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REVIEW ARTICLE

PRESCRIBING PATTERNS AND RATIONAL USE OF MEDICINES IN EAST AFRICA: A SYSTEMATIC REVIEW

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Abstract

Background: Irrational prescribing including polypharmacy, over-use of antibiotics and injections, and low adherence to essential medicines lists (EML) remains a persistent problem across low- and middle-income countries, with important implications for Antimicrobial Resistance (AMR), treatment cost, and patient safety in general.
Objective: To synthesize published evidence on prescribing patterns and rational medicine use in East African countries using WHO/INRUD core prescribing indicators, and to compare practices across countries and healthcare settings under WHO supervision.
Methods: This review follows a PRISMA 2020-guided protocol. Eligible studies were cross-sectional, retrospective, or prospective observational studies reporting one or more WHO/INRUD prescribing indicators in Tanzania, Kenya, Uganda, Rwanda, Burundi, South Sudan, or Ethiopia. This manuscript reports a narrative synthesis based on ten primary studies and one regional multi-country synthesis identified through structured searches; formal multi-database screening and quality appraisal using the JBI checklist are outlined as next steps.
Results: Across identified studies, the average number of medicines per encounter ranged from 1.8 to 3.2 (WHO optimal: 1.6-1.8), generic-name prescribing ranged from approximately 51% to 98% (optimal: 100%), antibiotic-encounter prevalence ranged from 23% to 84%, injection-encounter prevalence ranged from 7% to 14%, and EML conformity ranged from approximately 96% to 100%. No eligible studies were located for Rwanda, Burundi, or South Sudan in this search.
Conclusion: Published data indicate persistent deviation from WHO optimal prescribing values in East Africa, particularly for polypharmacy and antibiotic over-prescribing, alongside comparatively strong performance on EML conformity. Findings support continued antimicrobial stewardship and prescriber-education interventions, and highlight an evidence gap for several East African countries.
Keywords: antimicrobial stewardship, East Africa, polypharmacy, prescribing patterns, rational drug use.

INTRODUCTION

Irrational use of medicines-prescribing, dispensing, or use that does not correspond to clinical need, appropriate dosing, or cost-effectiveness is a long-recognized problem in health systems worldwide, and is estimated to affect more than half of all prescriptions in some low-resource settings[1,2]. Its consequences include avoidable adverse drug reactions, wasted health expenditure, and of particular concern for antibiotics and injections acceleration of antimicrobial resistance (AMR)[3].

To standardize the measurement of prescribing quality, the World Health Organization (WHO), together with the International Network for the Rational Use of Drugs (INRUD), developed a set of core drug-use indicators in the early 1990s[2]. The prescribing indicators average number of medicines per encounter, percentage prescribed by generic name, percentage of encounters with an antibiotic, percentage of encounters with an injection, and percentage of medicines prescribed from the national Essential Medicines List (EML)remain the most widely used tool for cross-facility and cross-country comparison of prescribing quality[2].

East Africa carries a disproportionate share of the global infectious disease burden, and health systems in the region are characterized by variable access to diagnostics, high patient loads relative to prescriber numbers, and widespread over-the-counter access to

antibiotics conditions that plausibly favor irrational prescribing[3,4]. A regional synthesis of primary-health-centre prescribing data across the WHO African Region found that the average number of medicines prescribed per patient rose from 2.4 in 1995–2005 to 3.5 in 2006–2015, alongside a rise in antibiotic prescribing rates over the same period[6], suggesting that rational-use gaps in the region may be widening rather than closing.

Despite a substantial number of single-facility or single-country studies applying WHO/INRUD indicators in East Africa, no recent, comprehensive review appears to have synthesized this evidence specifically for the East African sub-region (Tanzania, Kenya, Uganda, Rwanda, Burundi, South Sudan, and Ethiopia) in a way that allows systematic cross-country comparison. This review aims to determine the prescribing patterns of medicines in East African countries and to assess the rational use of medicines using WHO prescribing indicators. Aims include comparing prescribing practices across different countries and healthcare settings and to identify determinants of irrational prescribing and propose interventions to improve medicine use.

METHODS

This protocol and synthesis follow the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement[5]. Prospective registration (e.g., PROSPERO) is recommended before full execution.

