ESIC2024 Posted: 05/12/2024

The Role of Hospital Administrators in Facilitating Antibiotic Stewardship Programs with a Focus on Microbial Resistance: A Depth Review Study

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Abstracts

Hospital administrators play an essential role in the implementation of Antibiotic Stewardship Programs, which is instrumental in the fight against antimicrobial resistance. The foundation and sustenance of such programs has been made possible through leadership; this is through interdisciplinary collaboration that is done with policy formulation and stewardship inclusion into the institutional systems. Indeed, it is immense strength where ID physicians and clinical pharmacists with special training proactively involve themselves in the program. Beyond that, the accreditation standards that incorporate ASPs really enhance compliance and institutional commitment. Obstacles to movement include an absence of resources, unwilling prescriber, and other competing health conditions for priority. To achieve such success, the hospital administrators must ensure adequate staffing, proper utilization of advanced technologies, and instillation of accountability through focused education and participation. Besides the reduction of resistance, ASPs contribute to such improvements in patient outcomes, efficient consumption of resources, and significant reductions in costs. As this narrative review indicates, leadership at the hospital level plays an important role in augmenting antibiotic stewardship. Addressing major barriers, along with strategic implementation, means that administrators may play an important role in further maximizing effectiveness while truly adding to the world-wide effort against antimicrobial resistance.

Keywords: Antibiotic Stewardship Programs (ASPs); Infection Control; Disciplinary Measures; Stakeholder Engagement; CDC Core Elements.

1. Introduction

The VA Central Office has been at the helm of mobilizing local leadership toward promoting antibiotic stewardship within all VA medical centers, starting with the release of the Antibiotic Stewardship Directive in January 2014. The directive necessitated each VA medical center to establish a formal written policy of antibiotic stewardship as this was considered to be part of the essential responsibility for leadership to develop and create such programs (Appaneal et al., 2018). Similar evidence shows that antibiotic stewardship programs should be headed by infectious disease (ID) physicians who have received extra training in stewardship. Two-thirds of hospitals had an ID physician on their stewardship team, and among respondents, the lack of an ID-trained leader at smaller hospitals was a proposed obstacle to effective antibiotic stewardship (Vaughn et al., 2019). Implementation of AMS models requires leadership and culture change supported by policy development. External motivators, such as embedding AMS frameworks into national accreditation standards, have also been shown to drive the implementation of AMS programs in the hospital setting (Avent et al., 2020). It will also require explicit leadership support by the form of active and constant participation in antibiotic stewardship, verbal advocacy for stewardship, and visible interaction with the staff.

In the long run, these initiatives need collaborative relationships between nurses, prescribing providers, and other partners who have expertise in antibiotic stewardship (Seshadri et al., 2020). Effective communication further enables doctors to support the education of patients on the right utilization of antibiotics. As a result, hospital leadership should also advance and facilitate antibiotic stewardship programs since they have an immediate influence on prescription trends and patient awareness (Atif & Tufail, 2022). While position statements by professional infectious disease societies have advocated for physician leadership of ASPs, preferably ID-trained, the Centers for Disease Control and Prevention's "Core Elements of Hospital Antibiotic Stewardship Programs" guidance suggests that accountability for ASPs should be assigned to a physician leader with a pharmacist co-lead, acknowledging the central role of pharmacists (Morgan et al., 2018; Barlam et al., 2020). Top barriers for antimicrobial stewardship program implementation, cited by hospital administrators, include potential opposition from prescribers and competing clinical initiatives. This is why strong support from the leadership is quite important to surmount this and other challenges that allow for the effective implementation of antibiotic stewardship programs (Buckel et al., 2016). In some countries, national antibiotic stewardship programs have been made compulsory and, with hospitals facing financial penalty, prescribers would face disciplinary actions. This attests to the role leadership plays in such initiatives (Dijck et al., 2018). It was indicated by studies that explicit leadership support through active engagement, vocal support, and visible involvement is crucial to the sustainability of ASPs.

