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# EVALUATING ANTIBIOTIC STEWARDSHIP PROGRAMS IN PRIMARY CARE THROUGH THE INTEGRATED ROLES OF GENERAL PRACTICE, CLINICAL LABORATORY SCIENCE, PHARMACY, AND SOCIAL WORK

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**ABSTRACT**

**Background:** Antimicrobial resistance (AMR) is one of the most significant worldwide health challenges in contemporary reality, and the misuse of antibiotics in the primary care is one of the major reasons. Even though hospitals have been using the Antibiotic Stewardship Programs (ASPs), most of the antibiotic prescriptions are done in the community. To practice good stewardship in the primary care, there must be multidisciplinary collaboration between general practitioners (GPs), clinical laboratory scientists, pharmacists, and social workers.

**Purpose:** The purpose of the review is to assess the practice of antibiotic stewardship programs in primary care using the combined efforts of the general practice, clinical laboratory science, pharmacy, and social work.

**Methods:** PubMed and Google Scholar were used to conduct a narrative synthesis of peer-reviewed literature on the topic published between 2016 and 2024. They included studies on outpatient antibiotic stewardship, diagnostic stewardship, pharmacy-led interventions, and the social determinant of antimicrobial use.

**Results:** It has been seen that primary care ASPs can help decrease inappropriate prescribing, especially with the help of the CDC Core Elements and diagnostic feedback, pharmacist collaboration, and the behavioral interventions. The accuracy of infection management, pharmacists in prescribing, patient education, and social work on the determinants of antibiotic use behavior, cultural, and equity-related are improved with the help of laboratory diagnostics. But there are still loopholes in implementation, infrastructure and interprofessional integration.

**Conclusion**: A collaborative, interdisciplinary ASP model in primary care, which incorporates clinical, along with laboratory, pharmaceutical, and social aspects, can be the most sustainable means of fighting AMR. Collaborative models, diagnostic innovations and social-behavioral interventions should be given priority in future as a way of ensuring effective stewardship.

**Keywords:** antibiotic stewardship, primary care, interdisciplinary collaboration, antimicrobial resistance, diagnostic stewardship.

## INTRODUCTION

Antibiotic resistance remains a big menace to the overall health of people worldwide and this has been fueled by the practice of over prescribing antibiotics in medical institutions. Although hospitals have been targeted by antimicrobial stewardship interventions, majority of antibiotic prescribing is done in primary care. As one example, in England, more than 70% of antibiotic prescriptions are made in primary care, and at least 20% of them can be described as clinically unnecessary (Wanat et al., 2022). Therefore, it is essential to enhance the antibiotic stewardship programs (ASPs) in the primary care. These efforts need interprofessional strategies in which the general practitioners, clinical laboratory scientists, pharmacists and social workers play distinct roles in ensuring the optimization of antibiotic usage and reduction of resistance.

General practitioners (GPs) are the initial contact of the majority of the infected patients in primary care and hence the focus of stewardship. As Avent, Cosgrove, Price-Haywood, and van Driel (2020) contend, antibiotics are most commonly prescribed in the outpatient environment, antimicrobial stewardship (AMS) programs have not achieved as much success as they have in the hospital environment. They demand an integrated approach of top-down systems and bottom-up behavioral reforms that will assist in the long-term implementation of stewardship in general practice. In the same vein, dissemination of the Centers of Disease Control and Prevention (CDC) Core Elements of Outpatient Antibiotic Stewardship by Barlam and colleagues offers step-by-step guidance through which practices should implement stewardship interventions in the areas of commitment, practice action, tracking and reporting, and education (CDC, n.d.).

Clinical laboratory science, in addition to the role of the prescriber, forms the basis of the diagnostic and monitoring system that are necessary in stewardship. The idea of diagnostic stewardship focuses on right test, right patient, right time, and right clinical management (Crawford, Shotorbani, and Swanson, 2024). Professionals in the laboratory are involved in the generation of antibiograms, the optimization of the practice of selecting specimen orders and timely feedback, which facilitate the choice of antibiotics and reduce empirical over-treatment and the use of broad-spectrum antibiotics. They, therefore, play a critical role in microbiological diagnosis and prescription.