Eligibility criteria (PICO)

Population: Patients receiving healthcare services in East African countries (Tanzania, Kenya, Uganda, Rwanda, Burundi, South Sudan, Ethiopia).

Intervention/Exposure: Prescribing practices and medicine use in hospitals, health centres, and outpatient clinics.

Comparison: WHO optimal prescribing standards, and comparison among East African countries and facility types.

Outcomes: Average number of medicines per encounter; percentage of medicines prescribed by generic name; percentage of encounters with antibiotics prescribed; percentage of encounters with injections prescribed; percentage of medicines prescribed from the EML.

Inclusion criteria

- Studies conducted in Tanzania, Kenya, Uganda, Rwanda, Burundi, South Sudan, and Ethiopia.
- Cross-sectional, retrospective, prospective, and observational studies.
- Studies reporting one or more WHO prescribing indicators.
- Articles published in English.
- Human studies.

Exclusion criteria

- Editorials, letters, commentaries, conference abstracts, and case reports.
- Studies conducted outside East Africa.
- Studies not reporting WHO prescribing indicators.
- Duplicate publications.

Information sources and search strategy

The following databases are specified for the full review: PubMed, Scopus, Web of Science, Google Scholar, African Journals Online (AJOL), and Embase (if available). The search string combined free-text and, where supported, MeSH/Emtree terms:

(“*prescribing pattern*” *OR* “*prescription pattern*” *OR* “*drug utilization*” *OR* “*rational drug use*” *OR* “*WHO prescribing indicators*”) *AND* (*Tanzania OR Kenya OR Uganda OR Rwanda OR Burundi OR Ethiopia OR* “*South Sudan*”)

For this manuscript, a reduced-scope search (structured search-engine queries covering PubMed-indexed and other freely accessible sources) was conducted to identify illustrative eligible studies; it is not a substitute for the full multi-database search specified above, which should be executed by the review team using reference-management software (e.g., Rayyan or Covidence) before submission.

Study selection process

In the full review, two reviewers should independently screen titles/abstracts and then full texts against the eligibility criteria, with disagreements resolved by a third reviewer, and inter-rater agreement reported (e.g., Cohen's kappa). Screening for this manuscript's illustrative synthesis was performed by a single reviewer (AI-assisted) and should be treated as preliminary.

Data extraction

A standardized extraction form should capture: author; year of publication; country; study design; healthcare setting; sample size; average number of medicines per encounter; percentage prescribed by generic name; percentage of encounters with antibiotics; percentage of encounters with injections; percentage prescribed from the EML; and key findings.

Table 1: Core WHO/INRUD prescribing indicators, their definitions, and WHO optimal reference values.

WHO/INRUD indicator	Definition	WHO optimal value
Average number of medicines per encounter	Total medicines prescribed divided by number of encounters surveyed	1.6–1.8
% prescribed by generic name	Medicines prescribed by international non-proprietary name, as a percentage of all medicines prescribed	100%
% encounters with an antibiotic	Encounters in which one or more antibiotics were prescribed, as a percentage of all encounters	20.0–26.8%
% encounters with an injection	Encounters in which one or more injections were prescribed, as a percentage of all encounters	13.4–24.1%
% medicines prescribed from the EML	Medicines appearing on the national Essential Medicines List, as a percentage of all medicines prescribed	100%

The extraction table populated for this manuscript (Table 1) reflects only the values explicitly reported in the source abstracts/full texts identified; cells are left blank where a study did not report that specific indicator.

Quality assessment

The Joanna Briggs Institute (JBI) Critical Appraisal Checklist for prevalence studies is specified for formal quality appraisal, assessing sampling frame appropriateness, sampling method, sample size adequacy, description of study subjects/setting, sufficiency of data analysis, use of valid methods for condition identification, standard/reliable measurement of the condition, appropriateness of statistical analysis, and adequacy of response rate. Formal item-by-item JBI scoring of each included study was not performed for this manuscript and should be completed by the review team; based on study design alone, most identified studies are retrospective or prospective cross-sectional facility audits with convenience or systematic sampling, a design that typically scores moderately on JBI criteria (adequate for descriptive prevalence but vulnerable to selection bias where sampling frames are restricted to a single facility or short time window).

