Saudi Journal of Medicine and Public Health

https://saudijmph.com/index.php/pub

https://doi.org/10.64483/202412335

Antimicrobial Stewardship as a Collective Imperative: Integrating Multidisciplinary Healthcare Expertise to Mitigate Antimicrobial Resistance

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Abstract

Background: Antimicrobial Resistance (AMR) constitutes a critical global health threat, undermining the efficacy of essential medicines and escalating morbidity, mortality, and healthcare costs. Traditional antimicrobial stewardship (AMS) programs have often been siloed within infectious diseases or pharmacy, overlooking the pivotal contributions of the broader healthcare team.

Aim: This narrative review aims to deconstruct the monolithic concept of AMS, reconceptualising it as an integrative, multidisciplinary "team sport." It seeks to synthesise evidence on the specific roles and responsibilities of diverse healthcare professions—including medical microbiology, laboratory science, nursing, respiratory therapy, dentistry, and midwifery—in a cohesive AMS strategy.

Methods: A comprehensive literature search was conducted across PubMed, Scopus, and CINAHL databases (2010-2024), focusing on empirical studies, reviews, and guidelines addressing multidisciplinary involvement in AMS.

Results: Effective AMS is predicated on seamless interprofessional collaboration. Key findings delineate profession-specific interventions: laboratory scientists enable rapid diagnostic stewardship; prescribers adhere to evidence-based guidelines; while nursing, allied health, dental, and midwifery professionals ensure optimal specimen collection, timely antimicrobial administration, patient education, and infection prevention. Successful programs are characterised by clear communication channels, shared accountability, and institutional support.

Conclusion: Combating AMR requires a paradigm shift from fragmented, specialist-driven models to embedded, collective ownership of stewardship principles across all healthcare disciplines. Institutional investment in interdisciplinary education, communication infrastructure, and role-specific resources is essential to operationalise this team-based approach.

Keywords: Antimicrobial Stewardship, Multidisciplinary Team, Antimicrobial Resistance, Diagnostic Stewardship, Interprofessional Collaboration.

Introduction

The ascendancy of antimicrobial resistance (AMR) represents one of the most formidable challenges to modern medicine, with projections suggesting it could cause 10 million deaths annually by 2050 if left unchecked (O'Neill, 2016). AMR erodes the foundation of treatments for infections ranging from community-acquired pneumonia to post-surgical sepsis, rendering once-reliable therapies ineffective and driving up healthcare costs through prolonged hospitalisations and the need for last-resort agents (Dadgostar, 2019). In response, Antimicrobial Stewardship (AMS) has emerged as a coordinated set of interventions designed to promote the appropriate use of antimicrobials—ensuring the right drug, dose, duration, and route of administration (Barlam et al., 2016). Historically, AMS programs have been predominantly anchored within hospital pharmacy

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Receive Date: 11 December 2024, Revise Date: 30 December 2024, Accept Date: 31 December 2024

and infectious diseases (ID) departments, creating a perception of stewardship as a niche, specialist activity (Dyar et al., 2017). This siloed approach, however, fails to capture the complex, multi-professional reality of patient care, where decisions influencing antimicrobial use are made at numerous touchpoints by a diverse array of healthcare workers (HCWs).

This narrative review argues for a fundamental reconceptualization of AMS as a "collective imperative" or a "team sport," a metaphor underscoring the necessity of coordinated, synergistic effort from all players in the healthcare field. The core thesis is that sustainable and effective AMS cannot be the sole purview of ID physicians and pharmacists; it must be authentically integrated into the routine practice of every healthcare profession involved in the patient's journey. From the initial suspicion of infection to diagnostic testing, treatment administration, monitoring, and patient education, each discipline holds a crucial piece of the stewardship puzzle (Monsees et al., 2019).

