Trend analysis of rational medicine use and WHO indicators compliance at a tertiary referral hospital in Ghana

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ABSTRACT

Background: Rational medicine use is critical to ensuring patient safety, cost-effectiveness, and optimal health outcomes. The World Health Organization (WHO) evaluates prescribing practices using key indicators, including antibiotic and injectable use, adherence to the Essential Medicines List (EML), polypharmacy, and documentation of patient vitals and diagnoses.

Objectives: This study evaluated prescribing patterns at Sunyani Teaching Hospital (STH) against WHO standards, focusing on antibiotic and injectable use, adherence to the Essential Medicines List, polypharmacy, and documentation.

Methods: A retrospective trend analysis of outpatient prescription records (2022-2024) was conducted at STH a tertiary referral facility in the Bono region of Ghana. A total of 360 cases (30 per quarter) were randomly sampled from the Lightwave Health Information Management System (LHIMS). Data were analysed using Stata version 16.

Results: Proportions of prescriptions with antibiotic use (23.3%-73.3%, mean: 45%) exceeded WHO's ≤20 % standard. Injectable use (0%-14.9%) remained compliant. Diagnosis documentation (92.5%-100 %) and patient vitals recording (temperature: 45.8%, weight: 49.5%, blood pressure: 51.7%) fell short of WHO's 100% standard. EML adherence (80.2%-87.6%) and generic prescribing (81.2%-95.8%) were suboptimal. Polypharmacy was prevalent (mean drugs per prescription: 2.77; WHO standard: ≤2).

Conclusion: Despite good injectable use compliance, antibiotic overuse, declining documentation of vital signs, and polypharmacy require attention. Strengthening antibiotic stewardship, improving patient assessment protocols, and implementing medication reviews are critical for optimizing prescribing practices at STH.

Keywords: Rational Medicine Use, WHO Indicators, Trend Analysis, Sunyani Teaching Hospital, Ghana

Analyse des tendances en matière d'utilisation rationnelle des médicaments et de conformité aux indicateurs de l'OMS dans un centre hospitalier universitaire de référence au Ghana

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RÉSUMÉ

Contexte: L'usage rationnel des médicaments est essentiel pour garantir la sécurité des patients, la rentabilité et des résultats optimaux en matière de santé. L'Organisation mondiale de la Santé (OMS) évalue les pratiques de prescription à l'aide d'indicateurs clés, notamment l'utilisation d'antibiotiques et de médicaments injectables, le respect de la Liste des médicaments essentiels (LME), la polypharmacie et la documentation des signes vitaux et des diagnostics des patients.

Objectifs: Cette étude a évalué les habitudes de prescription au centre hospitalier universitaire de Sunyani (STH) par rapport aux normes de l'OMS, en se concentrant sur l'utilisation d'antibiotiques et d'injectables, le respect de la liste des médicaments essentiels, la polypharmacie et la documentation.

Méthodes: Une analyse rétrospective des tendances des dossiers de prescriptions ambulatoires (2022-2024) a été menée au STH, un établissement de soins tertiaires de référence dans la région de Bono au Ghana. Au total, 360 cas (30 par trimestre) ont été prélevé de manière aléatoire à partir du système de gestion des informations de santé Lightwave (LHIMS). Les données ont été analyséesà l'aide du logiciel Stata version 16.

Résultats: Les proportions d'ordonnances comportant des antibiotiques (23,3 %-73,3 %, moyenne : 45 %) dépassaient la norme ≤20 % de l'OMS. L'utilisation d'injectables (0 % -14,9 %) est restée conforme. La documentation des diagnostics (92,5 %-100 %) et l'enregistrement des signes vitaux des patients (température : 45,8 %, poids : 49,5 %, tension artérielle : 51,7 %) n'atteignaient pas la norme de 100 % de l'OMS. L'adhésion à la LME (80,2 %-87,6 %) et la prescription de génériques (81,2 %-95,8 %) étaient sous-optimales. La polypharmacie était répandue (moyenne de médicaments par ordonnance : 2,77 ; norme OMS : ≤ 2).

Conclusion: Malgré une bonne conformité à l'utilisation des injectables, la surconsommation d'antibiotiques, la diminution de la documentation des signes vitaux et la polypharmacie nécessitent une attention particulière. Le renforcement de la gestion des antibiotiques, l'amélioration des protocoles d'évaluation des patients et la mise en œuvre d'examen de médicaments sont essentiels pour optimiser les pratiques de prescription à STH.

Mots-clés: Usage rationnel des médicaments, Indicateurs de l'OMS, Analyse des tendances, centre hospitalier universitaire de Sunyani, Ghana

INTRODUCTION

Rational medicine use is a fundamental principle in healthcare that ensures patients receive the most appropriate medications in the correct dosage, duration, and formulation while minimizing unnecessary costs to both the individual and the healthcare system.[1] The World Health Organization (WHO) defines rational prescribing as a process in which medications are prescribed based on clinical evidence, tailored to patient needs, and accessible in an affordable and sustainable manner.[2] When medicines are used appropriately, they contribute to improved treatment outcomes, reduced healthcare costs, minimized adverse drug reactions, and a lower risk of antimicrobial resistance.[3,4] However, deviations from rational prescribing practices, such as the overuse of antibiotics, excessive polypharmacy, and poor adherence to essential medicines lists, have been shown to result in worsened health outcomes, increased drug resistance, and financial burdens on health systems.[5-7]

Irrational medicine use remains a major global and regional health concern, contributing to antimicrobial resistance, adverse drug reactions, treatment failures, and increased healthcare costs.[5] The overuse of antibiotics, in particular, has led to the emergence of resistant bacterial strains, making common infections harder to treat.[6] WHO has declared antimicrobial resistance a global health crisis, warning that if irrational antibiotic use is not controlled, infections that were once easily treatable may become deadly due to drug resistance.[7] In low- and middle-income countries like Ghana, antimicrobial resistance has been exacerbated by poor prescribing practices, lack of antibiotic stewardship, and limited regulation of antimicrobial use.[8] Polypharmacy, defined as the prescription of more than two drugs per patient, is another significant issue in tertiary care settings.[9,10] While some degree of polypharmacy is expected in complex cases, excessive medication use increases the risk of drug interactions, treatment non-adherence, and medication-related complications. Furthermore, deviations from WHO's recommended Essential Medicines List (EML) compliance have been associated with the use of non-essential, high-cost, or inappropriate medications, placing financial strain on both patients and the healthcare system.[11,12]

To monitor and improve prescribing practices, WHO developed a set of prescribing indicators (Table 1) that serve as benchmarks for rational medicine use.[2] These indicators evaluate various aspects of prescription patterns and ensure that medicines are prescribed according to best practices.

Table 1: Key WHO Prescribing Indicators

WHO Prescribing Indicator	Recommended Standard
Percentage of prescriptions containing antibiotics	=20%
Percentage of prescriptions containing injectables	=20%
Percentage of prescriptions from the Essential Medicines List (EML)	100%
Percentage of prescriptions written using generic names	100%
Average number of drugs per prescription	=2
Documentation of patient vitals (temperature, weight, blood pressure) and diagnosis	100%

Source: Adapted from World Health Organization. How to investigate drug use in health facilities: Selected drug use indicators. Geneva: World Health Organization; 1993. (WHO/DAP/93.1).

These indicators provide an objective framework for evaluating prescribing behaviours, detecting deviations from best practices, and implementing interventions to enhance efficacy, safety, and cost-effectiveness in medicine use.

Tertiary referral hospitals, have unique prescribing patterns compared to primary and secondary care facilities. This is because they manage complex and severe cases, often referred from lower-level health facilities.[13] This means that higher rates of polypharmacy, antibiotic use, and injectable medications are expected due to the nature of cases seen, such as multidrug-resistant infections, intensive care unit admissions, surgical procedures, and chronic disease management.[14] While some deviations from WHO standards may be clinically justified, it is crucial to evaluate prescribing practices to ensure that these deviations do not result in irrational medicine use, unnecessary drug exposure, or poor patient outcomes. This study was conducted to assess prescribing patterns at STH and determine their alignment with WHO prescribing indicators.

METHODS

Study design
This study employed a retrospective trend analysis to assess prescribing practices at Sunyani Teaching Hospital (STH) from 2022 to 2024.

Study setting
STH is a tertiary referral centre located in the Bono Region of Ghana. It serves as a major referral facility for lower-level healthcare institutions, including district hospitals, health centres, and private clinics, handling complex cases that require specialized care, advanced diagnostics, and higher levels of medical intervention.[15] The hospital provides services across multiple specialties, including internal medicine, surgery, paediatrics, obstetrics and gynaecology, emergency care, and infectious disease management. The hospital serves a diverse patient population, including individuals with chronic conditions such as hypertension, diabetes, and cardiovascular diseases, infectious diseases such as malaria, tuberculosis, and HIV/AIDS, post-surgical cases, and acute medical emergencies.[15] As a teaching hospital, it also serves as a training centre for medical students, pharmacists, and other healthcare professionals, making it an ideal setting for evaluating prescribing practices and rational medicine use.

