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RESEARCH ARTICLE

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Assessment of Rational Medicines Prescribing in Healthcare Facilities in Four Regions of Tanzania

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Abstract

Objective: The purpose of the study was to measure rational medicines prescribing in healthcare facilities from selected regions in Tanzania with focus on WHO/INRUD core medicines use indicators. **Methods:** The study is across-sectional and a total 2067 prescriptions were collated and studied from 67 health care facilities in four regions of Tanzania. WHO/INRUD core medicines use indicators were employed and these are; proportions of encounters with an injection prescription, % of prescriptions with an antibiotic, polypharmacy, use of generic name and medicines prescribed from National Essential Medicines List was determined. Collected data were analysed using the Statistical Package for Social Sciences (SPSS) version 16.0, SPSS, Inc; Chicago, USA. Index of Rational Drug Prescribing (IRDP) was used to rank facilities to their level of rational medicines prescribing. **Results:** The proportion of prescriptions with injections was found to be 18.1% while that containing antibiotics was 67.7% and the average number of medicines per prescription was 2.3. The proportion of medicines prescribed by generic was 95.7%while one that contained medicines in line with the National Essential Medicines List was 96.7%. The overall IRDP for the current study was 3.81with optimal level of 5. Kilimanjaro region scored highest IRDP (3.35) while Mbeya region scored the least (IRDP of 3.11). Rural healthcare facilities scored low IRDP (3.25) while for urban facilities IRDP was higher (3.42). IRDP for public healthcare facilities was higher (3.65) than for private facilities (3.02). **Conclusion:** Rational drug prescribing in Tanzania is not yet optimal leading to over-prescribing of antibiotics and injections.

Key words: Rational Prescribing, Essential Medicines, Inappropriate Use, Healthcare Facilities, Tanzania.

INTRODUCTION

Rational prescribing and use of medicines is defined as "Patients are prescribed and receive their medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community.[1] Appropriate medicines use by the communityis a precondition for quality health care provision, prevention of resistance, reducing the occurrence of adverse events, and efficient use of

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resources.Inappropriate use of medicines has been an issue of concern all over the world and the outlooks in developing countries are more severe.[2] It is estimated that 60% of medicines in public health facilities and 70% of medicines in private facilities were prescribed and sold inappropriately in developing countries, which leads to the decreased safety and quality of health care as well as enormous wastage of health resources.[3]

Inappropriate use of medicines results in wastage of scarce resources and widespread health hazards. Examples of inappropriate use of medicines include: use of too many medicines per patient ("poly-pharmacy"); inappropriate use of antimicrobials, often in inadequate dosage, for non-bacterial infections; over-use of injections when oral formulations would be more appropriate; failure to prescribe in accordance with clinical guidelines; inappropriate self-medication, often of prescription-only medicines; non-adherence to dosing regimens. Worldwide, it has been estimated that 50% of all patients fail to take their medication as prescribed or dispensed, in other words do not adhere to treatment.[4]

Consequences of inappropriate use include; adverse medicines events that may eventually cause significant morbidity and mortality. In the United States of America for instance they rank among the top causes of death. Antimicrobial resistance is dramatically increasing worldwide in response to antibiotic overuse. Furthermore, the use of unsterile injections has been found to be associated with the spread of blood borne infections, such as hepatitis B and C and HIV/AIDS.[4]

In China, about 2,500,000 inpatients per year are closely related to adverse drug reactions and almost 60% of deaf and dumb children have resulted from irrational use of drugs.[5] In addition, misuse of antibiotics, overuse of injections, inadequate treatment of serious illness, self-medication of prescription drugs, etc. are common practices in China.[6] Another study conducted across ten provinces in China in 2010 showed higher percentage of prescriptions containing antibiotics (48.3%) exceeding the optimal level of 30% and low percentage (64.12%) of essential medicines list prescribed.[7] In Chinese study, injection were highly prescribed posing risks of transmission of blood-borne infections.

In a study conducted at tertiary pediatric hospital in Sierra Leone, prescribing habits for under-five out patients were far from being rational.[8] In that study percentage of encounters with antibiotics was 74.8 while percentage of medicines prescribed from the National Essential Medicines List was 70.6. Percentage of drugs prescribed by generic was 71.0 and the average number of medicines prescribed per encounter was 3.77. The authors concluded that there were needs of improvement, especially with respect to poly-pharmacy, antibiotics and injection prescribing.

