undertake a diverse range of responsibilities in antimicrobial stewardship. These include administering pharmacotherapy, implementing thorough therapeutic drug monitoring, using assessment information to optimize pharmacotherapy, and disseminating the concept of "choosing wisely" regarding antimicrobials.[4,8,10] Pharmacists also contribute to infectious disease diagnostic aid, coordinate with infection control teams, and apply clinical pharmacometrics to optimize treatment for drug-resistant bacteria.[11,12] Community pharmacists ensure appropriate antibiotic use, collaborate with other healthcare professionals, and participate in antimicrobial awareness campaigns.[13] Hospital pharmacists serve as antimicrobial advisors, guardians, and liaison personnel.[19]

Studies have highlighted issues such as limited resources, organizational barriers, and ambivalent attitudes toward antibiotic resistance that hinder pharmacists' full participation in AS.[16,20] Efforts to enhance pharmacist-led involvement include establishing dedicated committees to oversee appropriate antibiotic use, ensuring prompt microbiology laboratory services, fostering a high level of AS understanding among staff, and developing established guidelines.[15]

Collaboration with general practitioners was identified as essential, requiring improved awareness and uptake of evidence-based strategies.[18] The findings underscore the significant roles pharmacists play in AS, including optimizing pharmacotherapy, providing advice on AMS, and participating in interprofessional collaborations.[10,14,17]

Pharmacist-led interventions in ASPs

Six studies identified effective pharmacist-led interventions in ASPs and their impact on antimicrobial use and resistance.[18,21-25] The review reveals that effective interventions include audit and feedback, prior authorization with educational components, real-time alert technology, and the implementation of evidence-based guidelines.[23] These interventions optimize antimicrobial selection, reduce inappropriate antibiotic use, and enhance patient care. The implementation of specific policies and strategies has demonstrated promising results in lowering antimicrobial consumption, costs, and antimicrobial resistance.[21,25] Interventions focused on reducing inappropriate antimicrobial use and decreasing infection treatment costs have also been shown to be effective.[18]

For respiratory tract infections specifically, the implementation of point-of-care C-reactive protein testing by pharmacists has proven effective, enabling timely and accurate diagnostic information. Pharmacist-led interventions that incorporated educational components and self-care advice also yielded positive outcomes.[22,24] demonstrated the effectiveness of an AMS webinar and a patient-facing leaflet in reducing inappropriate antimicrobial use and improving patient care for respiratory tract infections.

Barriers and facilitators to pharmacists' full participation in ASPs

Eighteen studies identified challenges and proposed strategies to address them.[14-19-24,26-32] The results also reveal key challenges, including limited access to resources and knowledge, communication barriers between laboratory, pharmacists, and clinicians, and limited training and resources for ASP activities.[14-16,18-19]

Communication style challenges, relationship dynamics between ASP and non-ASP personnel, and limitations in generating ASP-specific data were also identified as significant obstacles.[23] Organizational culture and healthcare professionals' attitudes were also identified as barriers, including a lack of pharmacy leadership support for ASPs, a shortage of trained infectious disease physicians and pharmacists, and communication challenges with colleagues.[21] Hospital-onset C. difficile

infection, patient complexity, and organizational culture affected the success of interventions.[26] Doctors' prescribing power, limited interactions with general practitioners, and the absence of reimbursement models impede pharmacist engagement.[20,21] Additional challenges include time constraints, heavy documentation requirements, and limited resources, which serve as practical obstacles.[22,24] Complexities in antimicrobial susceptibility testing methods and the emergence of new resistance mechanisms pose challenges, while physician education requires further attention.[31,32]

To address these barriers, interventions such as increasing access to resources and knowledge, improving communication and collaboration among healthcare professionals, providing adequate training and resources, and fostering a supportive organizational culture have been proposed.[30,32] Implementing guidelines, using point-of-care tests and patient information leaflets, and enhancing pharmacist involvement in decision-making processes can facilitate pharmacist participation in ASPs.[17,25,28]

Pharmacists' recognition and support mechanisms in improving engagement and motivation

Ten studies identified support and recognition mechanisms to improve pharmacists' engagement and motivation in ASPs.[19-22,24,26,28-31] The literature shows various support mechanisms that enhance pharmacists' engagement. Administrative support, commitment, and perseverance significantly contribute to recognition of pharmacists' ASP contributions.[19] Governmental agencies that mandate ASP practice and implement formalized approaches to improving antimicrobial use provide necessary support.[21]

ASP success relies on strong programs, pharmacy involvement in decision-making, provider education, and an organizational culture that values stewardship efforts.[26] Collaboration with general practitioners, improved access to patient data, and adherence to guidelines enhance pharmacists' recognition and support within ASPs.[28] Addressing role-based limitations, interprofessional dynamics, and organizational/resource constraints is essential for providing necessary pharmacist support.[20] Improved education and awareness, streamlined application processes, clear communication, and the involvement of antimicrobial pharmacists in review processes enhance recognition and support.[29]

Training and resource provision play vital roles in recognizing and supporting pharmacists' contributions.[30] Efficient service delivery, adequate remuneration, and addressing time constraints and heavy documentation are essential in promoting engagement and motivation.[22] Targeted interventions, such as webinars, educational materials, and self-care advice, enhance pharmacists' recognition and support within ASPs.[24] Development of new technologies, clinician-laboratory collaboration, and optimizing antimicrobial use support pharmacists in combating antimicrobial resistance.[31]

DISCUSSION

This scoping review examined the role of pharmacists in antimicrobial stewardship programs (ASPs), barriers and facilitators to their participation, and recognition mechanisms that enhance their engagement. The findings highlight the multifaceted responsibilities pharmacists in ASPs undertake, ranging from administering pharmacotherapy and performing therapeutic drug monitoring to assessing patients and implementing interventions to optimize pharmacotherapy.[10,14] Community pharmacists contribute to ASPs through ensuring appropriate antibiotic use, collaborating with healthcare professionals, and participating in antimicrobial awareness campaigns.[13] Hospital pharmacists serve as antimicrobial advisors, guardians, and liaisons, actively implementing strategies to optimize antimicrobial use.[19] These roles are essential in combating antimicrobial resistance and improving patient outcomes. However, limited resources, organizational barriers, and ambivalent attitudes towards antibiotic resistance hinder pharmacists' full participation in ASPs.[16,20] Addressing these challenges requires establishing dedicated committees overseeing appropriate antibiotic use, improving collaboration with general practitioners, and enhancing access to resources and support for pharmacists' involvement in ASP initiatives.