Sampling and data collection
A simple random sampling approach was used to select 30 outpatient cases per quarter from 2022 to 2024, resulting in a total sample of 360 cases. The sample size was estimated based on the WHO/INRUD methodology for drug-use indicator surveys, which recommends assessing a minimum of 30 patient encounters per facility. This number is deemed adequate to provide estimates for routine monitoring of prescribing practices, while also being practical and feasible in terms of data collection. Similar sample sizes have been employed in recent studies,[16,17] supporting the appropriateness of using 30 prescriptions in our analysis.

The data were retrieved from the Lightwave Health Information Management System (LHIMS), the hospital's electronic medical record system, which stores comprehensive patient information, including prescription details. The sampling process involved assigning a unique identification number to each outpatient record within the given quarter. Using random number generation in Microsoft Excel, 30 cases were selected to ensure an unbiased and representative sample of outpatient prescriptions. This approach minimized selection bias and ensured that all cases had an equal probability of being chosen. Once selected, the prescription data were extracted and cleaned in Microsoft Excel before further analysis. Data cleaning involved removing incomplete records that were missing key information such as medication name, dosage, or diagnosis. Standardizing medication names and dosage formats ensured consistency in the analysis. Verification of WHO classification for antibiotics, injectables, and essential medicines was also conducted to maintain accuracy in the evaluation.

Prescribing indicators and trend measurement
The study assessed trends in prescribing practices at STH by tracking key WHO prescribing indicators over time. The primary indicators evaluated included the percentage of prescriptions containing antibiotics, the percentage of prescriptions containing injectables, and the percentage of cases with written diagnosis documentation. Other indicators analysed were the percentage of cases documenting patient vitals, including temperature, weight, and blood pressure, as well as the percentage of prescriptions from the WHO Essential Medicines List (EML) and the percentage of prescriptions using generic drug names. The study also calculated the average number of drugs per prescription as an indicator of polypharmacy.

Data analysis
Data analysis was conducted using Stata version 16 to perform descriptive statistics and trend analysis. The percentage of prescriptions meeting WHO standards for each indicator was calculated for every quarter from

2022 to 2024. The analysis involved computing the mean, standard deviation, and range (minimum - maximum) of prescribing indicators across the study period. Trend analysis was used to assess changes in prescribing patterns over time, particularly in relation to antibiotic use, injectable prescriptions, and polypharmacy. The study also included a comparative analysis to evaluate the extent to which prescribing trends aligned with or deviated from WHO-recommended standards. Results were presented in graphs and tables to illustrate quarterly fluctuations in medicine use patterns, highlighting deviations from WHO indicators.

Ethical considerations

Since the study relied solely on secondary data obtained from the hospital's electronic records, no direct patient contact was involved, and no ethical approval was required. However, approval was obtained from the hospital authorities before accessing the LHIMS database. All patient records were anonymized to ensure confidentiality, with identifying information removed prior to analysis. Data handling adhered to ethical guidelines for research involving medical records, ensuring compliance with data protection and patient privacy policies.

RESULTS

Table 2 summarizes the key prescribing indicators over the study period. The average percentage of prescriptions containing antibiotics was 44.7% (SD = 15.3%), with values ranging from 23.3% to 73.3%. Injectable prescriptions had a mean of 4.9% (SD = 5.8%), with a minimum of 0% and a maximum of 14.9%. The percentage of prescriptions with a written diagnosis averaged 95.5% (SD = 3.9%), while blood pressure measurement was recorded in 70.9% (SD = 13.3%) of cases. Further, an average of 84.0% (SD = 2.7%) of prescribed medicines were from the essential medicines list, and 88.0% (SD = 4.1%) were generic drugs. Temperature and weight were documented in 70.5% (SD = 13.9%) and 70.2% (SD = 14.1%) of cases, respectively. The average number of drugs per prescription was 2.8 (SD = 0.4), with a minimum of 2.2 and a maximum of 3.4.

Table 2: Summary statistics compared to WHO standards

Indicator	Mean (%)	Std. Dev.	Min	Max	WHO Standard (%)
Average Number of Drugs Per Prescription	**2.8**	0.4	2.2	3.4	**= 2**
% Generic Prescriptions	88.0	4.1	81.2	95.8	**100**
% Antibiotics Prescribed	44.7	15.3	23.3	73.3	**= 20**
% Injectables Prescribed	4.9	5.8	0.0	14.9	**= 20**
% From Essential Medicines List (EML)	84.0	2.7	80.2	87.7	**100**
% With Written Diagnosis	95.5	3.9	86.7	100.00	**100**
% Blood Pressure Recorded	71.0	13.3	51.7	93.3	**100**
% Temperature Recorded	71.0	14.0	45.8	93.3	**100**
% Weight Recorded	70.0	14.1	50	93.3	**100**

Antibiotic Use

The proportion of prescriptions containing antibiotics ranged from 23.3% to 73.3% during the period under consideration (Table 3), consistently exceeding the WHO-recommended ≤20% threshold. The highest usage was recorded in Q4 of 2022 (73.3%), while the lowest was in Q4 of 2023 (23.3%). The data shows fluctuations across the quarters, with increases observed in Q2 and Q3 of 2024 (60%-64%).
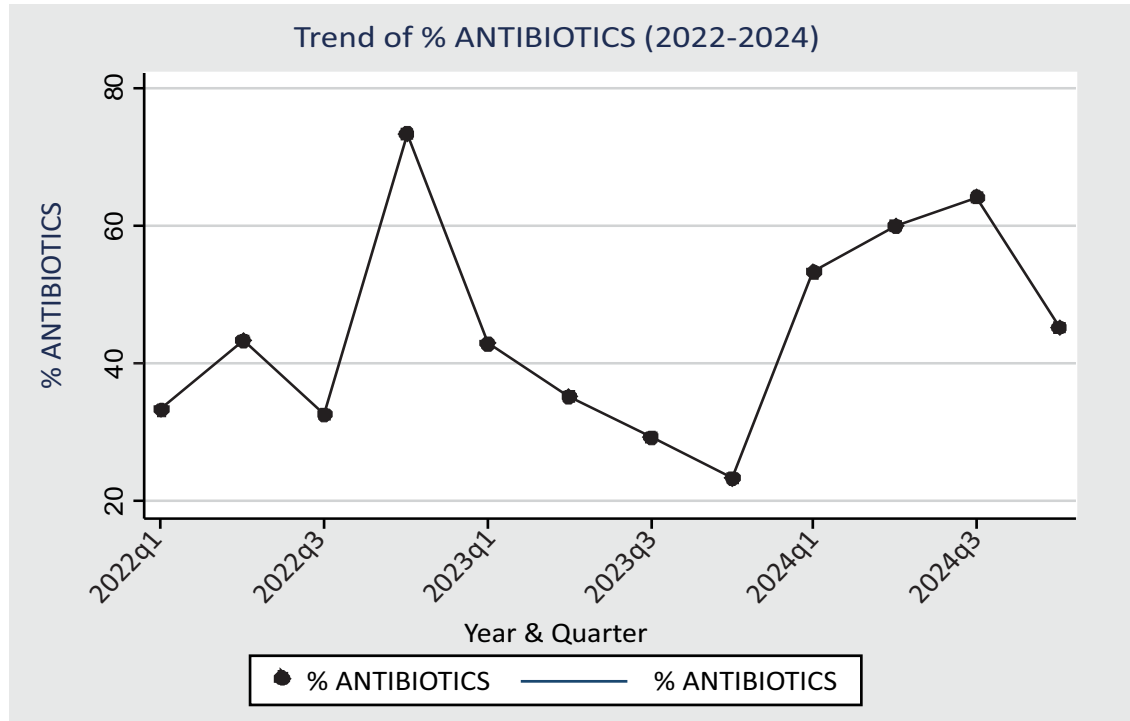

Fig. 1 The proportion of prescriptions containing antibiotics

Table 3. Quarterly distribution of prescribing indicators (2022–2024)

Year	Quarter	% Antibiotics	% Injectables	% with Written Diagnosis	% Blood Pressure	% from EML	% Generic	% Temperature	% Weight	Average Number of Drugs per Prescription
2022	1Q	33%	0%	100%	80%	84%	88%	80%	80%	2.3
2022	2Q	43%	3%	97%	93%	87%	86%	93%	93%	2.7
2022	3Q	33%	13%	100%	73%	82%	84%	73%	73%	3.2
2022	4Q	73%	0%	93%	57%	88%	92%	57%	53%	2.4
2023	1Q	43%	0%	87%	73%	87%	91%	73%	73%	2.3
2023	2Q	35%	0%	97%	63%	88%	90%	63%	63%	2.9
2023	3Q	29%	3%	97%	77%	84%	85%	77%	77%	3.2
2023	4Q	23%	7%	97%	90%	80%	81%	90%	90%	3.4
2024	1Q	53%	3%	93%	67%	81%	91%	57%	63%	3.3
2024	2Q	60%	13%	100%	73%	82%	88%	73%	73%	2.2
2024	3Q	64%	15%	93%	52%	85%	96%	46%	50%	2.6
2024	4Q	45%	0%	93%	53%	82%	85%	63%	53%	2.8

