

BEYOND DISPENSING: THE EXPANDING ROLE OF NURSES IN ANTIMICROBIAL STEWARDSHIP AND PHARMACOTHERAPY SAFETY

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ABSTRACT

Antimicrobial resistance (AMR) represents one of the most pressing threats to global health, with hospital-based Antimicrobial Stewardship Programs (ASPs) traditionally governed by physician- and pharmacist-led models that overlook nursing's structural position within healthcare delivery. This commentary argues that nurses, who constitute the largest professional group in the global health workforce and maintain near-continuous bedside presence, are uniquely positioned to contribute to antimicrobial stewardship and pharmacotherapy safety, yet remain systematically underutilized due to the persistence of task-oriented practice models, hierarchical team dynamics, and educational gaps in pre-registration curricula. Drawing on international evidence from hospital and community settings, the commentary demonstrates that nurse-integrated stewardship models—including bedside surveillance, IV-to-oral antibiotic conversion prompting, penicillin allergy de-labeling, and patient education initiatives—produce measurable reductions in antimicrobial consumption, healthcare-associated infections, and medication errors. Specialist nurse champion programmes from the United Kingdom, Australia, and other national health systems illustrate replicable implementation pathways, although barriers including understaffing, inconsistent competency frameworks, and regulatory limitations on prescribing authority constrain scalability. The commentary further examines the ethical dimensions of expanded nursing roles, emphasizing professional accountability, advocacy obligations under the International Council of Nurses' Code of Ethics, and equity considerations for resource-limited settings. We conclude with a call to action for institutions, policymakers, educators, and nursing professional bodies to formally integrate nurses into ASP governance structures, reform nursing curricula, and recognize nursing as an indispensable asset in the global response to AMR as a health security imperative.

KEYWORDS: antimicrobial stewardship; nursing role; pharmacotherapy safety; antimicrobial resistance; interprofessional collaboration

1. INTRODUCTION

Antimicrobial resistance (AMR) has emerged as one of the most consequential public health threats of the twenty-first century, undermining the foundations upon which modern medicine rests. A landmark systematic analysis published in *The Lancet* estimated that bacterial AMR was associated with approximately 4.95 million deaths globally in 2019, with 1.27 million deaths directly attributable to resistant organisms.[1] More recent global burden estimates covering the period from 1990 to 2021 confirm that this trajectory remains deeply alarming: without robust countermeasures, annual mortality from resistant bacteria could nearly double by 2050.[2] The burden falls disproportionately on low- and middle-income countries (LMICs), where diagnostic capacity, sanitation infrastructure, and access to quality antimicrobials remain severely constrained.[3] Against this backdrop, there is broad international consensus that the optimization of antibiotic use — through structured Antimicrobial Stewardship Programs (ASPs) — represents a critical and non-negotiable component of the global response to AMR.[4]

Despite this urgency, the governance of ASPs has been predominantly structured around a physician- and pharmacist-led model. Leading regulatory and accreditation bodies, including the Joint Commission, explicitly require hospitals to appoint a qualified physician and/or pharmacist to lead stewardship programs,[5] while the Centers for Disease Control and Prevention (CDC) similarly designates physician and pharmacist leadership as the cornerstone of effective hospital ASPs.[6] Although this model has yielded measurable improvements in prescribing quality, it remains structurally limited by a fundamental workforce reality: nurses represent the largest occupational group in healthcare, comprising approximately half of the global health workforce, with a total of 29.8 million nurses worldwide as of 2023.[7,8] Their near-continuous presence at the patient bedside, their role in medication administration, and their capacity for real-time clinical surveillance position nurses as uniquely placed — yet systematically underutilized — contributors to antimicrobial stewardship and pharmacotherapy safety.

