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Expert Review of Anti-infective Therapy

ISSN: 1478-7210 (Print) 1744-8336 (Online) Journal homepage: www.tandfonline.com/journals/ierz20

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To cite this article: Esther Ugo Alum , Bashar Haruna Gulumbe , Friday Ogbu Edeh , Christine Ainebyoona , Daniel Ejim Uti , Okechukwu Paul-Chima Ugwu , Benedict Nnachi Alum , Michael Ben Okon , Patrick Maduabuchi Aja , Vaithiyalingam Subramanian Manjula & Peter Chinedu Agu (19 Aug 2026): Antimicrobial stewardship implementation in Western Uganda: a narrative policy and implementation review, Expert Review of Anti-infective Therapy, DOI: 10.1080/14787210.2026.2720593

To link to this article: https://doi.org/10.1080/14787210.2026.2720593

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Published online: 19 Aug 2026.

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EXPERT REVIEW OF ANTI-INFECTIVE THERAPY
https://doi.org/10.1080/14787210.2026.2720593

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REVIEW

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Antimicrobial stewardship implementation in Western Uganda: a narrative policy and implementation review

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ABSTRACT

Introduction: Antimicrobial resistance (AMR) is a major health-system challenge in Uganda. Western Uganda has documented inappropriate antibiotic prescribing and local resistance patterns, but evidence on routine antimicrobial stewardship (AMS) implementation remains fragmented.

Areas covered: This structured narrative policy and implementation review synthesizes evidence on AMR and antimicrobial stewardship (AMS) implementation in Western Uganda, drawing on Western Uganda-specific studies, Uganda-wide evidence, national policy documents, and broader low- and middle-income country implementation literature. Evidence was identified through targeted PubMed searches, World Health Organization resources, and Ugandan Ministry of Health repositories focused on AMR, AMS, antibiotic use, diagnostics, surveillance, community pharmacies, drug shops, One Health, and low-resource settings.

Expert opinion: The strongest immediate case for stewardship in Western Uganda is supported by local prescribing studies, national hospital point-prevalence data, and Uganda's current policy framework. A feasible minimum package should combine named facility responsibility, Uganda Clinical Guideline and AWaRe-informed prescribing support, small-sample prescription review, laboratory referral and feedback, private pharmacy engagement, and district supervision. The phased framework proposed in this review is an author-developed implementation synthesis; it has not yet been adopted or evaluated.

ARTICLE HISTORY
Received 4 June 2026
Accepted 14 August 2026

KEYWORDS
Antimicrobial resistance; antimicrobial stewardship; healthcare infrastructure; One Health integration; implementation; Western Uganda

1. Introduction

Antimicrobial resistance (AMR) was estimated to be directly responsible for 1.27 million deaths and associated with 4.95 million deaths globally in 2019, with a disproportionate burden in low-resource settings [1]. AMS seeks to improve antimicrobial selection, dose, route, and duration while preserving access to effective treatment. In LMIC health systems, stewardship must be adapted to diagnostic constraints, medicine availability, staffing, financing, and the large role of community and private-sector medicine access [2,3].

Uganda has established national AMR surveillance and has adopted a second One Health NAP-AMR for 2024/25–2028/29. The plan prioritizes public awareness and training, IPC, stewardship and responsible use, surveillance and data sharing, and research and innovation [4]. Uganda also has updated clinical guidance and a national AMS manual [5,6]. The implementation question is therefore not whether stewardship is required, but which actions are supported by evidence and feasible at facility, district, pharmacy, community, and One Health levels.

Western Uganda warrants a distinct implementation lens because the region includes regional referral hospitals, district and lower-level health facilities, rural communities, private medicine outlets, livestock-production systems, and uneven access to microbiology services. Although the evidence base specific to the region has expanded, it remains smaller and more geographically concentrated than the national literature. This review therefore applies four explicit evidence levels: (1) evidence generated specifically in Western or South-Western Uganda; (2) Uganda-wide evidence or evidence from other Ugandan settings that may inform regional planning; (3) multicountry evidence containing separable findings from Ugandan sites; and (4) broader African, low- and middle-income country, or global evidence used only where its relevance and potential transferability to Western Uganda are plausible. This hierarchy is used to prevent national or non-local findings from being presented as direct estimates for Western Uganda. The objectives of the review are to summarize current evidence on antimicrobial use, resistance, and stewardship in Western Uganda and Uganda; identify implementation barriers and enabling

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/14787210.2026.2720593

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Article highlights

- Antimicrobial resistance is a major public health challenge in Western Uganda, driven by limited diagnostic capacity, health-system constraints, inappropriate antimicrobial use, private-sector antibiotic access, and community self-medication practices.
- Antimicrobial stewardship implementation in Western Uganda remains uneven, with limited region-specific evidence on functional stewardship teams, audit-and-feedback systems, surveillance capacity, and community-level antibiotic-use drivers.
- Effective stewardship in this setting requires coordinated action across hospitals, primary care facilities, laboratories, pharmacies, drug shops, communities, regulatory systems, and One Health sectors.
- Immediate priorities include appointing facility antimicrobial stewardship focal persons, strengthening standard treatment guideline use, introducing basic prescription review, improving infection prevention and control awareness, and engaging communities and private medicine outlets.
- Medium-term priorities include audit-and-feedback, improved specimen referral, sentinel AMR surveillance, pharmacy supervision, and routine monitoring of antimicrobial use.
- Long-term priorities include laboratory strengthening, sustained AMR and antimicrobial-use reporting, integration of One Health surveillance, and stronger enforcement of prescription-only antimicrobial access.
- The proposed phased roadmap provides a practical implementation guide for Western Uganda and similar low-resource settings, but local empirical evaluation is needed to assess feasibility, effectiveness, and sustainability.

factors; and propose a phased, explicitly non-validated implementation framework for local consideration.

