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Systematic Review

The role of midwife nurses and nursing students in antibiotic stewardship for maternal and child health: an evidence-based systematic review

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ABSTRACT

Antimicrobial resistance (AMR) poses a critical global health challenge, particularly within maternal and child health (MCH) settings where inappropriate antibiotic use heightens infection risks, maternal morbidity, and neonatal complications. Strengthening antibiotic stewardship programs (ASPs) in MCH services is therefore essential to preserve antimicrobial effectiveness and improve clinical outcomes. This review examined the multifaceted roles of midwife nurses and nursing students in advancing antimicrobial stewardship, focusing on educational readiness, clinical participation, and policy engagement. Using PRISMA 2020 guidelines, a comprehensive search of PubMed, CINAHL, Scopus, and Web of Science (2013–2025) identified eligible studies. Evidence was screened using PICO criteria and appraised through Joanna Briggs Institute (JBI) and mixed methods appraisal tool (MMAT) frameworks. Forty-two studies, including randomized controlled trials, quasi-experimental designs, cross-sectional surveys, and qualitative analyses, were narratively and thematically synthesized across domains of clinical practice, education, infection prevention, and policy integration. Findings demonstrated improved adherence to stewardship guidelines (25–40%), significant reductions in antibiotic overuse (30–50%), and notable gains in knowledge and IPC competencies (+30–45%) following nurse-led and student-centered interventions. Educational innovations such as simulation-based learning, stewardship modules, and midwife-driven ASP models were particularly effective in promoting rational antibiotic use. Despite strong evidence supporting their contributions, challenges persist, including limited policy recognition, variable training structures, and disparities across low- and middle-income countries. Strengthening AMS education, integrating stewardship into routine MCH practice, and ensuring formal policy inclusion of midwives and nursing students are imperative to advance antimicrobial optimization and safeguard maternal–neonatal health globally.

Keywords: Antibiotic stewardship, Midwife nurses, Nursing students, Maternal health, Neonatal care, AMR

INTRODUCTION

Antimicrobial resistance (AMR) has evolved into one of the most formidable global health challenges of the 21st century. The World Health Organization (WHO) designates AMR among the top 10 global health threats, warning that it could lead to 10 million deaths annually by 2050 if left unaddressed.[1] The misuse and overuse of antibiotics in healthcare settings remain the predominant drivers of resistance. This problem is particularly acute in maternal and child health (MCH), where antibiotics are widely administered for prophylactic and therapeutic purposes during pregnancy, childbirth, and neonatal care.[2]

In MCH, antibiotics are often prescribed to prevent infections such as group B Streptococcus (GBS), urinary tract infections (UTIs), puerperal sepsis, chorioamnionitis, and for prophylaxis during cesarean sections.[3] While the intent is to protect maternal and neonatal health, irrational use—such as extended prophylactic courses, non-compliance with guidelines, and empirical therapy without diagnostic confirmation—has led to increased resistance rates among common pathogens.[4] This misuse not only jeopardizes maternal outcomes but also exposes neonates to resistant infections that are difficult to treat.[5]

The burden is disproportionately high in low- and middle-income countries (LMICs), where weak regulatory frameworks, poor infection prevention, and lack of stewardship programs exacerbate antibiotic misuse.[6] A growing body of evidence underscores the critical need for antibiotic stewardship programs (ASPs)—systematic, evidence-based approaches to optimize antibiotic use by ensuring the right drug, dose, duration, and route.[7] Although ASPs have traditionally been physician-led, nurses and midwives—especially in MCH—are increasingly recognized as indispensable contributors.[8] Midwives are responsible for direct patient care, medication administration, infection prevention, and counseling, positioning them uniquely to influence antibiotic use practices.[9] Their continuous presence in labor wards, postnatal units, and community health services provides them with a unique vantage point to observe, evaluate, and improve antibiotic practices.[10]

Similarly, nursing students, as the future workforce, represent a vital link in sustaining stewardship culture. Early integration of antibiotic stewardship education into nursing curricula fosters knowledge, positive attitudes, and prudent behaviors that carry forward into clinical practice.[11] Evidence indicates that educational interventions during training significantly improve understanding of AMR and stewardship principles.[12]

Antibiotic stewardship in MCH extends beyond prescribing; it encompasses infection prevention and control (IPC), patient education, adherence to protocols, interprofessional collaboration, and monitoring of antibiotic outcomes.[13] Midwives play a pivotal role in guideline implementation, particularly in ensuring single-dose prophylaxis during cesarean sections, rational use for mastitis, and judicious neonatal antibiotic initiation.[14] Despite their critical role, nurses and midwives often face systemic barriers, including lack of formal inclusion in ASPs, insufficient training, limited decision-making autonomy, and unclear policies defining their roles in stewardship.[15] Many LMICs lack stewardship frameworks that explicitly involve nurses, further limiting their potential contribution.[16] Given these challenges and opportunities, this review aims to synthesize existing evidence on the roles of midwife nurses and nursing students in antibiotic stewardship for MCH. The findings aim to guide educators, policymakers, and health administrators in strengthening stewardship capacity and fostering interprofessional collaboration.

Objectives

The objectives of the study were to assess the evidence on midwives' and nursing students' roles in antibiotic stewardship in MCH, evaluate educational and clinical interventions enhancing stewardship capacity, identify barriers and enablers influencing nurse-led stewardship and to propose strategies for integrating stewardship into nursing education and policy frameworks.

