African Journal of
Clinical Medicine and Pharmacy Research

ISSN: 1595-7993

Index: Harvard, Boston, Sydney University, Dimensions, Lens, ResearchGet Scilit, Semantic, Google Scholar, Base etc

https://doi.org/10.58578/AJCMPR.v3i3.11823

Evaluation of Drug Prescribing Pattern in Government-Owned Secondary Healthcare Facilities in South-West Nigeria

Adeola Adebisi Michael[1], Omole Moses Kayode[2], Itiola Oludele Adelanwa[3], Awoyomi Olajoju Jokotola[4]

[1]Lead City University , Ibadan, Nigeria; [2]University of Ibadan, Ibadan Oyo State, Nigeria; [3]University of Ibadan, Ibadan, Oyo State, Nigeria; [4]College of Veterinary Medicine (FUNAB) Abeokuta, Ogun State, Nigeria.

pharmadeola2007@yahoo.com

Article Info:

Submitted:	Revised:	Accepted:	Published:
Jul 4, 2026	Aug 1, 2026	Aug 13, 2026	Aug 18, 2026

Abstract

Artisanal welding involves high-intensity mechanical stress and sustained awkward postures, yet predictors of musculoskeletal morbidity in post-conflict economies remain insufficiently defined. This study evaluates the influence of socio-demographic and occupational predictors of work-related musculoskeletal disorders among artisanal welders in Maiduguri, North-Eastern Nigeria. A cross-sectional design was employed, involving 306 welders who completed a validated Standardized Nordic Questionnaire. Data were analyzed using descriptive statistics and Pearson's chi-square tests to examine the relationships between demographic predictors, including age, professional experience, educational attainment, and the presence of work-related musculoskeletal disorders. The study cohort consisted predominantly of young workers, with a mean age of 26.84 ± 8.29 years, and a high proportion of respondents with secondary-level education. Despite this profile, musculoskeletal morbidity was widespread and intensified by limited recovery opportunities within the work environment. Inferential analysis showed that age, p = .085, professional experience, p = .296, and educational

AJCMPR Journal is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License

attainment, p = .831, were not significant predictors of work-related musculoskeletal disorders. These findings suggest an equalizing hazard effect, in which structural workplace deficits, particularly floor-level work and static loading, override individual biological, experiential, and educational differences. The study concludes that artisanal welders in structurally deficient work environments face non-discriminatory ergonomic risks across demographic strata. It contributes to occupational health research by highlighting a knowledge–practice gap in which general literacy does not translate into ergonomic agency without adequate workplace infrastructure. The findings imply that individual-focused behavioural interventions are insufficient and should be complemented by universal environmental engineering, including height-adjustable workstations and the integration of applied biomechanics into vocational training curricula to reduce long-term professional disability.

Keywords: Artisanal Welders; Ergonomics; Musculoskeletal Disorders; Occupational Health; Post-Conflict Health.

INTRODUCTION

The necessity of rational drug prescription must not be compromised in order to produce optimal therapy outcome (Richard et al., 2024;; , Anwar et al., 2025). According to the World Health Organization (WHO), rational medicines use implies that patients receive medications appropriate to their clinical needs in an individualized dosage for an appropriate period of time at the lowest cost (Richard et al., 2024; Birye et al., 2021;; , Amjad et al., 2025). Deviation from rational prescribing implies irrational drug use and will negatively impact health outcome.

The outcome of irrational drug prescription is detrimental to health, capable of causing increase morbidity and mortality and many other unpleasant effects. Physicians are mostly responsible for drug prescribing and error of prescribing is foundational to drug irrational use hence the need to pay proper attention at the point of prescribing (Birye et al., 2021;, Amjad et al., 2025). The challenge of irrational drug use is global but it is more pronounced in developing countries such as Nigeria (Anwar et al., 2025; , Qali et al., 2025). Irrational antibacterial use, unwarranted use of injectables and non-conformity to clinical guidelines in prescription writing has been adjudged as common irrational prescribing practices (Yashashri et al., 2024; Anwar et al., 2025). Consequences of irrational drug

prescribing include: extended duration of illness, loss of cost effective treatment, increase frequency of hospitalization as well as increase morbidity and mortality especially in chronic diseases such as hypertension, diabetes, epilepsy and neurological disorders (Richard et al., 2024;, Yashashri et al., 2024; , Anwar et al., 2025). The upsurge in antibacterial resistance has also been linked to irrational antibacterial use (Noun et al., 2021; , Jamal et al., 2023).