2. Methodology

2.1. Study design and reporting approach

This article is a structured narrative policy and implementation review of antimicrobial resistance and antimicrobial stewardship in Western Uganda. The review was guided by the Scale for the Assessment of Narrative Review Articles (SANRA) principles, including justification of the topic, clear aims, description of the literature search, appropriate referencing, scientific reasoning, and balanced presentation [7]. It is not a systematic review or meta-analysis; therefore, no pooled effect estimates were calculated and no formal certainty-of-evidence assessment was undertaken.

2.2. Information sources and search approach

Relevant literature was identified through searches of PubMed, World Health Organization (WHO) resources, and Ugandan policy documents. Searches were conducted for English-language sources published from 1 January 2013 through 28 July 2026, with older sources included only where they provided important Uganda-specific evidence or policy context. Search concepts covered antimicrobial resistance, antimicrobial stewardship, antibiotic use, Uganda, Western and South-Western Uganda, One Health, community pharmacies, drug shops, surveillance, diagnostics, infection prevention and control, governance, financing, sustainability, monitoring, and low-resource settings. Example search strings included: 'antimicrobial stewardship AND Uganda'; 'antimicrobial resistance AND Western Uganda'; 'antimicrobial resistance surveillance AND Uganda'; 'antibiotic self-medication AND Uganda'; 'private pharmacies AND antimicrobial stewardship AND Uganda'; 'One Health antimicrobial resistance AND Uganda'; and 'antimicrobial stewardship low-resource settings.' Backward citation checking was applied to included Uganda-specific studies and key reviews; forward citation searching was not systematic. Policy and technical documents were included because they define the current Ugandan clinical, regulatory, and implementation expectations against which recommendations must be assessed. Broader African and LMIC sources were included only when they described implementation mechanisms, barriers, or interventions not adequately studied in Western Uganda; they were not used as estimates of regional prevalence or effect. The exact revision-stage search concepts and strings are provided in Supplementary Material S1.

2.3. Eligibility and source hierarchy

Eligible sources addressed at least one of the following: antibiotic prescribing or consumption; AMS attitudes, practices, interventions, or implementation; AMR surveillance or laboratory capacity; community self-medication or private-sector dispensing; veterinary or agricultural antimicrobial use; or policy and implementation guidance relevant to Uganda or comparable LMIC settings. Peer-reviewed empirical studies, systematic reviews, and official policy or technical guidance were prioritized. Sources were excluded when they were unrelated to the review question, duplicated stronger evidence, lacked sufficient bibliographic traceability, were superseded by current guidance, or were too remote from the implementation context to support the claim for which they had been cited.

Evidence was classified by geography as Western Uganda-specific, Uganda-wide/other Ugandan setting, multicountry evidence including Uganda, or other LMIC evidence. It was also classified by source type and design. Claims in the Results section are source-derived. Interpretive statements are explicitly introduced as an interpretation or proposal and are concentrated in Sections 4–6.

2.4. Evidence selection and categorization

Potentially relevant sources were assessed first from titles and abstracts or executive summaries, followed by full-text assessment where the source appeared to meet the eligibility criteria. Bibliographic details and the relevance of sources retained from the earlier manuscript were rechecked. Included sources were classified into four geographical evidence levels: Western or South-Western Uganda-specific evidence; Uganda-wide or other Ugandan evidence; multicountry evidence containing separable Ugandan findings; and broader African, LMIC, or global evidence. This classification prevented national or non-local findings from being presented as Western Uganda estimates and made the transferability basis of recommendations explicit.

Evidence was also grouped according to implementation domains: facility-level stewardship capacity, diagnostic and

surveillance infrastructure, regulatory and private-sector medicine access, community antibiotic-use behavior, workforce and training, infection prevention and control, and One Health interfaces involving human, animal, and environmental health.

2.5. Evidence-selection accounting

Because this article is a structured narrative policy and implementation review rather than a systematic review, evidence selection was documented through a revision-stage evidence-corpus audit rather than a PRISMA-style selection process. The final retained corpus comprised 59 sources: 41 empirical or implementation studies, 12 review or conceptual sources, five policy or technical-guidance documents, and one narrative-review methods source. Fifteen empirical studies were conducted specifically in Western or South-Western Uganda; two additional multicountry studies reported separable data from sites in or around Mbarara, and one Ugandan multisite study included western and south-western referral hospitals. Because a complete deduplicated export of the original search was unavailable, total database-yield and duplicate-removal counts are not reported. The source-by-source audit trail is provided in Supplementary Table S2. These figures represent the auditable evidence corpus used for the revised narrative review. They should not be interpreted as exhaustive systematic-review database yields because the original database exports and deduplication log were unavailable.

2.6. Data extraction

For each included source, information was charted on publication year, geography, setting, design or source type, population or data source, stewardship domain, principal finding, stated or evident limitation, and contribution to the review. For policy and technical documents, the issuing organization, policy scope, and implementation relevance were recorded. The source-level charting is summarized in Supplementary Table S2.

2.7. Evidence synthesis and development of recommendations

Findings were synthesized thematically across policy and regulation, diagnostics and infrastructure, workforce and education, community and private-sector medicine use, IPC, and One Health. Within each theme, the synthesis compared the direction and consistency of findings, study designs, setting-specific limitations, and the extent to which evidence could reasonably be transferred to Western Uganda. Recommendations were developed by mapping locally documented problems to current Ugandan guidance and to implementation strategies reported in Uganda or other resource-constrained settings. Where no Western Uganda intervention study existed, the recommendation was labeled as a proposal requiring local feasibility and effectiveness testing. Proposed actions were then classified as evidence-supported interpretations rather than empirically validated interventions for Western Uganda.