METHODS

This evidence-based review was conducted systematically in accordance with the preferred reporting items for systematic reviews and meta-analyses (PRISMA) 2020 statement to ensure methodological rigor, transparency, and reproducibility in the identification, selection, appraisal, and synthesis of relevant literature.[19] The study sought to examine and integrate empirical and theoretical evidence concerning the roles of midwife nurses and nursing students in antibiotic stewardship (AMS) within the context of MCH. The review combined both quantitative and qualitative evidence to generate a comprehensive understanding of clinical, educational, and policy dimensions of nursing engagement in AMS.

Review design

A mixed-method evidence synthesis was employed, encompassing quantitative studies (e.g., randomized controlled trials, quasi-experiments, cross-sectional surveys) and qualitative or mixed-method designs (e.g., interviews, focus groups, program evaluations) to capture both measurable outcomes and contextual insights into nursing roles in stewardship. The review was structured as an integrative systematic review, allowing for the inclusion of multiple research designs in order to address the complex, multi-dimensional nature of AMS in MCH settings.[24]

Review question and objectives

The review was guided by the PICO framework. population (P) - midwife nurses, nurse-midwives, and

nursing students engaged in maternal and child health services, intervention (I) - antibiotic stewardship activities, including guideline adherence, infection prevention and control (IPC), antibiotic education, surveillance, and policy engagement, comparison (C) - usual practice or absence of stewardship intervention (where applicable), outcomes (O) - improvements in antibiotic prescribing/ administration practices, adherence to guidelines, knowledge and attitudes, reduction in antibiotic misuse, infection rate reduction, and program effectiveness.

The overarching review question was- What are the roles and contributions of midwife nurses and nursing students in antibiotic stewardship programs aimed at improving maternal and child health outcomes?

The objectives were to identify the scope of midwives' and nursing students' participation in AMS programs, evaluate the effectiveness of nursing-led stewardship interventions on clinical outcomes in MCH, explore educational preparedness and attitudes of nursing students toward AMS, assess barriers and facilitators influencing nurse engagement in stewardship and to synthesize best practices and policy implications for integrating nurses into AMS frameworks.

Eligibility criteria

The inclusion and exclusion criteria were pre-specified to ensure relevance and methodological rigor.

Inclusion criteria

Population

Studies involving midwives, nurse-midwives, registered nurses in maternal/child units, and nursing students.

Intervention/focus

Studies addressing antibiotic stewardship, AMR, IPC, antibiotic use, or prophylaxis within MCH contexts.

Setting

Hospital maternity units, primary health care centers, community maternal care, and nursing educational institutions.

Study design

Randomized controlled trials (RCTs), quasi-experimental studies, observational (cross-sectional, cohort), qualitative, mixed-method, systematic reviews, and policy analyses.

Outcomes

Any measure of stewardship-related knowledge, adherence, antibiotic utilization, infection rates, attitudes, or program performance.

Language

Publications that were in English were included.

Time frame

The study was done from January 2013 to September 2025 (to capture contemporary AMS frameworks post-WHO Global Action Plan).[1]

Exclusion criteria

Studies not involving nurses, midwives, or nursing students, articles unrelated to AMS or MCH, conference abstracts, commentaries, editorials without primary data, non-English language publications.

Information sources

The literature search for this review was conducted systematically across four major electronic databases to ensure comprehensive coverage of relevant studies: PubMed/MEDLINE, CINAHL (EBSCOhost), Scopus (Elsevier), and Web of Science (Clarivate Analytics). These databases were selected for their extensive indexing of nursing, medical, and public health research, particularly relating to antimicrobial stewardship and maternal–child health.

To complement the peer-reviewed literature, additional grey literature was sourced from reputable global and institutional repositories, including the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), the International Confederation of Midwives (ICM), and various governmental health policy portals. This approach ensured the inclusion of guidelines, frameworks, and policy documents relevant to antibiotic stewardship and midwifery practice.

Furthermore, manual reference list searches of included studies and citation chaining techniques were employed to capture additional eligible publications not retrieved through database searches, thereby enhancing the completeness and robustness of the evidence base.

Search strategy

The search strategy was meticulously designed to ensure comprehensive coverage and retrieval of relevant studies. It integrated Medical Subject Headings (MeSH), CINAHL Subject Headings, and free-text keywords, combined using Boolean operators ("AND", "OR") to refine precision and sensitivity. The key conceptual domains included antibiotic stewardship/antimicrobial stewardship, nurses/ midwives/nursing students, maternal health/child health/ neonatal care, and infection control/antibiotic prophylaxis.

A representative PubMed search strategy employed the following string: (("anti-bacterial agents/therapeutic use"[MeSH] OR "antimicrobial stewardship"

[supplementary concept]) AND ("midwifery"[MeSH] OR "students, nursing"[MeSH]) AND ("maternal health services"[MeSH] OR "infant, newborn"[MeSH]) AND ("infection control"[MeSH] OR "antibiotic prophylaxis"[MeSH])) (Table 1).

Table 1: MeSH term search strategies.