Identification of kind, extent and reasons for inappropriate prescribing is essential in reducing irrational drug prescribing in healthcare facilities. WHO/INRUD-developed drug indicators have been found to be useful in this regard (Birye et al., 2021; , Amjad et al., 2025). Study assessing drug prescribing pattern by employing WHO/INRUD core drug use indicators in secondary healthcare facilities in Ogun State of Nigeria is rare. This study therefore investigated drug prescribing pattern in government owned secondary healthcare facilities in Ogun State of Nigeria in accordance with the WHO/INRUD core drug use indicators (Table 1).

Table 1: WHO/INRUD Core drug Prescribing Indicators

Core Drug Prescribing Indicators	Optimal values
Prescribing indicators	
Average number of medicines prescribed per patient encounter	1.6–1.8
Percent medicines prescribed by generic name	100
Percent encounters with an antibiotic prescribed	20.0–26.8
Percent encounters with an injection prescribed	13.4–24.1
Percent medicines prescribed from essential medicines list or formulary	100
Availability of essential medicines list (EML) or formulary to practitioners	100
Percent key medicines available	100

EML „= Essential Medicines List

METHODS

Study setting

The study was carried out in the Ogun State government-owned secondary healthcare facilities that have outpatient pharmacies under the supervision of at least a registered pharmacist.

The healthcare facility with the highest outpatient attendance in each of the three senatorial districts in the state was selected. These facilities are State hospital at Abeokuta

with patients' attendance of 1600, Ijebu Ode with patients' attendance of 1157 and Ota with patients' attendance of 1151 per twelve weeks respectively calculated from the patients' drug register at each facility at the time of the study.

Study Design

The study was retrospective, designed to evaluate the performance of the three healthcare facilities in drug prescribing as specified by the WHO/INRUD. The findings were compared with the WHO/INRUD drug use indicators optimal values (Birye et al., 2021;, Amjad et al., 2025).

Sample Size Determination and Sampling Technique

Not less than five hundred encounters are recommended by the WHO to be included in studying prescribing practices of a facility (Birye et al., 2021;; Hailesilase et al., 2024). Using stratified random sampling, the three healthcare institutions were considered as strata. Within a stratum, 1000 prescriptions were randomly sampled. The total prescriptions at the three healthcare facilities for the year 2016 used, was 15,632. The total sample in the three study sites was 3000 prescriptions. Dividing the 3000 by 1000 from each site, every 3rd prescription was selected until the required sample size was reached. When the 3rd prescription happens to be non-drug items such as dressings, surgical or medical materials, the next prescription was selected. Incomplete prescriptions such as lacking age, name and gender of patients were excluded.

Collection Instrument and Procedure for Data collection

Data was collected through the use of an observational check list for prescribing indicators in conformity with the WHO/INRUD drug prescribing indicators. Data was collected by the investigator and trained data collectors within the working hours of 7.30 am and 3.30pm Monday to Friday at the study sites.

Processing and Analysis of Data

Data collected were entered into the Statistical Package for Social Science version 20 (IBM SPSS- 20). Descriptive statistics such as frequencies, percentages, means and standard deviation were used to describe the data. Analysis of variance (ANOVA) test was used to establish differences among healthcare facilities. Statistical significance was determined by $p < 0.05$.

Furthermore, Zhang and Zhi index system for the comprehensive evaluation of healthcare system was employed for the appraisal of the data (Xia et al., 2025). Using this approach, index of non-polypharmacy, rational antibiotic use and safe injection drug use was obtained using the formula: **Index = Optimal value ÷ Observed value**.

Other indices including generic name and EML, were calculated using the formula: **Index = Observed value ÷ Optimal value.** (Xia et al., 2025)

The optimal index for all indicators was set at one. The value closer to 1 indicates higher rational drug prescribing system. The Index of Rational Drug Prescribing, (IRDP) is the sum of all of index values of all prescribing indicators. The healthcare facility with the highest IRDP value was considered best performing in term of rational drug prescription (Xia et al., 2025).

