ORIGINAL RESEARCH

Prescribing for Patients Seeking Maternal and Child Healthcare in Sierra Leone: A Multiregional Retrospective Cross-Sectional Assessments of Prescribing Pattern Using WHO Drug Use Indicators

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Purpose: Rational use of medicines is a necessary constrict towards increasing access for those that desperately need them in society. In this study, we assess medicines prescribing patterns in healthcare facilities implementing free healthcare policy for pregnant women, lactating mothers and children under the age of five in Sierra Leone.

Materials and Methods: Using WHO drug use indicators, we evaluated prescription records from the pharmacies of four hospitals; one from each of the four regions in Sierra Leone. To study prescribing indicators, we systematically sampled 1200 prescriptions overall (300/hospital) retrospectively spanning a year, from June 2017 to July 2018. In evaluating patients care indicators, we randomly sampled 120 (30/hospital) patients encounter prospectively. We used MS Excel 2016 and IMB SPSS in data analysis, and p< 0.05 was considered significant for associational analysis.

Results: The average drug per prescription was 3.6 (SD=1.3) overall, 3.5 (1.3) for children under five and 3.4 (1.4) for pregnant women/lactating mothers. Eighty-seven percent of prescriptions for under-five children contains antibiotics as opposed to 68.4% of prescriptions for pregnant women/lactating mothers. More injections were prescribed per encounter for pregnant women/lactating mothers 23.2% than for children under five 18.1%. Overall, generic prescribing and prescribing from the National Essential Medicines List were 74.9% and 73.8%, respectively. None of the studied health facilities dispensed all of the prescribed medicines. The most prescribed pharmacological class of drugs were antibiotics, and paracetamol was the most commonly prescribed drug.

Conclusion: Following WHO drug use indicators used in this study, drugs were irrationally prescribed within government hospitals providing free healthcare in Sierra Leone. Sustainability of the free healthcare scheme will require efficient medicine supply and management strategies. Therefore, the formulation of stewardship programs and/or an active Drug and Therapeutics Committee may be necessary to optimise drug use in these hospitals.

Keywords: prescribing pattern, rational drug use, drug utilisation, free healthcare, Sierra Leone

Introduction

Prescribing medicines based on clinical evidence, at the correct dose, for the required duration and at an effective cost to the patients, their family, or the society constitute appropriate and rational use of medicines.[1–3] Healthcare providers' adherence to rational prescribing has been shown to contribute to a decrease in

inpatient hospital stay, minimise adverse drug reactions and toxicity, improve the quality of life and productivity of patients.[4] At the health system level, rational prescribing contributes to reducing wastage and prevent the emergence of resistant organisms.[2] However, research evidence suggests otherwise, for instance, the World Health organization (WHO) estimated that more than 50% of all drugs were inappropriately prescribed, dispensed or sold globally.[5,6] Constituent of irrational drug use includes; under and over-prescribing,[7] selecting branded over generic drugs, indiscriminate prescription of injections, prescribing not in accordance with standard treatment guidelines (STG) or not from the Essential Medicines List (EML)[2,8] and selection of unjustified combination therapies that are relatively expensive with no added advantages than single products.[9]

Such an untoward effect of irrational prescribing as reported in previous studies is enormous.[1,2,5,10,11] It has been proposed that a dollar is needed to salvage the unfavourable consequence resulting from a dollar spent on medication. Countries like Sierra Leone classified as low-income countries[12,13] suffer the most due to fragile health systems, limited resources,[5,10] lack of active monitoring systems and policies for centralised medication usage[14,15] shortage of professional prescribers, and widespread empiric prescribing.[16]

Sierra Leone has a population of about seven million and is divided into four provinces: North, East, South, and Western area.[17] The country faces substantial health challenges with a high prevalence of infectious diseases; the most common are malaria, tuberculosis, diarrhoea and acute respiratory infections.[18] Although not well documented, non-communicable diseases are on the rise[19] with cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes being the standouts.[20] To address the abysmally high maternal and under-five mortality rate, the government introduced a free healthcare (FHC) policy: for under five, lactating mothers and pregnant women.[20] The FHC policy was enacted to removing all healthcare-related costs, which were considered as barriers to accessing healthcare by these patient groups. With all progress made towards delivery and uptake of maternal and child healthcare over the years, challenges remain with financing, because demand exceeds available resources.[21] Drugs alone account for 30% of the total expenditure of the FHC scheme[21,22] promoting the need for rational prescribing. No previous studies have reported the pattern of drug utilisation within the framework of the FHC on a multiregional scale.

