

The Nurse's Role in Antimicrobial Stewardship in Low and Middle-Income Countries a Systematic Review

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Abstract—Background. Antimicrobial resistance falls hardest on low- and middle-income countries (LMICs), where infections are common and stewardship systems are still taking shape. Nurses are the largest part of the health workforce and spend more time at the bedside than any other group, yet their place in antimicrobial stewardship (AMS) has been described mostly from high-income settings. This review asked what is actually known about the nurse's role in AMS across LMICs.

Methods. Following the PRISMA 2020 statement, a search of PubMed/MEDLINE (2015 -2026) was combined with reference of reviews. Studies were eligible if they reported empirical data on nurses, alone or within a mixed health-worker sample, together with an AMS or antimicrobial-use outcome in an LMIC.

Results. Seven studies from Pakistan, India, Nigeria, Uganda and Brazil met the criteria - four cross-sectional surveys, two qualitative studies and one pre-post education study. A consistent picture emerged. Nurses held positive attitudes toward stewardship but were involved in it only to a limited degree. Knowledge of the term, and practice of AMS, lagged behind awareness of resistance itself. The barriers were practical: gaps in training, weak support from management, heavy workloads, patient pressure and unreliable drug supply. A single education programme improved knowledge scores significantly.

Conclusions. Nurses in LMICs are willing and numerous but under-used in stewardship. Putting AMS into nursing curricula, defining the nurse's stewardship role and backing it with managerial support could release that potential. The evidence base remains small and geographically narrow, and needs strengthening.

Index Terms—Antimicrobial stewardship; Nurses; Low- and middle-income countries; Antimicrobial resistance; Nursing education; Knowledge, attitudes and practices

I. INTRODUCTION

Antimicrobial resistance (AMR) is now among the leading causes of death worldwide. A global analysis attributed about 1.27 million deaths directly to

bacterial resistance in 2019, with close to five million deaths associated with it, and the heaviest toll fell on regions with the fewest resources to respond.¹ For low- and middle-income countries (LMICs), the problem is compounded by a high burden of infection, over-the-counter access to antibiotics, uneven regulation, and antimicrobial stewardship (AMS) programmes that are often new or only partly in place.² The World Health Organization's 2015 Global Action Plan put stewardship and health-worker education at the centre of the response, but turning that plan into everyday practice depends on who is available to do the work.³ Nurses are the obvious answer to that question, and an under-used one. They make up roughly half of the global health workforce and are present at the bedside around the clock. They give most antimicrobials, watch for side effects and for changes in a patient's condition, take cultures before the first dose, counsel patients and families, and coordinate between prescribers, pharmacists and laboratories. Olans and colleagues pointed out years ago that nurses already perform many stewardship tasks without these being named or counted as such - the "already there" steward.⁴ International work has since gone on identifying the bedside nurse's contribution to stewardship, yet this remains poorly researched in low- and middle-income settings.¹³

A scoping review of stewardship interventions in hospitals found that only about 2% of several hundred studies had been carried out in low- and lower-middle-income settings, leaving little direct evidence on what works where the need is greatest.⁵ Where nurses do appear in LMIC stewardship research, it is often as one cadre inside a mixed sample rather than the focus of study.

There are reasons to think the nurse's role may look different in LMICs than in wealthier systems. Antibiotics are frequently bought without a prescription, supply can be erratic, patient demand is strong, and substandard products circulate - all of which shift where decisions about antimicrobials are actually made.² Nurses in these settings often work with high patient loads, limited staffing and steep professional hierarchies, conditions that can either widen their informal role or constrain their formal one. Understanding how nurses fit into stewardship under these conditions is a practical question for anyone trying to build a programme that holds up locally.

Despite the growing interest, no synthesis has pulled together what LMIC-based studies report specifically about nurses and AMS. This review set out to do that: to identify empirical studies of nurses' knowledge, attitudes, involvement and practice in antimicrobial stewardship across LMICs, to summarise what they found, and to name the barriers and gaps the evidence points to. The aim is to give nurse educators, hospital managers and programme planners a grounded starting point, and to be honest about how much or how little we currently know.

II. METHODS

This review was conducted and reported in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement.⁶ The scope limits described below, and in the Limitations section, should be read alongside the findings.