The ASP should have clear accountability assigned to a physician leader, preferably an ID specialist, with a pharmacist co-lead (Morgan et al., 2018). The VA Central Office has shown leadership by making all VA medical centers have formal written antibiotic stewardship policies; policy development is shown to drive these initiatives, as reported by Appaneal et al. in 2018. Embedding the ASP frameworks into national accreditation standards can also motivate hospitals to pursue these programs (Avent et al., 2020). The CDC core elements for

ASPs recommend that hospital leadership ensure that there is sufficient time given to the staff to participate in stewardship activities because lack of protected time has been a key barrier cited (Appaneal et al., 2018). This would require support from the leadership and, most importantly, organizational culture, which is the backbone in the effective utilization of ASPs. Administrators in the hospitals should engage prescribers, nurses, and other stakeholders to encourage a collaborative relationship and shared commitment toward appropriate antibiotic use (Charani et al., 2019).

Some countries have made participation in national antibiotic stewardship programs compulsory, with financial penalties for hospitals and disciplinary actions for individual prescribers, demonstrating the critical role of leadership in driving these initiatives (Enani, 2015). Data suggest that ASPs are most effective when led by ID physicians with additional stewardship training, as well as clinical pharmacists with infectious diseases expertise (Vaughn et al., 2019). Hospital leaders should encourage and facilitate antibiotic stewardship by influencing prescribing practice and enhancing patient knowledge directly through proper communication strategies, according to Atif and Tufail (2022).

2. Development and Implementation of Antibiotic Stewardship Policies

Evidence from various studies demonstrates that explicit leadership support in terms of active participation, public endorsement, and clear display is critical to the ASPs sustainability. Administrators should define a clear role for ASP by holding the physician leader accountable, ideally with an infectious disease ID specialty, with a colead pharmacist (Morgan et al., 2018; Vaughn et al., 2019). The VA Central Office has demonstrated leadership by requiring that all VA medical centers have a formal written antibiotic stewardship policy, showing how the process of policy development will be able to drive these initiatives forward (Appaneal et al., 2018). Integrating ASP frameworks into national accreditation standards can also help to encourage hospitals to focus more on such programs (Avent et al., 2020). The CDC core elements for ASPs recommend that hospital leadership ensure that staff are given ample time to contribute to stewardship activities, as lack of protected time has been cited as a key barrier, according to Appaneal et al. (2018); Sayood et al., 2020. Leadership support combined with a culture change at the organizational level is required to successfully implement ASPs.

There should be active engagement of prescribers, nurses, and other stakeholders by the administrators with a view to having more cooperation to develop a shared commitment for appropriate antibiotic use (Charani et al., 2019; Seshadri et al., 2020). Some countries have incorporated participation in national antibiotic stewardship programs as a necessity with financial penalties on the hospitals and disciplinary measures to individual prescribers showing that leadership plays an integral part in driving these programs forward (Enani, 2015; Dijck et al., 2018). Data indicate that ASPs function best when managed by ID physicians with stewardship experience and clinical pharmacists with ID training (Vaughn et al., 2019; Morgan et al., 2018). The leaders of the hospitals must promote and support efforts to promote antibiotic stewardship, as they can immediately influence prescribing practices and patients' knowledge through effective communication strategies (Atif & Tufail, 2022). An active collaboration

between the key stakeholders of the teams such as pharmacy, microbiology, infection control, and clinical departments would ensure successful implementation of antibiotic stewardship. Atif & Tufail (2022); Appaneal et al., 2018.

Table 1. Key Factors for Sustaining and Implementing Antibiotic Stewardship Programs (ASPs)

