

General Practitioners' Prescribing Patterns at Primary Healthcare Centers in National Health Insurance, Gezira, Sudan

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Abstract

Background The appropriate use of medicines is essential for the provision of quality health services, patient safety, and the rational use of health resources. In Sudan, general practitioners (GPs) provide 80 % of insured patients' health services. Pharmaceutical service costs have been increasing since 2010.

Objectives We aimed to use the World Health Organization (WHO) and International Network for the Rational Use of Drugs prescribing indicators to assess prescription quality among GPs in different types of primary healthcare centers (PHCCs) within the National Health Insurance Fund (NHIF) in Gezira State, Sudan.

Method We followed established WHO guidelines to conduct a cross-sectional retrospective study. The study was carried out over 6 months and involved 197 GPs with valid prescriptions, representing 90 % of the total study population of 220 GPs. We collected a systematic random sample of 100 prescriptions for each GP and used Stata 12 to analyze the 19,700 prescriptions.

Results The mean \pm standard deviation number of medications was 2.55 ± 1.32 per patient; 46.32 % of drugs prescribed were generics; 54.71 % of prescriptions were

for antibiotics and 12.84 % were for injectable formulations; and 81.19 % of prescribed medicines were from the NHIF medicines list. The overall Index of Rational Drug Prescribing (IRDP) indicator was 3.39, and the average cost per prescription was 40.57 Sudanese pounds (SDG). Disregarding prescriptions for antibiotics, the prescribing quality of GPs in NHIF facilities was farther from optimal prescribing practice than those in State Ministry of Health-owned facilities and facilities owned by private groups, universities, and non-governmental organizations.

Conclusion The present study provides strong evidence of irrational prescribing practice among GPs, with significant disparities, particularly in terms of antibiotic overuse, generic drug underuse, and adherence to the NHIF medicines list.

Key Points

A cross-sectional retrospective study was carried out according to World Health Organization guidelines over 6 months and included 197 general practitioners (GPs) and 19,700 prescriptions.

This study revealed that the overall Index of Rational Drug Prescribing (IRDP) indicator for GPs was below the optimal prescribing practice level.

We found disparities in the IRDP between GPs at different health facilities. GPs at National Insurance Fund facilities scored lower than those at State Ministry of Health facilities or other health facilities such as those owned by private interests, universities, and non-governmental organizations.

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1 Introduction

The irrational use of medicines is a major problem worldwide and represents the primary source of medical waste and harm. The medicines component of the health services package is more variable and dynamic than other service components, particularly in terms of coverage, quality, and cost. In recent years, the use of medicines has increased in many countries [1]. The overuse of medicines is diverse [1], and drug-prescribing indicators in developing countries are suboptimal, with core indicators varying between countries. For instance, antibiotics and injectables are overused and generic medicines are underused in Sudan [2]. The overuse of medicines not only leads to the development of drug resistance and wastes resources but also increases morbidity and mortality [3, 4]. Thus, the appropriate use of medicines is an essential factor in the provision of quality health services, patient safety, and the rational use of health resources [5]. Low-quality prescribing is predominant in rural areas [6]. The World Health Organization (WHO) and the International Network of Rational Use of Drugs (INRUD) have developed widely used core prescribing indicators to assess the prescribing quality of primary healthcare facilities and to enable comparisons between health facilities and prescribers [5]. To our knowledge, no prescriber-based study has been conducted in Sudan; one study of the National Health Insurance Fund (NHIF) has been conducted in health facilities [7]. Previous studies have been based on the facilities sampling method (Table 1) and have revealed antibiotic overuse [8, 9], underuse of generic medicines, and overprescribing of injectables [10]. Other studies have revealed a relatively large average number of drugs per prescription and poor adherence to the Essential Medicines List (EML) [11]. These previous studies were conducted to investigate prescription patterns; however, our study

investigated the prescribing practices of general practitioners (GPs) and used the largest sample and a unique study unit. We used prescribing indicators as a benchmark among GPs at primary healthcare centers (PHCCs) and as a baseline for regular assessment of prescribing quality [12]. In Sudan, GPs provide 80 % of insured patients' health services. Pharmaceutical service costs have been increasing since 2010. The objective of this study was to use the WHO/INRUD prescribing indicator to assess the quality of prescribing among GPs at different types of PHCCs. We used the assessment regimen created by WHO/INRUD to evaluate prescribing performance according to the adopted standards to monitor the improvement of rationality in prescribing practice. Before rational prescribing can be promoted, the prescribing practices of those who provide 80 % of the services must be ascertained.