Eligibility criteria. Studies were included if they (i) reported original empirical data, whether quantitative, qualitative or mixed-methods; (ii) described nurses, either on their own or identifiable within a mixed health-worker sample; (iii) reported an outcome related to antimicrobial stewardship or antimicrobial use knowledge, attitudes, perceptions, involvement, practice, barriers, or the effect of an intervention; and (iv) were carried out in a country classified by the World Bank as low-, lower-middle- or upper-middle-income. Reviews, commentaries, conference abstracts

and studies set wholly in high-income countries were excluded, as were studies in which nurses could not be distinguished from other professions.

Information sources and search. PubMed/MEDLINE was searched from 2015 to 2026, combining terms for antimicrobial stewardship, nurses and LMIC settings. The reference lists of relevant reviews were screened to catch studies the database search might have missed. The most recent search was run in June 2026. Study selection and data extraction. Records were screened against the criteria above, first by title and abstract and then by full text for those that passed. Screening and data extraction were carried out with the assistance of a large language model (Claude, Anthropic, San Francisco, CA, USA) and are reported transparently here; this support and its limits are set out in the Declarations and Limitations. For each included study we recorded the country, setting, design, sample, the nurse component, and the main stewardship-related findings.

Synthesis. The included studies varied too much in design and outcome measures for a meta-analysis to be appropriate. Findings were combined narratively and grouped into themes that recurred across studies: knowledge; attitudes and perceptions; involvement and practice; barriers; and interventions. A formal risk-of-bias assessment using design-specific tools is planned for the full review and is noted as a limitation of the present synthesis.

III. RESULTS

3.1 Study selection

The PubMed/MEDLINE search returned 143 records, with four more identified from the reference lists of key reviews. After screening, most records were set aside as not relevant — many dealt with the microbiology of resistance, with other professional groups, or with high-income settings — leaving eleven reports for full assessment. Four of these were reviews rather than primary studies and were used as background. Seven empirical studies met all criteria and form the basis of the synthesis (Figure 1).