2.8. Limitations of the method

Because this is a structured narrative policy and implementation review, the review does not claim exhaustive retrieval of all relevant studies and does not include formal risk-of-bias scoring. The strength of the review lies in contextual synthesis and implementation interpretation rather than statistical aggregation.

3. Results of the narrative review

3.1. Evidence profile and study designs

Fifteen empirical studies were conducted specifically in Western or South-Western Uganda. These included retrospective and prospective prescribing studies, a mixed-method pediatric antibiotic-use study, an implementation/action-research study, a mystery-client dispensing study, and hospital- or district-based microbiology and genomic surveillance studies. Two further multicountry studies provided separable data from sites in or around Mbarara, and one Ugandan multisite drug-utilization study included western and south-western referral hospitals. Uganda-wide evidence additionally included provider surveys, hospital point-prevalence surveys, national antimicrobial-consumption analyses, surveillance implementation studies, patient surveys, qualitative pharmacy and prescriber studies, and household or farm surveys. This broader design mix improves the description of the regional problem, but most studies remain observational and do not establish the effectiveness of a comprehensive AMS package (Table 1).

3.2. What is known specifically about Western Uganda

The search identified 15 empirical studies conducted specifically in Western or South-Western Uganda, in addition to two multicountry studies with separable Mbarara-area data and one Ugandan multisite study that included western and south-western referral hospitals. The regional evidence is therefore larger than stated in the earlier draft, although it remains concentrated in Mbarara and in selected clinical populations, syndromes, facilities, and organisms.

Prescribing studies consistently identify substantial non-guideline-concordant antibiotic use. Okello et al. [9] found that 68.4% of antibiotic prescriptions reviewed for children younger than five in Mbarara lower-level facilities were irrational. Muwanguzi et al. [10] reported antibacterial prescribing in 77.6% of 780 respiratory-tract-infection encounters. Abeja et al. [11] classified 75.1% of 229 eligible prescriptions for children hospitalized with severe pneumonia at Bwizibwera Health Centre IV as irrational. In the largest directly regional study, Nantongo et al. [12] reviewed 9,899 prescriptions from 39 facilities in Mbarara, Bushenyi, and Kasese and classified 65.8% as irrational against the Uganda Clinical Guidelines. These estimates arise from different populations and assessment methods and should not be pooled, but their direction is consistent.

Additional studies broaden the picture beyond outpatient prescription audits. Obura et al. [13] documented off-label antibiotic use in the pediatric ward at Mbarara Regional

Table 1. Core Uganda and Western Uganda empirical evidence relevant to the review.