Key Points	Details	References
Leadership Support	Explicit leadership support through active participation, public endorsement, and clear display is critical for ASP sustainability.	Morgan et al., 2018; Vaughn et al., 2019
Role Definition	Administrators should define a clear role for ASP by holding the physician leader accountable, ideally with an infectious disease (ID) specialty, supported by a co-lead pharmacist.	Morgan et al., 2018; Vaughn et al., 2019
Policy Development	VA Central Office requires all VA medical centers to have a formal written antibiotic stewardship policy to drive initiatives forward.	Appaneal et al., 2018
Integration with Accreditation	Incorporating ASP frameworks into national accreditation standards encourages hospitals to focus on stewardship programs.	Avent et al., 2020
Protected Time for Staff	CDC core elements recommend hospital leadership ensure staff have ample time for stewardship activities, as lack of protected time is a key barrier.	Appaneal et al., 2018; Sayood et al., 2020
Organizational Culture Change	Leadership support combined with organizational culture change is required for successful ASP implementation. Administrators should engage prescribers, nurses, and stakeholders to develop a shared commitment to appropriate use.	Charani et al., 2019; Seshadri et al., 2020
National Stewardship Participation	Some countries mandate participation in national antibiotic stewardship programs with financial penalties for hospitals and disciplinary measures for non-compliant prescribers.	Enani, 2015; Dijck et al., 2018
Management by Specialists	ASPs function best when managed by ID physicians with stewardship experience and clinical pharmacists with ID training.	Vaughn et al., 2019; Morgan et al., 2018
Hospital Leadership's Role	Hospital leaders should promote and support antibiotic stewardship efforts, influencing prescribing practices and patient knowledge through effective communication strategies.	Atif & Tufail, 2022
Collaboration Among Stakeholders	Active collaboration among pharmacy, microbiology, infection control, and clinical departments is essential for successful ASP implementation.	Atif & Tufail, 2022; Appaneal et al., 2018

Regular meetings and shared decision-making, as well as information sharing between the teams, should be supported by administrators. Hospital-wide policies for antibiotic stewardship must be developed with input from all departments' representatives. The policies should define the role, responsibility, and accountability of each department clearly (Appaneal et al., 2018). Administrators must ensure that representatives of different departments-pharmacists, infectious disease physicians, and infection preventionists-receive adequate time and resources to actively participate in stewardship practices (Appaneal et al., 2018). Administrators should facilitate the collection and analysis of antibiotic use data, resistance trends, and clinical results

of each department. These analyses should be constantly made and then fed back to the prescribers and used for changes in the policies (Kim et al., 2016; Saatchi et al., 2021). All relevant personnel such as physicians, nurses, pharmacists, and laboratory professionals should be provided in-depth education and training on the topic of antibiotic stewardship. It helps in developing shared knowledge and responsibility to be taken for the stewardship principles (Kalu et al., 2021; Lim, 2024). Administrators should invest in information technology solutions, such as electronic medical records and clinical decision support tools, to make adherence to stewardship policies and guidelines across departments possible (Xu et al., 2022; Escobar et al., 2023). Administrators should actively promote a culture of antibiotic stewardship where all departments and staff members realize their role and responsibility for optimizing antibiotic use (Charani et al., 2019; Kim et al., 2021). Administrators should include antibiotic stewardship metrics as part of the performance evaluation and incentives for departments and individual providers to stimulate sustained engagement and adherence (Vaughn et al., 2022; Szymczak, 2024).