The scale of inappropriate antibiotic use in hospital settings further underscores the urgency of this gap. Studies examining in-hospital empiric antibiotic prescribing in patients with severe infections have found that the proportion of inappropriate prescriptions ranges from 14% to as high as 79%, with more than half of reviewed studies reporting rates exceeding 50%.⁹ Such misuse not only accelerates resistance but is independently associated with significantly increased 30-day and in-hospital mortality.^[9] Despite their daily engagement with antimicrobial administration, nurses have consistently reported feeling marginalized from stewardship decision-making, describing the physician-dominated nature of ASPs as a structural barrier to meaningful nursing participation.^[10] A recent meta-synthesis of qualitative evidence confirmed that, while nurses recognize antimicrobial stewardship as integral to their professional role, their involvement remains constrained by organizational barriers, insufficient pharmacotherapy training, and a lack of institutional recognition.^[10] This commentary argues that the prevailing conception of nurses as passive implementers of antimicrobial prescriptions — the final link in a dispensing chain — is both clinically inaccurate and professionally untenable. Drawing upon emerging evidence from stewardship science, nursing practice research, and workforce policy, we contend that nurses must be recognized, trained, and formally integrated as active agents within ASPs and broader pharmacotherapy safety frameworks. As the most consistent providers of care at the bedside, nurses are in an ideal position to enhance antimicrobial management through sustained monitoring, patient education, and multidisciplinary collaboration.^[11] A systematic review of bedside nursing activities in antimicrobial stewardship described nurses as a "hidden gem" in the multidisciplinary stewardship landscape — a characterization that captures both their unrealized potential and the structural neglect that has historically obscured it.^[12] Realizing this potential requires coordinated action across clinical practice, professional education, and health policy. The following sections examine the evidence base for expanding nursing roles in antimicrobial stewardship, identify existing models of implementation, and propose a framework for institutional and policy-level reform.

2. The Traditional Model: Where Nurses Have Stood

The role of nurses in pharmacotherapy has long been defined — and confined — by a task-oriented framework centered on medication administration rather than therapeutic decision-making. At the institutional and educational level, this framing is most visibly embodied by the so-called "five rights" of medication administration: the right patient, drug, dose, route, and time.^[13] Introduced during an era in which medical errors were attributed solely to individual providers and patients exercised limited agency in their own care, the five rights framework was designed as a procedural safeguard, not a clinical reasoning tool.^[14] While its mnemonic utility in reducing acute administration errors has value, its continued application as the primary scaffold of nursing pharmacotherapy practice reflects a reductionist understanding of the nurse's role — one that positions nurses as the final checkpoint in a prescriptive chain rather than as active contributors to therapeutic optimization. Nursing scholars have increasingly characterized this model as a ceiling of expectation rather than a floor of competency, noting that it neither captures the full spectrum of pharmacological knowledge nurses possess nor the clinical judgments they routinely exercise in practice.^[14,15]

In the context of antimicrobial therapy specifically, the traditional model has translated into a narrow operational remit. Studies spanning multiple healthcare systems and settings consistently document that nursing contributions to antimicrobial stewardship (AMS) have been predominantly limited to administrative and supportive functions: ensuring timely antibiotic administration, obtaining microbiological specimens, and documenting treatment parameters in the clinical record.^[16,17] An integrative review by Gotterson, Busing, and Manias published in the *International Journal of Nursing Studies* found that, while nurses perform a range of stewardship-relevant activities in daily practice, these contributions remain largely informal, unrecognized, and embedded within routine care rather than formally constituted as AMS responsibilities.^[18] This invisibility is not incidental — it reflects a structural arrangement in which AMS governance has been institutionally assigned to physicians and pharmacists, with nurses occupying an ancillary rather than a participatory role.^[16,19]

"Antimicrobial stewardship has traditionally been the domain of doctors and pharmacists, but there is growing recognition that successful stewardship incorporates a multidisciplinary approach that includes nursing staff."^[19]

Several interrelated structural and organizational barriers sustain this model. Chief among these is the persistence of hierarchical team dynamics, in which professional boundaries and cultures of deference to physicians constrain nurses from initiating stewardship-relevant conversations, questioning prescribing decisions, or advocating for de-escalation of therapy.^[20,21] A systematic review of ICU nurses' roles in antimicrobial optimization identified interprofessional dissonance and the entrenched culture of physician deference as primary barriers to active nursing engagement, alongside knowledge deficits in antimicrobial pharmacology that limit nurses' confidence in clinical dialogue.^[22] Compounding these dynamics is the reality that nurses, in the majority of jurisdictions worldwide, possess no independent prescribing authority over antimicrobials — a regulatory asymmetry that structurally excludes them from the prescribing and de-prescribing decisions that lie at the heart of stewardship.^[23] Furthermore, systematic deficiencies in nursing education have left significant gaps in pharmacotherapy and AMS-specific knowledge: a national audit of United Kingdom pre-registration nursing programmes found that only 63% included any instruction on AMS, and a mere 12% covered all core stewardship principles.^[24]

The inadequacy of this traditional model has become increasingly untenable in the context of escalating AMR, rising clinical complexity, and global nursing workforce expansion. As the most consistently present healthcare professionals at the bedside — and as those most frequently responsible for identifying adverse drug reactions, clinical deterioration, and treatment non-adherence — nurses are, in practice, already performing stewardship-relevant functions.^[17,25] The critical question is no longer whether nurses contribute to antimicrobial management, but whether health systems are prepared to formally recognize, educate, and empower them to do so. A realist review published in 2025 in the *International Journal*

of Nursing Studies confirmed that nurse participation in hospital AMS is not contingent upon role creation from scratch but upon dismantling the contextual and structural mechanisms that currently suppress it.[26] The following sections build upon this premise by examining the evidence for a proactive nursing stewardship mandate and the models through which it can be realized.