Results of a baseline survey conducted in 2002 by WHO in Tanzania indicated that number of patients received antibiotics per encounter was 42%, the use of antibiotics for non-pneumonia Acute Respiratory Infection (ARI) was 90% and patient knowledge on dispensed medicines stood at 80%. The baseline survey also indicated 14% of patients were receiving injections and 6% of prescriptions had more than one antibiotic. Poly-pharmacy seemed not to be a challenge as average number of prescription per encounter was low standing at 1.8. The survey suggested overuse of antibiotics in Tanzania which posed a danger of antibiotic resistant bacteria.[9]

In 2010, a study conducted in Kilimanjaro region in Tanzania indicated that antibiotics such as ciprofloxacin was available in all 15 studied unauthorized drug outlets and could be purchased without a prescription from pharmacies and other drug stores.[10] The study pointed out high burden of infectious diseases in Tanzania and limited diagnostic facilities has resulted in empirical use of antibacterial. Another study by Viberg and colleagues that sought to determine patient and drug seller attitudes and behaviour towards antibiotics and resistance found that 24 percent of patients were sold antibiotics for ailments such as cough, stomachache, and diarrhea. In-depth interviews with patients who were sold antibiotics by medical officers found that 49 percent of those prescriptions were inappropriate.[11] A cross-sectional study conducted in drug stores in Coast and Morogoro regions in Tanzania using simulated client method ("mystery shopper") for data collection found that 30-35 percent of drug stores dispensed incomplete doses of antibiotics.[12]

We hereby report outcome of measured rational prescribing of medicines that was observed between July and October 2014 in four regions of Tanzaniafocusing on WHO/INRUD medicines use indicators.

MATERIALS AND METHODS

This was a cross-sectional study in which data were collected using both prospective and retrospective

methods. Data collection instruments were prepared, pre-tested, corrected and printed. Research assistants were trained on research methodology, ethics and on how to collect data.

The assessment was conducted in 4 regions of Tanzania mainland, namely Dar es Salaam, Kilimanjaro, Mwanza and Mbeya between August and October 2014. The four regions were purposefully selected because of presence of zonal medical stores and relatively better availability of medicines hence creating a favorable environment for conducting assessment of rational use of medicines. Similarly, in 2002 WHO did collect baseline data on Pharmaceutical Sector in Tanzania from those four regions.[9] Collecting data from these 4 regions provided opportunity for comparison of data collected previous by the WHO.

In each region two districts, one urban and one rural were randomly selected and studied. Similarly, public and private facilities within the selected districts were randomly picked and studied. In each facility exit encounters were randomly selected to examine prescriptions and knowledge of medicines use. Also observation during dispensing was conducted to determine dispensing time. The tool for capturing prospective data was used to collect this data. A retrospective data collection to determine prescribing habits was done by checking and recording patient records available at the facility. The tool for recording retrospective data was used to capture this information.

To estimate the minimum number of prescriptions or patient records (N) to be collected from either public or private facilities group, or rural and urban facilities group, a formula to calculate a sample size for two means wasemployed.[13]

A Prescribing Indicators Form was used to collect both prospective and retrospective prescribing information such as number of drugs prescribed, number of generics medicines prescribed, prescription with antibiotics, prescription with injection, and number of drugs on essential medicines list. Data collection exercises were conducted during the period of July to October 2014.

Data Analysis: WHO/INRUD core indicators to describe rational drug prescribing were used, they include; percentage of encounters with an antibiotic prescribed, average number of medicines per encounter, percentage of encounters with an injection prescribed, percentage of medicines prescribed by generic name and percentage of medicines prescribed from National Essential Medicines List (NEML). The collected data were analysed using the Statistical Package for Social Sciences (SPSS) version 16.0, SPSS, Inc; Chicago, USA. Percentages, averages and frequency counts were calculated using descriptive statistics.