The WHO has developed standardised methods for studying medicine utilisation using specific drug use indicators. This protocol aims at providing broader insight into the extent of rationality in drug usage in healthcare facilities. An understanding of how drugs are used within a health system will enable a comparison of results and helps create informed policy formulation in managing health resources which is an essential aspect of patient care.[23] There have been several of these studies in Pakistan,[24] Nigeria,[25] Iran,[7] Egypt,[26] China,[11] Ethiopia,[2,9] and even in Sierra Leone.[1,27]

Findings from the studies in Sierra Leonean[1,27,28] show medicines are inappropriately used in public hospitals. Nonetheless, the most common limitation to all these studies is that they are all localised to one city or one healthcare facility and are not centred on FHC beneficiaries hence not representative nationally. Therefore, there is a need for a multiregional study that will give a national picture of medicines use within public hospitals, thereby providing baseline information for future research.

The primary objective of this study is to assess and compare prescribing patterns of Children under age five and pregnant women/lactating women utilising FHC services from public hospitals in Sierra Leone, using WHO methodology on "How to investigate drug use in health." These findings will inform evidence-based policies towards rational medicines use within the FHC scheme in Sierra Leone.

Materials and Methods
Study Design and Setting
In this study, we used retrospective and prospective cross-sectional designs, adhering to guidelines published by the WHO on 'how to assess drug use in health facilities'[29] to evaluate health facility, patients, and prescribing indicators. Details of these indicators include;

Prescription indicators: average medicines per prescription, percentage encounter with an antibiotic prescribed, percentage of encounters with an injection prescribed, percentage of drugs prescribed by generic name, and from the national essential medicines list (NEML).

Patient care indicators: percentage of prescribed medicines actually dispensed.

Facility indicators: the availability of a copy of the NEML.

We retrospectively collected prescription data of patients from prescription leaflets stored at the pharmacies to access prescribing patterns. According to the free healthcare policy, all medicines prescribed must be dispensed free of charge to all patients within the free health category of beneficiaries. We, therefore, prospectively collected dispensing data, ie, patients care indicators, to evaluate the extent to which hospitals dispensed medicines prescribed.

In Sierra Leone, each of the four regions, except for the Western area, has one regional hospital, which was selected for data collection. In an instance were prescriptions stored within the pharmacy of the selected regional hospital did not span a year, as in the case of Kenema Government hospital in the Eastern region, a secondary hospital was randomly selected within the same region. In the western area, we randomly selected one secondary hospital. We collected data from Lumley government hospital in the Western area; Kono government hospital is in the eastern region, Makeni government hospital in the north and Bo government hospital in the southern region. All hospitals were anonymised and no unique identifiers were recorded.

Sample Size Estimate and Sampling

With regards to evaluating prescribing indicators, the WHO recommends a minimum of 600 prescriptions with at least 100 from each health facility to be reviewed.[29] We, however, sampled 300 prescriptions systematically[23] of patients seeking free healthcare services from records stored at the pharmacies in each of the four hospitals, spanning a 1-year time frame (June 2017 to July 2018) to account for seasonal variation. To assess medicines prescribed that were actually dispensed, we randomly sampled 30 prescriptions prospectively of the same patients' group at the selected hospital pharmacy on the

day of the study. Additionally, all Pharmacists-in-charge were interviewed about facility indicators.

The principal investigator (PI) oversaw the data collection process with assistance from two trained pharmacy students. From each prescription record, we collected patients' characteristics (age, category of free healthcare, and sex), names, and dosage forms of prescribed medication. We only collect information on the number of drugs prescribed and dispensed for prescription sampled prospectively to assess the proportion of prescribed medicines dispensed. We collected data between June and September 2018.