Pharmacist-led interventions in ambulatory settings (ASP) demonstrate effectiveness in improving patient outcomes and reducing healthcare costs. These interventions include audit and feedback, prior authorization with educative components, real-time alert technology, and implementation of evidence-based guidelines.[23] The implementation of specific policies, strategies, and procedures for the appropriate selection of antimicrobial drugs has shown promising results in reducing antimicrobial consumption, costs, and resistance.[21,25] For respiratory tract infections, point-of-care C-reactive protein testing services provided by pharmacists offer timely and accurate diagnostic information, facilitating better treatment decisions.[22] Educational components and self-care advice also demonstrate positive outcomes, with studies showing increased provision of self-care advice, appropriate referrals, and signposting to non-prescription medicines.[24] These findings underscore the value of integrating pharmacists into ASPs and leveraging their clinical knowledge to enhance the appropriateness of antimicrobial prescribing.

Various barriers affect pharmacists' full participation in ASPs, including limited access to resources and knowledge, ineffective communication, and organizational constraints. Communication barriers between the laboratory, pharmacists, and clinicians impede collaboration and hinder the implementation of effective stewardship practices.[14,16] Limited training and resources for ASP activities, along with insufficient communication with general practitioners, pose additional challenges.[18,19] Organizational culture and healthcare professionals'

attitudes also influence pharmacist participation, with a lack of pharmacy leadership support, shortage of trained personnel, and communication challenges with colleagues creating substantial obstacles.[21] Practical challenges, including time constraints, heavy documentation requirements, and limited resources, further constrain pharmacists' involvement.[22,24] Addressing these barriers requires initiatives that improve resource availability, enhance knowledge sharing, promote effective communication among healthcare professionals, and foster a supportive organizational culture.

Recognition and support mechanisms play a crucial role in enhancing pharmacists' engagement and motivation in ASPs. Administrative support, commitment, and perseverance contribute significantly to recognizing pharmacists' contributions.[19] Governmental agencies that mandate ASP practice and implement formalized approaches provide necessary support and validation.[21]

ASP success relies on strong programs, pharmacy involvement in decision-making, provider education, and an organizational culture that values stewardship efforts [26]. Improved collaboration with general practitioners, enhanced access to patient data, and guideline adherence support pharmacists in their ASP roles.[28] Addressing role-based limitations, inter-professional dynamics, and resource constraints creates an environment that enables pharmacists to contribute effectively to ASPs.[20] Training provision, efficient service delivery, adequate remuneration, and streamlined processes further enhance pharmacists' recognition and support.[22,30] These mechanisms collectively create an environment that acknowledges the value of pharmacists' contributions and encourages their active participation in antimicrobial stewardship initiatives.

The implications of these findings extend to practice, policy, and education. Healthcare institutions should develop comprehensive antimicrobial stewardship frameworks that formally integrate pharmacists as core team members with clearly defined roles and responsibilities. Policy makers need to establish regulations that mandate pharmacist inclusion on antimicrobial stewardship committees and allocate adequate resources to support pharmacist participation. Educational institutions must strengthen pharmacy curricula to emphasize antimicrobial stewardship principles, inter-professional collaboration skills, and practical training in stewardship activities.

Future research should focus on quantifying the economic impact of pharmacist-led interventions, developing standardized metrics to measure their contributions, and testing innovative models to overcome identified barriers. Implementing these recommendations will maximize pharmacists' impact on antimicrobial stewardship, ultimately reducing antimicrobial resistance rates, improving the quality of patient care, and optimizing healthcare resource utilization.

CONCLUSION

This scoping review identifies pharmacists as integral contributors to antimicrobial stewardship programs through diverse roles, including therapeutic drug monitoring, patient assessment, antimicrobial advisement, and intervention implementation. Effective pharmacist-led interventions encompass audit and feedback systems, prior authorization protocols with educational components, real-time alert technologies, and point-of-care diagnostic testing services, collectively optimizing antimicrobial use, reducing inappropriate prescribing, and enhancing patient outcomes. Despite these proven benefits, pharmacists face substantial barriers, including limited access to resources, ineffective interprofessional communication, organizational constraints, insufficient training, and practical challenges such as time limitations and documentation requirements. Recognition and support mechanisms are essential for enhancing pharmacist engagement, encompassing administrative endorsement, formalized frameworks, involvement in decision-making processes, improved collaboration with general practitioners, enhanced access to data, adequate remuneration, and streamlined processes. Healthcare institutions must strengthen inter-professional collaboration, expand educational initiatives, implement clinical decision support systems, foster antimicrobial stewardship culture, and support research innovations. Future research should validate the mechanisms underlying effective implementation strategies, establish standardized metrics to measure pharmacist contributions, develop innovative collaborative models, and evaluate the long-term impacts of pharmacist-led interventions on antimicrobial resistance patterns. This gives evidence-based guidelines that maximize pharmacists' contributions to combating antimicrobial resistance.

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