Use of Injectables
The percentage of prescriptions containing injectables remained within the WHO's acceptable limit of ≤20%, fluctuating between 0% and 14.9% (Table 3). The highest use was observed in Q3 of 2024 (14.9%), while several quarters recorded 0% injectable use (Fig 2).
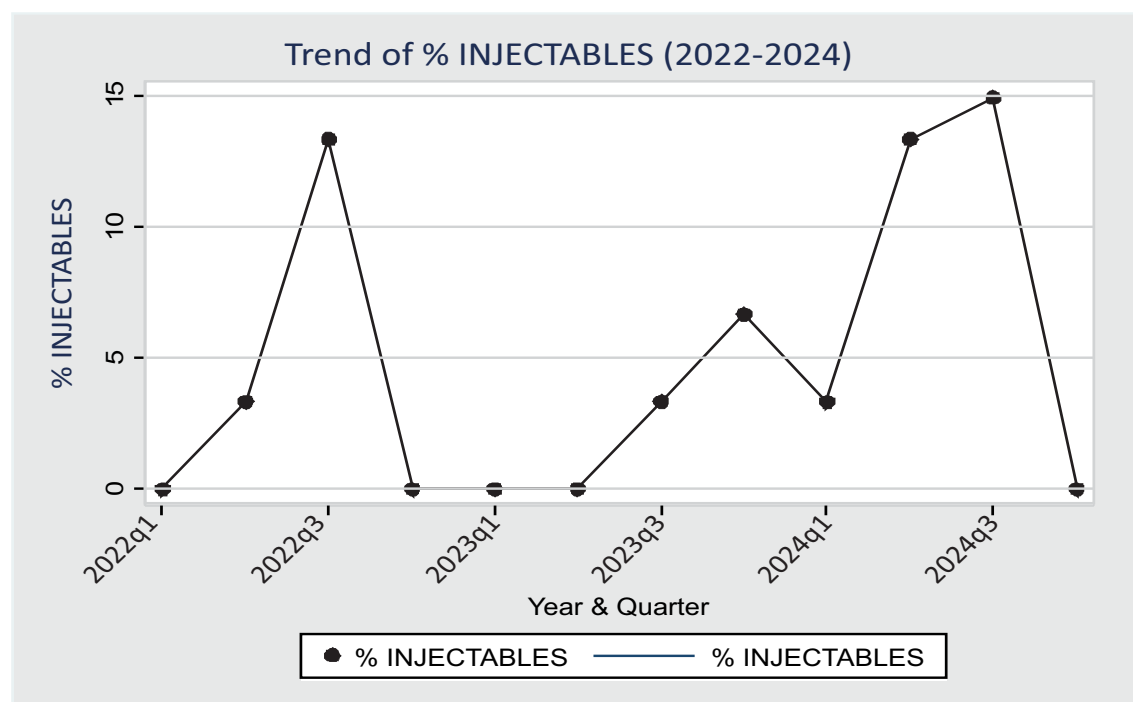

Fig. 2 The percentage of prescriptions containing injectables

Written Diagnosis Documentation
The percentage of prescriptions with a documented written diagnosis was consistently high, ranging from 92.5% to 100% (Table 3). The lowest documentation rate occurred in Q1 2023 (92.5%), while full compliance was observed in multiple quarters (Fig 3).
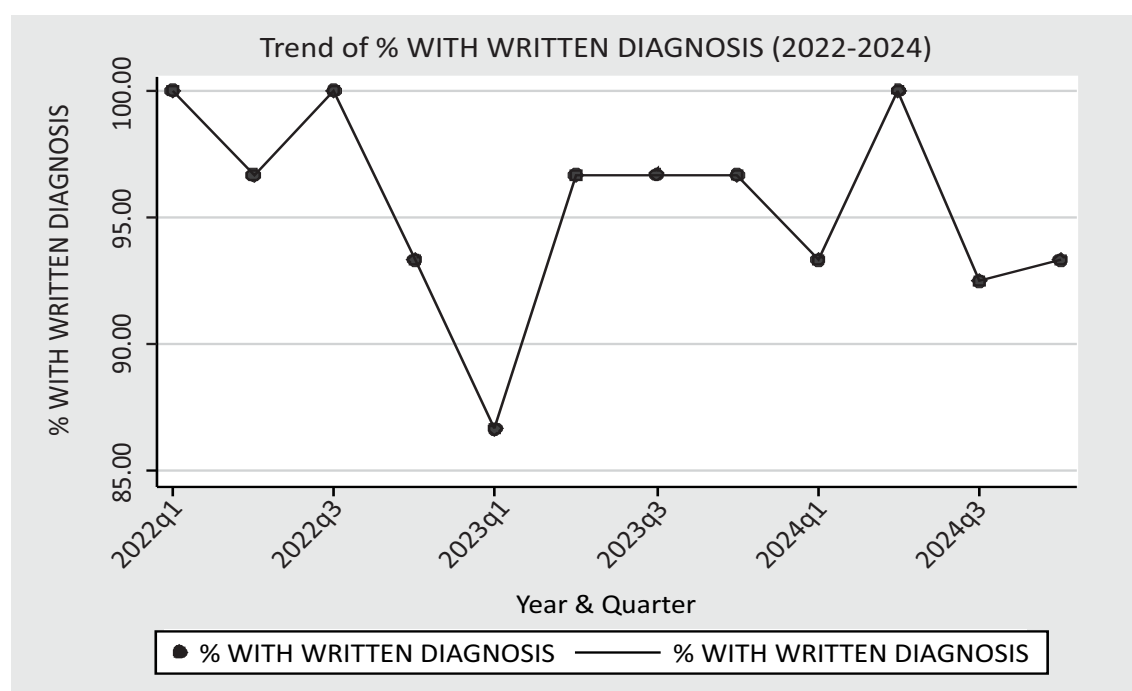
Fig. 3 The percentage of prescriptions with a documented diagnosis

Blood Pressure Measurement

Blood pressure measurement rates ranged from 51.7% to 93.3% (Table 3), showing a declining trend in 2024. The lowest rate was recorded in Q3 2024 (51.7%), indicating a reduction in routine blood pressure monitoring over time.
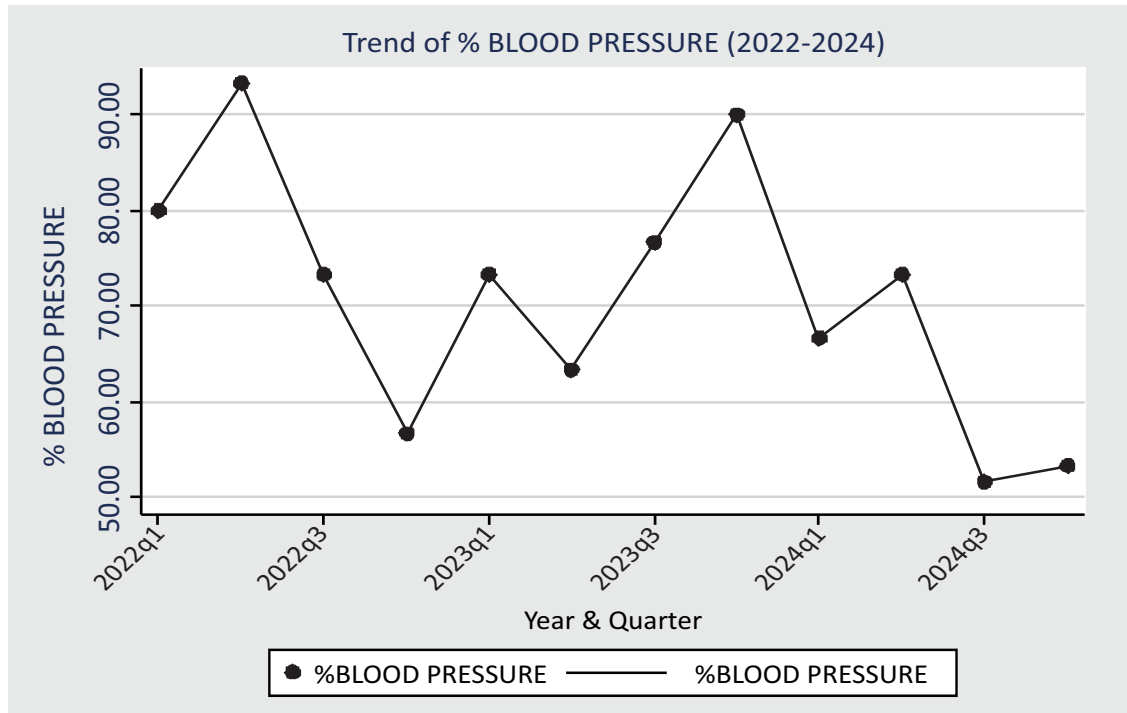