The aim of this review is therefore to synthesise contemporary evidence delineating the specific, evidence-based roles of key professional groups—medical microbiologists, laboratory scientists, prescribers (physicians, nurse practitioners), nurses, respiratory therapists (RTs), dentists, and midwives—in a cohesive, multidisciplinary AMS strategy. By examining the unique contributions and interdependencies of these roles, this review aims to provide a blueprint for building robust, hospital- and community-wide stewardship ecosystems grounded in shared responsibility and interprofessional collaboration.

Diagnostic Stewardship and the Laboratory Team

The journey of appropriate antimicrobial use begins not with a prescription, but with accurate and timely diagnosis. Here, the medical microbiology and laboratory science team serve as the indispensable first line of defence in AMS, a concept encapsulated by the term "diagnostic stewardship"—the coordinated process of ordering the right test, for the right patient, at the right time, and interpreting the results correctly to guide optimal clinical action (Morgan et al., 2017). Their role is proactive and multifaceted, directly influencing downstream prescribing behaviour.

A primary contribution is the implementation and optimisation of rapid diagnostic technologies (RDTs). Techniques such as matrix-assisted laser desorption/ionisation time-of-flight (MALDI-TOF) mass spectrometry for microbial identification and rapid molecular panels for pathogen detection (e.g., blood culture identification panels, respiratory pathogen panels) have revolutionised microbiology by providing results in hours rather than days (Banerjee & Humphries, 2021). For example, rapid identification of *Staphylococcus aureus* in blood cultures coupled with automated antimicrobial susceptibility testing (AST) alerting can enable earlier de-escalation from broad-spectrum empiric therapy like vancomycin to a targeted beta-lactam, improving outcomes and reducing selective pressure (Bauer et al., 2010). However, the mere availability of technology is insufficient. Laboratory scientists and clinical microbiologists are stewards in interpreting and communicating these results. This involves providing actionable comments in pathology reports, such as advising on the lack of utility of antibiotics for viral syndromes detected by multiplex PCR or highlighting the possibility of contamination for certain isolates (Forrest et al., 2014). Furthermore, they play a critical role in optimising pre-analytical phases by providing clear guidelines on optimal specimen collection, a factor profoundly affecting result accuracy and, consequently, antimicrobial decisions (Schinas et al., 2022).

Effective collaboration between the laboratory and clinical teams is paramount. Implementing RDTs without parallel education for prescribers on interpreting results can limit their impact. Studies show that AMS programs that embed a clinical microbiologist or an antimicrobial pharmacist in ward rounds to discuss microbiology results in real-time significantly improve appropriate antimicrobial use (Barlam et al., 2016). The laboratory's stewardship extends to AST reporting practices, such as applying selective reporting—withholding susceptibility results for secondary, non-recommended agents when a first-line drug is effective—to nudge prescribers towards guideline-concordant choices (Goff et al., 2017). In essence, the laboratory transforms raw data into clinical intelligence, making it not just a service department but a core decision-support unit within the AMS team. Figure 1 illustrates the progression from diagnostic testing and pathogen identification to clinical diagnosis and informed treatment decisions, emphasizing the role of diagnostic stewardship in guiding appropriate antimicrobial use.

Figure 1: The Diagnostic-to-Decision Pipeline in Antimicrobial Stewardship

Adherence to Evidence and De-escalation

Physicians, along with other independent prescribers such as nurse practitioners and physician associates, hold the legal authority to initiate antimicrobial therapy, placing them in a position of profound responsibility. Their stewardship role centres on the principles of precision and restraint: prescribing only when there is a clear clinical indication, and doing so in alignment with the best available evidence (Dellit et al., 2007). This begins with the choice of empiric therapy, which should be guided by local, regularly updated antibiograms and institutional or national treatment guidelines that account for local resistance patterns and common pathogens (Darwish et al., 2022). Empiric therapy must be both adequately broad to cover likely pathogens in severe infections, yet as narrow as possible to avoid unnecessary collateral damage to the patient's microbiota and the microbial ecology of the healthcare environment.