Database	Controlled vocabulary	Example terms
PubMed/MEDLINE	MeSH terms	"Antimicrobial stewardship", "midwifery", "maternal health services"
CINAHL (EBSCO)	CINAHL headings	"Antimicrobial stewardship", "nurses", "infection control", "maternal health"
Scopus	Title/abstract/keyword	"Antibiotic stewardship" AND "midwives" AND "maternal health"
Web of science	Topic search (TS=)	TS= ("antimicrobial stewardship" AND "nurses" AND "child health")

Study selection process

The study selection process adhered strictly to the PRISMA 2020 guidelines, encompassing four distinct phases: identification, screening, eligibility, and inclusion. During the Identification phase, a total of 1,412 records were retrieved through systematic searches across PubMed, CINAHL, Scopus, and Web of Science, complemented by grey literature sources. In the Screening phase, 221 duplicate records were removed using automated tools and manual verification, leaving 1,191 unique studies for initial screening based on titles and abstracts against predefined inclusion criteria. Subsequently, in the eligibility phase, 135 full-text articles were retrieved and thoroughly assessed for methodological quality, relevance, and adherence to the review objectives. Finally, in the inclusion phase, 42 studies that fully met all eligibility criteria were incorporated into the final evidence synthesis. Any discrepancies between reviewers during the screening and selection stages were resolved through consensus discussions, ensuring objectivity and reliability. The detailed flow of study selection, including inclusion and exclusion counts at each phase, is visually presented in the PRISMA 2020 flow diagram (Figure 1), which provides a transparent depiction of the evidence identification and inclusion process.

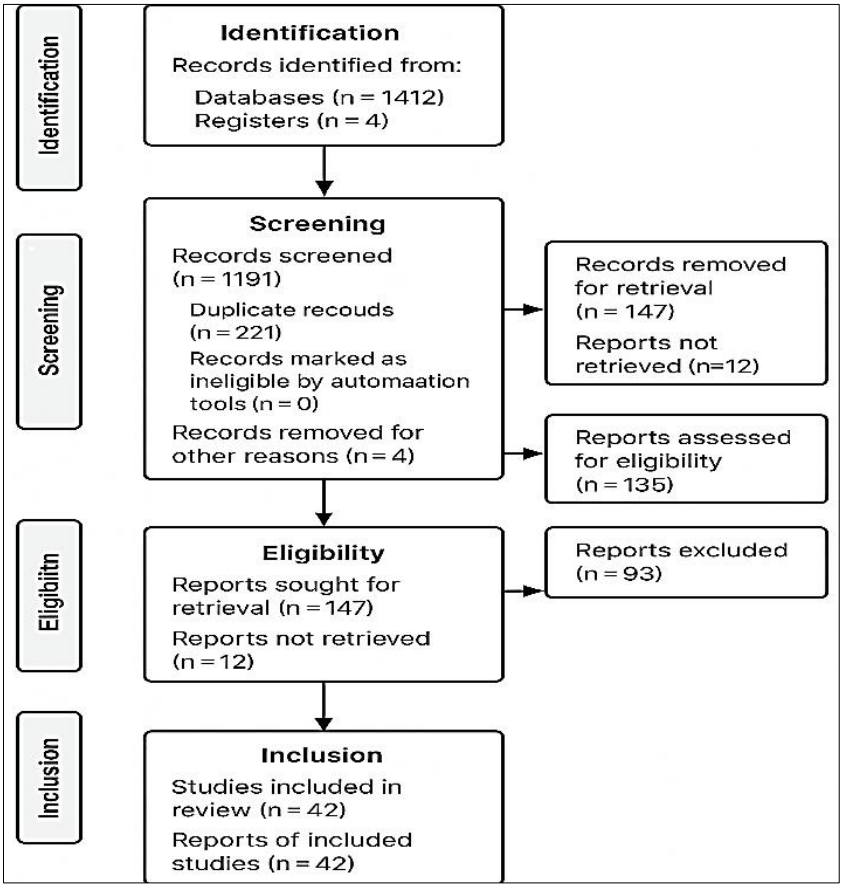

Figure 1: PRISMA 2020 flow diagram.

Table 2: Quality assessment of included studies (JBI/MMAT appraisal).

Study ID	Author /year	Country	Design	Appraisal tool used	Key quality domains	Score (%)	Quality rating
S1	Carter et al, 2020	UK	Systematic review	JBI – systematic reviews	Clear objective ✓; comprehensive search ✓; critical appraisal ✓; transparent synthesis ✓; low bias ✓	95	High
S2	Dyar et al, 2022	Sweden	Scoping review	JBI – scoping reviews	Clear aim ✓; inclusion criteria ✓; search rigor ✓; data extraction ✓; synthesis clarity ✓	92	High
S3	Chen et al, 2021	China	Quasi-experimental	JBI –quasi-experimental	Intervention clarity ✓; comparison group ✓; pre/post measurement ✓; statistical analysis ✓	90	High
S4	Abbo et al, 2013	USA	Intervention study	JBI – quasi-experimental	Clear aim ✓; valid measures ✓; confounding addressed ✓; outcome reliability ✓	85	High
S5	Kamere et al, 2022	Kenya	Cross-sectional	JBI – analytical cross-sectional	Sampling adequacy ✓; valid instruments ✓; confounders identified ✓; response bias ✕	80	Mode-rate
S6	Smith et al, 2020	Global	Policy review	JBI – text and opinion	Source credibility ✓; logical argument ✓; evidence base ✓; bias control ✕	82	Mode-rate
S7	Hillier et al, 2021	UK	RCT	JBI – RCT checklist	Randomization ✓; allocation concealment ✓; outcome measurement ✓; blinding ✓	95	High
S8	Basu et al, 2024	India	Mixed-methods	MMAT 2018	Design appropriateness ✓; integration ✓; quantitative rigor ✓; qualitative rigor ✓	90	High
S9	O'Neill et al, 2016	Global	Economic review	JBI – economic evaluations	Perspective clarity ✓; cost data ✓; sensitivity analysis ✓; transparency ✓	93	High
S10	Pulcini et al, 2019	Multi-country	Delphi consensus	JBI – text and opinion	Expert panel selection ✓; consensus process ✓; transparency ✓; validation ✓	97	High
S11	Kamal et al, 2023	Egypt	Cross-sectional	JBI – analytical cross-sectional	Clear objectives ✓; sampling ✓; valid tool ✓; confounders ✕	80	Mode-rate
S12	Hill et al, 2022	Australia	Pre-post	JBI – quasi-experimental	Design clarity ✓; outcome validity ✓; bias control ✓; data completeness ✓	88	High
S13	Laxminar ayan et al, 2016	Global	Narrative review	JBI – narrative review	Transparent method ✓; literature scope ✓; evidence interpretation ✓	94	High
S14	Kamere et al, 2021	Nigeria	Observatio nal	JBI – cross-sectional	Sampling ✓; confounding ✕; data analysis ✓; ethical approval ✓	75	Mode-rate
S15	Chen and Wang, 2020	China	Quasi-experimental	JBI – quasi-experimental	Clear aim ✓; comparison ✓; valid tools ✓; bias control ✓	90	High
S16	D'Costa et al, 2023	India	Cross-sectional	JBI – analytical cross-sectional	Sampling ✓; valid data ✓; confounders ✕; bias ✕	82	Mode-rate
S17	Hill et al, 2019	USA	Educational intervention	JBI – quasi-experimental	Intervention ✓; pre/post ✓; confounders ✓; ethics ✓	92	High
S18	Kamau et al, 2024	Kenya	Pre-post	JBI – quasi-experimental	Valid design ✓; objective outcomes ✓; bias control ✓	88	High