Fig. 4 Blood pressure measurement rates

Essential Medicines List Adherence

The proportion of drugs prescribed from the WHO EML remained between 80.2% and 87.6% (Table 3), failing to meet the 100% WHO recommendation. The lowest adherence was recorded in Q4 2023 (80.2%), while the highest occurred in Q4 2022 (87.6%).
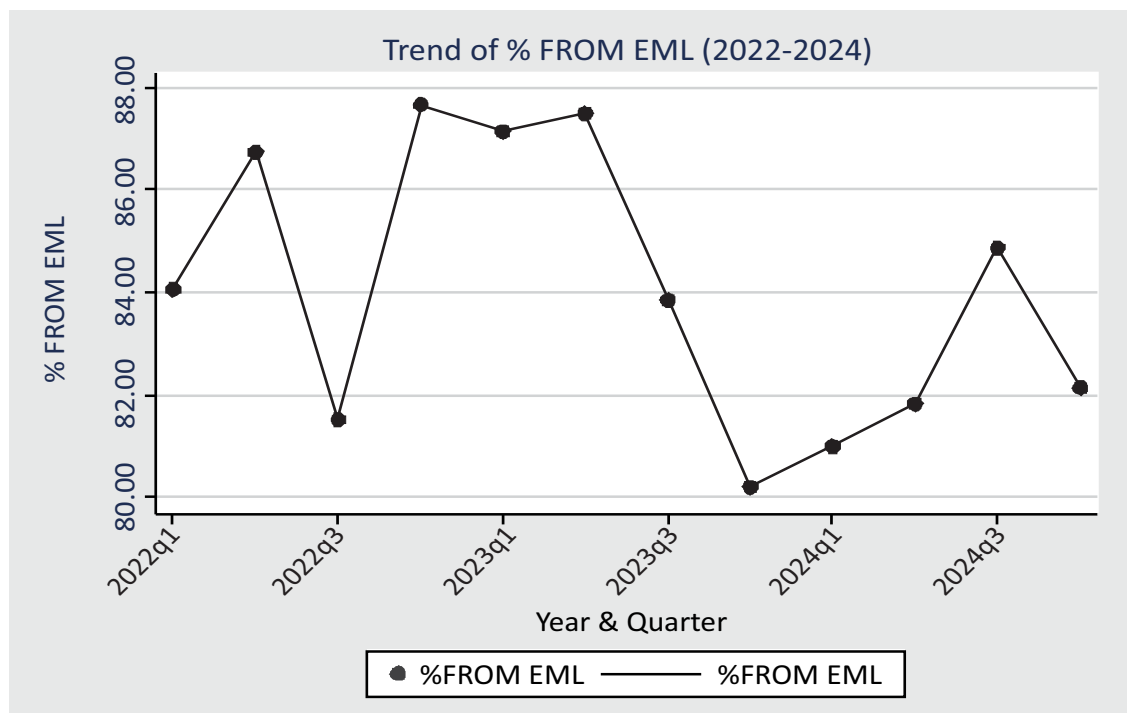
Fig. 5 The proportion of drugs prescribed from the WHO Essential Medicines List

Generic Drug Prescriptions

The use of generic medications varied from 81.2% to 95.8% (Table 3), with the highest rate in Q3 2024 (95.8%). Although the hospital maintained high levels of generic prescribing, it still did not meet the WHO target of 100% (Fig 6).
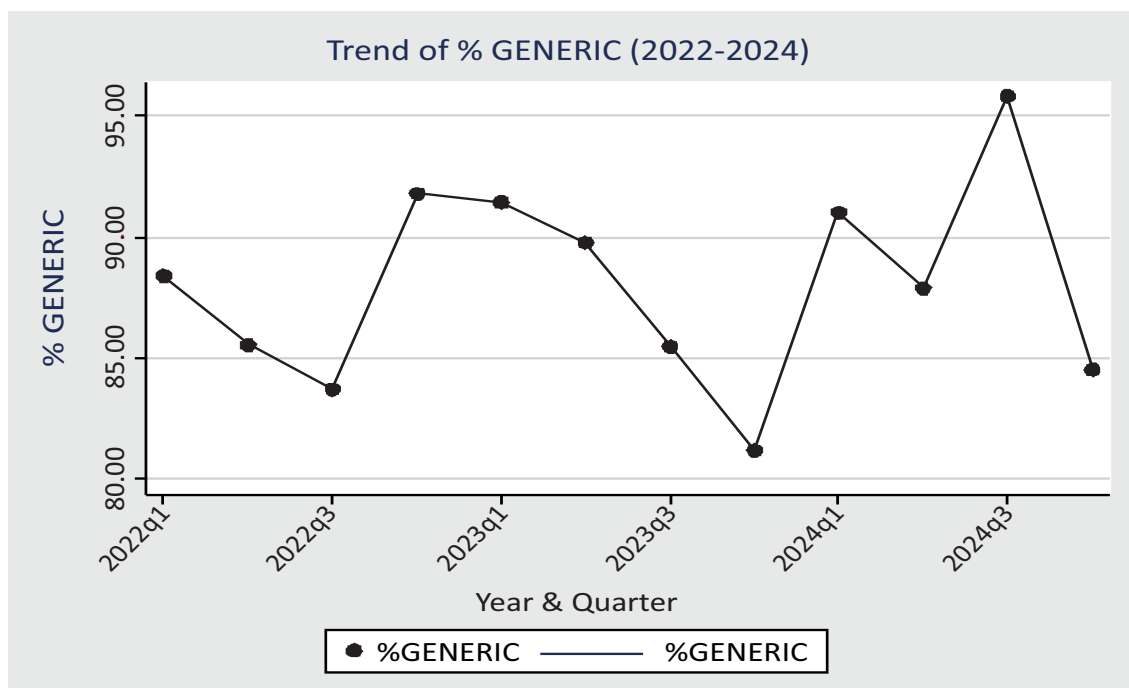
Trend of % GENERIC (2022-2024)

Fig. 6 The proportion of drugs prescribed with generic names

Temperature Recording

The percentage of patient records with a recorded temperature declined over time, dropping from 93.3% in Q2 2022 to 45.8% in Q3 2024. The data indicates a steady decline in temperature recording compliance, particularly in 2023 and 2024.
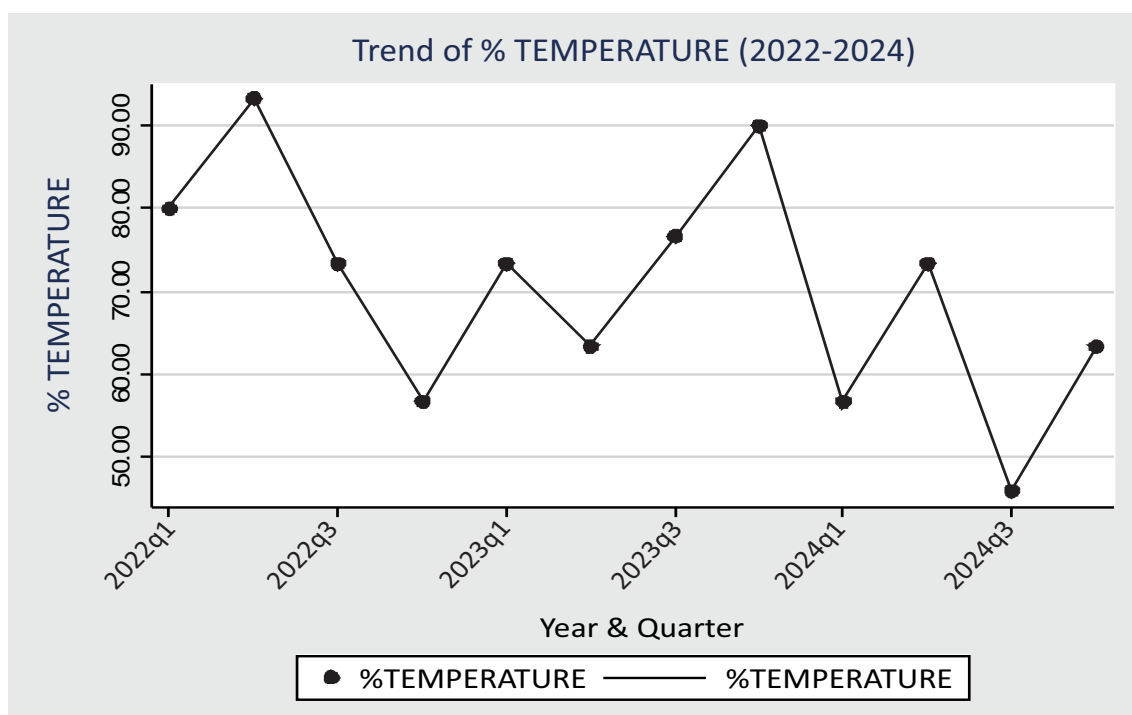
Trend of % TEMPERATURE (2022-2024)