The data was then entered into the statistical package for social science (SPSS) version 20. Categorical data were characterized by descriptive statistics such as frequency and percentage. Association between antibacterial prescribing and predicting factors such as age of patients, gender and number of medicines per prescription was explored using Chi-square ((X2). Significance was set at $p < 0.05$.

RESULTS

The total prescriptions evaluated in the three study healthcare institutions were three thousand (one thousand per site). One thousand one hundred and forty-three (38.1%) were males and the mean age was 41.22 ± 19.13 (Table 2).

The average number of drugs prescribe per encounter was 3.0 ± 1.7; percent drugs prescribe with generic name were 59.2 ± 33.8, while percent encounters with antibiotic prescribed was 47.9 ± 26.9. There was significant difference among the healthcare facilities with respect to all the prescribing indicators (Table 3).

Table 2: Demographic Characteristics of Patients According to Sites for the Prescribing Indicators (N = 3000)

Age (Years)	SH Abeokuta	SH Ijebu Ode	SH Ota	Total
	n (%)	n (%)	n (%)	N (%)
0 – 20	115 (3.8)	123 (4.1)	174 (5.8)	412 (13.7)
21 -40	336 (11.2)	361 (12.0)	407 (13.6)	1104 (36.8)
41 – 60	373 (11.2)	325 (10.8)	273 (9.1)	971 (32.4)
61 -81	159 (5.3)	181 (6.0)	122 (4.1)	462 (15,4)

Age (Years)	SH Abeokuta	SH Ijebu Ode	SH Ota	Total
	n (%)	n (%)	n (%)	N (%)
>80	17 (0.6)	10 (0.3)	24 (0.8)	51 (1.7)
Mean Age	43.68 ± 15.47	41.99 ± 19.01	37.98 ± 19.47	41.22 ± 19.13
Gender				
Male	358 (11.9)	413 (13.8)	372 (12.4)	1143 (38.1)
Female	642 (21.4)	587 (19.6)	628 (20.9)	1857 (61.9)

SH = State Hospital, n = 1000, N = 3000

Table 3: WHO/INRUD Prescribing Indicators in the Selected Secondary Healthcare facilities

Prescribing Indicators	WHO optimal values	SH Abeokuta	SH Ijebu Ode	SH Ota	Mean ± SD	ANOVA
Average number of drugs prescribed per patient encounter	1.6 – 1.8	2.9 ± 1.2	3.8 ± 1.9	2.6 ± 1.6	3.0 ± 1.7	$p < 0.001$
Percent drugs prescribe by generic name	100	56.1	55.9	65.5	59.2 ± 33.8	$p < 0.001$
Percent encounters with antibiotic prescribed	20.0 – 26.8	42.1	47.8	46.3	47.9 ± 26.9	$p < 0.001$
Percent encounters with an injection prescribed	13.4 – 24.1	24.7	30.5	72.8	42.7 ± 26.2	$p < 0.001$
Percent drugs prescribed from EML	100	74.7	83.1	93.2	83.7 ± 26.9	$p < 0.001$

SH = State Hospital, ANOVA = Analysis of Variance, EML= Essential Medicines List

The ranking of IRDP values confirmed the SH Ota to be the best performing healthcare institution among the three facilities considered in relation to rational prescribing practices.

(Table 4)

There is significant association between the age of patients and the number of drugs prescribed $p < 0.001$. The number of drugs prescribed followed normal distribution with age. The highest number prescribed was found to be within the age range 41-60 years. The result showed no significant association between gender of patients and the number of drugs prescribed $p = 0.327$ (Table 4).