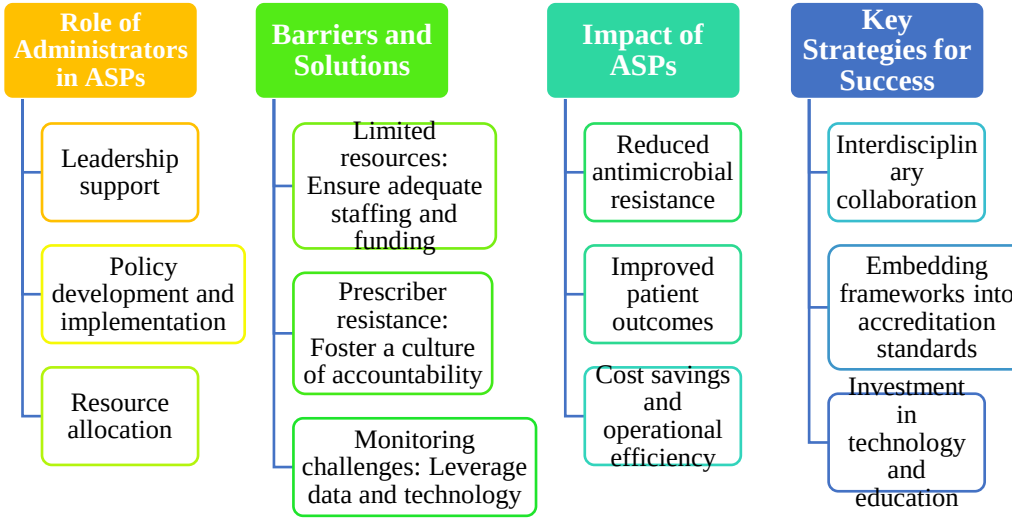

Figure 1. Key Components of Antibiotic Stewardship Programs: Roles, Strategies, and Outcomes.

3. Resource Allocation and Support for Antibiotic Stewardship

The ASP should have sufficient staffing, including infectious disease physicians, clinical pharmacists, and infection preventionists, in the ASP (Chiotos et al. 2019; Appaneal et al., 2018). They should also provide them with protected time to be actively involved in stewardship activities (Appaneal et al., 2018). The administrators should provide adequate funds for ASP; this will involve funding for data collection, analysis, and reporting and funding for educational

initiatives and technological solutions (Kelly et al., 2017). The administrators ought to invest in the adoption of information technology solutions that include electronic medical records as well as clinical decision support tools to enable easy adherence to stewardship policies and guidelines across all departments (King et al., 2017). Regular meetings, shared decision-making, and information exchange between administrators should facilitate the key stakeholders like pharmacy, microbiology, infection control, and clinical departments so that stewardship efforts could be comprehensive and coordinate effectively (Atif & Tufail, 2022; Appaneal et al., 2018). All the pertinent staff, that is physicians, nurses, pharmacists, and laboratory persons, must be educated comprehensively and trained on the principles of stewardship concerning antibiotics so everyone understands it and is devoted to stewardship principles, Kalu et al. (2021); Lim (2024). Managers must contemplate the use of telehealth and remote infectious diseases service support to aid the ASPs, especially small-size resource-poor hospitals, among others (Santos et al., 2018; Stevenson et al., 2018; Wilson et al., 2019). Managers should consider metrics such as antibiotic stewardship be implemented in performance assessment packages coupled with reward structures for various departmental and physician-related tasks to ensure continuous improvement participation and compliance (Vaughn et al., 2022; Szymczak, 2024). Administrators should support an active culture of antibiotic stewardship where all staff members are well aware of their role and responsibility in optimizing antibiotic use Charani et al., 2019; Kim et al., 2021. Administrators should investigate the potential for embedding ASP frameworks into national or regional accreditation standards, which would motivate hospitals to focus on such programs Charani & Holmes (2019).

Some countries have made involvement in national antibiotic stewardship programs compulsory, and financial penalties against hospitals, along with disciplinary actions against individual prescribers, demonstrate the critical role that leadership plays in moving such initiatives forward (Dijck et al., 2018). The administrators should also ensure that sufficient staff, in terms of infectious disease physicians, clinical pharmacists, and infection preventionists, are assigned to the ASP (Chiotos et al., 2019). They should also make time for these staff to be fully involved in stewardship practice because lack of time has been reported as one of the major barriers (Appaneal et al., 2018). Administrators can see into the promise of telehealth and remote infectious disease expertise for the support of ASPs, especially in smaller or resourcepoor hospitals (Santos et al., 2018). Information technology investments may include electronic medical records as well as clinical decision support tools that would allow for stewardship policies and guidelines across departments (King et al., 2017). The administrators should facilitate the holding of regular meetings, shared decision-making, and information exchange between key stakeholders including pharmacy, microbiology, infection control, and clinical departments for comprehensive and coordinated efforts of stewardship (Atif & Tufail, 2022). Administrators should support education and training in broad stewardship principles for any staff members who would influence antibiotic prescribing, including physicians, nurses, pharmacists, and laboratory personnel, to further a common understanding and commitment to stewardship principles (Kalu et al., 2021). Antibiotic stewardship metrics could be integrated into performance evaluations and incentive packages for departments and individual clinicians to propel sustained engagement and adherence

(Vaughn et al., 2022). Administrators should encourage an environment of antibiotic stewardship wherein all staff members acknowledge the role and responsibility they play to optimize antibiotic use (Charani et al., 2019).