Pharmacists are the other key players in stewardship and mostly in ambulatory and community prescribing. According to Liaskou, Duggan, Joynes and Rosado (2018), the pharmacy role in AMS is evolving, which means that pharmacists are best placed to play a role in the education, formulary guidance, audit and feedback and connecting with prescribers. The outpatient literature demonstrates that the use of interventions led by pharmacists in relation to antibiotic prescriptions in lower respiratory and urinary tract infections led to quantifiable changes in the prescription patterns (Smith et al., 2020). These results show the value of collaboration between pharmacy and prescribers as part of primary care stewardship.

Lastly, social and behavioral factors should also be discussed because it is just as important to the success of stewardship programs. Prescription of antibiotics is not a biomedical choice as such: it is influenced by clinician-patient relationships, social norms, institutional culture and the determinants of health at large. The study by Szymczak and Newland on the role of social determinants of antimicrobial prescribing highlights the impact that beliefs of clinicians and patients, power, and social norms have on antibiotic consumption (2018). The qualitative researches underline that the consideration of the contextual and cultural aspects of prescribing behavior will improve the design and use of AMS interventions in primary care (Wanat et al., 2022). Social work professionals, their training in psychosocial processes, patient advocacy, community involvement and health literacy are in a unique position to aid behavioral change, patient-centered education and equal access to stewardship interventions.

Taking into consideration the fact that these areas of professional activity are interdependent, the primary care stewardship programs should also be evaluated through an integrated prism. This is a review article, Evaluating Antibiotic Stewardship Programs in Primary Care through the Integrated Roles of General Practice, Clinical Laboratory Science, Pharmacy, and Social Work, which discusses the potential of synergies of GPs, laboratory scientists, pharmacists and social workers to improve on the effectiveness, sustainability and equity of antibiotic stewardship in the ambulatory context. Incorporating existing literature and defining gaps in implementation in these fields, we would be able to shed light on interprofessional collaboration and system-wide optimization of antibiotic administration.

## AIM OF WORK

The main purpose of this review is to assess the issue of antibiotic stewardship program (ASP) at the primary care level in a multidisciplinary, integrated approach; that is, the cooperation between general practice, clinical laboratory science, pharmacy, and social work. The review aims at evaluating the role of the combination of these spheres of professionals in improving the efficiency of antibiotic usage, decreasing antimicrobial resistance (AMR) and enhancing the overall health outcomes of patients and communities.

## METHODS

A thorough review was performed by scientific platforms as Google Scholar and Pubmed, using specific keywords like Antibiotic Stewardship Programs, Primary Care, Interprofessional Collaboration, Antimicrobial Resistance, Diagnostic and Social Stewardship. Gathering all relevant research papers was the aim. Certain criteria were used to choose the articles. We removed case reports, publications lacking complete material and duplicate articles after thoroughly examining the abstracts and noteworthy titles of every publication.

## RESULTS

The current study focused on the vital role that public health, social services, health administration, and health informatics play in promoting digital transformation in healthcare systems. The research was consequently published under numerous headings in the discussion section, such as Primary care as a critical setting for antibiotic stewardship, Role of clinical laboratory science and diagnostic stewardship, The evolving role of pharmacy in outpatient stewardship, The social work/social behavioral dimension: addressing the human and social factors, Integrated multidisciplinary synergy and challenges, Evidence of effectiveness and gaps for future work, Practical considerations and recommendations and Limitations and caution.

## DISCUSSION

This review discusses the way in which the interdisciplinary approach of general practice, clinical laboratory science, pharmacy, and social work can influence the development of antibiotic stewardship programs (ASPs) in primary care. The multidisciplinary strategy is imperative: the separate disciplines have distinct lenses and intercessions and the combination of their interaction can enhance the effect of stewardship actions- especially in outpatient practice where most antibiotic prescriptions are dispensed.

### 1. Primary care as a critical setting for antibiotic stewardship

Antibiotic prescribing occurs at the front-line with primary care. As it was demonstrated, a significant number of antibiotics are prescribed in outpatient care and are issued without necessity or without any agreement with the guidelines. As an example, a narrative review has discovered that clinicians in the primary care area could be the most influential professional to manage the issue of antibiotic resistance, yet the prevalence of inappropriate prescribing is high (van Driel et al., 2020). These results reveal why ASPs need to be specific to the primary care setting, and not necessarily a simple replication of the hospital-based model.