Geographic level	Study	Design / data source	Review-relevant finding and limitation
Western Uganda	Ackers et al. [8]	Action research / implementation analysis; maternal sepsis intervention at a regional referral hospital	Described multidisciplinary stewardship opportunities and constraints involving medicine access, training, staffing, and implementation conditions; focused on maternal sepsis rather than whole-facility AMS.
Western Uganda	Okello et al. [9]	Retrospective review of 1,218 pediatric outpatient records plus interviews with 35 prescribers in 17 Mbarara facilities	68.4% of antibiotic prescriptions were classified as irrational against existing guidance; applies to children younger than five in lower-level facilities.
Western Uganda	Muwanguzi et al. [10]	Retrospective review of 780 respiratory-tract-infection encounters in four Mbarara facilities	77.6% received an antibacterial and amoxicillin comprised 80.4% of antibacterial prescriptions; findings are syndrome- and facility-specific.
Western Uganda	Abeja et al. [11]	Retrospective cohort of 229 eligible severe-pneumonia records at Bwizibwera Health Centre IV	75.1% of included prescriptions were classified as irrational against Uganda Clinical Guidelines; limited to children aged 2–59 months with severe pneumonia.
Western Uganda	Nantongo et al. [12]	Prospective cross-sectional review of 9,899 prescriptions in 39 facilities across Mbarara, Bushenyi, and Kasese	65.8% of antibiotic prescriptions were classified as irrational against the Uganda Clinical Guidelines; the largest directly regional prescribing dataset identified.
Western Uganda	Obura et al. [13]	Prospective mixed-method drug-utilization study in the Mbarara Regional Referral Hospital pediatric ward	Documented off-label antibiotic use among children younger than five and explored prescriber explanations; focused on a single pediatric ward.
Western Uganda / Niger	Mambula et al. [14]	Retrospective prescribing analysis plus interviews/focus groups; four Uganda sites in and around Mbarara	In the Uganda sites, antibiotics were prescribed in 47.6% of 3,865 pediatric encounters; 21.8% of 1,982 antibiotic prescriptions were Watch agents. Microbiology access, stock constraints, workload, and caregiver factors shaped use.
Western Uganda / Tanzania	Olamijuwon et al. [15]	Mystery-client study in 440 pharmacies and 67 drug shops in Mbarara, with a parallel Tanzania arm	Most Mbarara sellers dispensing prescription-only medicines did not request a prescription; partial-course dispensing was also observed. The simulated scenario was COVID-19 symptoms.
Uganda; includes western sites	Nambasa et al. [16]	Retrospective drug-utilization study in four regional referral hospitals	None of 371 levofloxacin prescriptions complied with Uganda Clinical Guidelines; 59.3% were appropriate by WHO prescribing indicators. Hospital-specific data were not always separately reported.
Western Uganda	Bazira et al. [17–19]	Retrospective Mbarara laboratory surveillance of ESKAPE, respiratory, and urinary isolates	Documented substantial and changing resistance in multiple clinical syndromes. These are referral-laboratory data and cannot be interpreted as community or region-wide prevalence.
Western Uganda	Ackers-Johnson et al. [20]; Odoki et al. [21]; Tuhamize et al. [22]	Clinical isolate studies in Fort Portal, Bushenyi, and rural South-Western Uganda	Reported resistance and multidrug-resistance patterns in S. aureus and urinary pathogens, supporting local susceptibility surveillance; each study was pathogen-, syndrome-, or site-specific.
Western Uganda	Ezekiel et al. [23]; Mohamed et al. [24]	Cross-sectional respiratory or pneumococcal studies in Hoima and Bushenyi	Provide recent local susceptibility data among selected respiratory populations; findings should guide local investigation rather than be generalized to all respiratory infections.
Western Uganda	Owokuhaisa et al. [25]	Whole-genome characterization of selected ESKAPEEE isolates from Mbarara Regional Referral Hospital	Identified resistance, virulence, mobile-element, and sequence-type characteristics in selected isolates; useful for surveillance but not a prevalence study.
Uganda; region-stratified	Kimbowa et al. [26]	Cross-sectional survey of 582 healthcare providers in 32 facilities	58% had high AMS attitude scores and 46% had fair AMS practice scores. Providers in the western region had lower adjusted practice scores than those in the central region (aOR 0.52, 95% CI 0.34–0.79).
Uganda; includes western sites	Kiggundu et al. [27]	WHO-method point-prevalence survey in 13 hospitals; 1,077 patients and 1,387 antibiotic prescriptions	73.7% of patients received at least one antibiotic; Uganda Clinical Guidelines concordance was 30%; 44% of prescriptions were Watch antibiotics and ceftriaxone accounted for 37%.
Uganda	Kizito et al. [28]	Hospital consumption analysis and point-prevalence survey at Kiruddu National Referral Hospital	Antibiotics were prescribed to 56% of sampled outpatients and 57.5% of inpatients; this is not Western Uganda evidence.
Uganda	Murungi et al. [29]	National antimicrobial-import analysis, 2018–2021	Estimated 2021 consumption was 29.02 DDD per 1,000 inhabitants per day; import data are a national proxy and do not measure regional appropriateness.
Uganda	Nabadda et al. [30]; Chaplain et al. [31]	National GLASS implementation and laboratory-capacity analyses	Demonstrated surveillance progress while identifying data-quality, standardization, and susceptibility-testing capacity gaps.
Uganda / Tanzania	Kiggundu et al. [32]	Implementation-experience analysis of antimicrobial-use surveillance	Poor data quality, limited digitization, insufficient human resources, and weak routine systems constrained surveillance implementation.
Uganda	Mukonzo et al. [33]; Nabaweesi et al. [34]; Musoke et al. [35]	Simulated-client, patient-survey, and qualitative pharmacy studies	Documented non-prescription dispensing, self-medication, incomplete courses, and business, cost, client-retention, and guideline barriers; most settings were outside Western Uganda.
Uganda	Kizito et al. [36]	Qualitative study with 12 prescribers in a private not-for-profit hospital	Patient demand, diagnostic turnaround, prior experience, senior influence, and medicine marketing shaped prescribing; conducted in Kampala.

(*Continued*)

Table 1. (Continued).

Geographic level	Study	Design / data source	Review-relevant finding and limitation
Uganda	Nayiga et al. [37]; Dione et al. [38]; Mikecz et al. [39]; Emes et al. [40]	Household, livestock, supply-chain, and farm studies	Identified antimicrobial use and access, veterinary-service, handling, economic, and disease-prevention factors requiring One Health responses.
Uganda; region-stratified	Kimbowa et al. [41]	Cross-sectional provider-perspective survey; 582 providers in 32 facilities	63.1% had a low-level perspective regarding adopted hospital policies supporting ASP establishment; measures perceptions rather than direct programme functionality.
Uganda	Kiggundu et al. [42]	One Health implementation-experience report	Reported multisectoral coordination, IPC, and AMS capacity-building outputs; did not provide a controlled estimate of effects on antimicrobial use, resistance, or patient outcomes.

Referral Hospital. A mixed-method study at four sites in and around Mbarara reported antibiotics in 47.6% of 3,865 pediatric encounters and Watch agents in 21.8% of 1,982 antibiotic prescriptions; interviews linked practice to limited microbiology, medicine availability, staff workload, guideline usability, and caregiver circumstances [14]. Ackers et al. [8] similarly described implementation constraints and multidisciplinary opportunities in a maternal-sepsis intervention. A Ugandan multisite review also found no levofloxacin prescription among 371 reviewed prescriptions to be concordant with the Uganda Clinical Guidelines, although the study did not report every indicator separately for western hospitals [16].

The repeat search also identified direct evidence on private medicine outlets in Mbarara. In a mystery-client study of 440 pharmacies and 67 drug shops, more than three-quarters of sellers who supplied prescription-only medicines did not request a prescription, and some supplied partial courses [15]. The simulated presentation involved COVID-19 symptoms, so the exact dispensing proportions should not be assumed for all illnesses, but the study establishes that non-prescription and partial-course antibiotic access occurs locally rather than only in other Ugandan regions.

Local microbiology studies show that resistance patterns vary by organism, syndrome, facility, and period. Mbarara Regional Referral Hospital studies have described resistance among ESKAPE pathogens, uropathogens, and respiratory isolates, while studies in Fort Portal, Bushenyi, rural Mbarara, and Hoima have reported resistance or multidrug resistance in selected clinical populations [17–24]. Genomic characterization at Mbarara further documents resistance determinants and mobile genetic elements in selected ESKAPEEE isolates [25]. These studies support local laboratory surveillance and antibiogram development, but none alone estimates resistance prevalence across Western Uganda.