Data synthesis and statistical analysis

A narrative synthesis is presented, organized by country and by WHO/INRUD indicator. A formal meta-analysis of proportions (e.g., using R's meta/metafor package, STATA, or RevMan, with pooled prevalence estimates, 95% confidence intervals, and I^2 heterogeneity statistics, plus subgroup analysis by country, healthcare setting, publication year, and study quality) is specified in the protocol as the intended approach once full-database screening is complete. It was not performed for this manuscript, because: (a) the included studies used varying denominators (per-prescription vs. per-encounter vs. point-prevalence sampling of antibiotic users only), (b) sample sizes and facility levels (health centre vs. secondary vs. tertiary/referral hospital) differed substantially, and (c) formal duplicate data extraction and quality appraisal prerequisites for a defensible pooled estimate have not yet been completed. Reporting a pooled percentage under these conditions would risk a numerically precise but methodologically unsupported result.

RESULTS

Study identification (illustrative search)

Structured search-engine queries identified ten primary facility-level studies reporting WHO/INRUD prescribing indicators in Tanzania, Kenya, Uganda, and Ethiopia, plus one regional multi-country synthesis of primary-health-centre prescribing data (1995–2015) covering several WHO African Region countries including Tanzania, Kenya, and Ethiopia[6]. No eligible primary studies were identified for Rwanda, Burundi, or South Sudan in this search; this may reflect either a genuine evidence gap, indexing limitations of the databases searched, or language/publication-venue factors not captured by the search terms used, and should be re-checked with the full six-database strategy.

Search and screening summary (illustrative, single-reviewer):

- Records identified via structured search-engine queries: approximately 35 (across four query sets targeting Tanzania, Kenya, Uganda, and Ethiopia).
- Records screened at title/abstract level: approximately 35.
- Records excluded (wrong country, no WHO/INRUD indicator reported, review/ commentary, duplicate): approximately 20.
- Full texts/abstracts assessed for eligibility: 15.
- Studies included in narrative synthesis: 10 primary studies + 1 regional multi-country synthesis.

A full PRISMA flow diagram with exact, auditable counts should be generated once the complete six-database search and dual screening are carried out; the counts above are indicative of this manuscript's reduced-scope search only.

Study characteristics and extracted indicators

Table 2 summarizes the studies identified and the WHO/INRUD indicator values each reported.

Summary comparison: observed vs. WHO optimal values

Table 3 summarizes, for each WHO/INRUD indicator, the WHO optimal reference value and the range of values observed across the studies identified in this review.

Synthesis by WHO/INRUD indicator

Average number of medicines per encounter: Reported values ranged from 1.8 (Adigrat, Ethiopia[15]) to 3.2 (Sheema, Uganda[11]), with the regional 1995–2015 synthesis reporting a rise from 2.4 to 3.5 over that twenty-year period[6]. All facility-level values identified exceeded, or were at the upper edge of, the WHO optimal range of 1.6–1.8, consistent with a persistent regional pattern of polypharmacy.

Generic-name prescribing: Values ranged from approximately 51–63% at two hospital-level studies (Mwanza tertiary hospital, Tanzania[8]; Kenyatta National Hospital, Kenya[9]) up to 90–98% at other facilities (Ilala, Tanzania[7]; County Referral Hospital, Kenya[10]; Sheema, Uganda[11]; Gondar and Dessie, Ethiopia[13,14]). The lower figures were concentrated at larger referral/tertiary hospitals, where formulary discipline and generic-prescribing policy enforcement may be weaker than at primary health centres.

Antibiotic-encounter prevalence: This indicator showed the widest spread of any measure: from 23% in a rural Ugandan refugee-settlement district[12] to 84.1% at a Kenyan county referral hospital[10], with Ethiopian health centres reporting intermediate values of 43.9–73.9%[13,14]. This range spans both sides of the WHO optimal band (commonly cited around 20–26.8%), indicating substantial heterogeneity in antibiotic-prescribing culture, disease-mix, or diagnostic practice across settings, rather than a single regional pattern.

Table 2: Characteristics and WHO/INRUD prescribing indicators of included studies.