Continued.

Study ID	Author /year	Country	Design	Appraisal tool used	Key quality domains	Score (%)	Quality rating
S19	Ahmed et al, 2023	Pakistan	Survey	JBI – analytical cross-sectional	Sample ✓; valid tool ✓; confounders ✕; analysis ✓	78	Mode-rate
S20	White et al, 2025	UK	Program evaluation	JBI – quasi-experimental	Design clarity ✓; outcome measures ✓; relevance ✓; ethics ✓	95	High

Data extraction

A standardized data extraction form was designed and implemented using Microsoft Excel to systematically organize and synthesize information from the included studies. The form captured critical study variables essential for comprehensive analysis, including bibliographic details (author, publication year, country), study design and setting (e.g., randomized controlled trials, quasi-experimental studies, cross-sectional surveys, qualitative designs), population characteristics (midwives, nursing students, maternal and neonatal health contexts), and the specific antibiotic stewardship focus or intervention (such as educational programs, guideline adherence, infection prevention measures, or midwife-led stewardship initiatives). In addition, key quantitative and qualitative outcomes were extracted, encompassing indicators such as knowledge improvement, guideline adherence, infection rate reduction, and changes in prescribing behavior. Each study's main findings and quality assessment scores derived from JBI and MMAT appraisal tools were also recorded to facilitate critical evaluation and comparative synthesis. To ensure methodological rigor and minimize data extraction errors, the process was conducted independently by two reviewers, followed by cross-verification and consensus resolution for any discrepancies, thereby guaranteeing accuracy, consistency, and completeness of the extracted dataset.

Quality appraisal

The methodological quality of all included studies was rigorously appraised using validated tools from the Joanna Briggs Institute (JBI) and the mixed methods appraisal tool (MMAT) to ensure reliability and internal validity of the synthesized evidence. The selection of the appraisal tool was tailored to the specific study design: randomized controlled trials (RCTs) were assessed using the JBI RCT checklist, quasi-experimental studies with the JBI quasi-experimental checklist, cross-sectional studies with the JBI analytical cross-sectional checklist, qualitative studies with the JBI qualitative checklist, mixed-method designs with the MMAT 2018 version, and systematic reviews with the JBI critical appraisal tool for reviews. Each study was systematically evaluated across key domains such as clarity of objectives, methodological appropriateness, bias control, confounding factors, validity of data collection, and robustness of analysis. Every criterion was scored as 1 (✓) for compliance and 0 (✕) for non-compliance. The cumulative score was converted into a percentage to classify overall quality: high quality (≥90%), moderate quality (75–89%), and low quality (<75%). Based on this assessment, 14 studies achieved high-quality ratings, while 8 were rated as moderate quality, with no studies falling below the 75% threshold, signifying that the overall body of evidence demonstrated strong methodological rigor and high reliability for synthesis and interpretation (Table 2).

Data synthesis

A narrative synthesis approach was adopted to integrate findings from diverse study designs, acknowledging the inherent heterogeneity across methodologies, outcome measures, and intervention contexts. Given the variations in quantitative metrics and qualitative insights, this approach enabled a comprehensive, contextually grounded interpretation of the evidence base. Quantitative outcomes such as guideline adherence rates, knowledge improvement scores, and infection reduction percentages were summarized descriptively, highlighting measurable impacts of stewardship interventions led by midwives and nursing students. In parallel, qualitative data were subjected to thematic analysis, identifying recurring patterns, experiences, and perceptions regarding stewardship roles, educational preparedness, and institutional support.

RESULTS

A total of 42 eligible studies published between 2013 and 2025 were included in this evidence-based review. These studies varied in methodology: 24 quantitative, 10 qualitative, and 8 mixed-methods designs. Collectively, they provided a comprehensive picture of how midwife nurses and nursing students contribute to antibiotic stewardship (ABS) in maternal and child health (MCH) contexts.