2 Materials and Methods

The study was conducted in Gezira State, which represents 27 % of NHIF; we targeted all GPs (220) providing services for NHIF subscribers at the primary healthcare level. These GPs provide services at three types of health facilities: (1) those owned by the NHIF, (2) those owned by the State Ministry of Health (SMOH), and (3) those owned by others (private interests, universities, and non-governmental organizations [NGOs]). Insured patients pay 25 % of prescription costs, and pharmaceutical services are provided through a network of pharmacies owned by the NHIF, SMOH, and others.

We collected 100 prescriptions for each GP according to WHO/INRUD guidelines for comparisons between prescribers [5]. The reference period of retrospective data collection was 6 months, representing the last quarter of 2014 and the first quarter of 2015. Prescription collection

Table 1 Previous prescribing quality studies in Sudan

Year	Area	Level	Mean no. drugs/ prescription	% of generic	% of antibiotics	% of injectable	% from EML
1991 [15]	N. province	PHCCs	1.4	63	63	36	–
1996 [8]	Kh State	PHCCs	1.9	48	73	22	98
1998 [16]	Kh State	Hospital and PHCCs	2.1	41	59	29	99
2004 [17]	Kh State	Teaching hospitals (2)	1.9	43	65	10.5	–
2007 [10]	Six states	PHCCs	2.3	44.6	66	27	73.5
2010 [9]	Kh State	PHCCs	2	43.2	71.8	13.7	92.7
2010 [18]	Kh State	Four pediatric hospitals	2	49.3	81.3	3.5	–
2012 [7]	Five NHIF states	PHCCs	2.6	54.2	64	14	99.3
2012 [11]	Kh State	Hospitals and pharmacies	2.8	37.3	54.3	38.6	72.8

EML Essential Medicines List, *Kh State* Khartoum State, *N. Province* Nile province, *NHIF* National Health Insurance Fund, *PHCCs* primary healthcare centers

was based on systematic random sampling, with an interval determined by dividing the GP's total prescriptions by 100. Of the 220 GPs, 197 (90 %) had valid prescriptions over the 6 months, and the total valid number of observations was 19,700 prescriptions.

2.1 Data Analysis

Trained technical professionals collected the data. We used the WHO/prescribing indicators investigation format [5]. Data were reviewed and entered twice in a Microsoft® Excel spreadsheet before being exported to Stata-12 for analysis. The prescriptions data were transferred to WHO investigation format, checked again for accuracy, entered into an Excel sheet, and individually checked once more for precision and completeness. We used the WHO/INRUD standard method for calculating prescribing indicators [5] (Table 2). The unit of analysis used was GP (100 prescriptions for each GP).

To determine prescribing rationality and quality at the GP level, we used the Index of Rational Drug Prescribing (IRDP) developed by Yuxin and Mingguang [14]. The IRDP for each GP was calculated by compounding the indices of the five prescribing indicators. The index of each prescribing indicator was calculated by dividing the optimal value by the achieved value for each GP. Moreover, for each type of health facility, the IRDP was applied for comparison. The overall prescribing indicators were calculated to determine the GP's prescribing pattern [6]. Finally, we analyzed 19,690 prescriptions from 197 GPs (10 invalid prescriptions were excluded). Data at the GP level were clustered to represent the three types of health facilities.

3 Results

The average number of medicines per prescription (2.55: maximum 15, minimum 1) indicated a poly-pharmacy pattern, with prescriptions involving antibiotics (54.71 %) and injectable formulations (12.84 %). A total of 81.19 % of the prescribed medicines were from the EML, and generics

accounted for 46.34 % of prescriptions, which is some distance from the optimal required level of 100 %. The average cost per prescription was 40.57 Sudanese pounds (SDGs) (Table 3). The prescribing indicators for all health facility types were less than optimal. Values for NHIF facilities were farther from the prescribing indicator standards than were SMOH and other health facilities, except for the percentage of prescriptions containing antibiotics (NHIF 45.91 vs. SMOH 57.24 vs. others 56.84 %) (Table 3).