The Centers of Disease Control and Prevention (CDC) has provided so-called Core Elements of outpatient antibiotic stewardship (commitment, action, tracking/reporting, education) as a guideline to be used in implementing outpatient care (Sanchez, 2016). There is implementation research evidence of small decreases in inappropriate prescriptions following the use of guideline-based interventions. E.g., an analysis of three adult primary care clinics linked to a tertiary care facility showed that inappropriate prescribing reduced by 61 to 55 percent after the intervention (education + guideline creation) but with a significant amount of residual inappropriate prescribing (Wubishet et al., 2022).

These results point to the fact that clinical interventions (guideline dissemination, education) are needed, but may not be effective enough alone to produce significant, long-term gains in inappropriate prescribing in primary care. This fact brings in the concern of other wider fields than the prescriber alone.

### 2. Role of clinical laboratory science and diagnostic stewardship

Diagnostic stewardship is an important, but poorly considered element of outpatient stewardship. It can be critical to the clinical laboratory and diagnostic pathways ensuring that the right test is ordered to the right patient at the right time, which leads to the reduction of unnecessary empirical antibiotic use and increases accuracy of the therapy (Dumm et al., 2024).

As an example, Sullivan (2022) in a review explained how the principles of diagnostic stewardship (pre-analytics, analytics, post-analytics) can be used to improve the ordering and processing of tests and improve patient outcomes and antibiotic use (Sullivan, 2022). These interventions can allow the prescriber to be more confident in diagnosing or eliminating the possibility of a bacterial infection and decrease the initiation of antibiotics inappropriately.

The diagnostic uncertainty that frequently prevails in the primary care setting (as in the case of upper respiratory tract infection or urinary symptoms) could be overcome by incorporating the laboratory science into ordering of specimens and timely reporting as well as providing feedback regarding the local susceptibility of microbes. This assists the general practitioners to make enhanced decisions regarding empirical therapy, narrow-spectrum options, and termination of therapy which is unnecessary. In this regard, laboratory science serves as a mediator between the diagnostic confidence and prescription excellence.

Nonetheless, the body of knowledge regarding diagnostic stewardship in ambulatory/primary care is scarce as compared to the body of knowledge on the same in hospital settings. This loophole indicates the opportunity to fill in-stewardship programs to add lab-clinician feedback loops, antibiogram reporting, rapid diagnostic test (RDT)

implementation and data-driven decision-support in primary care. Diagnostic stewardship therefore is an important facilitator of the bigger ASP in outpatient care.

**3. The evolving role of pharmacy in outpatient stewardship**

The role of pharmacists in the primary care and outpatient setting is gaining more importance, although pharmacists have traditionally been considered key participants in antimicrobial stewardship programs in hospitals. Some current reviews underline the growing role of pharmacy profession in AMS. As an example, Liaskou et al. (2018) have described the pharmacy roles in primary/community care (guideline development, education, audit, feedback) and emphasized the necessity to integrate and support pharmacy (Liaskou et al., 2018).

Besides, systematic review of the pharmacist roles over 20 years revealed that pharmacists played a role in stewardship activities in countries and settings with wide disparities (Bonacaro et al., 2024). Pharmacists can engage in outpatient stewardship through a variety of means: evaluating the appropriateness of antibiotic therapy (indication, dose, duration), formulary restrictions, or guideline-concordant prescribing, patient counselling, adverse effects and interactions, and physician collaboration.

Since it is complex to prescribe antibiotics in primary care (viral versus bacterial, need for delay or watch-wait), pharmacists are able to offer valuable second-checks, educational interventions and feedback loops. Their (prescriber) clinical lens and the laboratory diagnostic lens are their complement. Pharmacists are likely to take a more active role as interdisciplinary team members, as opposed to a downstream role, to be effective in primary care stewardship.

**4. The social work/social behavioral dimension: addressing the human and social factors**

Whereas the clinical, diagnostic and pharmacological aspects are well studied, the social aspects of antibiotic prescribing and antibiotic use have not been incorporated adequately into the stewardship programs which is where social work comes in. Prescription is not an entirely pure biomedical choice and it is influenced by clinician-patient interaction, patient anticipations of antibiotics, time constraints, professional standards, hierarchy, risk aversion, social processes and inequalities. As an illustration, a health-equity analysis has discovered that the prescription of antibiotics differed considerably among patients in terms of race, ethnicity, socioeconomic status, geography, clinician specialty, and setting-which means there were structural inequities in antibiotics (Kim et al., 2023).