4. Staff Training and Education

All staff in the organization including physicians, nurses, pharmacists, and laboratory personnel must be educated and trained by the administrators comprehensively on stewardship of antibiotics (Kalu et al. 2021; Charani et al., 2019). All staff in the organization would then understand and agree to abide by stewardship principles. It should be focused on the various healthcare professionals and their needs and responsibilities, such as targeted prescriber education on antibiotic choice and dosing, and nursing education on their responsibilities in administering and monitoring antibiotics (Carter et al., 2018; Lim et al., 2023). Administrators should determine what the gaps in knowledge are and develop appropriate educational initiatives that can fill in the gaps specifically to address the needs of the staff. Administrators should develop a continuing education program that would provide regular refreshers and updates to maintain knowledge and skills over time. It has been noted that knowledge repeated or rehearsed is better retained by health professionals (Carter et al., 2018). Administrators can use the option of online training programs, virtual educational sessions, and telehealth consultations in providing continuous education and support in resource-poor environments. That help bridge some gaps of distance in geography and access to subject matter experts to at least some extent (Santos et al., 2018).

For antibiotic stewardship, Administrators should work with a network of external professionals; for example, infectious diseases specialists, that will inform their educational programs and presentations to staff (Seshadri et al., 2020). Such collaborations will increase the chances that the materials and the approach are evidence-based and the content is relevant to the local context in which they are being created (Seshadri et al., 2020). Administrators should work with academic institutions and professional organizations to include antibiotic stewardship principles in curricula for healthcare students and continuing education programs for practicing professionals. This will pave a way for a solid foundation in stewardship knowledge at an early career stage among those future healthcare providers (Castro-Sánchez et al., 2016). Administrators should encourage the antibiotic stewardship culture and involve all workers who need to be acknowledged in their roles and their responsibilities to optimize the utilization of antibiotics (Charani et al., 2019; Kim et al., 2021). This can be achieved through constant messaging, role modeling, and reinforcement of stewardship principles within the organization (Charani et al., 2019).

5. Monitoring and Evaluation of Antibiotic Stewardship Programs

Administrators should track and report on antibiotic consumption in DDDs or DOTs per 1,000 patient-days. This tracking data can follow trends, compare performance over time, and monitor the impact of stewardship interventions on antibiotic consumption (Kelly et al., 2017; Liew et

al., 2011). Administrators should track patterns of antimicrobial resistance, including prevalence of resistant organisms, such as MRSA and CRE. This will enable them to inform antibiotic choice and to monitor the stewardship practice put in place to help reduce resistance (Majlander et al., 2021). The administrators should seek to establish whether the care professionals implemented the antibiotic stewardship policies, guidelines and recommendations which include selecting proper antibiotics, proper dosages and the proper duration according to Wangi & Jaya, 2022; Aldeyab et al., 2011). The clinical outcomes including Clostridioides difficile infection rates, length of stay, and mortality, which are usually monitored for determining the success of stewardship programs towards patient care (Schultz et al., 2014). Administrators must evaluate the financial effects of stewardship programs in terms of cost savings related to reduced antibiotic use and prevention of adverse events and complications (Schultz et al., 2014).

This may enable administrators to justify their investment in stewardship programs and show the value that these programs bring to the attention of hospital leadership. Administrators need to gather information from the healthcare professionals in question through surveys, interviews, and focus groups so as to determine their perceptions, knowledge, and experiences of antibiotic stewardship. Such would lead to the identification of the barriers, facilitators, and areas that may improve the implementation and sustainability of stewardship programs (Atif et al., 2021; Saleem et al., 2019). Administrators must participate in national or regional antibiotic stewardship registries or reporting systems to allow benchmarking against peer institutions, sharing best practices, and driving continuous quality improvement that will aid in the spread of effective stewardship strategies (Berrevoets et al., 2017). Administrators should monitor and trend antibiotic use, including defined daily doses (DDDs) or days of therapy (DOTs) per 1,000 patient-days and provide regular reports of such data to stakeholders Kelly et al. (2017) Liew et al., 2011).