A Uganda-wide provider survey also reported a region-stratified signal: providers in the western region had lower adjusted AMS practice scores than providers in the central region [26]. The study found high AMS attitude scores in 58% of participants and fair practice scores in 46%; it did not establish the causes of the regional difference. The result should therefore guide targeted assessment rather than be treated as evidence of a single regional determinant.

3.3. Uganda-wide evidence on antibiotic use and stewardship

National and multisite studies show high antibiotic exposure and incomplete guideline concordance. In a 13-hospital PPS that included western facilities, 73.7% of patients were receiving at least one antibiotic, only 30% of prescriptions complied with the UCG, 44% of prescriptions were in the WHO Watch category, and ceftriaxone was the most frequently prescribed antibiotic at 37% of prescriptions [27]. These aggregate results are relevant to regional planning, but they do not provide Western Uganda-specific estimates for each indicator.

At Kiruddu National Referral Hospital in Kampala, antibiotics were prescribed to 56% of sampled outpatients and 57.5% of inpatients, with substantial Watch antibiotic use [28]. This is not Western Uganda evidence, but it demonstrates the type of PPS and consumption monitoring that can be adapted. National import data estimated antimicrobial consumption at 29.02 defined daily doses per 1,000 inhabitants per day in 2021; 62.91% of consumption was Access-class, while Watch-class consumption increased in 2021 [29]. Import data are a proxy for national consumption and do not describe prescribing appropriateness or regional distribution.

Kimbowa et al. [26] surveyed 582 providers in 32 Ugandan facilities. Fifty-eight percent had high AMS attitude scores and 46% had fair practice scores. The frequently reported practices included documenting antibacterial use and using treatment guidelines, but the study was self-reported and therefore may overestimate routine performance. Together, the PPS, consumption, and provider studies show that Uganda has measurable stewardship activity but persistent gaps in antibiotic selection, guideline concordance, and regional practice.

A 2024 Ugandan analysis of 582 providers in 32 facilities found that 63.1% had a low-level perspective regarding adopted hospital policies intended to support establishment of antimicrobial stewardship programs [41]. This measure reflects provider perspectives rather than a direct audit of whether each policy or program component was operational. It therefore complements, but does not independently verify, the earlier self-reported attitude and practice findings. Together, the studies support direct facility assessment of governance, assigned accountability, and routine stewardship activity rather than reliance on provider perception alone.

3.4. Surveillance and diagnostic capacity

Uganda has made important progress in national AMR surveillance. Nabadda et al. [30] described implementation of a GLASS-aligned program and analyzed 19,216 isolates collected between 2015 and 2020. The program established national coordination, reference-laboratory support, surveillance sites, and data management, while the authors also emphasized quality-assurance and standardization needs. A separate records review identified substantial gaps in routine antimicrobial-susceptibility-testing capacity in Ugandan facilities [31].

Antimicrobial-use surveillance is also constrained by weak data quality, limited digitization, and human-resource shortages [32]. These are surveillance and diagnostic-system constraints; they are distinct from sanitation. WASH and IPC reduce infection incidence and transmission, whereas diagnostic stewardship improves decisions about whether, when, and how to use microbiology and other tests [43]. Both are relevant to AMR, but they require separate implementation actions and indicators.

3.5. Community, private-sector, and behavioral evidence

Evidence on non-prescription access includes a directly local study as well as Uganda-wide and other regional evidence. In Mbarara, a mystery-client study found that most sellers who supplied prescription-only medicines did not request a prescription and that partial-course dispensing occurred in both pharmacies and drug shops [15]. A national simulated-client study also documented suboptimal antibiotic dispensing without a valid prescription [33]. At a national referral hospital, 22.2% of antibiotic users reported self-medication, and some participants reported not completing courses [34]. Only the Mbarara study provides directly regional dispensing data; prevalence estimates from Kampala or other districts are not presented as Western Uganda estimates.

Qualitative studies show that antibiotic use is influenced by cost, perceived treatment success, client retention, patient expectations, diagnostic turnaround time, and professional norms. In Wakiso private pharmacies, commonly sold products included Ampiclox®, a brand name for a fixed-dose ampicillin–cloxacillin combination; the study did not establish that the same product mix applies in Western Uganda [35]. Rural Ugandan research has also shown that antibiotic use for respiratory symptoms is embedded in social interpretations of illness and prior experience [44]. Prescribers in a Kampala private hospital described patient demand, fear of poor outcomes, senior influence, and delayed investigations as factors affecting decisions [36]. These studies support locally adapted behavioral work rather than a single awareness campaign.

3.6. One Health evidence

Ugandan household, farm, and veterinary-supply studies document antimicrobial use across human and animal systems and identify gaps in veterinary oversight, medicine handling, disease prevention, and surveillance [37–40]. These studies are not all specific to Western Uganda. Their relevance lies in showing that a regional AMS strategy should connect human health with veterinary and environmental governance rather than treating hospital prescribing as the entire AMR problem. A One Health definition of stewardship similarly emphasizes coordinated responsible use across sectors [45,46].

A national One Health implementation report described coordinated capacity-building activities across multisectoral AMR governance, IPC, and stewardship, including training and support to health facilities and district teams [42]. The report demonstrates that coordinated implementation at scale is feasible within Uganda, but it primarily reports program activities and capacity outputs rather than controlled effects on antimicrobial consumption, resistance, patient outcomes, or long-term sustainability.