3. The Case for Nurse-Led Antimicrobial Stewardship

3.1 Nurses as First-Line Surveillance Agents

Among all members of the clinical team, nurses occupy the most temporally continuous position in patient care — present across day, evening, and night shifts, and responsible for the moment-to-moment assessment of patient status that forms the empirical substrate of therapeutic decision-making. This unique positioning places nurses at the front line of antimicrobial surveillance in ways that no other profession can replicate. Bedside nurses are routinely the first to detect clinical deterioration, alterations in vital signs, failure to defervesce, new rashes, or signs of systemic adverse drug reaction — all of which carry direct implications for the adequacy or safety of ongoing antimicrobial therapy.[27] A scoping review by Zhao and colleagues, published in the *Journal of Clinical Nursing* (2023), systematically mapped nursing practice scope and competencies in AMS across acute hospital settings and confirmed that surveillance — encompassing the monitoring of infection markers, culture results, and patient response — constitutes a core, evidence-supported nursing stewardship function.[27]

Beyond passive observation, nurses have demonstrated effectiveness in proactively flagging stewardship-relevant concerns. A landmark quality improvement study by Ray Bardhan and colleagues, published in the *American Journal of Critical Care* (2020), implemented a structured nurse-prompting strategy in a critical care unit, in which nurses inserted a standardized script about antimicrobial days-of-therapy into ward rounds, cuing prescribers to reassess antibiotic necessity and duration. The intervention was associated with a significant reduction in antimicrobial utilization — from a mean of 804 days of therapy per 1,000 patient days pre-intervention, with an upward trend, to stabilization and subsequent reduction post-implementation — with no adverse effect on mortality, length of stay, or readmission rates.[28] This study provides compelling proof-of-concept that nurse-initiated prompting, without prescriptive authority, can produce clinically meaningful and statistically significant reductions in antimicrobial overuse. A scoping review of nurse engagement in AMS programs further confirmed that incorporating nurses into structured antimicrobial review processes reduces error rates and time-to-antibiotic administration, particularly in intensive care settings.[29]

3.2 Medication Reconciliation and Therapeutic Review

Nurses are frequently the healthcare professionals most systematically engaged in medication reconciliation — the process of comparing a patient's current medication orders against all medications a patient has been taking — a process that carries particular significance in antimicrobial therapy where polypharmacy, drug-drug interactions, and allergy documentation errors pose substantial patient safety risks.[17] The nurse's role in identifying discrepancies, querying inappropriate drug combinations, and escalating concerns about dose or route forms a critical layer of therapeutic review that operates independently of and in complement to pharmacist-led reconciliation.

One of the most impactful and actionable nursing stewardship roles lies in intravenous-to-oral (IV-to-oral) antibiotic switch prompting. Early transition from parenteral to oral antibiotics — where clinically appropriate — is a well-established stewardship intervention associated with reduced venous access complications, shorter hospitalization, and lower cost, yet it is frequently delayed due to system inertia rather than clinical necessity.[30] A 2023 evaluation of a nurse-led IV-to-oral (IVOS) prompt tool at Nottingham University Hospitals NHS Trust found that 98 nurses who used the tool rated prompting for IVOS as clearly within nursing scope (mean score 4.2/5.0) and felt confident applying the tool in clinical practice (4.1/5.0), supporting the feasibility of nurses as primary drivers of IV-to-oral conversion review.[30]

Equally significant is the nursing role in penicillin allergy reconciliation. Approximately 10% of patients in the United States carry a documented penicillin allergy label, yet over 90% of these individuals can tolerate penicillin without an immediate hypersensitivity reaction — a discrepancy that drives prescription of broader-spectrum and often inferior antimicrobial alternatives, increasing *Clostridioides difficile* infection risk, multidrug-resistant organism selection pressure, and hospital costs.[31] A nurse-initiated penicillin allergy de-labeling study demonstrated that nurses could successfully use a structured questionnaire to remove inappropriate allergy labels in inpatients, providing evidence that nursing-led allergy assessment is both feasible and effective as a component of antimicrobial stewardship.[31]