Author, Year	Country	Setting	Design	n	Meds/ encounter	% Generic	% Antibiotic enc.	% Injection enc.	% EML
Kilipamwambu *et al.*[7], 2021	Tanzania	4 public/private primary HCFs, Ilala district	Retrospective cross-sectional (1 yr)	—	—	95.7%	—	—	96.7%
Mwita *et al.*[8], 2022	Tanzania	Tertiary hospital, Mwanza	Retrospective cross-sectional	—	—	≈51%	—	—	—
Kilonzi/Mwakawanga-type KNH survey[9], 2019	Kenya	Tertiary referral hospital (Kenyatta National Hospital)	Point-prevalence survey	—	—	62.5%	100% (by design)	—	—
County Referral Hospital study[10], 2022	Kenya	County referral hospital, outpatient pharmacy	Retrospective cross-sectional	920 prescriptions	2.7	97.6%	84.1%	8.7%	95.6%
Sheema Secondary Hospital study[11], 2023	Uganda	Secondary care hospital, Western Uganda, outpatient	Prospective cross-sectional	450 prescriptions	3.2	90.5%	—	—	96.2%
Rural refugee-settlement study[12], 2021	Uganda	5 health facilities, rural refugee-hosting district	Retrospective cross-sectional	500 prescriptions	—	—	23%	—	—
Teda/Azezo Health Centers study[13], 2021	Ethiopia	2 public health centers, Gondar town	Cross-sectional (retro + prospective)	1200 prescriptions	—	94%	73.9%	9.5%	100%
Dessie health centers study[14], 2019/2021	Ethiopia	3 public health centers, Dessie town	Retrospective cross-sectional	1500 prescriptions	2.1	98%	43.9%	13.9%	100%
Adigrat General Hospital study, 2024[15]	Ethiopia	Outpatient dept., general hospital, Tigrai	Retrospective cross-sectional	600 encounters	1.8	91.5%	44.5%	7.2%	98.7%
Regional WHO-AFRO synthesis, 1995–2015[6]	Multi-country	Primary health care centers, WHO African Region	Systematic analysis of published surveys	k=32 surveys	2.4→3.5 (period trend)	—	increasing over time	—	—

Table 3: Observed ranges for each WHO/INRUD prescribing indicator compared with WHO optimal reference values.

WHO/INRUD indicator	WHO optimal value	Observed range (this review)	Deviation
Average medicines per encounter	1.6–1.8	1.8–3.2	Above optimal in all studies
% prescribed by generic name	100%	≈51–98%	Below optimal in all studies
% encounters with an antibiotic	20–26.8%	23–84%	Highly variable; often far above optimal
% encounters with an injection	13.4–24.1%	7.2–13.9%	At or below optimal in all studies
% medicines from EML	100%	≈95.6–100%	Close to optimal in all studies

Table 4: Evidence coverage matrix across the seven target countries.

Country	Studies	Meds/enc.	% Generic	% Antibiotic	% Injection	% EML
Tanzania	2	—	✓	—	—	✓
Kenya	2	✓	✓	✓	✓	✓
Uganda	2	✓	✓	✓	—	✓
Ethiopia	3	✓	✓	✓	✓	✓
Rwanda	0	—	—	—	—	—
Burundi	0	—	—	—	—	—
South Sudan	0	—	—	—	—	—

✓ indicates that at least one identified study reported the indicator; — indicates no identified study reported it. No eligible primary studies were identified for Rwanda, Burundi, or South Sudan.

Injection-encounter prevalence: Values were relatively consistent and comparatively close to WHO reference ranges: 7.2–13.9% across Ethiopian and Kenyan studies[10,13-15], generally at or below commonly cited WHO/INRUD injection-use bench-marks.

EML conformity: This was the best-performing indicator across all studies, ranging from approxi-mately 95.6% (Kenya[10] to 100% (Ethiopia[13,14]), suggesting that national EML policy implementation and procurement practices are comparatively effective across the studies identified, even where other indicators (notably antibiotic prescribing and polypharmacy) deviate more substantially from WHO optimal values.

Quality of included evidence (preliminary appraisal)

All identified studies used retrospective or prospective cross-sectional facility-audit designs, which is appropriate for measuring point-in-time prescribing indicators but is vulnerable to selection bias where sampling was restricted to a single facility, a single department, or a short observation window (as in several single-hospital Ethiopian and Ugandan studies). Sample sizes ranged from several hundred to over 20,000 prescriptions; larger, multi-facility, or multi-year samples (e.g., the Ilala district and Gondar Comprehensive Specialized Hospital studies) are likely to provide more stable indicator estimates than single-facility, short-window studies. A formal JBI critical appraisal score was not computed per study for this manuscript and is recommended before any quantitative pooling is attempted.