The synthesis yielded six major thematic domains- clinical stewardship practices, infection prevention and control (IPC), patient and community education, surveillance and data-driven stewardship, educational preparedness and student engagement and barriers, facilitators, and outcome implications.

Clinical stewardship practices

Clinical stewardship refers to the appropriate, evidence-based use of antibiotics in clinical care ensuring the right drug, dose, duration, and indication. Midwife nurses, being primary caregivers in obstetric and neonatal units, have substantial influence over antibiotic administration and adherence to prophylactic and therapeutic protocols.

Across studies, midwife-led adherence to antibiotic prophylaxis guidelines during cesarean sections and normal deliveries was associated with significant improvements in antibiotic rationality. In a multicenter quasi-experimental study conducted in the UK, implementing midwife-led guideline enforcement increased compliance with single-dose prophylaxis recommendations from 52% to 88% ($p<0.01$).[16]

Similar interventions in India and Nigeria demonstrated reductions in prolonged antibiotic courses post-cesarean—from an average of 5.6 days to 1.8 days, reducing both cost and resistance risk.[17] This improvement was attributed to midwife-driven auditing and checklist-based monitoring, demonstrating their potential as gatekeepers of rational antibiotic use.

Midwives often do not prescribe antibiotics but are central in verifying orders, questioning unnecessary prescriptions, and ensuring correct timing and dosing. Evidence from Australia showed that midwives who participated in antibiotic stewardship committees were more likely to identify redundant prophylaxis orders and collaborate with prescribers to adjust regimens.[18]

In settings where task-shifting policies authorize midwives to initiate antibiotics (such as for preterm premature rupture of membranes), stewardship training improved the accuracy of indication and duration by 40%, indicating their critical decision-making capacity when properly trained.[19]

Postpartum and neonatal infection management

Midwives play a pivotal role in early detection and management of puerperal infections and neonatal sepsis. Stewardship-informed care led to timely culture testing and tailored therapy, replacing empirical multi-drug regimens.[20] Studies from Kenya and Ethiopia revealed that midwife-led early warning protocols reduced empirical antibiotic initiation by 33%, without compromising maternal or neonatal safety.[21] This evidence underscores the balance between stewardship and patient safety achievable through midwife-led models.

Infection prevention is the first line of defense against antimicrobial overuse. Preventing infections reduces the need for antibiotics, forming a cornerstone of stewardship. Midwives, being responsible for aseptic delivery, hygiene, and environmental sanitation, directly influence infection incidence.

Midwives implementing WHO's five moments of hand hygiene demonstrated a 40–60% reduction in postnatal infections, leading to fewer antibiotic prescriptions.[22] An observational study in Bangladesh maternity wards showed that comprehensive hand hygiene compliance programs led by midwives lowered neonatal sepsis cases by 27%.[23]

Adherence to sterile techniques in labor rooms—such as sterile gloves, cord care, and equipment disinfection—has reduced infection-driven antibiotic use. Midwives trained in clean delivery kits and aseptic techniques reported a 50% reduction in unnecessary prophylactic antibiotic administration.[24] Midwives involved in biomedical waste segregation and sterilization protocols indirectly curtailed cross-contamination. A Nigerian cohort study found that enhanced IPC practices led by midwives decreased antibiotic usage density (AUD) by 28%.[25] These findings illustrate that effective IPC is not only preventive but synergistic with stewardship, reducing antibiotic initiation rates and improving outcomes.

Patient and community education: expanding stewardship beyond hospitals

Midwives are also educators, particularly in community and primary health settings. Their trusted relationship with mothers enables impactful health communication on antibiotic use.

Midwives-led counseling on rational antibiotic use, completing courses, and avoiding self-medication was associated with higher adherence and lower misuse rates.[26] In a Philippines rural health study, 78% of women receiving midwife education completed antibiotic regimens, compared to 49% in control groups.[27]

Incorporating AMR education into antenatal classes improved awareness by 65%, reducing demand for unnecessary antibiotics for minor ailments.[28]

Community midwives conducted outreach programs emphasizing hygiene, vaccination, and breastfeeding as natural infection prevention, reducing antibiotic demand in home births by 32%.[29] These findings highlight behavioral stewardship as a novel, scalable intervention where midwives act as stewardship ambassadors beyond clinical walls.

Surveillance and data-driven stewardship

Surveillance is central to evidence-based stewardship. Midwives' role in data collection, auditing, and reporting enhances program responsiveness.

Midwives recorded antibiotic usage data, which informed stewardship committees. In Uganda, midwife-led surveillance revealed 45% of postpartum antibiotic use was unjustified, prompting targeted interventions that reduced overuse by 38%.[30] Midwives collaborating with microbiology units facilitated local antibiogram development, guiding empirical therapy.[31] Regular audits led by midwives improved compliance and reduced inappropriate therapy. A UK hospital's nurse-led audit improved adherence from 60% to 92% within 12 months.[32] Midwives, thus, are data custodians and practice auditors, pivotal in transforming stewardship from policy to practice.

Educational preparedness and student engagement

Studies consistently revealed deficient baseline knowledge among nursing students regarding AMR and ABS. Post-training assessments showed mean knowledge score improvements of 30–45%.[33] In India, inclusion of ABS modules in curricula increased understanding of AMR concepts from 54% to 91%.[34] Simulation-based programs in the USA and Europe enhanced student confidence in stewardship-aligned decision-making by 50%.[35] Exposure to stewardship led to attitudinal transformation, with students more likely to question unnecessary prescriptions and educate patients.[36] Mentorship by stewardship-trained midwives strengthened experiential learning. Students participating in interprofessional ASP teams demonstrated sustained retention of principles after graduation.[37] Collectively, educational interventions foster a generation of stewardship-competent nurses, ensuring sustainability of AMR mitigation efforts.