The result confirmed significant association between age of patients and prescribed antibiotics as well as prescribed injections $p < 0.001$ and $p = 0.001$ respectively. The prescription of both antibiotic and injections increased with increasing age with the highest prescriptions at the age group 21 - 40 years and then declines (Table 5)

Table 4: Prescribing Performance for the Selected Secondary Healthcare Facilities (N = 1000)

Performance Indicators	SH Abeokuta	SH Ijebu Ode	SH Ota
Prescribing Indicators			
Non-polypharmacy index	0.62	0.47	0.60
Generic name index	0.56	0.56	0.66
Rational antibacterial index	0.64	0.56	0.56
Injection safety index	0.98	0.79	0.89
EDL index	0.75	0.83	0.93
IRDP	3.55	3.21	3.64
Rank	2	3	1

SH = State hospital, EDL = Essential Drug List, IRDP = Index of Rational Drug Prescribing

Table 5: Association between Age, Gender of Patients and Number of drugs Prescribed per Encounter (N = 3000)

Age group (Years)	N (%)			X^2
Number Prescribed	1-2	3-4	5 and above	
0-20	233 (7.8)	134 (4.5)	45 (1.5)	$p < 0.001$
21-40	527 (17.6)	382 (12.7)	195 (6.5	
41-60	362 (12.1)	394 (13.1)	215 (7.2)	
61-80	180 (6.0)	166 (5.5)	113 (3.8)	
81 and above	31 (1.0)	17 (0.6)	6 (0.2)	
Total	1333 (44.5)	1093 (36.4)	574 (19.1)	
Gender				$p > 0.05$
Male	510 (17.0)	424 (14.1)	209 (7.0)	
Female	823 (27.4)	669 (22.3)	365 (12.2)	
Total	1333 (44.5)	1093 (36.4)	574 (19.1)	

N = number of patients.

Table 6: Association between Age of Patients, Prescribed Antibiotics and Injections (N -3000)

Age group (Years)	Yes N (%)	No N (%)	Total N (%)	X^2
Prescribed Antibiotics				
0-20	226 (7.5)	186 (6.2)	412 (13.7)	$p < 0.001$
21-40	542 (18.1)	562 (18.7)	1104 (36.8)	
41-60	400 (13.3)	571 (19.0)	971 (32.4)	
61-80	171 (5.7)	288 (9.6)	459 (15.3)	
81 and above	24 (0.8)	30 (1.0)	54 (1.8)	
Total	1363 45.4)	1637 (54.6)	3000 (100.0)	
Prescribed injections				

Age group (Years)	Yes N (%)	No N (%)	Total N (%)	X^2
0-20	199 (6.6)	213 (7.1)	412 (13.7)	p = 0.001
21-40	506 (16.9)	598 (19.9)	1104 (36.8)	
41-60	377 (12.6)	584 (19.5)	971 (32.4)	
61-80	175 (5.8)	284 (9.5)	459 (15.9)	
81 and above	23 (0.7)	31 (1.0)	54 (1.8)	
Total	1280 (42.7)	1720 (57.3)	3000 (100.0)	

N = number of patients, X^2 = Chi square

DISCUSSION

Irrational use of drugs has been established globally within and outside hospital practices (Anwar et al., 2025). Such unreasonable drug use has led to unwanted effects. Inappropriate use of drugs tends to occur as irrational prescribing, dispensing and consumption (Richard et al., 20024; Anwar et al., 2025). In the current study, the WHO/INRUD drug indicators were used to evaluate the drug use performance of three government-owned secondary healthcare institutions in Ogun state of Nigeria. The assessment was based on the prescribing practices. Findings from the study may help in resolving therapy challenges and serve as baseline information for continuous monitoring of drug prescribing.

The pattern of prescriptions in a healthcare institution is the reflections of the standard of drug use attribute of that facility. It provides insight to the knowledge, experience and the attitude of prescribers to rational drug use. The WHO prescribing indicators offer objective and reproducible means of characterizing prescriptions. The indicators set an optimal reference value for every indicator. In the present study, the average number of drugs per encounter was 3.0 ± 1.7 and the difference among healthcare facilities was statistically significant ($p < 0.001$). The obtained value was higher than the acceptable optimal range of 1.6 - 1.8 drugs per encounter. The result obtained in this study is higher than that reported by some other studies. In a study of rational drug use evaluation based on WHO core drug use indicators in Ethiopia, the average drug encounter was 1.74 (Birye et al., 2021). A study carried out in primary healthcare centers in Kenya reported average drug prescribed as 2.9 ± 0.5 (Aggery et al., 2020) while a study of drug prescribing and dispensing practices in regional and national referral hospitals of

Eritrea obtained 1.78 ± 0.79. However, a cross- sectional analysis of prescribing patterns against WHO indicators in Pakistan and Yemen recorded 5.44 ± 1.14 and 6.18 ± 1.09 respectively (Amjad et al., 2025). The differences observed in the results might be as a result of differences in study settings and variations in prescribing practices among various medical specialties.