Data Analysis

Data were analysed using MS Excel and SPSS version 21.0 software (IBM Corporation, Armonk, NY, USA). Descriptive statistics, frequencies, means, standard deviations, and percentages were computed following the WHO manual. We use Fischer exact two-tailed tests to determine the association between patients category and being prescribed medications that have a high prescribing rate. $P < 0.05$ was regarded statistical significance. The results are presented in tables and charts.

Results
Facility and Patient Care Indicator

Table 1 shows that all hospitals have the latest version of the NEML updated in 2016, and all drugs listed in it were identified by their International non-proprietary name (INN). There were no antimicrobial stewardship programs in any of the hospitals; however, all had established Drug and therapeutics committees (DTC) at the time of the study. Notwithstanding, only the DTC in Hospital C was effective and active. None of the hospitals dispenses 100% of the prescribed medicines as will be expected for free healthcare beneficiaries. Hospital B

Table 1 Facility Indicators According to WHO Drug Use Assessment Facility and Patients Care Indicators That Enhance Rational Drug Usage and Show Facility Readiness to Provide Optimum Patients Care, Respectively

Facility Indicators	Hospital A	Hospital B	Hospital C	Hospital D
Drug and Therapeutics Committee (DTC)	Yes	Yes	Yes	Yes
Last meeting date of DTC	N/A	31-May-17	18-Aug-18	2014
Availability of NEML in the hospital	Yes	Yes	Yes	Yes
Latest revision date of NEML	4-July-16	4-July-16	4-July-16	4-July-16
Drugs identify as generics in NEML	Yes	Yes	Yes	Yes
Antimicrobial stewardship program	No	No	No	No
Drugs actually dispensed (n=30/hospital)[a]	75.0%	85.7%	63.1%	81.3%

Note: [a]Prospective sampling.

Table 2 Prescribing Indicators According to WHO Drug Use Assessment Comparing Key Prescribing Indicators for Children Under Five and Pregnant Women/Lactating Mothers According to WHO Drug Use Indicators

Prescribing Indicators Assessed	Children Under Five	Pregnant Women/Lactating Mothers	Overall	Optimal Level
Prescriptions analyzed	639	561	1200	–
Average drugs/prescription mean (SD)	3.5 (1.3)	3.4 (1.4)	3.6 (1.3)	≤3
Percentage of encounter with antibiotics prescribed	87.3	68.4	78.5	≤30
Percentage of encounters with injection prescribed	18.1	23.2	20.5	≤10
Percentage of drugs prescribed by generic	73.3	76.6	74.9	100
Percentage of drugs from national essential drug list	72.0	75.7	73.8	100

Abbreviation: SD, standard deviation.

(85.7%) and hospital C (63.1%) had the highest and lowest proportions of dispensed medicines, respectively.

Prescribing Indicators

We analysed an overall 1200 prescriptions (Table 2). The average number of medicines per prescription was 3.5 (SD=1.3) for children under five (U5) and 3.4 (SD=1.4) for pregnant women/lactating mothers (PL). Children under five (87.3%) had a higher encounter in which antibiotics were prescribed as in comparison to 68.4% for pregnant women/lactating mothers. Contrastingly, children under five had a lower encounter with an injection prescribed 18.1% than for pregnant women/lactating mothers 23.2%.

Association of Free Healthcare Category and Drugs with a Higher Prescribing Rate

We assessed the association of free healthcare category and medicines with a higher prescribing rate using Fisher exact test. There was a statistically significant difference between children under five and pregnant women/lactating mothers in the rate at which vitamin/dietary supplements (49.5% vs 55.9%, p=0.028); paracetamol (78.6% vs 68.2%, p < 0.0001), antimalarial (61.1% vs 34.8%, p < 0.0001) and paracetamol + an NSAID (0.6% vs 6.4%, p < 0.0001) were prescribed as shown in Table 3.

Commonly Prescribed Medicines and Their Classification

According to Figure 1, the most commonly prescribed pharmacological class for both categories of patients were antibiotics; children under five vs pregnant women/ lactating mothers (29.7% vs 23.3%) followed by NSAID, children under five vs pregnant women/lactating mothers (30.9% vs 23.9%). More antimalarial; children under five vs pregnant women/lactating mothers (18.4% vs 12.4%), and electrolyte supplements; children under five vs pregnant women/lactating mothers (3.6% vs 1.5%), were prescribed for children under five than for pregnant women/ lactating mothers; but less of vitamin/dietary supplements; children under five vs pregnant women/lactating mothers (16.7% vs 17.7%).