In addition, assessment to determine levels of rational prescribing was done by employing the Index of Rational Drug Prescribing (IRDP). The IRDP was determined by adopting a previously validate method developed by Zhang and Zhi.[14]The method has been validated and used in medical and health research. The method consists of five indices derived from the WHO/INRUD prescribing indicators described above. The optimal level for each indicator is shown in Table 1 below as previously indicated by Joncheree and Melander.[15,16]

Each of the five prescribing indicators has an optimal index of 1; the closer to 1 the calculated index is, the more the rational the prescribing is considered to be. The index of polypharmacy was measured by the percentage of non-polypharmacy prescriptions; in this study, prescriptions with three or less medicines were considered non-polypharmacy. The generic name index and essential medicine index were measured by the percentage of drugs prescribed by generic name and from National Essential Medicines List (NEML) respectively. The index of rational antibiotic prescribing was defined as dividing the optimal level (30%) by the percentage of prescriptions with an antibiotic. The index of safety injection was calculated by dividing optimal level (10%) by percentage of prescriptions including the injection. The IRDP, a synthetic index which has a maximum value of 5, is calculated by adding up all the five indices above.

Table 1: Optimal levels of drug prescribing indicators

Prescribing indicators	Optimal level (%)	Optimal index
% Prescriptions including antibiotic	<30	1
% Prescription including injection	<10	1
% Drugs / medicines prescribed by generic name	100	1
% Drugs / medicines prescribed from NEML	100	1
% Polypharmacy prescription	≤3	1

NEML: National Essential Medicines List

Ethical issues: The study was requested by the Ministry of Health for policy guidance and did not require ethical clearance certificate. However, ethical principles for conducting medical research were adhered during implementation. Permission was requested from in-charges of health care facilities and where patients were involved their verbal consent was sought.

RESULTS

The minimum computed sample size of prescriptions for this study during tools pretesting was 240; however a total of 2067 prescriptions were collected from 67 healthcare facilities in four studied regionsin Tanzania which were used in data analysis in this study. Seven facilities were excluded during data analysis as most of their data were missing. Analysis also revealed missing 193 prescriptions.

The results on irrational drug prescribing are shown in Table 2. The average number of medicines per prescription was 2.3 while the percentage of prescription containing antibiotics was 67.7, and the percentage prescription with injection was 18.1. The percentage of drugs prescribed by generic name was 95.7, and the percentage of drugs from National Essential Medicines List was 96.7. The five medicines prescribing indicators varied across the 5 studied regions.

The four studied regions were ranked according to their IRDP as indicated in Table 3. The overall IRDP was 3.81 with the optimal level of 5. For this study, the IRDP above 4 was considered rational as well as an index above 0.8. Kilimanjaro region was ranked first with IRDP of 3.35 showing better rational prescribing than the rest of other regions while Mbeya region was ranked the last with IRDP of 3.12. The overall IRDP of 3.81 was made up of the index of antibiotic 0.44, the index of polypharmacy 0.88, the index of injection 0.55, the index of generic name 0.96 and that of essential medicines 0.97. The lowest indices are those of antibiotic and injection prescribing (044 and 0.55 respectively).

IRDP was also calculated for rural-urban setting and public-private health care facilities setting as shown in Table 4. Urban healthcare facilities had better IRDP of 3.42 while rural had IRDP of 3.25. Similarly, public healthcare facilities had better IRDP of 3.65 while private facilities had IRDP of 3.02.

DISCUSSIONS

Table 2: Indicators of rational drug prescribing across 5 regions of Tanzania

Region	% Prescriptions with antibiotics (95%CI)	Mean number of drugs per prescription (95%CI)	% Prescriptions with injections (95%CI)	% Drugs prescribed by generic name (95% CI)	% Drugs prescribed from essential drug list (95% CI)
Dar es Salaam	63.2(63.0-63.4)	2.4(2.3-2.5)	17.2(17.0-17.4)	95.2(95.0-95.4)	94.2(94.0-94.4)
Kilimanjaro	76.6(76.4-76.8)	2.2(2.1-2.3)	11.4(11.2-11.6)	93.6(93.4-93.8)	100.0(99.8-100.2)
Mbeya	67.8(67.6-68,0)	2.1(2.0-2.2)	23.8(23.6-24.0)	98.6(98.4-98.8)	99.2(99.0-99.4)
Mwanza	66.1(65.9-66.3)	2.6(2.5-2.7)	16.3(16.1-16.5)	94.0(93.8-94.2)	94.8(94.6-95.0)
Total	67.7(67.5-67.9)	2.3(2.2-2.4)	18.1(17.9-18.3)	95.7(95.5-95.9)	96.7(96.5-96.9)