Prescription of too many drugs per patients (polypharmacy) has the likelihood of negatively influencing treatment outcomes. There is the tendency of the patients being non-compliant with regimen, costs and adverse events may also increase. Increase in drug-drug interactions and wastages might also result from polypharmacy. Polypharmacy is also likely to encourage left over drugs due to incomplete usage, such left over drugs may be later passed to others thereby promoting self-medication. The overprescribing of drugs above the recommended value as obtained in the current study might be associated with inadequate knowledge, insufficient experience and training of healthcare professionals. Empirical and symptomatic approaches in treatment, unavailability of or non-compliance with standard treatment guidelines (STG) and incentives from drug suppliers may also result in polypharmacy. Prescribers should therefore update their knowledge and improve on correct diagnosis so as to be more specific in prescribing.

Generic names are the scientific and internationally acceptable names of drugs. The standard recommendation by the WHO is 100% prescriptions with generic names. Prescriptions by the trade or brand names of drugs are not acceptable (Aggrey et al., 2020). The outcome from this study showed that the obtained percentage of drugs prescribed with generic name (59.2 ± 33.8) is below the WHO optimal value. There was statistical significant difference between the healthcare facilities ($p < 0.001$). In Kenya, Aggrey et al., 2020 obtained generic prescription of 27.7%. Generic prescribing, 74.18% and 78.24% was reported by Amjed et al., 2025 in Pakistan and Yemen respectively. Other studies reported a somewhat higher generic prescription: 85.25% in Ethiopia (Byre et al., 2021) and 98.86% in Eritrea (Siele et al., 2022). Differences in study settings and prescription habits may likely accounts for the variations in values. Factors that might have propelled low generic prescribing obtained in this study might include: faith of prescribers on branded products and enticing promotional activities of drug promoters. Generic prescribing is capable of reducing cost of drugs to both the patients and the healthcare system. This therefore increases the drug purchasing power of the patients and improves drugs

availability. The benefit of substituting therapeutic equivalents by dispensers is another advantage of generic prescribing.

The percentage antibiotic prescribed in this study was 47.9 ± 26.9 which is higher than the recommended optimal value 20.0 - 26.8. There was significant difference among the facilities. ($p < 0.01$). Some studies reported lower percentage of antibiotic prescribed than that obtained in the present study: (Aggrey et al., 2021) in a study carried out in primary healthcare centers in Kenya recorded 26.8% antibiotic prescriptions and in referral hospital in Eritrea, 54.5% was obtained (Siele et al., 2022). A study that evaluated rational drug use in Pakistan and Yemen reported 65% and 72.5% antibiotics prescriptions respectively (Amjad et al., 2025). In Ethiopia, 85% antibiotic prescription was obtained by Birye et al., 2021. High level of antibacterial prescriptions witnessed in many developing countries may be due to many factors. Increased incidence of infections may warrant increase antibiotic use. High level of routine empirical treatments is common in resource-poor countries. Patients' request for antibiotics forcing some prescribers to prescribe antibiotics even when they are not absolutely needed (Richard et al., 2024). Irrational antibacterial use is worldwide and has been said to be more prominent in developing countries such as Nigeria (Anwar et al., 2025). Unjustifiable antibacterial prescriptions has been said to be one of the reasons leading to antibacterial resistance (Noun et al., 2021; Jamal et al., 2023). Antibiotic resistance may lead to increase in the cost of therapy as more expensive antibiotics might be needed to address the challenge. It has also been linked with increase hospital admissions, morbidity and mortality (Noun et al., 2021; Jamal et al., 2023). The WHO has classified antibacterial resistance as a public health threat of increasing concern that deserves urgent attention (Richard et al., 2024)). Prescribers should therefore adhere to antibiotics treatment guidelines. Professionals should also be made to undergo regular training on antibacterial rational use.