Table 3 Prescribing Pattern for Medicine with a High Prescription Rate Fisher's Exact Test on the Association of Free Healthcare Category and Been Prescribed with Medicine with a Higher Prescription Rate

Prescribing Pattern	Free Healthcare Category		P-value
	Children Under Five n=639	Pregnant Women/ Lactating Mothers n = 561	
Prescriptions with vitamin/dietary supplements	317 (49.5)	313 (55.9)	0.028
Prescriptions with four or more medications	314 (49.1)	305 (54.5)	0.64
Prescriptions with a paracetamol	503 (78.6)	382 (68.2)	**<0.0001**
Prescriptions with an antimalarial	319 (61.1)	196 (34.8)	**<0.0001**
Prescriptions with a paracetamol + an NSAID	4 (0.6)	36 (6.4)	**<0.0001**

Notes: Statistically significant p-values (*p*<0.05) are bolded. NSAID, nonsteroidal anti-inflammatory drug. The calculation was done within each category total percentage is not equal to 100%

A
Pregnant women/Lactating mothers

B
Children under five
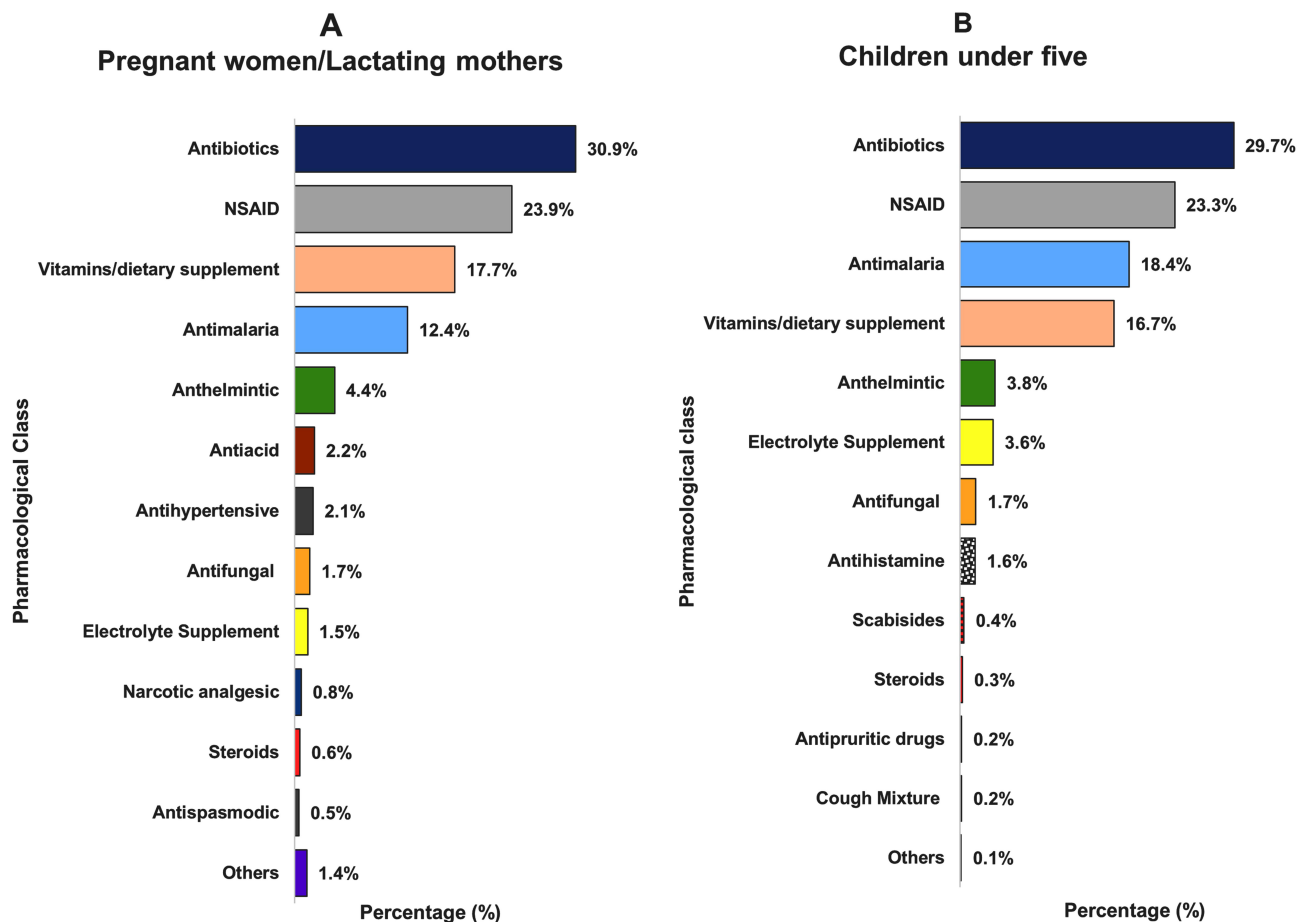
Figure I Prescribing pattern according to pharmacological classification. Pharmacological classification of the most prescribed medicines from the outpatients' department of hospitals providing free healthcare in Sierra Leone. Comparing (**A**) pregnant women/lactating mothers to (**B**) children under five.