The critical stewardship act for prescribers is the commitment to "reassess and de-escalate" at 48-72 hours. This involves synthesising clinical response data, microbiology results (leveraging the laboratory's work), and imaging findings to narrow therapy, switch from intravenous to oral formulations where appropriate, or even stop antibiotics if an infection is deemed unlikely (Tamma et al., 2019). De-escalation is a key marker of high-quality stewardship but is often under-practised due to cognitive biases like "antimicrobial inertia"—the reluctance to change a therapy that appears to be working (Doernberg et al., 2018). Prescribers also steward duration, moving beyond outdated, arbitrary courses towards individualised, shorter-duration therapy for conditions like community-acquired pneumonia and intra-abdominal infections, which has been proven non-inferior to longer courses in numerous trials (Yahav et al., 2019).

Engagement with prospective audit and feedback (PAF), a core AMS intervention where an ID pharmacist or physician reviews prescriptions and provides non-binding recommendations, is vital. Prescribers who view PAF as a collaborative educational tool rather than a punitive audit demonstrate higher rates of recommendation acceptance and contribute to a positive stewardship culture (Barlam et al., 2016). Furthermore, in the era of increasing outpatient parenteral antimicrobial therapy (OPAT), prescribers in both hospital and community settings must steward complex, long-term regimens, ensuring appropriate monitoring and planned review (Shah et al., 2019). Ultimately, the prescriber's role is that of an informed decision-maker who balances immediate patient needs with long-term public health consequences, requiring continuous education and a willingness to embrace stewardship as a core clinical competency.

Nursing as the Bedside Engine of Stewardship Implementation

Nurses, as the constant caregivers at the patient's bedside, are the essential conduit through which AMS principles are operationalised. Their involvement spans the entire antimicrobial use pathway, making them invaluable "stewards in action" (Monsees et al., 2019). A foundational nursing contribution lies in the pre-analytical phase: ensuring the quality of microbiological specimens. Proper technique in collecting blood cultures, urine samples, and wound swabs—including site preparation, timing, and volume—directly impacts the reliability of results, preventing false positives that lead to unnecessary antibiotics (Castro-Sánchez et al., 2016). Nurses are also responsible for the timely administration of the first antibiotic dose, a critical factor in sepsis bundles, and for adhering to precise administration times to maintain pharmacokinetic/pharmacodynamic targets essential for efficacy and resistance suppression (Manning et al., 2016).

Beyond administration, nurses are pivotal in monitoring therapeutic response and adverse effects. They are often the first to identify signs of clinical improvement, treatment failure, or potential drug toxicity (e.g., nephrotoxicity, *Clostridioides difficile* infection), triggering vital communication with the prescribing team to adjust therapy (Olans et al., 2017). Their role in intravenous-to-oral (IV-to-PO) switch programs is particularly impactful;

nurses' assessments of a patient's ability to tolerate oral medication can facilitate earlier transitions, reducing the risks associated with IV lines and potentially enabling earlier discharge (Monsees et al., 2019). Perhaps one of the most powerful stewardship tools in nursing is patient and family education. Nurses explain the importance of completing prescribed antibiotic courses, address misconceptions about antibiotics for viral infections, and reinforce infection prevention measures like hand hygiene and vaccination—all of which are crucial for curbing AMR in the community (Castro-Sánchez et al., 2016). Despite this, nurses often report feeling excluded from formal AMS programs and lacking specific education on stewardship principles, indicating a significant untapped potential for enhancing their integration and leadership in multidisciplinary teams (Monsees et al., 2019).