Table 3: IRDP in healthcare facilities across 5 studied regions in Tanzania

Region	Index of Rational antibiotic Prescription	Index of Polypharmacy	Index of Safety Injection	Generic name Index	Essential Medicines Index	IRDP	Rank
Dar es Salaam	0.47	0.20	0.58	0.95	0.94	3.15	3
Kilimanjaro	0.39	0.14	0.88	0.94	1.00	3.35	1
Mbeya	0.44	0.28	0.42	0.99	0.99	3.11	4
Mwanza	0.45	0.27	0.61	0.94	0.95	3.22	2
Total	0.44	0.88	0.55	0.96	0.97	3.81	

Table 4: IRDP calculated by geographical location (rural/urban) and ownership (public/private) across 5 studied regions

Georaphical settings/ Ownership	Index of Rational antibiotic Prescription	Index of Polypharmacy	Index of Safety Injection	Generic name Index	Essential Medicines Index	IRDP	Rank
Rural	0.43	0.38	0.48	0.98	0.98	3.25	2
Urban	0.46	0.50	0.61	0.94	0.91	3.42	1
Total	0.44	0.88	0.55	0.96	0.97	3.81	
Public	0.44	0.68	0.60	0.96	0.97	3.65	1
Private	0.47	0.20	0.43	0.95	0.97	3.02	2
Total	0.44	0.88	0.55	0.96	0.97	3.81	

The results of this study provide valuable information on prescribing patterns of healthcare providers at healthcare facilities across 4 regions in Tanzania. In addition, they provide information on the levels of rational prescribing of medicines in the studied regions and in health care facilities settings.

Assessment ofrational prescribing suggested by WHO/ INRUD core indicators include five dimensions of antibiotic, polypharmacy, injection, generic name and essential medicines.[17] IRDP, a measure of what extent prescription met the optimal level of rational drug prescribing, was synthesized by addition of those five dimensions. The IRDP for this study was 3.81 with optimal level of 5, implying that drug prescribing was still farfrom rational in the studied regions of Tanzania.

The percentage of prescriptions containing antibiotics was 67.7 while the optimal level is 30%. The index of rational antibiotic prescribing was 0.44 indicated that rational degree of antibiotic prescribing is around 44% which is far from optimal level. Rural healthcare facilities have lower index of antibiotics 0.43 than urban facilities where the index was 0.49. This implies that antibiotic prescribing was relatively more rational in urban healthcare facilities than in rural. Also antibiotic prescribing was more rational in private healthcare facilities with index 0.47 than in public facilities where index of rational prescribing was 0.44.

Index of rational antibiotic prescribing 0.44 is the lowest among the five indices implying inappropriate use of antibiotics in studied healthcare facilities. Overuse of antibiotics is a global challenge where multiple factors such as market forces, behaviour of the health systems, healthcare providers and drug companies could be associated with. Inappropriate uses of antibiotics cause development of drug resistance microbes which lead to prolonged hospital stay, death and increased healthcare expenditure.[18] Injection had the second lowest index of rational prescribing of 0.55 implying overuse of injections in the studied healthcare facilities. Overuse of injections is linked with transmission of blood-borne infections such as hepatitis C, hepatitis B and human immunodeficiency virus which are difficult to treat and cause economic loss. This necessitates immediate attention to curb overuse of antibiotics as well as injections. Interventions to improve antibiotic prescribing practices among healthcare providers in developing countries including Tanzania are needed [19], and education on safety injection on prescribers may help reduce injection prescribing.[20] Tanzania has finalised preparation of her National Antimicrobial Resistance Action Plan following WHO request for member states to prepare national action plans for curbing and preventing misuse of antibiotics and other antimicrobials.

Overuse of antibiotics can lead to bacterial resistance, which is a very intractable and difficult problem to deal with.[21] Overuse and misuse of antibiotics have also given rise to increased risk of side effects and high costs. There is close similarity of Chinese study results to our study results which indicate high use of injection misuse of antibiotics.