Simultaneously, sociological approaches emphasize that antibiotic prescribing is more of a social action that is affected by professional etiquette, patient demand, fear of omission of bacterial infection, risk perception, and normative pressure (Szymczak and Newland, 2018). These lessons imply that to have a significant change in the primary care antibiotic prescribing, stewardship programs should work on the behavioural, cultural and social levels- not on the what (which antibiotic) but the why (why was it prescribed).

Social work professionals have one advantage to address those dimensions: they can assist patients in educational (health literacy, antibiotic expectations) and community-based activities regarding antibiotic drug use, handle social determinants of health shaping the risk of infection and antibiotic demand, and collaborate with clinicians to assist with behavioral change. The inclusion of social work in ASPs implies the acknowledgement of the fact that antibiotic stewardship is not a clinical but rather a public-health and community matter.

**5. Integrated multidisciplinary synergy and challenges**

This combination of general practice and laboratory science, pharmacy and social work provides a strong multidisciplinary tool of primary-care ASPs. All disciplines deal with some other connection in the chain of antibiotic prescribing: General practitioners: decision-making, patient contact, first contact. Laboratory/diagnostics: to be sure that accurate and timely diagnostics are done to inform prescribing. Pharmacists: optimisation of medicine lifecycle, audit/feedback, patient counselling. Social work/behavioral: the needs of patients, patient expectations, social determinants, equity, education. These roles can be coordinated to make stewardship programs more effective. Indicatively, to address the patients in terms of expectation and norms of antibiotic use, a general practice clinic can dedicate itself to outpatient stewardship (CDC core element), use diagnostics to inform treatment, involve pharmacists to review prescriptions, and use social workers or behavioral specialists to communicate their expectations and the community norms of antibiotic use. Nevertheless, a number of obstacles still exist. The primary care aspect of implementation is not as straightforward as in hospitals. According to van Driel et al. (2020), sustainable adoption of ASPs in primary care is still a dream without top-down support, behavioral change, funding and infrastructure (van Driel et al. (2020). According to other studies, entrenched norms, time constraints, diagnostic uncertainty and social pressures have an effect on provider behavior. The combination of the factors makes it difficult to intervene easily. In addition, the diagnostic stewardship infrastructure in the ambulatory environments is lower. Most clinics do not have fast diagnostic tests, the lab feedback in a timely manner, and electronic health records to aid in decision-making. In primary care, the laboratory-clinician-pharmacy interface may be ineffective. In addition, social work and behavioral elements are usually missing in the ASP design, which is a significant gap. Pharmacologically, pharmacists possess the necessary skills, but they might not be able to integrate into primary care ASPs due to the workflow, financial support, interprofessional interactions, and role identification. Liaskou et al. (2018) mentioned that it requires proper integration and infrastructural support (Liaskou et al., 2018). Lastly, primary care monitoring, audit and feedback are not so mature as those of hospitals. Monitoring antibiotic prescribing, auditing suitability, providing feedback to prescribers demand information systems, quality-improvement ability and clinician buy-in. Other interventions would stall without effective tracking and reporting.

## 6. Evidence of effectiveness and gaps for future work

Meta-analysis and systematic reviews indicate that ASPs are linked to falls in antibiotic use in the settings, which include outpatient care. Ya et al. (2023) have discovered that the use of antibiotics in general decreased with the help of antimicrobial stewardship programs (52 studies, >1.7 million patients) (Ya et al., 2023). This argues in favor of the stewardship methods as a whole and highlights the possibilities of primary-care programs. Nevertheless, the relative accumulation of evidence related to primary care, as well as integrated multidisciplinary models, is not significant. Outpatient and primary-care setting also have different challenges (volume of prescribing, diagnostic uncertainty, patient expectation, lower acuity, resources) than inpatient settings (van Driel et al., 2020). Moreover, the importance of diagnostic stewardship as an outpatient has been less examined: the literature on the topic continues to increase in the hospital setting, but has not been well articulated in primary care. Aspects of stewardship were highlighted by Sullivan (2022), who urged to maximize the diagnostic pathway and involve laboratory professionals (Sullivan, 2022). Under the social and behavioral aspect, the variation in prescribing as a result of social determinants is recognized, but with less interventions involving a translation of social work or behavioral science into primary care ASPs. The health equity review identified patient and clinician differences in prescribing, which is poorly defined by the mechanisms of drivers (Kim et al., 2023). These gaps indicate critical research and practice directions: interprofessional pilot programs in primary care, which explicitly include social-behavioral interventions, diagnostic pathways, pharmacy collaboration and GP leadership; powerful evaluation of outcomes (prescribing rates, spectrum of antibiotic use, outcome measures); and structural support of sustaining implementation.