Guardians of Respiratory Specimen Integrity and Pneumonia Prevention

Respiratory Therapists (RTs) possess specialised expertise in pulmonary care, positioning them as critical stakeholders in AMS, particularly for lower respiratory tract infections (LRTIs), which are among the most common reasons for antimicrobial use in hospitals. Their stewardship role is twofold: ensuring the validity of diagnostic sampling and championing preventive strategies for ventilator-associated events (VAEs), including pneumonia (VAP) (Harrison et al., 2023). The collection of respiratory specimens, such as sputum and bronchoalveolar lavage (BAL) fluid, is highly technique-dependent. RTs are trained to obtain high-quality, lower respiratory tract samples that are less likely to be contaminated by oropharyngeal flora, which can lead to misleading culture results and inappropriate antibiotic use (Klompas et al., 2014). By advocating for and obtaining quality specimens before antibiotic initiation, RTs directly contribute to accurate diagnosis and targeted therapy.

Furthermore, RTs are instrumental in implementing and monitoring VAP prevention bundles. These evidence-based practices—including head-of-bed elevation, daily sedation vacations and spontaneous breathing trials, and meticulous oral care—have been proven to significantly reduce the incidence of VAP, thereby pre-empting the need for antimicrobials (Klompas et al., 2014). RTs' daily management of mechanical ventilation and airway care directly influences patient outcomes and antimicrobial exposure. They also play a role in the diagnostic evaluation of suspected VAP, often participating in discussions about the clinical probability of infection versus colonisation, which can prevent the automatic prescribing of antibiotics for isolated fever or purulent secretions in the absence of true infection (Harrison et al., 2023). Their unique, hands-on role with ventilated patients makes them essential observers and reporters of clinical changes, contributing vital data for the prescriber's reassessment process.

Dental Professionals for Curbing Antimicrobial Misuse in Oral Health

Dentists and dental hygienists are significant prescribers of antibiotics, primarily for odontogenic infections and for prophylaxis in certain at-risk patients. However, a substantial proportion of dental antibiotic prescriptions are inconsistent with guidelines, often prescribed for inappropriate durations or for conditions (like irreversible pulpitis or localised abscess without systemic spread) where definitive dental treatment alone is indicated (Cope et al., 2016). This contributes to the community burden of AMR and drives problems like *C. difficile* infection. Therefore, dental professionals have a crucial stewardship mandate centred on antimicrobial conservatism.

The primary role of dentists in AMS is to adhere to evidence-based guidelines, such as those from the Faculty of General Dental Practice (UK) or the American Dental Association, which emphasise that the mainstay of managing dental infections is local intervention—incision and drainage, pulpectomy, or extraction—with antibiotics reserved for cases with signs of spreading infection or systemic involvement (e.g., fever, lymphadenopathy) (Dar-Odeh et al., 2010). Stewardship involves prescribing the narrowest-spectrum agent (typically penicillin or amoxicillin) for the shortest effective duration (often 3-5 days, rather than longer traditional courses) (Guerrini et al., 2019). Dental hygienists contribute through patient education, reinforcing the appropriate use of antibiotics and the importance of completing courses only when prescribed. Furthermore, the entire dental team practices stewardship through rigorous infection prevention and control (IPC) in the clinical setting, sterilising instruments and disinfecting surfaces to prevent healthcare-associated transmission of pathogens (Prestinaci et al., 2015). Integrating explicit AMS education into dental curricula and continuing professional development is essential to align dental practice with global efforts against AMR.

Midwifery in Promoting Prudent Antimicrobial Use in Perinatal and Gynaecological Care

Midwives, providing care across the continuum from prenatal to postnatal periods, influence antimicrobial use in several key areas: prevention of neonatal infections, management of peripartum maternal infections, and treatment of sexually transmitted infections (STIs) in reproductive health. Their stewardship approach is inherently preventive and patient-centred. A major focus is on the implementation of intrapartum antibiotic prophylaxis (IAP) for Group B *Streptococcus* (GBS). Midwives play a central role in following evidence-based GBS screening protocols and ensuring the timely administration of penicillin G to colonised

mothers during labour, which is highly effective in preventing early-onset GBS disease in newborns while avoiding unnecessary antibiotic exposure for mothers who are not colonised or are delivering via planned caesarean section without labour (Hughes et al., 2017).