Fig. 7 The percentage of patient records with a recorded temperature

Weight Measurement

Weight measurement rates followed a declining trend, falling from 93.3% to 49.5% over the study period. The lowest recorded percentage was in Q3 2024 (49.5%), reflecting reduced documentation of weight in patient assessments.
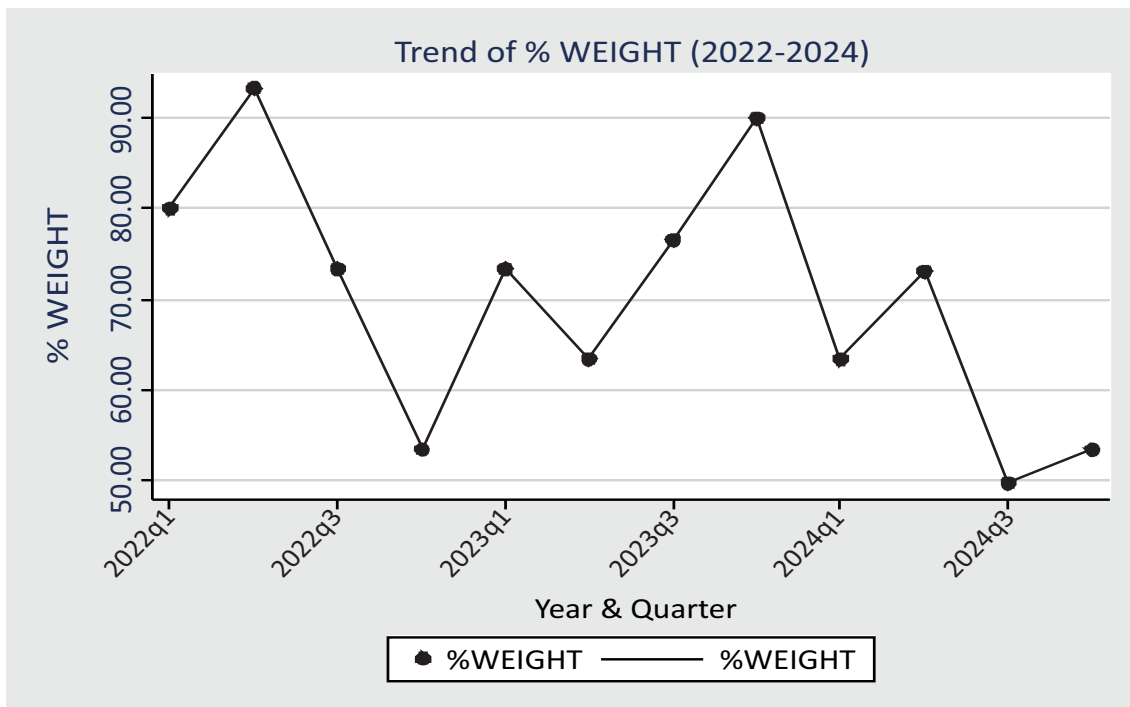

Fig. 8 Weight measurement rates

Polypharmacy: Average Number of Drugs per Prescription

The average number of drugs per prescription consistently exceeded the WHO standard of ?2 drugs per prescription, ranging from 2.2 to 3.37 (Table 3). The highest polypharmacy levels were observed in Q4 2023 (3.4) and Q1 2024 (3.3), indicating increased medication burden per patient.
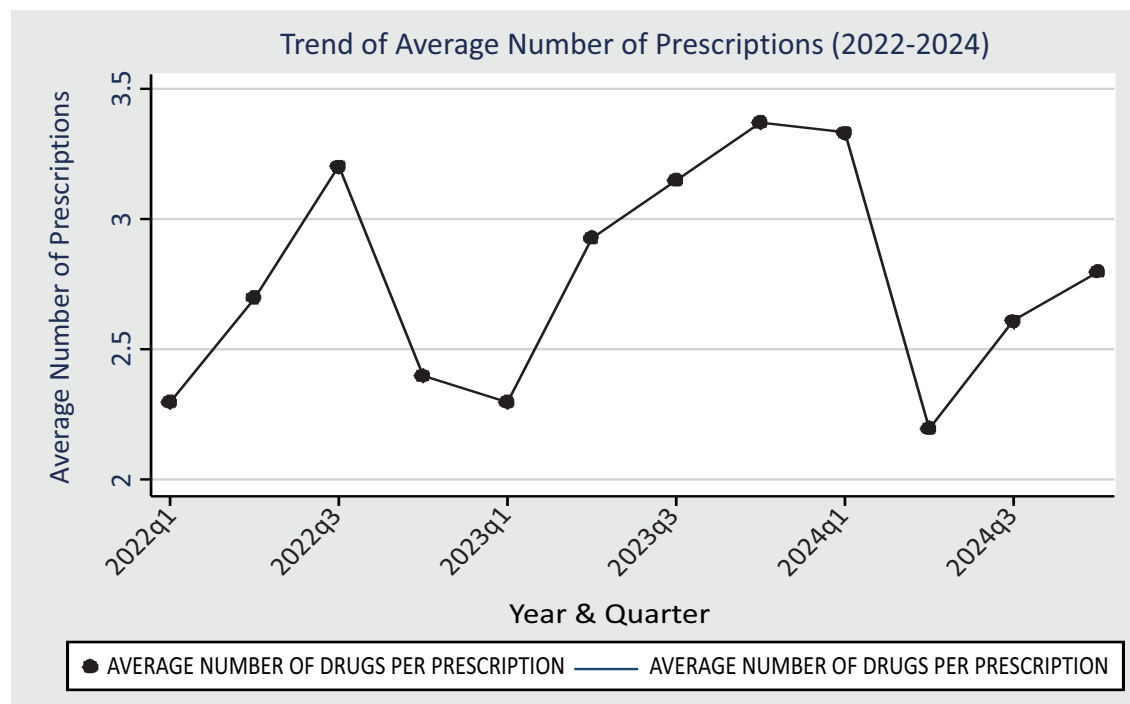

Fig. 9 The average number of drugs per prescription

DISCUSSION

General overview
The analysis of prescribing trends at STH from 2022 to 2024 revealed notable variations in compliance with WHO prescribing indicators. While the use of injectables remained within the WHO's recommended limit of <20%, antibiotic prescribing consistently exceeded this threshold across all quarters. Written diagnosis documentation also fell short of WHO's 100% recommendation, indicating inconsistencies in record-keeping. Additionally, the documentation of vital signs blood pressure, weight, and temperature declined over time, failing to meet the WHO standards. Polypharmacy levels remained high, with the average number of drugs per prescription in every quarter exceeding the WHO's recommended limit of <2. Although adherence to the WHO EML and generic prescribing was relatively high, neither reached the 100% standard, reflecting continued reliance on non-EML and branded medications.

Antibiotic use
The study revealed that the proportion of prescriptions containing antibiotics at STH consistently exceeded the WHO's recommended threshold of <20%, with peaks in Q4 2022 and Q2-Q3 2024. This trend is consistent with findings from previous studies in Ghana, where antibiotic prescribing rates were significantly higher than WHO standards i.e. close to two thirds of prescriptions in Ashanti Region[18], Eastern Region[19] and more than half at Ghana Police Hospital.[20,21] Regionally, a systematic review of prescribing indicators at primary healthcare centres within the WHO African region reported that close to fifty percent of patient encounters involved antibiotic prescriptions, exceeding the WHO standard.[22]

The high antibiotic use at STH can be attributed to the hospital's role as a referral centre, where severe infections such as sepsis, pneumonia, and post-surgical infections require antibiotic therapy.[23] Additionally, the high rates observed may also reflect empirical antibiotic prescribing, as limited diagnostic capacity continues to pose a challenge even within tertiary facilities in Ghana.[24-26] Where diagnostic services are available, coverage under the National Health Insurance Scheme (NHIS) is not always comprehensive, and patients are often required to pay out-of-pocket, creating barriers to timely testing.[27] While antibiotic use is expected to be higher in tertiary hospitals, the observed fluctuations suggest potential inconsistencies in prescribing guidelines or adherence to antimicrobial stewardship programs. Strengthening antibiotic stewardship programs, improving access to affordable diagnostic tools, and enforcing adherence to standard treatment guidelines are necessary to optimize antibiotic prescribing at STH.[25,26]

Injectable use
Unlike antibiotics, injectable prescriptions at STH remained within the WHO's recommended limit of <20%. This aligns with findings from Korle Bu Teaching Hospital (KBTH) and the KNUST University Hospital, where injectable use remained below 20%.[28,29] However, findings from other Ghanaian studies revealed higher proportions i.e. 24.2% - Eastern Region[17] and 13.4% - Ashanti Region.[16] Results from a regional analysis across Africa indicated that 25% of patient encounters involved injectable prescriptions, exceeding the WHO standard.[22] In other LMICs, injectable prescribing in Nepal was found to be 22.9%[30], slightly above the cutoff, whereas in Ethiopia's it was 13.5%[31], similar to our findings. These comparisons suggest that STH's injectable prescribing is relatively well controlled in comparison to many settings, though margins for improvement remain.