## 7. Practical considerations and recommendations

On the above, a number of useful suggestions can be made regarding the structure of integrated ASPs in primary care: Leadership and commitment: Clinics are expected to show leadership commitment to antibiotic optimization, which is consistent with the CDC Core Elements to outpatient stewardship (commitment, action, tracking/reporting, education) (CDC, n.d.).

- **Diagnostic integration:** Intertwine laboratory and diagnostic processes into primary care processes- de deploy decision-tools to order tests, report results quickly, provide feedback on antibiogram, and make clinical decisions. The stewardship program should be considered to be part of diagnostic stewardship (Dumm et al., 2024).
- **Pharmacy Collaboration:** Engage pharmacists in primary-care teams: get them to review antibiotic prescriptions, offer educational outreach to prescribers and patients, develop and spread guidelines about outpatient antibiotic use, and monitor the pattern of prescription.
- **Behavioral and social work contribution:** Involve social work or behavioral science to discuss patient expectations of antibiotics, health-literacy concerns, social factors that contribute or diminish the risk of infection or demand of antibiotics and to facilitate culturally-specific education and community outreach.
- **Audit, feedback and data-systems:** Have systems to monitor antibiotic prescription (volume, indication, spectrum, appropriateness) and give peer-benchmarking, prescribing feedback and continuous quality improvement loops. To illustrate, it has been found that feedback on social norms can also have an effect on prescribing behavior (Zeng et al., 2023).
- **Change education and culture:** Continuous education on antimicrobial resistance, pharmacist, lab staff and social work-colleagues on social work principles, diagnostic uncertainty, and social aspects of antibiotic prescribing. Interventions based on behavioural interventions (e.g. commitment posters, peer comparison letters) have been promising.
- **Sustainability and resources:** Devote specific resources (personnel time, IT support, interdisciplinary meetings, etc.) to maintaining that stewardship can be part of daily practice as opposed to a supplement. Van Driel et al. (2020) stated that sustainable implementation needs funding, infrastructure and integration (Van Driel et al., 2020).

## 8. Limitations and caution

Although the prospect of integrated stewardship in the primary care is very attractive, there are also certain limitations. The primary-care environment is highly heterogeneous (solo practices versus multi-specialty groups, resource constraints) and it is possible that a single size fits all models will not be effective. The diagnostic and social work integration of outpatient stewardship remains in its infancy as an evidence base and numerous interventions have been tested in more controlled research environments as opposed to practical primary care. In lower-resource settings, subscription to diagnostic tests or infrastructure investments could be a challenge. Also, prescribing independence and time primary care barriers can reduce the adoption of stewardship interventions. That the residual inappropriate prescribing in one of the studies was still high (55 % post-intervention) indicates that gradual change might be slow (Zeng et al., 2023). Lastly, the unintended consequences should be put into consideration by stewardship: e.g., over-restriction of antibiotics without sufficient diagnostics can make the necessary treatment take time; diagnostic stewardship should be supplemented with antimicrobial stewardship to prevent misdiagnosis or under-treatment (Morgan et al., 2017).

## CONCLUSION

In conclusion, the concept of the assessment of antibiotic stewardship programs in the primary care setting using the combination of the functions of the general practice, clinical laboratory science, pharmacy, and social work provides a complete roadmap towards the optimization of antibiotic use in the community. The addition of value is in each field: general practitioners are in charge of the decisions, laboratory science means diagnostics, pharmacists maximize the use of medications, and social work can solve behavioral and social determinants. The integration of these fields promises better, sustainable and effective stewardship. Nevertheless, implementation will be a success only with the help of leadership, proper infrastructure, behavioral change strategies, data tracking and resources allocation. Further studies are needed on the interprofessional pilot models within ambulatory practice, sound analysis of outcomes (such as decrease in inappropriate prescribing and narrowing spectrum, effect on resistance), and the study of social-behavioral interventions in stewardship models. It is only with these integrated and multi-disciplinary solutions that primary care will be able to have the meaning and lasting change in the use of antibiotics- and thus play a role in the international response to antimicrobial resistance.

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