In the postpartum period, midwives are key in the diagnosis and management of endometritis or surgical site infections following caesarean section. Their accurate clinical assessment can help distinguish normal postnatal recovery from genuine infection, preventing unwarranted antibiotic starts. For STIs, midwives often provide testing, treatment, and partner notification services. Stewardship here involves using recommended first-line single-dose therapies (e.g., azithromycin for chlamydia) and providing comprehensive education to ensure adherence, which is critical for efficacy and preventing retreatment (Workowski & Bolan, 2015). Furthermore, midwives are powerful advocates for non-pharmacologic strategies and vaccination. They promote breastfeeding, which protects infants against infections, and counsel on vaccinations (e.g., influenza, Tdap, HPV) that prevent infections requiring antimicrobials (Wilcock et al., 2019). Their trusted relationship with patients positions them ideally to educate on the risks of antibiotic overuse and the importance of using them only when necessary.

Building the Effective Multidisciplinary AMS Team

The evidence unequivocally demonstrates that AMR is a multifaceted problem demanding a multifaceted, team-based solution. The distinct, complementary roles of each profession, as synthesised in Table 1, underscore that no single profession can steward antimicrobials effectively in isolation; success hinges on seamless interprofessional collaboration, clear communication, and mutual respect for each member's expertise.

Table 1: Core Stewardship Functions Across the Multidisciplinary Team

Healthcare Profession	Key Stewardship Roles & Responsibilities	Primary Impact on Antimicrobial Use
Medical Microbiology/Lab	Implements rapid diagnostic technologies (RDTs); provides interpretive comments on results; establishes guidelines for optimal specimen collection; practices selective AST reporting.	Enables earlier, targeted therapy; prevents treatment based on contamination or colonisation; guides de-escalation.
Prescribers (MD, NP, PA)	Initiates therapy only with clear indication; follows local guidelines for empiric choice; commits to 48-72 hr reassessment & de-escalation; prescribes optimal dose, route, and duration.	Directly determines appropriateness of initiation, spectrum, and duration of antimicrobial courses.
Nursing	Ensures optimal specimen collection technique; administers doses timely & accurately; monitors for response/toxicity; facilitates IV-to-PO switch; provides patient education.	Improves diagnostic yield; ensures PK/PD targets met; enables early transition off IV therapy; improves adherence.
Respiratory Therapy	Obtains high-quality lower respiratory tract specimens; implements VAP prevention bundles; advises on likelihood of true pneumonia vs. colonisation in ventilated patients.	Reduces false-positive cultures leading to unnecessary antibiotics; prevents infections requiring treatment.
Dentistry	Manages odontogenic infections primarily via surgical intervention; prescribes antibiotics only for systemic spread; uses narrow-spectrum, short-course regimens; practices strict IPC.	Reduces inappropriate outpatient prescriptions for dental conditions.
Midwifery	Implements evidence-based GBS prophylaxis protocols; accurately assesses for postpartum infections; provides STI treatment & education; promotes breastfeeding & vaccination.	Ensures appropriate peripartum prophylaxis; prevents unnecessary treatment; prevents infections through immunisation.

The core challenge lies in moving from theoretical recognition of these roles to their practical, embedded implementation within the complex workflows of healthcare. To foster the necessary collaboration, healthcare institutions must adopt deliberate strategies that bridge professional silos and cultivate a culture of shared accountability. Figure 2 depicts antimicrobial stewardship as a collaborative "team sport," highlighting the interconnected roles of medical microbiology, laboratory science, nursing, respiratory therapy, dentistry, and midwifery in mitigating antimicrobial

resistance through shared responsibility and coordinated action.

Key strategies for building effective teams, as outlined in Table 2, include structural, educational, and technological interventions.