Polypharmacy and essential medicines list adherence
The study found that the average number of drugs per prescription at STH was 2.8, exceeding the WHO's recommended limit of <2.[32] This is consistent with previous research in Ghana, where polypharmacy levels in public hospitals ranged from 3.6 to 4.0 drugs per prescription.[16,18]

The polypharmacy levels observed at STH can be explained by the complexity of cases seen at tertiary hospitals, where multimorbidity is common, requiring multiple medications for conditions such as diabetes, hypertension, and cardiovascular diseases.[33] Regionally, a systematic review reported an average of 3.1 medicines per patient encounter, indicating a prevalent issue of polypharmacy across the African region.[22] This trend may increase the risk of drug interactions and medication-related complications, highlighting the need for regular medication reviews and deprescribing strategies.[34] Regular medication reviews and deprescribing strategies should be implemented to minimize unnecessary drug use while ensuring optimal patient care.

Adherence to the WHO EML fell below the 100% WHO target. This trend is similar to findings from other hospitals in Ghana.[24] Earlier findings from a regional analysis across Africa indicated that 88% of medicines

were prescribed from the EML, suggesting a consistent pattern of suboptimal adherence across the African region.[22] Comparable studies from Asia also report suboptimal adherence: for instance, Sri Lanka[35] reported about 68.8% of drugs prescribed from their EML, Thailand reported 66.5%,[36] and a mixed Vietnam/Thailand study reported 82.3%.[37] The lower-than-expected adherence may be due to the need for specialized medications in tertiary hospitals, particularly for conditions such as cancer and drug-resistant infections.[38] Teaching hospitals often require non-EML medicines for specialized care, and strict adherence to the EML may limit access to newer, life-saving drugs.[39,40] Additionally, Ghana's Essential Medicines List is outdated, with the latest 7th edition published in 2017, meaning that newer, cost-effective treatments may not be included.[12] While the EML should serve as a guiding standard, policymakers should ensure timely updates to accommodate evolving treatment needs.

Generic drug prescriptions

The proportion of prescriptions written using generic names failed to meet the WHO's 100% recommendation. This is consistent with findings from previous studies in Ghana, where generic prescribing rates ranged from 73.4% to 91.3%.[16,24] Comparatively, in Thailand, generic name prescribing was 73.9% in district hospitals [41]; in Ethiopia, a systematic review reported a median generic prescribing rate of 93.5%,[42] in Nepal, pooled data indicated a much lower rate (21.8%) among health facilities in resource-limited settings[30]; in England, about 81% of drugs in primary care are prescribed generically[43]; and across the EU, generics comprise 62% of medicines dispensed[44]. These international data highlight that, although some settings approach high rates of generic prescribing, many are well below ideal WHO standards.

While the high rate of generic prescribing at STH is commendable, the occasional preference for brand-name medications may be influenced by pharmaceutical marketing, physician preference, and patient demand.[18,45] Continued education for prescribers and patients on the cost-effectiveness and therapeutic equivalence of generic drugs is necessary to improve compliance with WHO guidelines.

Documentation of vitals and written diagnoses

The study found a declining trend in the documentation of vital signs, with blood pressure, temperature, and weight recording rates averaging 70.97%, 70.49%, and 70.20%, respectively. This decline is concerning, as

proper documentation of vital signs is crucial for disease monitoring and clinical decision-making.[46,47] Though vitals may sometimes be recorded, they are not always captured in the LHIMS system, potentially due to workload pressures, logistical constraints, and technology challenges.[47-49] Similar trends have been reported in other studies, where high patient loads, suboptimal healthcare worker-patient ratios, and system inefficiencies contributed to poor documentation.[49,50] Strengthening triage systems through training, provision of logistics, and routine monitoring while also addressing challenges related to patient-health worker ratios can help ensure that vital signs are consistently documented. Diagnosis documentation fell short of WHO's 100% recommendation. Incomplete diagnosis documentation affects not only reimbursement processes for the National Health Insurance Authority (NHIA) but also patient outcomes.[51,52] Missing or incomplete diagnostic information can compromise clinical decision-making, delay appropriate treatment, and increase the risk of adverse outcomes for patients.[53,54] At the institutional level, rejected NHIA claims undermine hospital revenue, which in turn constrains the availability of critical resources such as essential medicines, diagnostic supplies, and staff support that are necessary for quality healthcare delivery. Strengthening prescriber training, record-keeping protocols, and system automation is therefore critical to safeguard both clinical quality and health system sustainability.[55,56]

Limitations

This retrospective study did not capture patients' clinical conditions or results of culture and sensitivity testing, limiting interpretation of high antibiotic use and polypharmacy. Reliance on secondary LHIMS data may also have led to incomplete reporting, and some contextual factors such as diagnostic capacity and workload were inferred rather than directly measured. These limitations should be considered when interpreting the findings and generalizing them beyond this setting.

Implications and recommendations

This study highlights several opportunities to strengthen rational medicine use at STH. First, antibiotic stewardship programs should be reinforced to promote appropriate prescribing and help curb antimicrobial resistance. Second, routine prescription review and monitoring should be instituted to support compliance with WHO/INRUD prescribing indicators and reduce risks associated with higher-than-recommended prescribing

levels. [57] Third, improving documentation of vital signs will require strengthening triage systems, addressing patient-health worker ratios, and enhancing digital integration of assessments. Furthermore, adherence to the EML and generic prescribing should be supported through prescriber education, supervision, and policy enforcement. Finally, ensuring timely updates to Ghana's Essential Medicines List will help align standardized prescribing with the evolving therapeutic needs of tertiary-level care.

CONCLUSION

The findings of this study provide important insights into the prescribing patterns at STH and their alignment with the WHO prescribing indicators. While injectable use remained within the WHO recommendations, notable deviations were observed in antibiotic prescribing, polypharmacy, documentation of patient vitals, and written diagnosis recording. Adherence to the WHO EML and generic prescribing was relatively high but did not meet the 100% WHO standard, reflecting continued reliance on non-EML and branded medications. Addressing these prescribing challenges is critical to improving patient safety, cost-effectiveness, and compliance with WHO standards.

REFERENCES

1. Yulia Ningsih R, Kesehatan Kementeria Kesehatan Jambi P, Unggulan IPTEK P, Kesehatan Kementerian Kesehatan Jambi P. Evaluation of Rationality of Drug Use Based on National Rational Drug Use Indicators at Paal Lima Public Health Center Period January - March 2023. *Proceeding International Conference Health Polytechnic of Jambi* [Internet]. 2023 Nov 30 [cited 2025 Mar 7];2:49-54. Available from: https://journal.poltekkesjambi.ac.id/index.php/ICoHPJ/article/view/702

2. WHO. Rational use of medicines: progress in implementing the WHO medicines strategy: report by the Secretariat [Internet]. 2024 [cited 2025 Mar 7]. Available from: https://iris.who.int/handle/10665/21525

3. Ogaji DS, Owhondah KS, Zite Z. Prescription, Dispensing, and Rational Medicine Use in a Nigerian Teaching Hospital. *Nigerian Journal of Medicine*. 2024 Jan [cited 2025 Mar 7];33(1):31-8. Available from: https://journals.lww.com/njom/fulltext/2024/01000/prescription,_dispensing,_and_rational_medicine.6.aspx

4. Ahmed MAA, Ravinetto R, Diop K, Buitrago VT, Dujardin C. Evaluation of Rational Medicines Use Based on World Health Organization Core Indicators: A Cross-Sectional Study in Five Health Districts in Mauritania. *Integrated Pharmacy Research and Practice* [Internet]. 2024 Mar [cited 2025 Mar 7];13:17. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC10984847/

5. Rajan Rachlyn r., Sahay Melinal, George M, Sr DK. Assessment of Rational Medication Utilization in a Multi-specialty Hospital in Chennai: A Cross-sectional Study. *Research Square*. 2024 Apr 2 [cited 2025 Mar 7]; Available from: https://www.researchsquare.com/article/rs-4179767/v1

6. Uddin TM, Chakraborty AJ, Khusro A, Zidan BRM, Mitra S, Emran T Bin, et al. Antibiotic resistance in microbes: History, mechanisms, therapeutic strategies and future prospects. *Journal of Infection and Public Health*. 2021 Dec 1;14(12):1750-66.