3.3 Patient Education and Adherence

Patient education represents one of the most consistently identified, yet persistently underdeveloped, nursing contributions to AMS. The nurse-patient relationship — built on continuity, trust, and therapeutic communication — constitutes an ideal vehicle for conveying the rationale for antibiotic prescribing, the importance of completing treatment courses, and the personal and societal consequences of antimicrobial misuse.[32] A mixed-method study of nurses' awareness of and contributions to ASPs in Qatar found that patient education was recognized as a critical stewardship function, with nurses identifying their role in promoting treatment adherence, preventing self-medication, and reducing antibiotic overuse.[32] This educational mandate assumes heightened urgency in low- and middle-income countries (LMICs), where self-medication with antibiotics obtained without prescription from pharmacies, informal vendors, and unregulated markets remains alarmingly common.[33] A scoping review of self-medication with antimicrobials in LMICs found that the practice is driven by limited healthcare access, low health literacy, weak regulatory frameworks, and cultural acceptance of antibiotic self-treatment — factors that nurses working in community, primary care, and outpatient settings are uniquely

positioned to address through targeted education.[33] A qualitative systematic review of healthcare professionals' patient education practices regarding antibiotic use confirmed that nurses, alongside physicians and pharmacists, play a pivotal gatekeeping function in primary care, and that the quality of nurse-patient communication around antimicrobials is a determinant of both adherence and resistance risk behavior.[34] Effective delivery of this education requires health literacy-sensitive communication strategies — tailored messaging, teach-back methods, and culturally concordant framing — rather than uniform instruction, particularly for patients with limited formal education or language barriers.[34]

4. Pharmacotherapy Safety: Expanding the Nursing Mandate

The case for expanding the nursing role in antimicrobial management is inseparable from a broader argument about the nurse's foundational contribution to pharmacotherapy safety across all drug classes. While antimicrobials receive justified emphasis given the AMR crisis, the structural logic for nursing engagement applies with equal force to the full spectrum of high-alert medications — drugs defined by the Institute for Safe Medication Practices (ISMP) as those that bear a heightened risk of causing significant patient harm when used in error.[35] These include anticoagulants (heparin, warfarin, direct oral anticoagulants), insulin and other antidiabetic agents, and opioid analgesics — agents that, together with antibiotics, account for the largest share of preventable adverse drug events (ADEs) requiring emergency intervention in the United States.[36] Nurses administer these medications at every stage of inpatient care and are, by position, the most proximate professionals to the moment of drug-patient interaction; as the Patient Safety Network of the Agency for Healthcare Research and Quality (AHRQ) notes, nurses are most involved at the medication administration phase and simultaneously provide a vital function in detecting and preventing errors that originated in prescribing, transcribing, or dispensing.[37]

The most problematic medications leading to emergency adverse drug events include anticoagulants, diabetes medications, antibiotics, and opioid analgesics — all drug classes for which nurses constitute the last, most consistent line of safety verification.[38]

Nurses are also the most prolific contributors to hospital incident reporting systems. An analysis of a voluntary adverse event reporting system at a 1,300-bed tertiary university hospital found that nurses accounted for the substantial majority of reports in the institution's online risk management system, with insulin, heparin, vancomycin, and morphine — all high-alert medications — among the most frequently reported agents.[38] This reporting behavior reflects both the volume of nurse-medication contact and the degree of pharmacovigilance that nurses exercise, even absent formal stewardship mandates. However, underreporting of adverse events by nurses remains a documented concern, driven by fear of punitive responses, time pressures, and uncertainty about what constitutes a reportable event — a culture problem that constrains the full contribution nursing incident surveillance can make to institutional safety learning.[39]

The integration of clinical decision support systems (CDSSs) at the point of care represents a structural mechanism through which nursing pharmacotherapy vigilance can be amplified and standardized. A systematic review commissioned by the AHRQ (Making Healthcare Safer IV, 2024) found strong evidence from randomized controlled trials and non-randomized studies that CDSSs improve process-of-care outcomes related to medication safety, including alert-based prevention of drug-allergy interactions, dose-range checking, and renal function-adjusted dosing recommendations.[40] When embedded in nursing workflows at the medication administration stage, rather than exclusively at prescribing, these tools have the greatest potential to intercept errors before they reach the patient. District nurses' use of a CDSS-based medication assessment tool in a Swedish feasibility study identified significant proportions of drug-related problems in elderly patients — including polypharmacy, contraindicated drug combinations, and inappropriate dosing — that had not been detected during routine physician review, underscoring the independent pharmacovigilance value nurses add when equipped with decision support.[41]