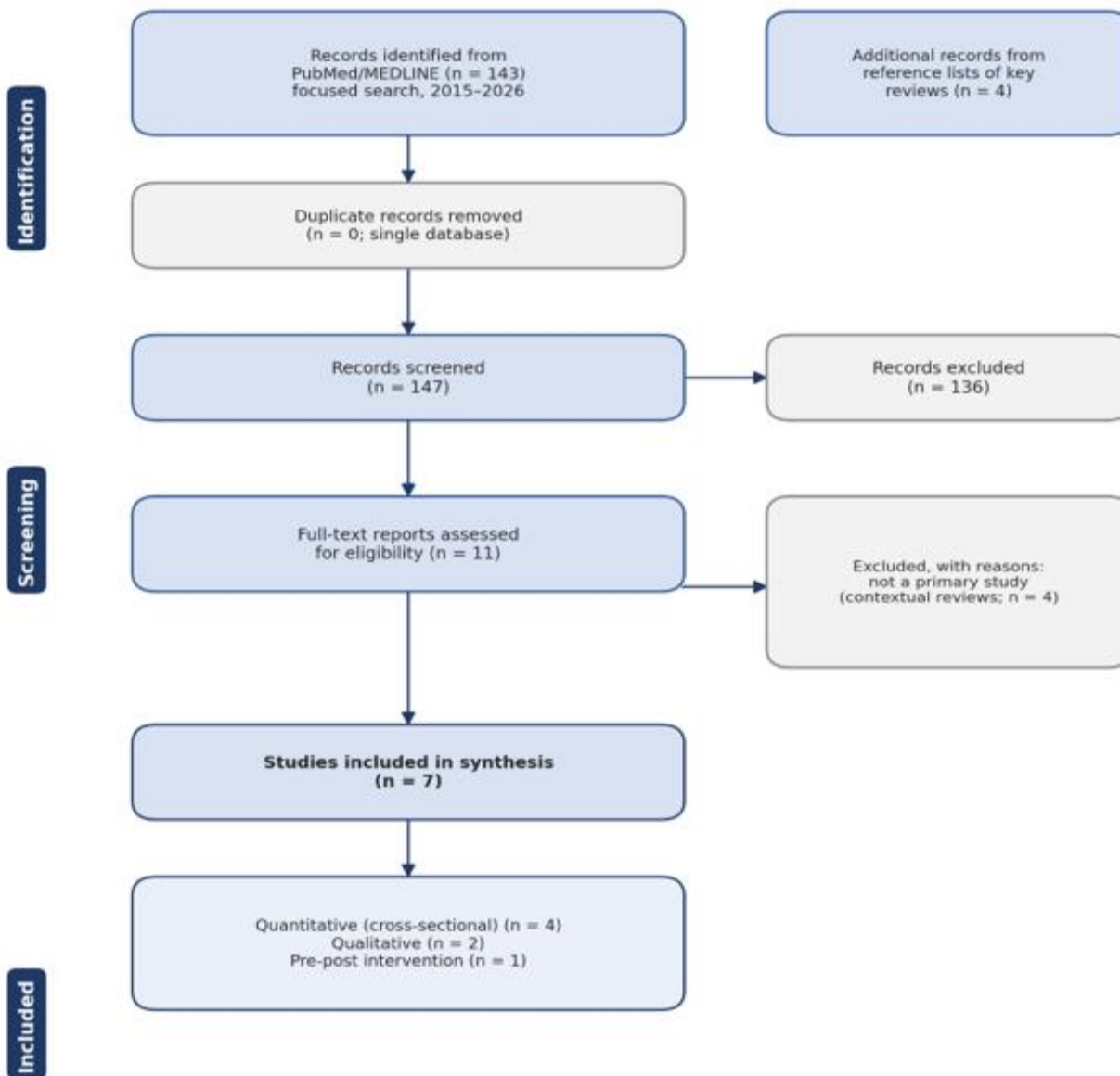


Figure 1. Study selection (PRISMA 2020 flow diagram). Counts are provisional and based on a PubMed/MEDLINE search.

3.2 Characteristics of the included studies

The seven studies came from five countries: Pakistan, India, Nigeria (two studies), Uganda (two studies) and Brazil (Table 1). Four were cross-sectional surveys, two were qualitative, and one used a pre-post design to test an education programme. Survey samples ranged from several hundred to nearly six hundred participants. Three studies looked at nurses specifically; the others included nurses within a mixed sample of health workers or students, with nurses usually the largest group. Settings spanned public tertiary hospitals, primary and secondary facilities, private pharmacies and nursing education.

Table 1. Characteristics of the included studies (n = 7).

Study, country	Design	Setting	Sample (nurse component)	Main stewardship-related findings
Mustafa et al., 2022; Pakistan	Cross-sectional survey	11 hospitals, Punjab	583 nurses	Positive perceptions of stewardship programmes (median 18/20) but

Study, country	Design	Setting	Sample (nurse component)	Main stewardship-related findings
				limited involvement (median 18/64); felt confident; barriers were lack of knowledge, weak administrative support and heavy workload
Mittal et al., 2023; India	Pre-post intervention	Public tertiary hospital	190 staff nurses	Four-module education programme ; significant gain in knowledge scores one week after training; existing nursing curriculum gap noted
Otu et al., 2026; Nigeria	Cross-sectional survey	13 primary + 23 secondary facilities, Cross River	431 health workers (nurses 37%, largest group)	Good knowledge in 60%, good perceptions in 81%, good practice in 65%; 54% prescribed outside guidelines; patient pressure (47%) and drug stock (66%) shaped decisions

Study, country	Design	Setting	Sample (nurse component)	Main stewardship-related findings
Kimbo wa et al., 2022; Uganda	Cross-sectional survey	32 health facilities	582 providers including nurses	High stewardship attitude in 58%; only fair practice in 46%; degree-level education linked to higher attitude
Jackson et al., 2023; Nigeria	Cross-sectional survey	Universities	335 students including nursing	60.8% unfamiliar with the term 'antimicrobial stewardship'; suboptimal knowledge; curriculum review recommended
Musoke et al., 2023; Uganda	Qualitative (31 interviews)	Private pharmacies, Wakiso	Pharmacy staff including nurses	Participants had heard of resistance but not stewardship; poor knowledge; limited practice; cost and business pressures were barriers
de Lima Gusmão et al.,	Qualitative (nominal group)	Online workshop	Nurses	Nurse role in stewardship poorly researched;