7. WHO. Antimicrobial resistance [Internet]. 2023 [cited 2025 Mar 7]. Available from: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance

8. Moyo P, Moyo E, Mangoya D, Mhango M, Mashe T, Imran M, *et al*. Prevention of antimicrobial resistance in sub-Saharan Africa: What has worked? What still needs to be done? *Journal of Infection and Public Health*. 2023 Apr 1;16(4):632-9.

9. Masnoon N, Shakib S, Kalisch-Ellett L, Caughey GE. What is polypharmacy? A systematic review of definitions. *BMC Geriatrics* [Internet]. 2017 Oct 10 [cited 2025 Mar 7];17(1):230. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC5635569/

10. Bojuwoye AO, Suleman F, Perumal-Pillay VA. Polypharmacy and the occurrence of potential drug-drug interactions among geriatric patients at the outpatient pharmacy department of a regional hospital in Durban, South Africa. *Journal of Pharmaceutical Policy and Practice* [Internet]. 2022 Dec 1 [cited 2025 Mar 7];15(1):1-12. Available from: https://joppp.biomedcentral.com/articles/10.1186/s40545-021-00401-z

11. Peacocke EF, Myhre SL, Foss HS, Gopinathan U. National adaptation and implementation of WHO Model List of Essential Medicines: A qualitative evidence synthesis. *PLoS Medicine* [Internet]. 2022 Mar 1 [cited 2025 Mar 7];19(3):e1003944. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8956172/

12. GNDP. Essential Medicines List. 2017;

13. Labi AK, Obeng-Nkrumah N, Nartey ET, Bjerrum S, Adu-Aryee NA, Ofori-Adjei YA, et al. Antibiotic use in a tertiary healthcare facility in Ghana: a point prevalence survey. *Antimicrobial Resistance & Infection Control* [Internet]. 2018 Jan 26 [cited 2025 Mar 7];7(1):15. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC5787245/

14. Abuosi AA, Anaba EA, Attafuah PYA, Tenza IS, Abor PA, Setordji A, et al. Comparing patient safety culture in primary, secondary and tertiary hospitals in Ghana. *Ghana Medical Journal* [Internet]. 2023 Jun 1 [cited 2025 Mar 7];57(2):141. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC1084665/

15. Sunyani Teaching Hospital. *Services - Sunyani Teaching Hospital* [Internet]. 2025 [cited 2025 Mar 7]. Available from: https://sth.gov.gh/services

16. Sema FD, Asres ED, Wubeshet BD. Evaluation of Rational Use of Medicine Using WHO/INRUD Core Drug Use Indicators at Teda and Azezo Health Centers, Gondar Town, Northwest Ethiopia. *Integrated Pharmacy Research and Practice.* 2021 Jun [cited 2025 Oct 1];10:51. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8232866/

17. Meena DK, Mathaiyan J, Thulasingam M, Ramasamy K. Assessment of medicine use based on WHO drug-use indicators in public health facilities of the South Indian Union Territory. *British Journal of Clinical Pharmacology* [Internet]. 2022 May 1 [cited 2025 Oct 1];88(5):2315-26. Available from: /doi/pdf/10.1111/bcp.15165

18. Djochie RDA, Owusu-Donkor R, d'Almeida EM, Fordjour F, Akwah FKG, Kyeremateng E, *et al*. Evaluation of rational medicine prescribing: A cross-sectional study of public hospitals in the Ashanti Region of Ghana. *Research Square.* 2023 Jun 21 [cited 2025 Feb 23]; Available from: https://www.researchsquare.com/article/rs-3059557/v1

19. Ahiabu MA, Tersbøl BP, Biritwum R, Bygbjerg IC, Magnussen P. A retrospective audit of antibiotic prescriptions in primary health-care facilities in Eastern Region, Ghana. *Health Policy Plan* [Internet]. 2016 Mar 1 [cited 2025 Feb 23];31(2):250-8. Available from: https://pubmed.ncbi.nlm.nih.gov/26045328/

20. Afriyie D, Tetteh R. A description of the pattern of rational drug use in Ghana Police Hospital. 2013 [cited 2025 Feb 23]; *International Journal of Pharmacy and Pharmacology ISSN*: 2326-7267 Vol. 3 (1), pp. 143-148, January, 2014. Available online at www.internationalscholarsjournals.org

21. Darkwah TO, Afriyie DK, Sneddon J, Cockburn A, Naa M, Opare-Addo A, et al. Assessment of prescribing patterns of antibiotics using National Treatment Guidelines and World Health Organization prescribing indicators at the Ghana Police Hospital: a pilot study. *Pan African Medical Journal* [Internet]. 2021 Aug 2 [cited 2025 Mar 7];39(1). Available from: https://www.ajol.info/index.php/pamj/article/view/221840

22. Ofori-Asenso R, Brhlikova P, Pollock AM. Prescribing indicators at primary health care centers within the WHO African region: a systematic analysis (1995-2015). *BMC Public Health* [Internet]. 2016 Aug 22 [cited 2025 Mar 7];16(1). Available from: https://pubmed.ncbi.nlm.nih.gov/27545670/

23. Bediako-Bowan AAA, Owusu E, Labi AK, Obeng-Nkrumah N, Sunkwa-Mills G, Bjerrum S, et al. Antibiotic use in surgical units of selected hospitals in Ghana: A multi-centre point prevalence survey. *BMC Public Health* [Internet]. 2019 Jun 21 [cited 2025 Feb 23];19(1):1-10. Available from: https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-019-7162-x

24. Amponsah OKO, Nagaraja SB, Ayisi-Boateng NK, Nair D, Muradyan K, Asense PS, *et al*. High Levels of Outpatient Antibiotic Prescription at a District Hospital in Ghana: Results of a Cross Sectional Study. *International Journal of Environmental Research and Public Health* 2022, Vol 19, Page 10286 [Internet]. 2022 Aug 18 [cited 2025 Oct 1];19(16):10286.

Available from: https://www.mdpi.com/1660-4601/19/16/10286/htm

25. Bediako-Bowan AAA, Owusu E, Labi AK, Obeng-Nkrumah N, Sunkwa-Mills G, Bjerrum S, et al. Antibiotic use in surgical units of selected hospitals in Ghana: A multi-centre point prevalence survey. *BMC Public Health* [Internet]. 2019 Jun 21 [cited 2025 Oct 1];19(1):1-10. Available from: https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-019-7162-x

26. Agyare E, Acolatse JEE, Dakorah MP, Akafity G, Chalker VJ, Spiller OB, et al. Antimicrobial stewardship capacity and antibiotic utilisation practices in the Cape Coast Teaching Hospital, Ghana: A point prevalence survey study. *PLoS One* [Internet]. 2024 Jan 1 [cited 2025 Oct 1];19(1):e0297626. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC1081054 44/

27. Kushitor MK, Boatemaa S. The double burden of disease and the challenge of health access: Evidence from Access, Bottlenecks, Cost and Equity facility survey in Ghana. PLoS One [Internet]. 2018 Mar 1 [cited 2025 Oct 1];13(3):e0194677. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0194677

28. Afriyie D, Owusu Aboagye G, Godman B. Rational Drug Prescribing at the Medical Outpatient-Department, Korle Bu Teaching Hospital, Accra, Ghana Conference: Fourth Training Workshop and Symposium MURIA Groupin conjunction with ISPE | Request PDF [Internet]. 2019 [cited 2025 Feb 23]. Available from: https://www.researchgate.net/publication/330449 055_Rational_Drug_Prescribing_at_the_Medical_ Outpatient-Department_Korle_Bu_Teaching_Hospital_Accra_ Ghana

29. Amponsah OKO, Ayisi-Boateng NK, Nagaraja SB, Nair D, Muradyan K, Hedidor GK, et al. Adherence to Prescribing Indicators at a District Hospital in Ghana: Do We Match WHO Standards? *International Journal of Environmental Research and Public Health* [Internet]. 2022 Oct 1 [cited 2025 Mar 7];19(19). Available from: https://pubmed.ncbi.nlm.nih.gov/36231554/

30. Agrawal R, Shrestha R, Poudel RS, Shrestha S. A Systematic Review on Evaluation of WHO Core Prescribing Indicators Across Healthcare Facilities in Low Resource Asian Setting: A Case of Nepal. INQUIRY: *The Journal of Health Care Organization, Provision, and Financing* [Internet]. 2025 Jan 1 [cited 2025 Oct 1];62:00469580251347136. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC1241785 7/

31. Dereje B, Workneh A, Megersa A, Yibabie S. Prescribing Pattern and Associated Factors in Community Pharmacies: A Cross-Sectional Study Using AWaRe Classification and WHO Antibiotic Prescribing Indicators in Dire Dawa, Ethiopia. *Drugs Real World Outcomes* [Internet]. 2023 Sep 1 [cited 2025 Oct 1];10(3):459-69. Available from: https://link.springer.com/article/10.1007/s40801-023-00367-1

32. WHO. Health products policy and standards [Internet]. 2025 [cited 2025 Oct 1]. Available from: https://www.who.int/teams/health-product-policy-and-standards/medicines-selection-ip-and-affordability/medicines-policy/rational-use?utm_source=chatgpt.com

33. Ye L, Yang-Huang J, Franse CB, Rukavina T, Vasiljev V, Mattace-Raso F, et al. Factors associated with polypharmacy and the high risk of medication-related problems among older community-dwelling adults in European countries: a longitudinal study. BMC Geriatrics [Internet]. 2022 Dec 1 [cited 2025 Feb 23];22(1):1-13. Available from: https://bmcgeriatr.biomedcentral.com/articles/10.1186/s12877-022-03536-z

34. Daunt R, Curtin D, O'Mahony D. Polypharmacy stewardship: a novel approach to tackle a major public health crisis. *Lancet Healthy Longevity.* 2023 May 1;4(5):e228-35.