Analysis of individual drugs shows that paracetamol (22.2%) was the most prescribed for children under five, followed by artemether/lumefantrine (16.7%), amoxicillin (11.4%), multivitamin (3.8%) and albendazole (3.7%) accounting for the top five Figure 2B. On the other hand, paracetamol (19.4%), amoxicillin (9.1%), metronidazole (9.1%), ferrous sulfate/Folic acid (8.5%) and arthemether/lumefantrin (8.3%) were the top five most prescribed for pregnant women/lactating mothers. See Figure 2A for details.

Distribution of Medicines, Antimicrobials, and Injections per Prescription

Further analysis of our results shows there was no significant difference in prescriptions containing four or more drugs between under-fives and pregnant women/lactating women (49.1% vs 54.5%, p=0.64) Table 3. A large proportion of prescriptions for children under five contain three (29.4%) and for pregnant women/lactating mothers,

four (32.1%) drugs, as shown in Figure 3A. The highest proportion of antimicrobial agent per prescription for children under five (47.0%) and pregnant women/lactating mothers (37.2%) was two (Figure 3B). More injections pre prescription was prescribed for pregnant women/lactating mothers than for children under five shown in Figure 3C.

Discussion

The findings show that the average medicines per prescription were 3.6 (SD=1.3) overall, children under five have a higher average when compare with pregnant women/lactating mothers. Both proportions were notably higher than the WHO cutoff point of less than or equal to three (≤3).[23,30] Further analysis of the extent of polypharmacy revealed that about half of all prescriptions for under five and pregnant women/lactating mothers had four or more prescribed medicines. These results are in line with a previous study[1] but higher than what was reported by
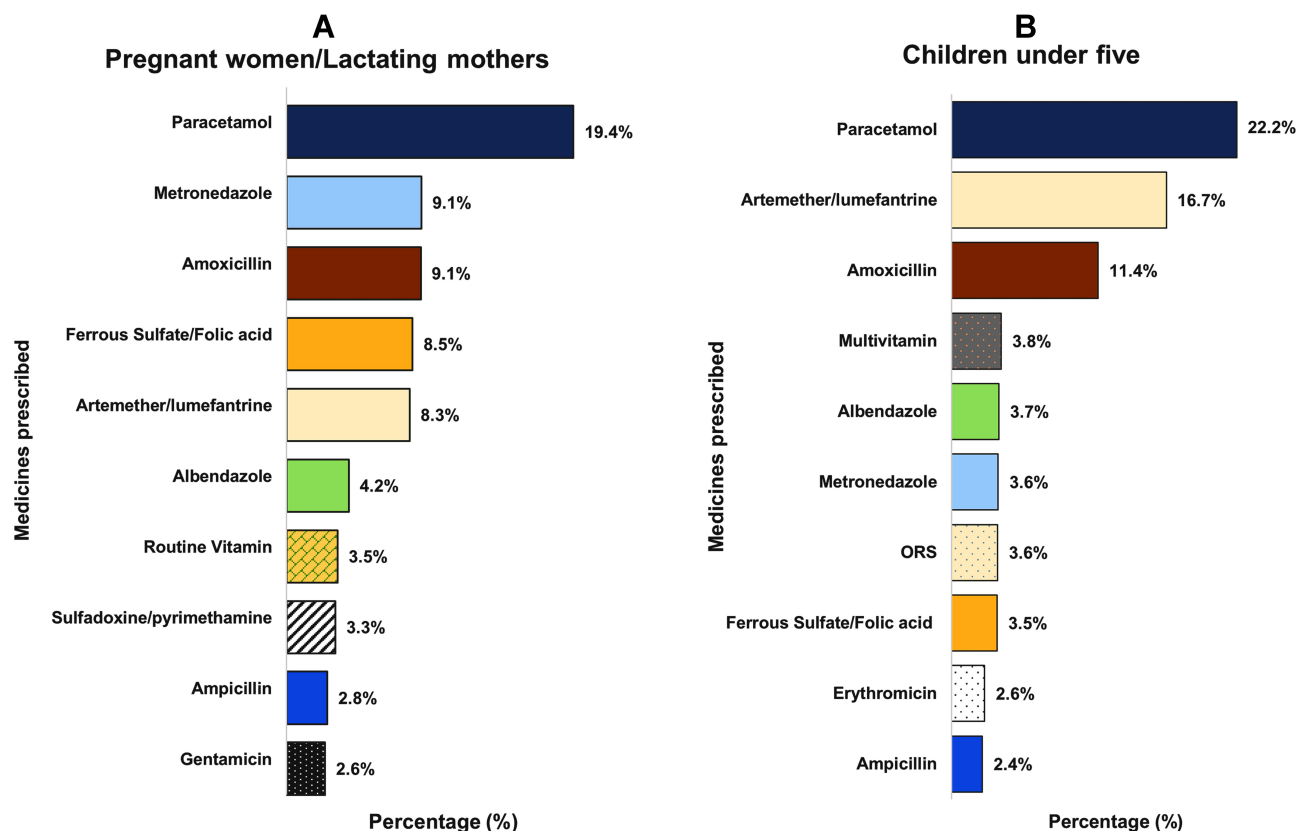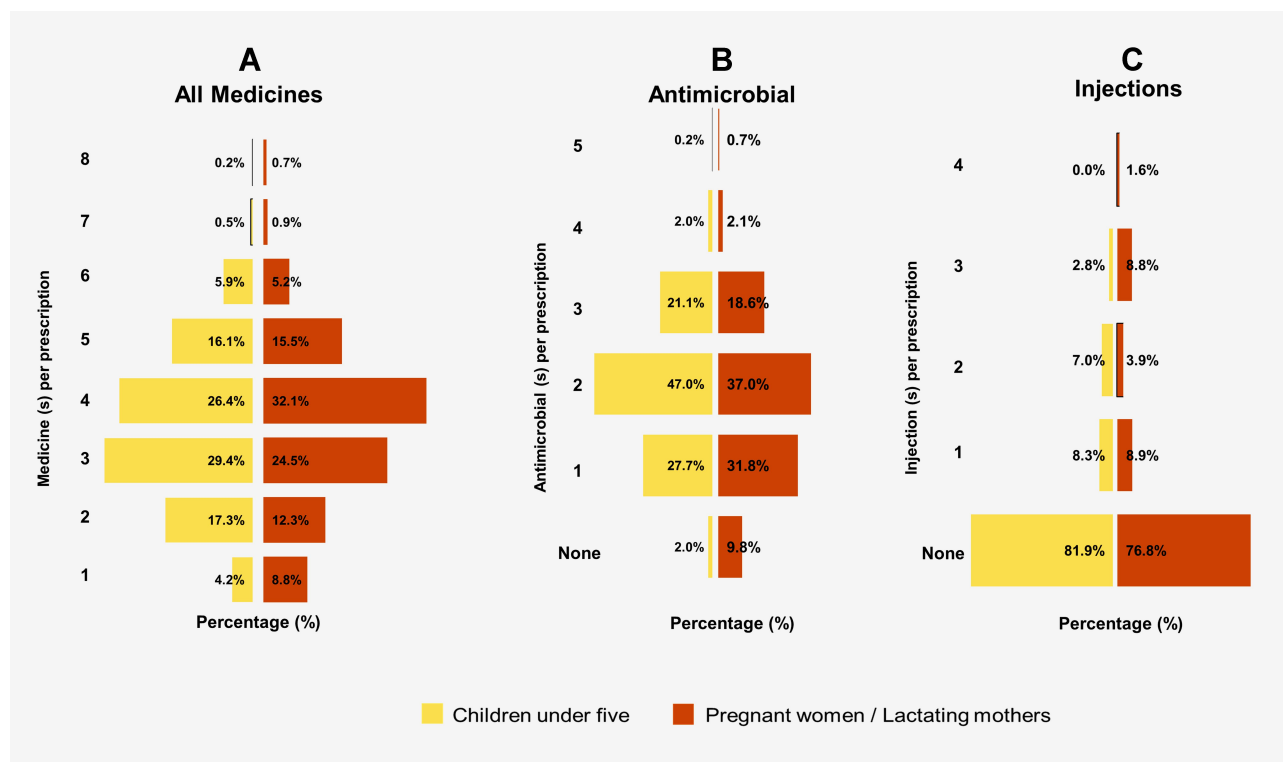
Figure 2 Distribution of the top 10 most prescribed medicine. Top 10 most prescribed medicines from the outpatients' departments of hospitals providing free healthcare in Sierra Leone; comparing (**A**) pregnant women/lactating mothers to (**B**) children under five.