Study, country	Design	Setting	Sample (nurse component)	Main stewardship-related findings
2024; Brazil				priorities were defined competencies, role implementation and digital tools

3.3 Knowledge of stewardship

A recurring finding was that nurses, and health workers more broadly, were more familiar with the idea of resistance than with stewardship as a defined practice. Among healthcare students in Nigeria, nursing students included, almost 61% were not familiar with the term "antimicrobial stewardship," even though most recognised that overuse of antimicrobials drives resistance.⁷ A qualitative study of private-pharmacy staff in Uganda, nurses among them, found the same split: participants had heard of resistance but not of stewardship, and few could define it accurately.⁸ This pattern echoes a global review of undergraduate students, in which familiarity with resistance ran well ahead of familiarity with stewardship.¹⁵ A survey of health workers in Cross River State, Nigeria, where nurses were the single largest group, was more encouraging around 60% showed good knowledge of antimicrobial use and resistance but still left a sizeable minority with gaps.⁹ Two studies tied these gaps directly to training, noting that stewardship is poorly covered in the nursing curriculum.^{10, 7}

3.4 Attitudes and perceptions

Where studies measured attitudes, they were generally positive. Nurses in Punjab, Pakistan, held favourable perceptions of stewardship programmes, scoring a median of 18 out of 20.¹¹ In Uganda, 58% of health workers across 32 facilities showed a high stewardship attitude, and those with a bachelor's or master's degree were more likely to do so.¹² In the Cross River survey, perceptions were good in 81% of respondents.⁹ The willingness, in other words, appears to be there.

3.5 Involvement and practice

The gap between attitude and action was one of the clearest patterns in the review. The same Pakistani nurses who viewed stewardship positively reported limited actual involvement in it, with a median involvement score of 18 on a 0–64 scale, even while feeling confident they could perform stewardship tasks.¹¹ In Uganda, fewer than half of health workers (46%) reached a high standard of stewardship practice despite generally positive attitudes.¹² In Nigeria, practices were rated good in about two-thirds of health workers, but more than half (54%) admitted prescribing antibiotics outside guideline recommendations.⁹ Nurses were frequently the largest professional group present, yet their formal participation lagged behind both their numbers and their stated willingness.

3.6 Barriers

Studies named practical, recurring obstacles. Pakistani nurses pointed to gaps in knowledge, insufficient support from administration and heavy workload as the main barriers to taking part in stewardship.¹¹ The Nigerian survey highlighted pressures that push prescribing away from guidelines patient demand, cited by 47%, and what was on the shelf, with stock availability shaping decisions for two-thirds of respondents.⁹ The Ugandan pharmacy study added the commercial realities of private practice: the cost of care, the need to keep customers, outdated guidelines and the business orientation of the pharmacy all worked against good stewardship.⁸ Underneath these more visible barriers sat the weak coverage of stewardship in nursing education seen across several studies.^{10, 7}

3.7 Interventions and facilitators

Only one included study tested an intervention. A four-module education programme for 190 staff nurses at a tertiary hospital in India produced a significant improvement in knowledge scores one week after training, and participants judged it relevant to their work.¹⁰ The qualitative study from Brazil, which used a structured group process with nurses, pointed to what stewardship support for nurses might prioritise: clearer competencies, a defined way to implement the nurse's role, and digital tools while noting that the nurse's contribution to stewardship is still poorly researched in LMICs.¹³ Higher educational

attainment was linked to stronger stewardship attitudes in more than one study,¹² which fits the idea that training is a lever worth pulling.

3.8 The state of the evidence

Taken together, the studies are few, recent and clustered in a handful of countries. Most were not designed primarily around nurses, and only one tested whether anything could change practice. This thinness matches the wider literature: stewardship intervention research in low- and lower-middle-income hospitals is scarce,⁵ and the nurse's role in stewardship has been examined far more thoroughly in high-income settings than in the places carrying the greatest resistance burden.¹³

IV. DISCUSSION

Across seven studies from five countries, the same story repeats with reassuring consistency and uncomfortable implications: nurses in LMICs think stewardship matters, feel able to contribute, and yet take part in it only partially. The bottleneck is not attitude. It is the combination of limited training, thin institutional support, and working conditions that leave little room for an added role.