35. Galappatthy P, Ranasinghe P, Liyanage CK, Wijayabandara MS, Mythily S, Jayakody RL. WHO/INRUD Core drug use indicators and commonly prescribed medicines: a National Survey from Sri Lanka. *BMC Pharmacology and Toxicology* [Internet]. 2021 Dec 1 [cited 2025 Oct 1];22(1):1-11. Available from: https://link.springer.com/articles/10.1186/s40360-021-00535-5

36. Khangtragool A, Nukompun K, teeyasuntranonn A, Wannasiri P, Moraray S, Khangtragool W. Evaluation of rational drug use based on World Health Organization indicators in a tertiary hospital, Thailand. *Pharmaceutical Sciences Asia.* 2023;50(1):1-8.

37. Nguyen PH, Nguyen MC, Tran CKH, Pham DT. Assessment of outpatient drug prescription at eight local hospitals in Can Tho city during the period of

2016-2017. *Pharmaceutical Sciences Asia*. 2019 Jan 1;46(1):39-45.

38. Moja L, Zanichelli V, Mertz D, Gandra S, Cappello B, Cooke GS, et al. WHO's essential medicines and AWaRe: recommendations on first- and second-choice antibiotics for empiric treatment of clinical infections. *Clinical Microbiology and Infection*. 2024 Apr 1;30:S1-51.

39. Govender T, Suleman F, Perumal-Pillay VA. Evaluating the implementation of the standard treatment guidelines (STGs) and essential medicines list (EML) at a public South African tertiary institution and its associated primary health care (PHC) facilities. *Journal of Pharmaceutical Policy and Practice* [Internet]. 2021 Dec 1 [cited 2025 Oct 1];14(1):1-14. Available from: https://joppp.biomedcentral.com/articles/10.1186/s40545-021-00390-z

40. Costa E, Del Grosso V, Cappello B, Genazzani AA, Huttner B, Leufkens HGM, et al. Medicines not recommended for inclusion in the who essential medicines list: a retrospective observational study. *Frontiers in Medicine* [Internet]. 2025 [cited 2025 Oct 1];12:1517020. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC11955596/

41. Plianbangchang P, Jetiyanon K, Suttaloung C, Khumchuen L. Physicians' generic drug prescribing behavior in district hospitals: a case of Phitsanulok, Thailand. *Pharmacy Practice* (Granada) [Internet]. 2010 [cited 2025 Oct 1];8(3):167-72. Available from: https://pubmed.ncbi.nlm.nih.gov/25126136/

42. Tefera BB, Getachew M, Kebede B. Evaluation of drug prescription pattern using World Health Organization prescribing indicators in public health facilities found in Ethiopia: systematic reviews and meta-analysis. *Journal of Pharmaceutical Policy and Practice* [Internet]. 2021 Dec 1 [cited 2025 Oct 1];14(1):1-10. Available from: https://joppp.biomedcentral.com/articles/10.1186/s40545-021-00313-y

43. NHSBSA. Medicines optimisation - generic prescribing | NHSBSA [Internet]. 2023 [cited 2025 Oct 1]. Available from: https://www.nhsbsa.nhs.uk/access-our-data-products/epact2/dashboards-and-specifications/medicines-optimisation-generic-prescribing?utm_source=chatgpt.com

44. Medicines for Europe. 62% of Medicines Dispensed in Europe are Generic, according to IMS New Data | Medicines for Europe [Internet]. 2017 [cited 2025 Oct 1]. Available from: https://www.medicinesforeurope.com/news/62-of-medicines-dispensed-in-europe-are-generic-according-to-ims-new-data/?utm_source=chatgpt.com

45. Dunne SS, Dunne CP. What do people really think of generic medicines? A systematic review and critical appraisal of literature on stakeholder perceptions of generic drugs. BMC Medicine [Internet]. 2015 Jul 29 [cited 2025 Feb 23];13(1):173. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC4520280/

46. Keene CM, Kong VY, Clarke DL, Brysiewicz P. The effect of the quality of vital sign recording on clinical decision making in a regional acute care trauma ward. *Chinese Journal of Traumatology - English Edition*. 2017 Oct 1;20(5):283-7.

47. Althmali MA, Almalki WM, Alzahrani MS, Al-Tuwairqi SKA, Althubity FS. The Value of Vital Sign Changes for Early Detection of Clinical Deterioration. *Journal Of Healthcare Sciences* [Internet]. 2024 Dec 31 [cited 2025 Mar 7];4(12):1044-50. Available from: https://johs.com.sa/admin/public/uploads/187/375_pdf.pdf

48. Ramgopal S, Martin-Gill C, Michelson KA. Pediatric Vital Signs Documentation in a Nationally Representative US Emergency Department Sample. *Hospital Pediatrics* [Internet]. 2024 Jul 1 [cited 2025 Mar 7];14(7):532-40. Available from: https://pubmed.ncbi.nlm.nih.gov/38910528/

49. McCormick PJ. Vital Sign Data Quality: Not Just a Retrospective Research Problem. *Anesthesiology* [Internet]. 2024 Jul 1 [cited 2025 Mar 7];141(1):4-6. Available from: https://pubmed.ncbi.nlm.nih.gov/38860789/

50. Jensen MSV, Meyhoff CS, Aasvang EK. In reply to: Frequency, extent, cumulative time and trend of postoperative vital sign deviation: The elements for a (remote) continuous early warning system. *Acta Anaesthesiologica Scandinavica | Anaesthesia Journal* [Internet]. 2025 Feb 3 [cited 2025 Mar 7];69(2). Available from: https://pubmed.ncbi.nlm.nih.gov/39749920/

51. Davis J, Shepheard J. Clinical documentation integrity: Its role in health data integrity, patient safety and quality outcomes and its impact on clinical coding and health information management. *Health Information Management Journal* https://doi.org/101177/18333583231218029 [Internet]. 2023 Dec 11 [cited 2025 Mar

7];53(2):53-60. Available from: https://journals.sagepub.com/doi/10.1177/18333583231218029

52. Tarantino I, Widmann B, Warschkow R, Weitzendorfer M, Bock S, Roeske S, et al. Impact of precoding on reimbursement in diagnosis-related group systems: Randomized controlled trial. *International Journal of Surgery*. 2021 Dec 1;96:106173.

53. Burnett SJ, Deelchand V, Franklin BD, Moorthy K, Vincent C. Missing Clinical Information in NHS hospital outpatient clinics: Prevalence, causes and effects on patient care. *BMC Health Services Research* [Internet]. 2011 May 23 [cited 2025 Oct 1];11(1):1-7. Available from: https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-11-114

54. Hofer IS, Cheng D, Grogan T. A Retrospective Analysis Demonstrates That A Failure to Document Key Comorbid Diseases in the Anesthesia Preoperative Evaluation Associates with Increased Length of Stay and Mortality. *Anesthesia &*

Analgesia [Internet]. 2021 Sep 1 [cited 2025 Oct 1];133(3):698. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC8280237/

55. Fajar A, Holipah H, Handayani I. Factors of Incomplete Inpatient Medical Records Filling at Dr. H. Slamet Martodirdjo Regional General Hospital Pamekasan. *Journal Kedokteran Brawijaya.* 2024 May 21;14-7.

56. Wahyuni A, Oktavia D, Lukmanita ZA. The Completeness of Filling Out Medical Record Documents and the Accuracy of Codes at Reksodiwiryo Hospital. *Journal of Health Sciences and Epidemiology* [Internet]. 2024 Apr 30 [cited 2025 Mar 7];2(1):44-50. Available from: https://ejurnal.r2z-scientificpublishing.com/index.php/jhse/article/view/34

57. World Health Organization. How to Investigate Drug Use in Health Facilities: Selected Drug Use Indicators. Geneva: World Health Organization; 1993. (WHO/DAP/93.1).