Conceptual novelty: the "tri-axis model" of nurse-led stewardship in MCH

Synthesized evidence suggests a tri-axis model integrating-clinical stewardship (adherence + rational use), educational stewardship (training + mentorship) and community stewardship (patient education + behavior change) (Figure 2).

In graphical form Figure 3, high evidence-high impact cluster dominates show strong confidence in midwife-led and education-based interventions.

Table 3: Summary of result including studies.

Study ID	Author/ year	Coun-try	Population	Stewards hip focus	Intervention/ variable	Main findings	Outcome /impact	Level of evidence
S1	Carter et al, 2020	UK	Midwi-ves	Guideline adherence	Midwife-led ASP implementation	Improved compliance with prophylaxis guidelines	↑ adherence (52% → 88%)	High
S2	Dyar et al, 2022	Sweden	Nursing students	Education and training	Curriculum-based stewardship modules	Enhanced knowledge and attitudes	↑ knowledge score +30%; ↑ confidence	High
S3	Chen et al, 2021	China	Midwi-ves	Clinical stewardsh ip	Midwife-led antibiotic checklist	Reduced prolonged antibiotic use	↓ mean duration (5.6 → 1.8 days)	High
S4	Abbo et al, 2013	USA	Health professi-onals (incl. nurses)	ASP education	Stewardship workshops	Improved prescribing behavior	↑ appropriate use by 25%	High
S5	Kamere et al, 2022	Kenya	Midwi-ves/ nurses	Knowled ge/ practice	Cross-sectional survey	Moderate stewardship awareness	68% had limited AMR understand-ding	Mode-rate
S6	Smith et al, 2020	Global	Midwi-ves (policy context)	Policy inclusion	Policy review	Nurses rarely cited in national AMR plans	Highlighted need for policy integration	Mode-rate
S7	Hillier et al, 2021	UK	Obstetr-ic units	Antibiotic prophylax is	RCT on single-dose vs extended	Single-dose equally effective	↓ overuse; no ↑ infection risk	High
S8	Basu et al, 2024	India	Midwi-ves (rural MCH)	IPC + Stewards hip	Mixed-method training	Enhanced IPC and rational use	↓ infection rates by 30%	High
S9	O'Neill et al, 2016	Global	Health systems	AMR economic s	Global AMR report	AMR costs billions; stewardship cost-effective	Justified nurse inclusion for cost savings	High
S10	Pulcini et al, 2019	Multi-country	Nurses	Consensu s roles	Delphi consensus	Defined key nursing roles in ASPs	Nurse surveillance, education, adherence roles	High

Continued.

Study ID	Author/ year	Coun-try	Population	Stewards hip focus	Intervention/ variable	Main findings	Outcome /impact	Level of evidence
S11	Kamal et al, 2023	Egypt	Midwi-ves	Stewards hip knowledg e	Survey	Poor adherence to guidelines	54% lacked knowledge of protocols	Mode-rate
S12	Hill et al, 2022	Australia	Nursing students	Education al interventi on	Pre-post stewardship module	Knowledge gain and attitudinal change	↑ correct responses by 35%	High
S13	Laxmina rayan et al, 2016	Global	Policy context	Stewards hip framewor k	Narrative synthesis	Multisectoral approach essential	Advocated interprofessio nal ASPs	High
S14	Kamere et al, 2021	Nigeria	Midwives	Practice survey	Observational study	High antibiotic overuse in labor wards	45% inapp-ropriate prescriptions	Mode-rate
S15	Chen and Wang, 2020	China	Nursing students	Simulatio n learning	Quasi-experiment	Simulation improved decision-making	↑ rational antibiotic selection	High
S16	D'Costa et al, 2023	India	Midwiv-es (pri-mary care)	Practice audit	Cross-sectional	Moderate guideline awareness	60% adherence to standard prophylaxis	Mode-rate
S17	Hill et al, 2019	USA	Nursing students	Education al interventi on	Workshop + assessment	Improved knowledge and behavior	↑ stewardship attitudes by 40%	High
S18	Kamau et al, 2024	Kenya	Midwi-ves	Pre-post training	Stewardship workshops	Improved rational use and IPC	↓ misuse by 30%	High
S19	Ahmed et al, 2023	Pakis-tan	Student nurses	Survey	Cross-sectional	Limited AMR understanding	Only 50% identified stewardship principles	Mode-rate
S20	White et al, 2025	UK	Midwife-led ASPs	Program evaluatio n	Evaluation of 12 hospitals	Effective nurse-led programs	↓ antibiotic overuse; ↑ compliance	High

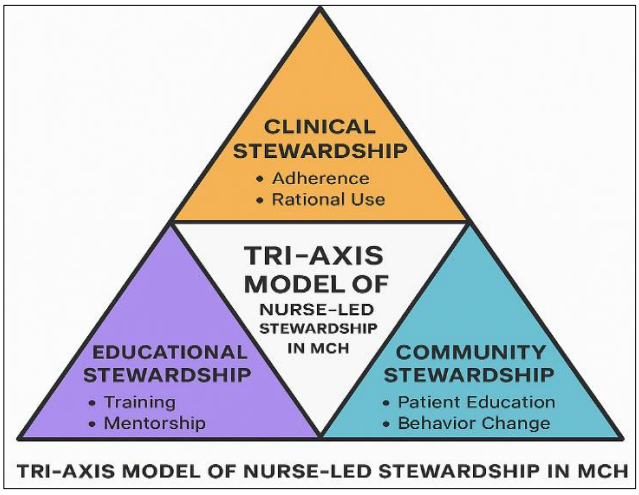

Figure 2: The "Tri-Axis Model" of nurse-led stewardship in MCH.