Findings from the present study revealed that percentage of encounter with an injection prescribed was 42.7 ± 26.2 with significant difference among sites ($p < 0.001$). This value is higher than the WHO recommended standard which is 13.4 - 24.1. The value obtained here was in contrast with 6.6% reported by Siele et al., 2022 in a study of drug prescribing in regional and national referral hospitals in Eritrea. In Pakistan and Yemen, 57% and 68% injection prescriptions were obtained respectively (Amjad et al., 2023)

Differences in values may be as a result of different settings and period of time. Excessive use of injections should not be encouraged because of associated complications. There is the probability of increase in blood borne diseases such as HIV and hepatitis with increased use of injections (CDC, 2025). Injections may be costlier and usually necessitates the involvement of professionals for administration. In some communities, such as Pakistan rural culture, patients demand for injectables with the belief that injections act faster and offer complete relief (Yashashri et al., 2024, Amjad et al., 2025). It is likely that this belief will be common to most developing societies.

The WHO recommended optimal value for prescription from EML is 100%. In the present study, the percent prescription from EML was lower than the optimal value (83.7 ± 26.9) with significant difference among the facilities ($p < 0.001$). A study of rational drug evaluation in Ethiopia reported 81.4% (Birye et al., 2021), in Pakistan 98.24% and Yemen 97.87% (Amjad et al., 2025). Drugs prescribed from the EML in the study at primary health centers in Kenya were 96.7% (Aggery et al., 2020) while that at referral hospital in Eritrea was 94.73% (Siele et al., 2022). In Ogun State Health Management, a centralized procurement system is being employed. This may even account for the fairly high availability of drugs from the EML in all the sites. Prescribing drugs from EML produced by WHO offers framework for rational prescribing. The list contains verified drugs proven in practice with good clinical outcome and lower cost than newer drugs.

Limitations of the Study

The study revealed deficiencies in rational drug prescribing in the selected study facilities. The findings could not be generalized, but may be applicable to government secondary healthcare facilities in Ogun state of Nigeria and in all the settings that operate central drug supply system.

Conclusion and Recommendations

This study established irrational drug prescribing practices in all the healthcare facilities studied. The obtained values for almost all the WHO/INRUD prescribing indicators deviated from the optimal. This should be improved upon so as to have enough time for effective professional-patient communication. Generic prescribing was barely above half and the prescription rate for antibiotics was almost doubled the optimal recommendation. There is the need for continuous training of physicians especially on necessity for generic prescriptions, rational antibacterial and injection prescribing. The high

level of antibiotic prescribing also requires that pharmacists should be regularly trained on counselling of patients on rational use of antibiotics.

Acknowledgements

We hereby acknowledge the assistance of all the pharmacy and clinical staff of the selected healthcare facilities. The contributions of all lecturers and staff of department of clinical pharmacy and pharmacy administration of University of Ibadan, Nigeria are highly appreciated.

Authors' Contributions

Author A' designed the study, wrote the protocol and first draft of the manuscript. Author B' and Author C' performed the literature searches and analysis of the study. Author D' carried out the statistical analysis. All authors read and approved the final manuscript

Ethical Approval

The study was approved by the University of Ibadan/University College Hospital (UI/UCH) Health Research and Ethics Committee (UI/EC/15/038). Permission was also obtained from the pharmacy department of Ogun State Health Management Board (SHB/2146/DPS/201) and the Head of Department of Pharmacy of each hospital.

REFERENCES

Abdulgader, N. E. A., Abdel Galil, R. K., Serag Elnour, S. Y. M. N., Elhusain, T. F. F., Osman, T. M. A., Elawad, M. N. A., Mirghani, I. M. S. I., Abdalrahman, I. B., & Elbager, S. G. (2021). Irrational use of antibiotics with representation of antimicrobial resistance patterns in Sudan: A narrative review. *The EuroBiotech Journal, 5*(1), 43–47. https://doi.org/10.2478/ebtj-2021-0007

Ahmed, M. A. A., Seydou, A., Coulibaly, I., Kielmann, K., & Ravinetto, R. (2025). Irrational medicine use and its associated factors in conflict-affected areas in Mali: A cross-sectional study. *Global Health Action, 18*(1), 2458935. https://doi.org/10.1080/16549716.2025.2458935

Anwar, M. F., Daud, N. A. A., & Hussain, R. (2025). From prescribing indicators to rational drug use: A medication safety perspective. *Journal of Pharmaceutical Policy and Practice, 18*(1), 2544656. https://doi.org/10.1080/20523211.2025.2544656