Antimicrobial Resistance Monitoring Patterns managers ought to monitor the patterns of antimicrobial resistance, which entails prevalence rates for resistant organisms, for instance, MRSA and CRE Majlander et al., 2021. Managers ought to keep track of how many health workers are following stewardship policy guidelines and recommendations, for example, selection of the appropriate type of antibiotics, dose administration, and length of usage (Wangi & Jaya, 2022; Aldeyab et al., 2011). Administrators should track clinical outcomes, for example, Clostridioides difficile infection rates, length of stay, and mortality to measure stewardship programs in improving patient care (Schultz et al., 2014). Administrators should measure the cost-effectiveness of stewardship programs, for example, decreased costs for antibiotics and prevention of adverse events and complications (Schultz et al., 2014). This will help the hospital leadership understand why they are investing in stewardship programs. Administrators should gather opinions of healthcare professionals through surveys, interviews, and focus groups on their perceptions, knowledge, and experiences with antibiotic stewardship (Atif et al., 2021; Saleem et al., 2019). This will be helpful in determining barriers, facilitators, and areas of improvement in implementing and sustaining stewardship programs. Administrators should get themselves enrolled in national or regional antibiotic stewardship registries or reporting systems to ensure the benchmarking of performances across peer institutions and share good practices (Berrevoets et al., 2017).

6. Collaboration with Healthcare Providers and External Stakeholders

Key disciplines that must be represented in the ASP team by the administrators are infectious disease specialists, clinical pharmacists, microbiologists, infection preventionists, and hospitalists, so different viewpoints and expertise may be considered in stewardship activities (Barlam et al., 2020; Vaughn et al., 2019). In that regard, roles and responsibilities for each member of the group need to be well clarified and accounted for, thus showing administrators to be accountable to the disciplines involved in interdisciplinary collaboration (Barlam et al., 2020). According to the CDC's "Core Elements of Hospital Antibiotic Stewardship Programs" guidelines, an ASP should be led by a physician, preferably an infectious disease specialist, and have a pharmacist co-lead (Barlam et al., 2020). The stewardship team should meet regularly to discuss antibiotic use, resistance patterns, and possible interventions. These meetings create an open communication platform and a basis for shared decision-making with the development of collaborative strategies. All the employees of the team should have a sense of ownership and accountability for the success of the ASP. This can be done through positive reinforcement, role modeling and through the incorporation of stewardship metrics in performance measurement, as suggested by Herawati et al. (2021). Administrators have to ensure that adequate resources-time devoted by staff, money, etc- for the collaborative work of the stewardship team are provided. This will provide enough time and resources to enable the various team members to participate and be involved actively in their stewardship activities (Dukhovny et al., 2019). Each member of the team shall be exploited in using some special expertise, for example, taking advantage of clinical guidance of an infectious disease specialist, medication management skills of pharmacists, among others, the interpretation of lab data by a microbiologist. This strategy ensures proper use of antibiotics and addresses several stewardship aspects (Howard et al., 2014 ; Kalu et al., 2021).