3.7. Transferable evidence from Africa and other LMICs

The broader African implementation literature is limited and heterogeneous. A systematic review identified only 13 eligible African ASP implementation studies through March 2019, with most studies conducted in South Africa and none in Uganda; reported outcomes were mainly improvements in process measures such as guideline compliance, appropriateness, antibiotic use, and cost [47]. This supports cautious transfer of core stewardship approaches but not the assumption that an intervention effective elsewhere will produce the same outcome in Western Uganda.

WHO and review literature recommend a context-adapted package built around governance, leadership support, guidelines, education, audit and feedback, monitoring, and access to microbiology where feasible [2,3,48]. A multicountry report involving Uganda also described practical pharmacist-led stewardship interventions in Ghana, Tanzania, Uganda, and Zambia, supporting the feasibility of involving pharmacists in locally adapted implementation while not providing Western Uganda-specific effectiveness estimates [49]. Regulatory interventions are more likely to succeed when law enforcement is combined with stakeholder education, access to qualified care, and feasible dispensing processes rather than relying on prohibition alone [50]. Community dialogue models show that engagement can be embedded in existing systems, but local adaptation and sustained facilitation are required [51,52].

Recent implementation literature adds detail but does not remove the need for local testing. A scoping review of 84 studies from 34 LMICs identified recurrent barriers including shortages of trained personnel, limited microbiology support, weak leadership, and limited governmental support; reported facilitators included accessible guidelines, multidisciplinary committees, stewardship protocols, and prompt laboratory support [53]. A CFIR-guided systematic review of 31 sub-Saharan African studies similarly identified underfunding, limited diagnostic infrastructure, weak governance and enforcement, insufficient training, and limited surveillance, while leadership and stakeholder engagement were recurring enablers [54]. In 32 hospitals across five East, Central, and Southern African countries, a harmonized regional approach was associated with improved scores for stewardship core elements, including leadership, training, AWaRe classification, and reporting [55]. Because that

study used an exploratory baseline/endline design without a concurrent control and did not evaluate Western Uganda, it supports feasibility and implementation design rather than a predicted local effect size.

3.8. Critical comparison and remaining evidence gaps

The Western Uganda prescribing studies are directionally consistent in identifying frequent non-guideline-concordant or high-volume antibiotic use, but their estimates are not directly comparable. They examine different age groups, syndromes, facility levels, time periods, and definitions of rationality. The consistency of the problem signal supports action, whereas the heterogeneity prevents calculation of a single regional prevalence and limits comparison of magnitude across studies [9–12].

Provider surveys and observed prescribing data also answer different questions. Favorable attitudes or reported practices do not demonstrate routine guideline concordance, and provider perspectives on hospital policies do not establish that stewardship structures are functional [26,41]. The contrast between self-reported measures and prescription-review or point-prevalence findings suggests a possible implementation gap, but the studies were not designed for direct individual- or facility-level comparison.

The microbiology evidence is similarly heterogeneous. Studies from Mbarara, Fort Portal, Bushenyi, Hoima, and rural South-Western Uganda involve different organisms, specimen types, clinical populations, referral patterns, laboratory methods, and study periods. They establish the need for local susceptibility surveillance but do not provide a population-representative Western Uganda resistance estimate or a single regional antibiogram [17–22].

The evidence base is therefore strongest for identifying prescribing, dispensing, diagnostic, and surveillance problems and weakest for estimating the effectiveness, cost, equity effects, and sustainability of a comprehensive stewardship package in Western Uganda. An earlier systematic review of antimicrobial resistance research in Uganda similarly found that the literature was more developed in some areas of resistance surveillance and burden description than in policy and stewardship implementation research [56]. Important remaining gaps include controlled or interrupted-time-series evaluations; adult, outpatient, district-hospital, and lower-level -facility interventions; private pharmacy and drug-shop implementation studies; cost and workforce analyses; patient-safety and access outcomes; and longitudinal One Health monitoring.

4. Interpretation for Western Uganda

This section is an author interpretation of the reviewed evidence rather than a report of a new empirical study. The evidence supports four linked implementation conclusions.

First, local prescribing data should anchor the regional case for action. Multiple Western and South-Western Uganda studies report high or frequently non-guideline-concordant antibiotic prescribing across pediatric primary care, severe pneumonia, respiratory-tract-infection encounters, and a large three-district primary-care sample [9–12]. The studies used different designs and definitions, so their proportions should not be pooled. National point-prevalence and provider data add breadth, but regional estimates should not be inferred from national aggregates without local measurement [26,27].

Second, facility education alone is unlikely to be sufficient. Local and Uganda-wide evidence links antibiotic decisions to limited or delayed microbiology, medicine availability, staffing and workload, patient or caregiver expectations, guideline usability, and private dispensing [8,14,15,31,32,35,36]. A minimum AMS package should therefore combine prescribing support with diagnostic referral, medicine and laboratory feedback, and community or private-sector engagement.

Third, WHO provides technical guidance, not national legal enforcement. Regulation of prescription-only access is a Ugandan governmental and regulatory function. WHO guidance can inform stewardship structures and medicine-use targets, while implementation and enforcement must be aligned with Ugandan law, the UCG, the national AMS manual, and the NAP-AMR [3–6,57].

Fourth, the feasibility of monitoring must be assessed before indicators are adopted. The literature documents limited digitization and staff capacity [32]. Facilities should therefore begin with a small indicator set derived from existing prescription, pharmacy, laboratory, or quality-improvement records. The roadmap below assumes that stewardship duties are assigned to existing staff only after the facility confirms a named responsible person, multidisciplinary support, and protected time. It does not assume that every facility currently has adequate staffing.