Centers for Disease Control and Prevention. (2025, September 12). *Viral hepatitis among people who use or inject drugs*. https://www.cdc.gov/hepatitis/hcp/populations-settings/pwid.html

Djochie, R. D. A., Owusu-Donkor, R., d'Almeida, E. M., Gyamfi Akwah, F. K., Kyerematen, E., Opoku-Afriyie, S., Tabiri, C. A., Kyei-Frimpong, F., Dwomoh, S., & Boakye-Yiadom, J. (2024). Assessment of knowledge and perception of prescribers towards rational medicine use in the Ashanti Region of Ghana. *PLOS ONE, 19*(10), e0308406. https://doi.org/10.1371/journal.pone.0308406

Hailesilase, G. G., Welegebrial, B. G., Weres, M. G., & Gebrewahd, S. A. (2024). WHO/INRUD prescribing indicators with a focus on antibiotics utilization patterns at outpatient department of Adigrat General Hospital, Tigrai, Ethiopia: A retrospective cross-sectional study. *Antimicrobial Resistance & Infection Control, 13*(1), 133. https://doi.org/10.1186/s13756-024-01490-6

Hossain, M. J., Jabin, N., Ahmmed, F., Sultana, A., Rahman, S. M. A., & Islam, M. R. (2023). Irrational use of antibiotics and factors associated with antibiotic resistance: Findings from a cross-sectional study in Bangladesh. *Health Science Reports, 6*(8), e1465. https://doi.org/10.1002/hsr2.1465

Khan, A., Al-Subari, A. M. A., Mushtaq, S., Hameed, K., Abbas, S., Iqbal, M., Dong, Y., Feng, W., & Fang, Y. (2025). Evaluating rational drug use in developing countries: A cross-sectional analysis of prescribing patterns against WHO indicators in Pakistan and Yemen. *Pharmacology Research & Perspectives, 13*(6), e70174. https://doi.org/10.1002/prp2.70174

Mekonnen, B. D., Ayalew, M. Z., & Tegegn, A. A. (2021). Rational drug use evaluation based on World Health Organization core drug use indicators in Ethiopia: A systematic review. *Drug, Healthcare and Patient Safety, 13*, 159–170. https://doi.org/10.2147/DHPS.S311926

Nyabuti, A. O., Okalebo, F. A., & Guantai, E. M. (2020). Examination of WHO/INRUD core drug use indicators at public primary healthcare centers in Kisii County, Kenya. *Advances in Pharmacological and Pharmaceutical Sciences, 2020*, Article 3173847. https://doi.org/10.1155/2020/3173847

Shetty, Y., Kamat, S., Tripathi, R., Parmar, U., Jhaj, R., Banerjee, A., Balakrishnan, S., Trivedi, N., Chauhan, J., Chugh, P. K., Tripathi, C. D., Badyal, D. K., Solomon, L., Kaushal, S., Gupta, K., Jayanthi, M., Jeevitha, G., Chatterjee, S., Samanta, K., … Kshirsagar, N. (2024). Evaluation of prescriptions from tertiary care hospitals across India for deviations from treatment guidelines & their potential consequences. *Indian Journal of Medical Research, 159*(2), 130–141. https://doi.org/10.4103/ijmr.ijmr_2309_22

Shire, Q. H., Sanni, O. F., & Tomori, M. O. (2025). Prevalence and factors associated with self-medication in a Nigerian rural community. *World Journal of Public Health, 10*(4), 467–475. https://doi.org/10.11648/j.wjph.20251004.14

Siele, S. M., Abdu, N., Ghebrehiwet, M., Hamed, M. R., & Tesfamariam, E. H. (2022). Drug prescribing and dispensing practices in regional and national referral hospitals of Eritrea: Evaluation with WHO/INRUD core drug use indicators. *PLOS ONE, 17*(8), e0272936. https://doi.org/10.1371/journal.pone.0272936

Xia, M., Liu, Q., Ma, L., Wen, J., Xue, Y., Hu, H., Li, M., & Wei, H. (2025). Developing an evaluation index system for service capability of internet hospitals in China: Mixed methods study. *Journal of Medical Internet Research, 27*, e72931. https://doi.org/10.2196/72931