Evidence from units with formalized nursing pharmacotherapy involvement further supports the case for expanding this mandate. Antimicrobial stewardship studies incorporating nurses in structured roles — from bedside prompting and antimicrobial rounding to culture result monitoring and IV-to-oral transition facilitation — have consistently demonstrated improvements in antibiotic use metrics, including reductions in days of therapy, earlier de-escalation, and improved culture-concordant prescribing, without adverse effects on clinical outcomes such as mortality or readmission.[28,29,42] A scoping review of nurse engagement in AMS, published in *Antimicrobial Stewardship & Healthcare Epidemiology* (2023), synthesized evidence from studies across multiple care settings and identified a consistent pattern: units and institutions that actively integrated nurses into stewardship activities achieved more sustainable reductions in antimicrobial overuse than those relying exclusively on physician-pharmacist dyads — largely because nurse engagement operationalizes stewardship at the continuous point of care rather than in periodic pharmacist-led reviews.[12] These findings provide a persuasive empirical foundation for the institutionalization of nurse-initiated medication review protocols as a standard component of ward-level safety governance.

5. Models of Implementation: Evidence from Practice

5.1 Successful Nurse-Integrated ASP Models: Hospital and Community Settings

A growing body of implementation evidence demonstrates that nurse-integrated ASP models can generate measurable, sustained improvements in antimicrobial use when designed with structural intentionality. In the United States, a quality improvement initiative implemented across a hospital system between 2024 and 2025 demonstrated that training frontline nurses in the "Four Moments of Antibiotic Decision-Making" — a framework adapted from Tamma, Miller, and Cosgrove's JAMA-published model — through unit-based education, nurse team meetings, pocket guides, and QR-coded posters, resulted in significant improvements in nurse knowledge of AMS principles and self-reported engagement in

stewardship behaviors.[42] Critically, the initiative employed nurse champions recruited unit-by-unit to serve as peer resources, embedding stewardship not as an external audit function but as a locally owned clinical culture. In tertiary care settings across South Asia and East Asia, comparative studies have documented meaningful reductions in antibiotic consumption metrics when nurse engagement is incorporated within multidisciplinary ASP teams. A three-year observational study at a tertiary care hospital in India, comparing a nurse-led phase (2022–2023) with a subsequent policy-driven multidisciplinary ASP phase (2023–2025), found that antibiotic use declined progressively across both phases, with defined daily doses (DDD) per 1,000 patient-days falling from 2,599.3 to 2,413.3 and culture-based therapy coverage increasing substantially — an effect attributable in part to nurses' systematic involvement in specimen collection, allergy documentation, and bedside antibiotic monitoring.[43] A qualitative systematic review of nursing strategies for antimicrobial management in hospital environments, conducted using Joanna Briggs Institute meta-aggregation methodology, confirmed that nursing-led contributions — spanning care practice, patient education, infection prevention, and policy advocacy — have demonstrated significant potential to reduce antimicrobial resistance across diverse institutional contexts.[44]

5.2 Nurse Antibiotic Stewardship Champions: UK, Australia, and Scandinavia

Some of the most advanced and structurally formalized nurse stewardship models have emerged from the United Kingdom, Australia, and Scandinavia. In the UK, a national AMS Nurses Group was established in June 2022, growing from 6 to 16 members across acute hospital trusts and extending into the Republic of Ireland by 2025; the group conducts monthly peer support meetings, shares stewardship intervention evidence, and delivered a nationally broadcast webinar — held during Infection Prevention and Control week — that equipped generalist nurses with AMS-aligned extensions of the five rights of medication administration.[45] This initiative operates under the framework of the UK's national AMR action plan, "Confronting Antimicrobial Resistance 2024–2029," which explicitly names workforce training — including role-specific AMS competency pathways and specialist career development — as a strategic priority.[45] In Australia, the Australian Commission on Safety and Quality in Health Care has formally recommended the inclusion of nurses and midwives in both the Antimicrobial Stewardship Committee and Antimicrobial Stewardship Team, providing published guidance on nursing and infection control practitioner contributions — one of the few national governance frameworks to institutionalize this mandate.[46]