4.1. Implementation constraints, sustainability, and monitoring

Workforce constraints affect both delivery and measurement. Stewardship tasks compete with routine clinical, pharmacy, nursing, laboratory, and managerial duties, while some facilities lack one or more of the cadres normally represented in a multidisciplinary team. Cadre-specific Ugandan evidence is also limited, although exploratory research has examined midwives' understanding of antimicrobial resistance and stewardship, indicating that nursing and midwifery perspectives should be considered when assessing training needs and designing multidisciplinary stewardship activities [58]. Ugandan surveillance experience and broader LMIC reviews identify limited staff time, training, laboratory support, and data-management capacity as recurrent constraints [32,53,54]. Assigning a focal person is therefore insufficient unless responsibility is accompanied by backup arrangements, protected time, management support, and district or regional mentorship where expertise is absent.

Financing and governance determine whether initial activity becomes routine practice. Training, specimen referral, quality assurance, supervision, data review, and feedback all have recurrent costs. Short externally supported projects can establish tools and skills, but sustainability requires incorporation into facility workplans, district supervision, medicine and laboratory budgets, and national reporting expectations.

Uganda's One Health implementation experience demonstrates the value of coordinated platforms, while recent African implementation studies emphasize leadership, governance, and context-specific institutionalization; neither source proves that financing or stewardship activity will be sustained after project support ends [42,55].

Monitoring should be proportionate to available data capacity. Requiring large indicator sets or new digital systems before workflows are stable may increase documentation burden without improving decisions. Facilities should begin with a small number of actionable measures, define who collects and reviews them, use existing records where possible, and document the time and resources required. Expansion should depend on data completeness, evidence that feedback occurs, and the absence of unintended effects such as delayed effective treatment or restricted access to necessary antibiotics.

5. Proposed phased implementation framework

Table 2 is an author-proposed framework derived from the reviewed evidence and current Ugandan and WHO guidance. It has not been formally adopted by the Government of Uganda, a district, or a health facility, and no outcome data exist for the framework as a package. It should therefore be treated as a testable implementation proposal, not an established program.

5.1. Evidence-to-action justification

The roadmap uses an explicit evidence-to-action hierarchy. Phase 1 responds to directly documented regional problems: non-guideline-concordant prescribing, limited documentation and diagnostic support, and non-prescription or partial-course dispensing [11,12,14,15]. Named responsibility, accessible guidance, targeted prescription review, and feedback are also consistent with Ugandan policy and African implementation experience, but this combination has not been evaluated as a package in Western Uganda [3,41,49,59].

Phase 2 is justified by national and regional evidence showing low guideline concordance, substantial Watch-antibiotic use, laboratory-capacity gaps, and weak routine data systems [27,31,32]. Broader implementation reviews support multidisciplinary audit and feedback, laboratory linkage, and monitoring, while also showing that effects depend on staffing, leadership, and context [53,54]. These actions therefore require local feasibility, cost, and outcome evaluation.

Phase 3 reflects national policy direction and implementation experience rather than proven regional effectiveness. Integration into routine quality improvement, stable financing,

Table 2. Author-proposed phased AMS framework for Western Uganda.

Phase	Priority actions	Responsible level	Minimum staffing and data assumptions	Minimum indicators	Evidence basis / status
Phase 1: Foundation (0–6 months)	Name an AMS focal person and small multidisciplinary group; make current UCG/AWaRe job aids available; document indication and intended duration; conduct a small targeted prescription review; orient staff on IPC and specimen collection; begin pharmacy/community dialogue.	Facility leadership and district health office; pharmacist or pharmacy technician where available; clinician, nurse/midwife, and laboratory representation.	No new full-time post is assumed. Facility must confirm a named lead, backup, and protected time. Use existing paper/electronic records and a deliberately small review sample. Where key cadres are absent, use district or regional mentorship.	Named focal person; current guideline available; proportion of reviewed prescriptions with indication and duration documented; guideline concordance in one priority syndrome; number of mentorship/community sessions.	Local prescribing and dispensing studies; Uganda policy and provider evidence; WHO and African implementation literature [3,11,12,15,41]. Proposed package; not evaluated as a unit.
Phase 2: Optimization (6–18 months)	Expand audit and feedback to selected wards/OPD; improve specimen collection and referral; summarize available susceptibility data; strengthen pharmacy/drug-shop supervision and referral; monitor selected Watch antibiotics.	Facility AMS group; district laboratory/pharmacy supervisors; regional referral laboratory or sentinel site.	Add a laboratory and data representative where available. Use a simple spreadsheet or standardized paper form. Review burden should remain compatible with routine QI meetings.	Guideline concordance for targeted syndromes; proportion of selected Watch prescriptions reviewed; specimens successfully referred; median result-return category where measured; quarterly feedback completed.	Uganda PPS, diagnostic, and surveillance evidence plus LMIC implementation reviews [27,31,32,53,54]. Local feasibility, cost, and effect require evaluation.
Phase 3: Scale and sustain (18–36+ months)	Integrate AMS into routine QI and onboarding/CPD; establish stable regional AMR and antimicrobial-use reporting; strengthen hub-and-spoke laboratory systems; connect human, animal, and environmental surveillance; align pharmacy enforcement with access to qualified care.	District/regional governance linked to national NAP-AMR structures and One Health actors.	Requires sustained financing, district supervision, laboratory quality systems, and defined data ownership. Digitalization is desirable but should follow a stable workflow rather than precede it.	Sustained reporting over 12 months; trend in targeted Watch use and guideline concordance; laboratory quality and turnaround measures; private-sector supervision coverage; agreed One Health reporting outputs.	Uganda NAP-AMR and One Health implementation experience plus regional African evidence [4,42,55]. Adoption, sustainability, and outcomes remain to be tested.

district governance, laboratory networks, and One Health reporting is supported by Uganda's NAP-AMR and implementation experience and by a recent regional African study [4,42]. Adoption, sustainability, and effects on antimicrobial use, resistance, access, and patient outcomes remain to be tested.