7. Impact of Antibiotic Stewardship on Microbial Resistance

Emergence of resistant organisms such as methicillin-resistant Staphylococcus aureus and carbapenem-resistant Enterobacteriaceae, monitored through antimicrobial resistance patterns, as documented by Alanazi in 2023 and Vaughn et al. in 2019). The data will inform the selection of antibiotics and monitoring of stewardship to decrease resistance, according to Alanazi in 2023. The administrators should monitor and assess data on antibiotic use, such as DDDs or DOTs per 1,000 patient-days (Atif & Tufail, 2022). This will help determine trends, benchmark performance, and determine the impact of stewardship interventions on antibiotic use (Atif & Tufail, 2022). The various clinical outcomes to be reviewed include infection rates of Clostridioides difficile, length of stay and mortality rates. This serves to measure the impact on patient care by stewardship initiatives (Tan et al., 2013). Administrators should monitor the implementation of healthcare professionals in using antibiotic stewardship policies, guidelines, and recommendations that include appropriate antibiotic selection, dosing, and duration. The above can be done by conducting regular audits, chart reviews, and feedback to prescribers (Buckel et al., 2016). Administrators should engage in national or regional antibiotic stewardship registries or reporting systems so that they can benchmark performance against peer institutions and share best practices. This could drive continuous quality improvement and

facilitate the spread of effective stewardship strategies (Pollack et al., 2016; Berrevoets et al., 2017). Administrators should gather information about the perceptions, knowledge, and experiences of health-care professionals through surveys, interviews, and focus groups to understand their perspectives, and this can identify the facilitators and barriers, thus areas for improvement, when implementing and sustaining stewardship programs (Hayat et al., 2021). Administrators should foster inter-professional collaboration among the significant stakeholders such as infectious disease specialists, clinical pharmacists, and microbiologists, toward an all-inclusive monitoring and evaluation of ASPs' impact (Vaughn et al., 2019; Limburg et al., 2014).

8. Barriers and Challenges in Implementing Antibiotic Stewardship Programs

Table 2. Barriers and Strategies for Implementing Antibiotic Stewardship Programs (ASPs)

Barrier	Description	Strategy to Overcome	References
Lack of Dedicated Resources and Staffing	Insufficient time and resources allocated to the ASP, including lack of dedicated staffing for pharmacists and ID specialists.	Ensure adequate staffing and protected time for ASP team members, such as allocating 1 FTE clinical pharmacist per 100 occupied beds.	Buckel et al., 2016; Appaneal et al., 2018
Resistance from Prescribers and Competing Priorities	Opposition from prescribers and competing clinical initiatives that hinder ASP implementation.	Foster a culture of stewardship, promote shared accountability, and align incentives for prescribers.	Buckel et al., 2016
Lack of ID-Trained Leadership	Shortage of ID-trained leaders, especially in small hospitals, limiting the effectiveness of ASPs.	Ensure ASPs are led by an ID physician with a pharmacist co-lead and provide training opportunities for staff.	Vaughn et al., 2019
Insufficient Interdisciplinary Collaboration	Siloed approaches and lack of coordination between key stakeholders such as pharmacy, microbiology, and infection control.	Establish interdisciplinary stewardship teams, facilitate regular meetings, and promote shared decision-making.	Mushtaque et al., 2019
Absence of Mandatory Participation and Enforcement	Lack of external mandates and accountability measures for ASP implementation.	Embed ASP frameworks into national or regional accreditation standards and implement compulsory participation with penalties for non-compliance.	Dijck et al., 2018
Inadequate Monitoring and Evaluation	Insufficient data collection, analysis, and utilization to guide program improvements.	Implement robust monitoring and evaluation mechanisms, including antibiotic utilization, resistance surveillance, and clinical outcome tracking.	Pollack et al., 2016

9. Cost-Effectiveness and Financial Considerations

Well-designed and executed ASPs can potentially result in annual savings as much as one million dollars, according to different figures in a range of $200,000 to $900,000, Mushtaque et al. (2019). This is reflected in one study that documented saving around $1.88 million in total systemic antibiotic financial expenditure from stewardship interventions (Timbrook et al., 2016). Unlike mere stockpiling of antibiotics, ASPs can help in reducing ICU and hospital stay, which otherwise tends to benefit the economy more positively. Shorter stay at the hospitals and lesser time spent in the ICU bring about massive cost avoidance to the health care system (Beardsley et al., 2012). This could decrease development and spread of antibiotic resistant pathogens, and successful ASP can be linked to significant cost-saving initiatives through averting costly hospital-acquired infections Beardsley et al., 2012. Better choice of empiric antibiotic therapies will contribute to cost-savings through reducing the necessity of escalating or de-escalating antibiotics. A cost-benefit analysis of the ASP on the financial bottom line of the administrators must be done considering both direct cost savings and indirect cost avoidance (Mamun et al., 2019). Costs for implementation and maintenance of the ASP and savings from reduction in expenditures of antibiotics, nosocomial infections, and other clinical outcomes must be included in the analysis. The performance of the program can also be benchmarked through the participation of administrators in national or regional antibiotic stewardship registries or reporting systems and identification of best practices to be implemented at the cost-effective manner (Umber & Moore, 2021).