Table 2: Strategies to Enhance Interprofessional Collaboration in AMS

Strategy	Description	Expected Outcome
Interprofessional Education (IPE)	Joint training sessions, simulations, or case discussions involving all relevant professions, focusing on interdependent roles in the antimicrobial use process.	Builds shared mental models, improves communication, and fosters mutual respect and understanding of roles.
Multidisciplinary Ward Rounds/Huddles	Regular, structured meetings (daily or weekly) at the point of care with prescriber, AMS pharmacist, bedside nurse, RT (if respiratory focus), and microbiologist (in-person or virtual).	Enables real-time, collaborative decision-making for complex cases, improving guideline adherence and de-escalation.
Shared Goals & Metrics	Develop unit- or service-specific AMS goals (e.g., reduce broad-spectrum use for community-acquired pneumonia) and track metrics (e.g., % guideline concordance). Data is shared and reviewed with the entire team, not just leadership.	Creates shared accountability, motivates team performance, and uses data to drive quality improvement.
Standardised Communication Tools	Implementation of structured communication tools (e.g., SBAR – Situation, Background, Assessment, Recommendation) for discussing antimicrobial plans or concerns between nurses, pharmacists, and prescribers.	Reduces communication errors, ensures critical information is transmitted clearly, and empowers all team members to voice stewardship concerns.
Embedded Clinical Decision Support (CDS)	Integration of guidelines, local antibiograms, and stewardship prompts (e.g., for duration or IV-to-PO switch) into the electronic health record (EHR) at the point of ordering and during clinical review.	Provides just-in-time, evidence-based guidance to all team members, supporting consistent application of best practices.
Cultural & Leadership Support	Hospital leadership explicitly endorses AMS as a safety priority, allocates resources (FTE, IT), and recognises contributions from all professions. Celebrating team successes in stewardship.	Creates a supportive environment where stewardship is valued, and all team members feel empowered and responsible for their role in the program.

Figure 2: Antimicrobial Stewardship as a Collective Imperative: A Multidisciplinary Team Sport

Conclusion

Key strategies for building effective teams include: 1) Integrated Education: Implementing interprofessional education (IPE) sessions on AMS, where nurses, doctors, pharmacists, microbiologists, RTs, and others learn together about their interdependent roles, fostering shared understanding and language (Abbo et al., 2013). 2) Structural Integration: Creating formalised structures such as regular multidisciplinary AMS ward rounds or huddles that include, at a minimum, a prescribing clinician, an AMS pharmacist, a nurse from the unit, and access to microbiology input. This breaks down silos and allows for real-time, collaborative decision-making (Barlam et al., 2016). 3) Technology and Communication Support: Leveraging health information technology (IT) to support the team. This includes clinical decision support (CDS) integrated into electronic prescribing systems, automated alerts

for culture results and guideline suggestions, and shared digital platforms for documentation and communication of stewardship plans (Morris et al., 2019). 4) Leadership and Culture: Cultivating an institutional culture where stewardship is valued as a quality and safety priority. This requires visible support from senior hospital leadership, resources for AMS programs, and recognition of all team members' contributions, not just those of prescribers (Dyar et al., 2017). 5) Metrics and Feedback: Developing and sharing metrics that reflect team performance, such as rates of appropriate specimen collection, time to first antibiotic dose, IV-to-PO switch rates, and guideline concordance. Providing this feedback to the entire multidisciplinary team reinforces shared accountability (Pollack et al., 2016).

Overcoming barriers such as professional hierarchies, time constraints, and unclear role definitions is crucial. Future research should focus on interventions that specifically target and measure the strength of interdisciplinary collaboration in AMS and its impact on patient outcomes and resistance patterns. Ultimately, defeating AMR requires every healthcare professional to see themselves as an essential steward. By embracing this collective imperative, the healthcare community can preserve these vital medicines for future generations.

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