6. Limitations

This is a narrative review and does not provide exhaustive retrieval, formal risk-of-bias assessment, or pooled effect estimates. The original Scopus and Google Scholar logs, database exports, and deduplication record were unavailable. The study therefore reports a reproducible PubMed and official-repository update, verification of the original reference corpus, a repeated locality-focused search, and backward citation checking rather than unverifiable retrospective database yields. The targeted update may still have missed relevant studies. Only 15 empirical studies were specific to Western or South-Western Uganda. Two additional multicountry studies provided separable Mbarara-area data, and one Ugandan multisite study included western hospitals. Nevertheless, the evidence remains concentrated in selected districts, facilities, syndromes, patient groups, and organisms, and the search may still have missed relevant studies. National and other Ugandan findings were used cautiously and were not treated as regional prevalence estimates. Several implementation recommendations are extrapolated from WHO guidance and broader LMIC literature and require local feasibility and effectiveness testing. The proposed framework has not been adopted or evaluated.

7. Conclusion

The literature supports a clear stewardship need in Western Uganda but also shows that the local evidence base is narrow. Regional studies document substantial non-guideline-concordant prescribing in primary care and pediatric settings, local non-prescription and partial-course dispensing, implementation barriers, and syndrome- or facility-specific resistance patterns. National studies add evidence of high hospital antibiotic exposure, substantial Watch use, surveillance constraints, and region-related variation in AMS practice. A credible regional response should distinguish what is locally measured from what is inferred from Uganda-wide or LMIC evidence. The proposed phased framework links facility responsibility, prescribing review, diagnostics, private-sector engagement, district supervision, and One Health coordination while recognizing staffing and data limitations. Its next step is empirical evaluation, not assumption of adoption or effectiveness.

8. Expert opinion

The review indicates that the most defensible starting point for Western Uganda is a minimum stewardship system rather than a highly specialized hospital program. Regional evidence includes several prescribing studies showing substantial non-guideline-concordant use, pediatric antibiotic-utilization data, local dispensing evidence, and syndrome-specific resistance surveillance [9–15]. National evidence additionally documents high hospital antibiotic exposure, low guideline concordance, and substantial Watch-antibiotic use [27]. The first objective should be reliable execution of a few core practices: named responsibility, accessible guidance, documented indication and duration, periodic review and feedback, and a route for obtaining and acting on laboratory information.

The review also indicates that stewardship should not be framed as a prescriber-knowledge problem alone. Western Uganda and national studies link antibiotic decisions to diagnostic turnaround time, microbiology access, medicine and resource constraints, workload, caregiver or patient expectations, private-sector incentives, and social interpretations of illness [8,14,15,35,36,44]. Education should therefore be combined with workflow redesign, supervision, referral arrangements, and pharmacy or community engagement. Regulatory action should be paired with access to timely and affordable clinical assessment because enforcement without accessible alternatives may shift rather than resolve unsafe antibiotic use [50].

The most important measurement gap is Western Uganda-specific implementation data. The region needs facility-level AMS readiness assessments, repeat PPSs, syndrome-specific prescribing audits, laboratory referral and turnaround measures, and studies of pharmacy and drug-shop dispensing. These studies should report patient outcomes and unintended consequences, including delayed effective treatment, medicine access, adverse events, and cost. The proposed framework should be piloted using implementation outcomes such as feasibility, acceptability, fidelity, reach, and sustainability before any claim of effectiveness is made.

Finally, One Health integration should be operational rather than rhetorical. Uganda's household, livestock, and veterinary-supply evidence supports coordinated surveillance, prevention, and communication across sectors [37–40]. For Western Uganda, a realistic early step would be agreement on shared priority indicators and referral/escalation pathways between district human-health and veterinary actors, followed by evaluation of whether joint reporting changes practice. This is a proposal based on the evidence; it is not a report of an existing regional One Health AMS system.

Funding

This paper was not funded.

Declaration of interests

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

The authors declare the use of QuillBot and Grammarly tools for language editing and grammar correction only. The authors subsequently reviewed, verified, and revised all assisted text and take full responsibility for the accuracy, originality, and integrity of the final article. The authors

confirm that all generative AI use complies with Taylor & Francis' policy on the responsible use of generative AI.

Reviewer disclosures

Peer reviewers on this manuscript have no relevant financial or other relationships to disclose.

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CRediT: **Esther Ugo Alum:** Conceptualization, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing; **Bashar Haruna Gulumbe:** Conceptualization, Investigation, Methodology, Supervision, Validation, Writing – review & editing; **Friday Ogbu Edeh:** Formal analysis, Funding acquisition, Investigation, Methodology, Resources, Writing – review & editing; **Christine Ainebyoona:** Funding acquisition, Investigation, Methodology, Resources, Validation, Writing – review & editing; **Daniel Ejim Uti:** Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing; **Okechukwu Paul-Chima Ugwu:** Investigation, Methodology, Resources, Supervision, Validation, Writing – review & editing; **Benedict Nnachi Alum:** Data curation, Investigation, Methodology, Writing – original draft, Writing – review & editing; **Michael Ben Okon:** Formal analysis, Investigation, Methodology, Resources, Writing – review & editing; **Patrick Maduabuchi Aja:** Investigation, Methodology, Resources, Supervision, Writing – review & editing; **Vaithiyalingam Subramanian Manjula:** Data curation, Investigation, Methodology, Resources, Writing – review & editing; **Peter Chinedu Agu:** Investigation, Methodology, Resources, Validation, Writing – review & editing.

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