10. Policy Advocacy and Public Awareness

Adoption of antibiotic stewardship frameworks into national or regional accreditation standards can encourage the hospitals to take top priority in these programs. For instance, a California mandate that hospitals participate in efforts to enhance antibiotic use made a high percentage of hospitals consider initiating stewardship programs (Pollack et al., 2016). Hospital administrators can advocate to local, regional, or national policymakers and regulatory agencies for the development and implementation of antibiotic stewardship policies and guidelines (Atif & Tufail, 2022). It may also include requiring mandatory participation in antibiotic stewardship programs, accompanied by financial penalties or disciplinary actions for non-participation (Dijck et al., 2018). Administrators can be part of national or regional antibiotic stewardship registries or reporting systems, which would help them benchmark their programs against peer institutions and share successful strategies with others. This continues the quality improvement for facilities and spreads successful policies in stewardship from healthcare setting to healthcare setting (Vaughn et al., 2019). Data related to the clinical and economic implications of the stewardship programs will be gathered and interpreted by the administrators to see why the use of antibiotics, nosocomial infections, and the health care cost was reduced. The information generated can then be used in order to advocate for increasing and replicating effective stewardship policies at local, regional, or national levels (Kelly et al., 2017; Zequinão et al., 2020). Administrators can encourage the policy development of antibiotic stewardship by working in tandem with infectious disease experts, pharmacists, and microbiologists. This

injects an interdisciplinary approach to the policy so that all such specific needs of the system in question are addressed (Buckel et al., 2016).

Abbreviations

ASP: Antibiotic Stewardship Program

ID: Infectious Disease

CDC: Centers for Disease Control and Prevention

VA: Veterans Affairs

ICU: Intensive Care Unit

DDD: Defined Daily Dose

DOT: Days of Therapy

11. Conclusion

Antibiotic stewardship must be a cornerstone of new healthcare, requiring proactive leaders, strategic investment, and interdisciplinary collaboration to address one of the world's new threats: antimicrobial resistance. Hospital administrators play important roles in fostering a responsible antibiotic use culture that contributes to global health objectives: overcoming persistent challenges such as scant resources, prescriber resistance, and inadequate systems for monitoring. Administrators can generate considerable benefits by ensuring the sustainability of Antibiotic Stewardship Programs: improved patient safety, reduced resistance rates, and enhanced financial efficacy. ASPs depend more on effective data-driven approaches, innovation, and strengthened cross-functional partnerships. Institutionalization of stewardship principles as part of institutional policies and practices must be done by including dedicated staffing, investment in next-generation technology, and support towards comprehensive education initiatives. This goes beyond maximizing the use of antibiotics because it improves operations and achieves significant cost-effectiveness. Adaptive leadership that embraces change and works with collaborative networks will facilitate the future evolution of antibiotic stewardship programs. Hospital leaders can therefore champion these efforts to inspire their institutions towards better practice and significant improvements in health outcomes worldwide.

Acknowledgment

Authors are thankful to the authors, editors, open access data bases and publishers such as Cochrane Database specially Cochrane Library, CINAHL, PubMed, Medline, Embase, Google Scholar, BMJ Clinical Evidence for providing the literature necessary to compile the article.

Author contributions

All co-authors were involved and participated in the manuscript editing and literature collection including table and figure creation. The first author drafted the original manuscript with the help

of the corresponding author. All authors are given the final approval for the manuscript submission to journal for publication.

Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

Ethical Approval

Not Applicable

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