"The Australian Commission on Safety and Quality in Health Care recommends formally including nurses in both the Antimicrobial Stewardship Committee and the Antimicrobial Stewardship Team, providing guidance on the role of nurses, midwives, and infection control practitioners — reflecting the important role that nurses play in hospital AMS efforts." [46] A cross-sectional study of nurses' AMS engagement in China — contextualized within the country's National Action Plan to Contain Antimicrobial Resistance 2022–2025, which mandates that all healthcare staff achieve an accurate antimicrobial knowledge rate exceeding 80% — found that deployment of clinical pharmacists within nursing departments was independently associated with higher nurse AMS engagement scores, and that nurses in ICU and infectious disease departments reported lower engagement, attributed to heavier workloads, more pronounced professional boundary dynamics, and greater nursing staff shortages in those settings.[47] This finding underscores that the effectiveness of nurse champion models is sensitive to staffing context and requires deliberate workforce investment rather than role addition alone.

5.3 Barriers to Scaling

Despite the promise of these models, several barriers constrain their generalization and institutional adoption. High nursing-to-patient ratios and chronic understaffing consistently emerge as the most frequently cited structural impediments, with nurses in high-acuity settings reporting time constraints that preclude sustained engagement in stewardship activities beyond immediate clinical demands.[47,48] The absence of standardized, internationally harmonized nursing AMS competency frameworks means that educational preparation for stewardship roles varies dramatically across institutions and jurisdictions — producing inconsistency in role definition, skill level, and accountability.[48] Regulatory inconsistency compounds this challenge: in most countries, nurses lack independent antimicrobial prescribing or de-prescribing authority, and the scope of formally recognized nursing stewardship activities differs substantially between healthcare systems in high-income countries and LMICs, where infrastructure and governance support for nurse-led interventions is often absent.[44,47]

6. Competency, Education, and Policy Imperatives

6.1 Gaps in Pre-Registration Nursing Education

The structural exclusion of nurses from antimicrobial stewardship decision-making cannot be separated from the educational deficits that underpin it. A landmark national cross-sectional survey of pre-registration nursing education programmes in the United Kingdom — conducted among lecturers from 35 universities — found that only 63% of programmes included any teaching on antimicrobial stewardship, and that coverage of all core AMS competency domains was even more limited, with particular gaps in microbiological interpretation, antibiotic pharmacology, and de-escalation principles.[49] A subsequent national survey of 523 pre-registration nursing students across 23 UK universities, published in the *Journal of Advanced Nursing* (2025), reinforced these findings: while students reported feeling well prepared in infection prevention and control and patient-centred care competencies, they felt significantly less prepared in competencies requiring application of microbiological and pharmacological knowledge to stewardship practice — a gap that directly limits their readiness to act as stewardship agents upon registration.[50] These data indicate that the

educational system is currently producing nurses whose AMS preparation is substantially below the level required to fulfil the stewardship role advocated in this commentary.

6.2 Postgraduate Training, Credentialing, and Competency Frameworks

Addressing these gaps requires both pre-registration curriculum reform and the development of robust postgraduate stewardship training pathways. A scoping review of nursing AMS competencies published in *Antimicrobial Resistance & Infection Control* (2022) proposed a six-domain consensus competency framework for nurses — encompassing infection prevention and control, antimicrobial pharmacology, diagnostic stewardship, prescribing practice, person-centred care, and interprofessional collaboration — that can serve as the foundation for internationally harmonized credentialing standards.[24] E-learning platforms have demonstrated effectiveness as a scalable vehicle for postgraduate AMS education: a study published in *Antimicrobial Stewardship & Healthcare Epidemiology* (2024) found that a modular online learning programme covering stewardship principles, antibiogram interpretation, IV-to-oral conversion, and allergy history-taking produced sustained knowledge improvements in nurses over a multi-year assessment window — without the scheduling constraints that preclude attendance at in-person training in high-acuity ward environments.[51] Institutional adoption of such programmes should be coupled with formal credentialing of nurse AMS champions, protected time allocations for stewardship activities, and competency-based performance evaluation frameworks that render nursing stewardship contributions measurable and accountable.