Palmer within the same setting.[27] It was also higher than findings from studies in Nigeria,[31] India,[32] Pakistan,[15,24] China[11] and Ethiopia.[8] The extent of polypharmacy seen in this study may be due to the prevailing scarcity of highly qualified health workers in the health sector,[18] forcing the system to allow community health workers and nurses to prescribe. Also, injections were prescribed, in 20.5% of encounters, more for pregnant women/lactating mothers than for children under five years of age. Both prescribing rates were higher than the WHO threshold,[9,15] but lower than a study in Nigeria[33] and Egypt.[26] Perhaps attributed to the common notion perceived by both patient and health worker that injections produce more significant therapeutic results than tablets.[34] The development of hospital-based local formulary by an active DTC[35] and possibly adhering to it may be a step towards mitigation these trends.

Despite emerging concerns over the inappropriate and overuse of antimicrobial agents, their use among children under five was very high in Sierra Leone (Figure 3B). Furthermore, singling out antibiotics in the analysis, our finding shows that 8 out of 10 prescriptions for children under five and about two-thirds of prescriptions for

pregnant women/lactating mothers contain an antibiotic. The rate of use of antibiotics presented in this report is lower than a study in Ethiopia[9] but higher than what the WHO recommended.[23,26] Also, higher than previous reports from in Sierra Leone.[1,27] Underscoring a likely increase in the trend of antibiotic use in the public sector over time. The basis for the high use of antimicrobials is complex and challenging to establish due to abysmal data management in the country. Nevertheless, possible explanations may be due to high infectious disease prevalence in the country or as a result of increased uptake of the FHC scheme in which all healthcare services including all medicines, are free for these groups of patients. More evidence is needed for definitive conclusions; nonetheless, the antimicrobial audit program might help in their rational use.[7]

The initiation of free healthcare was on the pretext that financial barriers were the primary deterrent affecting healthcare uptake, and the most affected are women and children under five.[21,36] Across all health facilities studied, none of their pharmacies were able to dispensing all prescribed medicines to patients seeking FHC

Figure 3 Proportion of medicines, antimicrobial and injections per prescription. Comparing the proportion of (**A**) all medicines, (**B**) antimicrobials and (**C**) injections prescribed per prescription between children under five and pregnant women/lactating mothers. Data from the outpatients' departments of hospitals providing free healthcare in Sierra Leone.

services, as will be expected. No previous data on this indicator to compare our results with exists, even so, prior reports highlighted FHC patient dissatisfaction with the unavailability of medicines in public health facilities.[21] Contributing to the general lack of confidence in the health system, increase use of informal healthcare approaches,[37,38] encourages self-medication, non-adherence to dosage schedules and the purchase of low-quality or falsified medicines because patients cannot afford full dosage nor quality regiments.[13,38] Healthcare workers had also pointed to the challenges that remain in the procurement and supply of drugs,[39,40] and recommends a pull supply system to be implemented, thereby reducing stock out of medicines in healthcare facilities.[36,40] Furthermore, drug shortages may be the result of corrupt practices in the distribution and management of drugs and medical supplies,[41–43] or ineffective third party drug procurement agents, which may contribute to delay in the time for drugs to reach the end-users.