Polypharmacy defined as prescribing more medicines than are clinically indicated or prescribing more number of medicines inappropriately. In our study, the polypharmacy index was 0.88 which is not far from to the optimal level of 1 indicating that occurrence of polypharmacy across the studied facilities was relatively low posing minimal risk. However, rural healthcare facilities had the lowest index of 0.38 compare to urban facilities which have index

of 0.50meaning poly-pharmacy was more prevalent in rural facilities than in Urban. Overuse of injections was also noted across the studied healthcare facilities with the index of safety injection 0.55. The index of safety of injection was much lower in rural facilities 0.48 and alsoin private healthcare facilities 0.43. This implies overuse of injection in rural and in private healthcare facilities. The generic name index of 0.96 and essential medicine index of 0.97 were close to the optimal level of 1, indicating that generic names and essential medicines were satisfactorily used by prescribers in healthcare facilities across the 5 studied regions.

The overall polypharmacy index of 0.88 was somehow encouraging in our study except when analysis was done on geographical location to consider rural-urban healthcare facilities. Polypharmacy is believed to be associated with increased healthcare cost and may cause prolonged hospital stay due to adverse reactions and drug interactions.[7] In our study an average of 2.3 medicines was prescribed per patient, indicating that polypharmacywasnot a major problem affecting rational medicines use in Tanzania. This is comparable by a study done in Gambia in which few medicines were prescribed per each encounter.[22] Our results did not deviate much from previous WHO study in Tanzania where an average of 2.2 medicines was prescribed per patient.[9]

Essential medicines list and generic prescribing are commonly used in drug utilization interventions across the globe for healthcare cost reduction.[23] Essential medicines are usually carefully selected to treat common diseases and are considered cost-effective. The high percentage of drug prescribed from essential drug list (96.7%) and those prescribed by generic name (95.7%) suggests that Tanzania has done well in advocating the use of national essential medicines list and generic prescribing. The current National Essential Medicines List and Standard Treatment Guidelines of 2013 is the fourth version to be printed.[24] The first version was printed in 1991. However, more efforts are needed to maintain the high percentage of prescribing essential medicines as well as prescribing by generic names.

Rural healthcare facilities need special interventions to improve in medicines prescribing indicators such as rational antibiotic prescribing, polypharmacy and injection safety. Index of polypharmacy is the lowest in rural (0.38) as well as in private healthcare facilities (0.20) meaning more medicines are prescribed than thoserequired. Public urban facilities in Tanzania usually enjoy presence of qualified prescribers than rural counterparts where some of facilities are manned by medical attendants which are the lowest cadre in medical field. This results in poor health services at the rural areas. Similarly the private sector prescribing of medicines was less rational than the public sector; hence IRDP of 3.65 in public facilities indicates much better rational prescribing of drugs than in private facilities (IRDP 3.02). Since private facilities operate in a commercial way, they tend to prescribe more medicines than requiredfor profit gain. Also lack standard treatment guidelines and trainings in rational medicines use in private outlets can be a contributing factor.

The findings of this study are in disagreement with the previous study in which use of antibiotics was relatively lower and mean prescribed medicines was low.[9] The possible explanation for these differences could be due tolack of National Anti-microbial Prescribing Policy and strategies to curb misuse and over-prescribing of antibiotics. In current study, data were collected in four different zones of Tanzania by competent and well trained research assistants. Data were collected from urban and rural facilities and were analysed by considering types of facilities (public/private) and geographical location (rural/urban).

Limitations: Reasons for inappropriate drug prescribing such as overuse of injections and misuse of antibiotics could not be analysed in the present study. The study did not conduct analysison supplementary drug use indicators such as ascertainingto whether prescribed medicines were related to medical condition of the patients.

CONCLUSION

Rational drug prescribing in Tanzania is not yet optimal leading to over-prescribing of antibiotics and injections. Concerted efforts must be made to improve use of medicines in the country by creating and enforcing national medicines prescribing policies, rising awareness among prescribers and community on rational prescribing and use of medicinesand enforcing implementations and use of standard treatment guidelines (STGs).

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CONFLICT OF INTEREST

None

ABBREVIATIONS

WHO: World Health Organisation; INRUD: International Network for Rational Use of Medicines; IRDP: Index of Rational Drug Prescribing; NEML: National Essential Medicines List; MoH: Ministry of Health; ARI: Acute Respiratory Infection.

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