6.3 Policy Call: Formal Inclusion in ASP Governance

Education reform must be matched by structural policy change. At the institutional level, hospitals should mandate nursing representation on Antimicrobial Stewardship Committees — not as observers but as voting members with defined responsibilities for surveillance reporting, nursing-specific outcome monitoring, and staff education. At the national level, regulatory bodies and ministries of health should formally codify the nursing stewardship role within national AMR action plans, ensuring that nurse AMS participation is a condition of hospital accreditation rather than an optional enhancement. The Australian model — which, uniquely among national health systems, has embedded this requirement in governance guidance — provides a replicable blueprint.[46] A national survey of clinical nurse involvement in ASPs in the United States found that, while nurses routinely perform stewardship-relevant activities, their formal integration into ASPs remains profoundly limited and inconsistent — a gap that nurse leaders are now called to address through structural advocacy and institutional accountability mechanisms.[52]

6.4 Interprofessional Education as a Vehicle for Integration

Interprofessional education (IPE) represents one of the most evidence-supported and logistically scalable mechanisms for embedding nurses within functioning stewardship teams. An interprofessional AMS education conference evaluated at universities in the United Kingdom and Australia — grounded in contact theory and structured around simulated case-based discussions among nursing, pharmacy, and medical students — demonstrated that participants achieved significantly greater understanding of each other's professional roles in antimicrobial management, reported improved confidence in interprofessional stewardship communication, and demonstrated changed attitudes toward collaborative prescribing practice.[53] A 2024 paper in *JAC-Antimicrobial Resistance* similarly argued that IPE offers the structural means to dissolve the professional siloes that sustain nursing's peripheral position in AMS, by creating shared experiential learning environments in which stewardship is framed as a team science from initial training rather than a physician-pharmacist specialism that nurses later join by invitation.[54] The U.S. Presidential Advisory Council on Combating Antibiotic-Resistant Bacteria (PACCARB) has further recommended the development of a core AMR curriculum founded on collaborative principles for all health science disciplines, with harmonized accreditation standards that mandate interprofessional AMS content — a recommendation that, if adopted, would structurally transform nursing's educational relationship with stewardship.[55]

6.5 The Role of Nursing Professional Bodies

Nursing professional bodies bear a particular responsibility for translating these educational and policy imperatives into practice. The American Nurses Association (ANA), in its landmark joint white paper with the CDC — *Redefining the Antibiotic Stewardship Team* — formally called for the recognition of registered nurses as integral members of hospital ASPs, providing a framework of nursing stewardship activities, and identifying microbiology and pharmacology as the primary educational gaps requiring institutional remediation.[57] Despite this document's influence, its recommendations remain incompletely implemented across U.S. hospital systems nearly a decade after publication, indicating that professional body advocacy must be accompanied by regulatory enforcement and accreditation requirements to effect durable change.[52] The International Council of Nurses (ICN), the Royal College of Nursing (RCN), and their counterparts in Asia, Africa, and Latin America are well positioned to advance nursing stewardship mandates at the global scale — through updated professional scope-of-practice standards, the development of nurse AMS specialist credentials, and the integration of stewardship competencies into national nursing registration examinations. A mapping review framed by Irvine's Nursing Role Effectiveness Model confirmed that structural empowerment — encompassing leadership support, defined role clarity, interprofessional collaboration, and targeted education — is the primary determinant of nursing engagement in AMS, and that without institutional and professional body backing, individual nurse motivation alone is insufficient to sustain meaningful stewardship participation.[46]

7. Ethical and Professional Dimensions

7.1 Professional Accountability versus Scope-of-Practice Constraints

The expansion of nursing roles in antimicrobial stewardship raises important questions at the intersection of professional accountability and scope-of-practice regulation. While nurses in most jurisdictions are held professionally accountable for the safety and appropriateness of the care they deliver, their legally recognised scope of practice often stops short of the prescribing, de-prescribing, and therapeutic decision-making authority that formal stewardship participation implies. This gap creates a structural tension: nurses are expected by professional codes to act in patients' best interests and to challenge unsafe or suboptimal care, yet they are simultaneously constrained by regulatory frameworks that confer therapeutic authority predominantly on physicians.[23] Oerther and Oerther, in a foundational paper on the ethical challenges of AMR for nurse practitioners, articulated this tension precisely, noting that the ethical imperative to optimise individual patient outcomes must be balanced against the broader obligation to preserve antimicrobial effectiveness for future populations — a stewardship obligation that is inseparable from nursing's professional mandate regardless of prescribing authority.[61] Resolution of this tension requires not the abandonment of scope-of-practice protections, but their thoughtful evolution: through formalised nurse stewardship roles that carry defined responsibilities within multidisciplinary teams, and through expanded collaborative practice arrangements that enable nurses to exercise clinical judgment in antimicrobial management within supervised, protocol-guided frameworks.