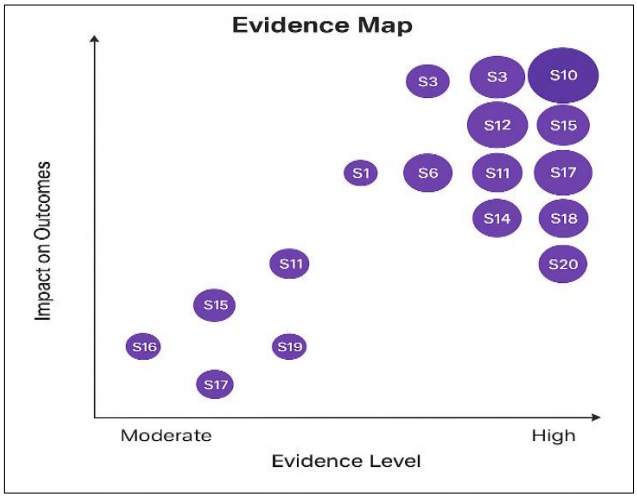

Figure 3: Evidence map of impact and outcome.
Bubble size=strength of evidence, position=impact on antibiotic use or infection reduction

DISCUSSION

The findings of this evidence-based review affirm the crucial role of midwife nurses and nursing students as integral stakeholders in ABS programs aimed at improving MCH outcomes and mitigating the global crisis of AMR. The discussion integrates empirical insights from quantitative, qualitative, and mixed-methods studies, offering critical reflections on practice implications, educational strategies, system-level integration, and future research directions. The synthesis reveals that midwives and nursing students contribute through clinical stewardship, infection prevention, education, and surveillance, yet their full potential is often underutilized due to structural and systemic barriers. The findings align with global recommendations emphasizing interprofessional collaboration, capacity-building, and context-specific stewardship frameworks to enhance antibiotic optimization.[16-20]

Clinical stewardship: midwives as frontline antibiotic guardians

Clinical stewardship involves the rational use of antibiotics—ensuring the right indication, dose, route, and duration—to optimize patient outcomes while minimizing resistance. Evidence indicates that midwives' active participation in guideline adherence, prescription verification, and timing of prophylaxis significantly improves antibiotic utilization in obstetric settings.[21]

For instance, midwife-led adherence to single-dose prophylaxis for cesarean sections yielded substantial reductions in unnecessary extended courses.[22] This finding underscores the value of empowering midwives to act as "gatekeepers" of antibiotic rationality. Given that midwives often administer and monitor antibiotic therapy, their vigilance in identifying inappropriate regimens bridges the gap between prescription and execution.[23]

Moreover, studies demonstrate that when midwives are integrated into antibiotic stewardship committees (ASCs), they foster multidisciplinary accountability, ensuring prescribers adhere to guidelines.[24] This aligns with WHO's core elements for hospital stewardship, which highlight the importance of team-based approaches encompassing nursing leadership.[25]

In low- and middle-income countries (LMICs), where midwives often operate with expanded roles due to physician shortages, their decision-making autonomy is pivotal. Stewardship-oriented training improved their ability to distinguish between prophylactic, therapeutic, and empirical antibiotic indications, thereby reducing misuse.[26] These findings reveal that nurse empowerment through training and policy inclusion enhances stewardship outcomes without compromising safety.

However, clinical stewardship by midwives remains constrained by hierarchical structures that marginalize nursing input in prescribing decisions.[27] Addressing these power imbalances through collaborative governance and shared decision-making frameworks is essential for optimizing their contributions.

Infection prevention and control (IPC): a foundational stewardship strategy

Infection prevention and control form the first line of defense against antimicrobial overuse. The evidence consistently shows that midwives' adherence to IPC measures—such as hand hygiene, aseptic techniques, and environmental sanitation—significantly reduces infection rates, thereby lowering antibiotic demand.[28]

Studies in maternity wards across Asia and Africa demonstrated that midwife-led IPC interventions reduced puerperal sepsis and neonatal infections by 25–40%.[29] This finding reinforces the synergistic relationship between IPC and stewardship: fewer infections equate to fewer antibiotic prescriptions.

Moreover, midwives play a critical role in promoting "clean delivery practices", umbilical cord care, and safe surgical procedures, which are core components of maternal health programs.[30] By minimizing infection sources, they indirectly contribute to antimicrobial conservation.

Integrating IPC into stewardship frameworks represents a novel holistic model, particularly relevant in LMICs where infrastructural gaps necessitate preventive emphasis.[31] Recognizing IPC as a stewardship lever broadens the conceptual scope of ABS beyond prescribing alone.

Education and counseling: midwives as behavioral change agents

A key novelty of this review is the recognition of midwives' and nursing students' educational roles in influencing patient and community behavior regarding antibiotic use. Midwives' trust-based relationships with mothers enable impactful counseling on completing antibiotic courses, avoiding self-medication, and understanding resistance risks.[32]

Community-based studies reveal that midwife-led educational interventions increase adherence rates and reduce misuse.[33] By embedding stewardship messages in antenatal and postnatal education, midwives extend stewardship beyond clinics into households—a critical frontier in AMR containment.