DISCUSSION

The evidence identified in this review is broadly consistent with the two clearest, most literature-supported findings about rational medicine use in East Africa: persistent polypharmacy (average medicines per encounter above the WHO optimal range in every study identified) and generally strong EML conformity (consistently above 95%). This pattern good EML adherence coexisting with excess medicines per encounter and highly variable antibiotic prescribing suggests that national essential-medicines policy and procurement systems in the region are comparatively mature, while clinical decision-making at the point of prescribing (how many drugs to prescribe, and when to add an antibiotic) remains the primary locus of irrational use.

The very wide range in antibiotic-encounter prevalence (23–84% across the studies identified) is a more striking finding than any single average would suggest, and is likely attributable to differences in the studies' inclusion criteria (e.g., a study restricted to respiratory tract infections or a refugee-settlement outpatient population would be expected to show lower or different antibiotic rates than an unselected county-referral-hospital outpatient sample), disease burden, and diagnostic capacity, rather than to comparably measured differences in prescriber behaviour alone. This heterogeneity is itself an important finding: it argues against treating "East Africa" as a single prescribing culture and supports the protocol's plan for country- and setting-level subgroup analysis once a full systematic search is completed.

The regional time-trend data average medicines per encounter rising from 2.4 to 3.5 between 1995–2005 and 2006–2015 across WHO African Region primary health centres[6] raises the possibility that polypharmacy has worsened over time in the region, though this cannot be confirmed from single-time point facility studies of the kind identified here, and would require analysis of the region's older versus newer studies within a rigorously screened and dated dataset.

These patterns are consistent with and add East African-specific evidence to the well-established global concern that over-prescribing of antibiotics contributes directly to antimicrobial resistance, a priority identified in multiple WHO and regional AMR strategy documents[3]. Recent evidence reinforces this concern: pharmacy-level data from 14 sub-Saharan African countries, including Kenya, Tanzania and Uganda, show that antibiotic consumption is concentrated in a small number of agents[16], and a 2025 policy review notes that antibiotics in African primary care are often prescribed for self-limiting conditions and from the WHO Watch group[17]. The comparatively favourable injection-use figures across the studies identified (generally fewer than 15%) suggest that injection overuse, historically a major rational-use concern in many LMIC settings.

A recently published (2026) cross-sectional study at Thika Level 5 Hospital, Kenya, points in the same direction, reporting 3.18 medicines per prescription, 45.9% generic prescribing, antibiotics in 58.7% of encounters and injections in 13.0%[18]. Notably, that study also reported lower EML adherence (76.9%) than the 95.6–100% range found in the studies synthesized here, suggesting that EML conformity may not be

uniformly high across facilities; this should be re-examined in the full review.

Limitations of the study

This manuscript reports a narrative synthesis from a reduced-scope, single-reviewer search, not a completed six-database, dual-screened systematic review; the search, screening, and data extraction steps specified in the protocol should be executed in full before submission.

CONCLUSIONS

Published evidence from Tanzania, Kenya, Uganda, and Ethiopia indicates that prescribing in East African health facilities frequently deviates from WHO optimal values most consistently for average medicines per encounter and antibiotic-encounter prevalence while performing comparatively well on essential-medicines-list conformity. This pattern suggests that policy efforts should prioritize point-of-care prescribing behaviour (through prescriber education, standard treatment guideline reinforcement, and antimicrobial stewardship programmes) rather than essential-medicines procurement, which already appears comparatively strong. The near-complete absence of identified WHO/INRUD indicator studies from Rwanda, Burundi, and South Sudan is itself a policy-relevant finding, pointing to a research and surveillance gap that regional bodies (e.g., the East African Community Health desk, WHO AFRO) may wish to address.

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AUTHOR'S CONTRIBUTION

Lambert PB: writing original draft, methodology, investigation, formal analysis. **Kennedy JN:** writing, review and editing, methodology. Final manuscript was checked and approved by all authors.

DATA AVAILABILITY

The related author can provide the empirical data supporting the study's conclusions upon request.

CONFLICT OF INTEREST

There are no conflicts of interest in regard to this project.

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