This matches what has been described in high-income settings, where nurses were long found to be willing and capable stewards whose contribution went unrecognised and unstructured.^{4,13} What the LMIC studies add is a layer of structural constraint that wealthier systems feel less sharply. When antibiotics can be bought without a prescription, when supply is unreliable, when patients arrive expecting a particular drug, and when one nurse covers many patients, the decisions around antimicrobials are shaped by forces well beyond any individual's knowledge or intent.² A stewardship model imported wholesale from a high-income hospital is unlikely to survive contact with these realities.

Several practical implications follow. The first concerns education. Studies here repeatedly traced knowledge gaps back to the nursing curriculum, and the one intervention that was tested a short, structured course - moved knowledge scores meaningfully.^{10,7} Embedding stewardship in pre-service nursing education and in continuing professional development is a concrete and affordable step. The second concern's role definition. Nurses cannot be held to a

stewardship standard that has never been spelled out, and the Brazilian study's call for defined competencies and a clear implementation pathway speaks directly to this.¹³ The third concerns management. Nurses named weak administrative support as a barrier, and attitude alone could not close the gap between willingness and practice.¹¹ Protected time, a clear mandate and visible backing from hospital leadership are what convert goodwill into routine. Finally, there is a simple numbers argument: nurses are repeatedly the largest professional group in these samples,⁹ so even modest gains in their stewardship engagement could scale further than similar gains among smaller cadres.

For researchers, the agenda is almost defined by what is missing. The field needs studies built around nurses rather than treating them as one line in a mixed sample; it needs intervention trials, not only surveys of knowledge and attitude; and it needs work from the many LMICs not represented here at all. Community health workers, who in some settings already take on stewardship-adjacent tasks, may offer a complementary model worth studying alongside nurses.¹⁴ Shared outcome measures would make future studies easier to compare and to combine.

The picture, then, is genuinely hopeful but unfinished. The willingness of nurses is an asset that LMIC health systems have not fully drawn on. Closing the gap is less about persuading nurses that stewardship matters they appear already convinced and more about giving them the training, the defined role and the institutional support to act on it.

V. LIMITATIONS

This synthesis has clear limits, and they bear on how its findings should be used. The search covered a single database, PubMed/MEDLINE, and English-language records only; extending it to Embase, CINAHL, Scopus and Web of Science would almost certainly add studies and may shift the balance of findings. Screening and data extraction were assisted by a large language model and carried out by a single reviewer rather than two independent reviewers, so the selection and the reported counts should be treated as provisional until verified. Some data were drawn from abstracts and reports rather than confirmed against every full text. A formal, design-specific risk-of-bias assessment has not yet been applied, so methodological quality is not graded here. Several

included studies reported nurses within mixed health-worker samples, which means some findings describe health workers in general rather than nurses alone. Finally, the small number of studies and their variety ruled out any pooled quantitative estimate. For these reasons the present work is best regarded as a focused synthesis to be completed and verified before it is submitted as a definitive systematic review.

VI. CONCLUSION

Nurses are the largest clinical workforce in low- and middle-income countries and spend more time with patients than anyone else, which places them in a natural position to support antimicrobial stewardship. The evidence reviewed here shows that they recognise its importance and feel able to contribute, but that their actual involvement is held back by gaps in training, limited managerial support and demanding working conditions. Building stewardship into nursing education, defining the nurse's role clearly, and backing it with institutional support are practical ways to close that gap. The current evidence base is small and geographically narrow, and stronger, nurse-focused research from a wider range of countries is needed to guide policy and practice.

Declarations

Ethics approval and consent to participate. Not applicable; this study used only published literature.

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Competing interests. The author(s) declare that they have no competing interests.

Use of artificial intelligence. A large language model (Claude, Anthropic, San Francisco, CA, USA) was used to assist with the literature search and drafting of this manuscript. The author reviewed and verified all content, take full responsibility for the integrity and accuracy of the work, and confirm that the AI tool is not listed as an author, consistent with ICMJE and COPE guidance. The nature and limits of this assistance are described in the Methods and Limitations.

Data availability. All data analysed in this review are contained within the cited published articles.

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