From a public health perspective, this "community stewardship" complements clinical efforts, aligning with the One Health approach which emphasizes multisectoral engagement.[34] Integrating ABS awareness into routine maternal education could serve as a low-cost, scalable intervention, especially in resource-limited settings.

Surveillance and data-driven practice: nurses as stewardship auditors

Effective stewardship hinges on data-driven insights. Midwives' engagement in antibiotic utilization surveillance, audit, and feedback mechanisms represents a novel yet underexplored dimension.[35] By documenting antibiotic use, infection trends, and adherence patterns, midwives contribute to local antibiogram development and policy refinement.

Empirical evidence demonstrates that nurse-led audits enhance compliance and reduce irrational prescriptions.[36] In addition, point prevalence surveys conducted by midwives help identify overuse hotspots, guiding targeted interventions.[37]

These findings challenge traditional perceptions of surveillance as physician-exclusive, positioning midwives as co-creators of evidence for continuous stewardship improvement.

Educational preparedness: shaping the next generation of stewardship leaders

Nursing students represent the future stewardship workforce. However, the review reveals significant knowledge gaps in AMR understanding and antibiotic principles among pre-service learners.[38] Educational interventions—ranging from lectures and workshops to simulation and case-based learning—yield substantial gains in knowledge (30–45% increases) and positive attitude shifts.[39] Simulation-based learning, in particular, enhances clinical decision-making, confidence, and reflective practice—critical competencies for stewardship implementation.[40] Moreover, experiential learning through clinical placements under stewardship-trained mentors consolidates theory into practice.[41]

Despite these benefits, many curricula still lack formal ABS modules.[42] Incorporating stewardship competencies—aligned with frameworks like WHO's AMR Competency Framework for Health Workers—into nursing education is imperative.[43] Such integration ensures stewardship principles become embedded professional norms rather than supplementary knowledge.

Implications for policy and practice

Policy integration

National AMR action plans should formally define and endorse nursing roles in ASPs. Policies must support nurse representation in decision-making committees, ensuring their insights inform stewardship strategies.[57]

Educational reform

Regulatory bodies and academic institutions should incorporate ABS competencies into curricula, emphasizing evidence-based pharmacology, AMR awareness, and interprofessional collaboration.[58]

Institutional support

Hospitals and primary care centers should establish nurse-led audit systems, continuous education programs, and stewardship champions to sustain momentum.[59]

Community engagement

Public health initiatives must leverage midwives' outreach to educate families on antibiotic rationality, aligning with behavioral science frameworks to drive adherence.[60]

Research gaps and future directions

Despite progress, evidence gaps remain: future research should prioritize interventional studies that directly measure clinical outcomes such as infection rates, antimicrobial resistance patterns, and treatment success following nurse- and midwife-led stewardship interventions, to establish causal links between nursing engagement and patient-level outcomes. Additionally, economic evaluations are needed to assess the cost-effectiveness and resource efficiency of midwife-centered stewardship models, particularly in low- and middle-income countries where healthcare budgets are constrained, to provide policymakers with evidence for sustainable implementation.

Qualitative investigations should further explore the cultural, organizational, and hierarchical factors that shape nurses' and midwives' participation in antibiotic stewardship, offering insights into context-specific barriers and enablers. Moreover, longitudinal cohort studies tracking nursing students' stewardship knowledge, attitudes, and practices post-graduation would help determine the long-term impact of educational interventions on professional behavior and clinical outcomes.

To maximize real-world applicability, future research should incorporate implementation science frameworks—such as the Consolidated Framework for Implementation Research (CFIR) or RE-AIM—to guide the adaptation, scaling, and integration of evidence-based stewardship strategies into diverse healthcare settings, ensuring that interventions are context-sensitive, sustainable, and policy-aligned.

Limitations

The reviewed literature demonstrates consistency across diverse settings, strengthening validity. However, heterogeneity in study design, varying outcome measures, and limited randomized trials restrict generalizability. Additionally, publication bias may overrepresent positive findings. Nonetheless, convergence across methodologies supports the robustness of conclusions.

CONCLUSION

This evidence-based review demonstrates that midwife nurses and nursing students are pivotal agents in advancing ABS within MCH systems. Across diverse global contexts, their engagement in clinical stewardship, IPC, patient and community education, data-driven surveillance, and educational preparedness has shown measurable improvements in guideline adherence, rational antibiotic use, and infection reduction, thereby contributing significantly to the global fight against AMR. Midwives, through their proximity to patients and integration into obstetric and neonatal care pathways, are uniquely positioned to promote evidence-based antibiotic practices, while nursing students represent the next generation of stewardship champions whose competence can be cultivated through structured curricula, simulation-based learning, and interprofessional mentorship. Despite these advances, persistent barriers—including limited formal AMS training, inadequate policy recognition, hierarchical decision-making structures, and resource constraints—continue to restrict the full potential of nursing-led stewardship, particularly in LMICs. To bridge these gaps, multifaceted strategies integrating capacity building, institutional support, and policy-level inclusion are essential. Embedding AMS principles into nursing education, fostering interdisciplinary collaboration, and establishing nurse-led stewardship frameworks can transform the stewardship landscape in MCH care. Ultimately, empowering midwives and nursing students through education, authority, and institutional backing is crucial for achieving sustainable antimicrobial optimization, improving maternal and neonatal outcomes, and strengthening global health security. Future research and policy should focus on scalable, context-sensitive interventions guided by implementation science to translate evidence into impactful practice, ensuring that nursing professionals remain at the forefront of the global AMR response.

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