The extent of prescribing from the NEML and by generic name was lower than 100% but higher than previous findings.[1,27] The overhauling in the health system, including reforms in the national pharmaceutical sector[18],

may have influenced the increased adherence to the NEML after the introduction of the FHC scheme.

The most common diseases in Sierra Leone are; malaria, which affects the entire population, tuberculosis, acute respiratory infections, and diarrhea,[19] anemia is also highly prevalent.[20] This is reflective of the most commonly prescribed drugs classes: antibiotics, NSAIDs, anti-malarial, vitamins/dietary supplements. Paracetamol was the most prescribed drug in the OPD of public hospitals. This finding is in line with previous studies in Sierra Leone,[1] Ethiopia[8] and Nigeria.[25] Nonetheless, specific prescribing patterns for drugs and drug combination seem unjustifiable; for instance, there was high prescribing of paracetamol and paracetamol plus NSAID combination (Table 3). Anecdotal evidence suggests paracetamol is occasionally prescribed as an incentive to encourage patients' patronage with antenatal and postnatal care clinics. Such practice amounts to irrational medicines uses and increase wastage. Health literacy targeted at patients and hospital policy on rational prescribing may be necessary to halt such practice.

We believe our study findings are representative of the norm in public health facilities nationally, but there are

limitations that readers need to consider when interpreting the results. First, we were unable to link patient diagnosis with drugs prescribed, while we can certainly say there was irrational prescribing based on the indicators used and prescribing pattern observed; we cannot make conclusions based on the disease's condition of patients. Second, the most common non-dispensed medicines were not known; therefore, issues of incomplete dosages are mere assumptions. Also, we were unable to establish the influence of patients' age and sex on prescribing patterns. From the retrospective data, we know drugs were prescribed, but we are not sure if they were dispensed and eventually used correctly. Thirdly, there may be missing data or inaccurate data because the sample was drawn from hard copies of prescriptions stored at the pharmacy. In the future, an electronic database may help to capture accurate prescribing data. Finally, some indicators like medicines cost per prescription, dispensing and consulting time, and patients' knowledge assessment were left out due to constraints in the collection of data.

Conclusion

This study provides baseline data on the general nature of medicine used from hospitals across all four regions in Sierra Leone. From our findings, drugs are irrationally used in health facilities providing FHC as per WHO standards. There was a high and unjustified use of antimicrobial, paracetamols, injection and combination therapies.

Potential strategies towards rational medicines use in Sierra Leone should be holistic, targeting prescribers, dispensers, policymakers, the pharmaceutical industry and patients. Policymakers should introduce monitor and continuously improve drug use policies and programs,[44] like DTC[35] and antimicrobial stewardship (AMS)[45] nationally. When active, DTC and AMS have been proven to reduce irrational prescribing, increase medicine access and reduce wastage. Also, prescribers and dispensers should adhere to local treatment guidelines and good pharmacy practice, respectively, and continuous educational courses should emphasize on rational medicine use. Collectively, these measures may contribute to saving taxpayers money, effective use of donor resources, increase access to medicines and hence sustainability of the free healthcare policy.

Abbreviations

WHO, World Health Organization; STG, standard treatment guidelines; EML, Essential Medicines List; FHC, free healthcare; NEML, National Essential Medicines List; INN, International Non-Proprietary Name; DTC, Drug and Therapeutics Committees.

Data Sharing Statement

All data in this study are available upon request from the corresponding author.

Ethics Approval

The study was approved by the Health Science Center of Xi'an Jiaotong University, Xi'an, China (Ref: 2018-486) and the Sierra Leone Ethics and Scientific Review Committee Ministry of Health and Sanitation. All participants consented to the research and were assured of their anonymity.

Acknowledgments

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

Disclosure

The authors report no conflicts of interest for this work.

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