7.2 Advocacy as a Nursing Ethical Obligation in the Context of AMR

Patient and community advocacy is a foundational ethical obligation of nursing, codified in the International Council of Nurses' (ICN) revised Code of Ethics for Nurses (2021), which explicitly positions nurses as advocates for equitable health outcomes and holds nurses accountable not only for individual patient safety, but for their contribution to the health of populations and the integrity of health systems.[58] In the context of AMR — a crisis that the WHO Director-General has characterised as "without question one of the most pressing health challenges of our time"[59] — this advocacy obligation extends beyond the individual patient encounter to encompass advocacy for stewardship systems, professional scope expansion, and the institutional reforms described throughout this commentary. A landmark correspondence in *The Lancet* by Castro-Sánchez and colleagues (2022), co-signed by nursing leaders and researchers across twelve countries, argued explicitly that the planetary threat of drug-resistant infections demands the formal inclusion of nurses in the global AMR response — calling on healthcare institutions, professional bodies, and governments to mobilise the nursing workforce as an active stewardship force rather than a passive recipient of prescribing decisions.[60] The ethical case is reinforced by evidence that nurses who receive AMS training and institutional support demonstrate measurably changed stewardship behaviours: a multi-country survey using the Theoretical Domains Framework, published in the *Journal of Hospital Infection* (2022), found that nurses who had received AMS training reported significantly more engagement in stewardship behaviours across nine countries, confirming that education translates into ethical practice when institutional conditions enable it.[61]

7.3 Equity Considerations: Ensuring Stewardship Nursing Roles Are Feasible in Resource-Limited Settings

Any vision of expanded nursing roles in AMS must grapple honestly with equity. The burden of AMR falls most heavily on low- and middle-income countries (LMICs), where fewer than 30% of facilities in parts of sub-Saharan Africa and Asia have routine access to culture and susceptibility testing,[62] and where healthcare infrastructure, diagnostic capacity, nursing workforce density, and regulatory governance for stewardship activities remain severely constrained.[63] Nurse-led AMS models developed in well-resourced NHS trusts, Australian hospitals, or U.S. academic medical centres cannot be transplanted without adaptation to contexts where nurses operate with minimal support, no protected time, and limited access to clinical decision support. As Ayukekbong and colleagues have documented, AMS challenges in LMICs include inadequate funding, overcrowded systems, lax regulatory frameworks, absence of electronic health records, and shortage of trained pharmacists and microbiologists — the very professional partners on whom nurse stewardship champions in high-income settings depend.[63] This demands a differentiated approach: in LMIC settings, nurse-led AMS frameworks must be designed around the realities of existing workflows, built into pre-service and in-service training as a priority, and accompanied by investment in laboratory capacity, regulatory reform, and national AMR governance at the community and district level. Brazil's Nursing Network Tackling Antimicrobial Resistance (REBRAN), launched in 2022 as a national initiative to formalise nurses' AMR roles across Brazilian health settings, provides a compelling model for how LMIC nurse leaders can build advocacy infrastructure that is contextually grounded and nationally scalable.[64] The goal of equity in stewardship must mean not only equality of access to effective antimicrobials, but equality of investment in the nursing workforce as a stewardship resource — across all income settings, healthcare tiers, and geographies.

8. CONCLUSION

The Evidence reviewed across this commentary converges on a single conclusion: nurses are not ancillary to antimicrobial stewardship — they are structurally central to it. As the largest professional group in the global health workforce,[7] and as the clinicians most continuously present at the bedside, nurses occupy a position in medication administration, surveillance, and patient education that no other profession replicates.[11,12] The persistent failure to formalise this role reflects professional inertia and educational under-investment rather than any deficit of nursing capacity or willingness.[21,46]

Formalising nursing roles in antimicrobial stewardship carries demonstrated transformative potential. Studies from the United States, United Kingdom, Italy, India, and China show that embedding nurses within stewardship teams reduces antibiotic consumption, improves prescribing quality, and strengthens patient safety outcomes.[42,43,45,47] Competency

frameworks, 24 implementation models, [45,46] and policy mandates from the ANA, ICN, and CDC [56,58] already provide the foundation for change.

We call on institutions to integrate nurses formally into ASP governance, on policymakers to embed nursing mandates within national AMR plans, on educators to close curricular gaps, [49,50] and on nursing leaders to advocate with the full weight of the profession's ethical mandate. [57,58] As world leaders affirmed in their 2024 political declaration on AMR, [59] this is a global health security imperative — and nurses, nearly 30 million strong, [7] are its most indispensable, underused asset. [60]

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