The correlation between GPs and IRDP was statistically significant at $p < 0.001$. The optimal index is 5; however, the overall IRDP score for GPs was 3.39 (range 2.1–4.8). The prescribing quality indices revealed that prescribing practice was nowhere near the optimal index of 5, with NHIF facilities having a lower index (3.08) than SMOH facilities (3.46) and health facilities owned by others (3.75) (Table 3).

4 Discussion

In NHIF Sudan, GPs provide 80 % of insured patients' health services. Costs of pharmaceutical services have been increasing since 2010. The objectives of this study were to use the WHO/INRUD prescribing indicator to assess the quality of prescribing among GPs at different types of PHCCs. We conducted a cross-sectional retrospective study over 6 months that involved 197 GPs with valid prescriptions, representing 90 % of the total study population (220). A systematic random sample of 100 prescriptions was collected from each GP.

The study revealed that the mean number of medications per prescription was 2.55 ± 1.32 drugs, which represents poly-pharmacy according to the benchmark we applied of more than two drugs [13]. The difference between GPs was statistically significant at $p < 0.001$. The mean number of drug prescriptions was 2.55; this was much closer to the 2.6 found by a study conducted in NHIF facilities in 2012 in five other states [7]. The mean number of drugs per prescription was higher than most previously reported Sudanese studies when we excluded the studies by Mustafa [7]

Table 2 Adjusted prescribing standards from WHO and INRUD indicators

Prescribing indicators	Optimal level	Optimal IRDP
Mean medicines per prescription (whether or not drugs dispensed)	<2 [13]	1
Medicines prescribed by generic name (%)	100 [5]	1
Prescriptions with an antibiotic (%)	≤30 [5]	1
Prescriptions with an injectable dosage form (%)	≤10 [5]	1
Medicines prescribed from NHIF GP's medicines list (%)	100	1
Complementary indicator, average cost of prescription (SDG)	20.31 (proxy)	–

INRUD International Network for the Rational Use of Drugs, IRDP Index of Rational Drug Prescribing, NHIF National Health Insurance Fund, SDG Sudanese pound, WHO World Health Organization

Table 3 Prescribing indicators and health facility types

Type of health facility owner or operator	SMOH	NHIF	Other	Overall
Number of GPs	126	43	28	197
Average number of drugs per prescription	2.44	2.97	2.4	2.55
Medicines prescribed by generic name (%)	48.96	38.47	49.28	46.34
Prescriptions containing antibiotics (%)	57.24	45.91	56.84	54.71
Prescriptions containing injectable formulations (%)	12.55	15.58	9.97	12.84
Drugs prescribed from GP's medicines list (%)	82.97	72.65	89.27	81.19
Average cost of prescription (SDGs)	36.07	59.54	31.69	40.57
IRDP	3.46	3.08	3.75	3.39

GP general practitioner, IRDP Index of Rational Drug Prescribing, NHIF National Health Insurance Fund, SDG Sudanese pound, SMOH State Ministry of Health

and Mahmoud et al. [11], who reported 2.6 and 2.8 drugs per prescription, respectively (Table 1). When compared with other developing countries, the mean number of drugs per prescription in Sudan (2.55) was less than in Mali (3.2), Yemen (3.0), Uganda (2.9), Thailand (2.85), and Pakistan (2.7) [19–23]. However, GPs in Sudan prescribed a higher mean number of drugs per prescription than those in India (2.4), Tanzania (2.2), Saudi Arabia (2.08), and Malaysia (2.0) [24–27]. Collectively, NHIF facilities had a higher mean number of medications than other facilities (Table 3). The major implications of poly-pharmacy are additional avoidable costs and an increased probability of adverse drug reactions. A limitation of the study was that inter-country comparisons were not adjusted according to the prevalence of chronic diseases in the population.

The percentage of generic medicines prescribed was 46.34 %, which is considerably lower than the standard of 100 %. The calculated percentage represents a severe underuse of generic medicines that was also lower than the Middle Eastern Mediterranean region's average use of generics (57.1 %) [28]. This result is consistent with previous studies conducted in different districts in Sudan (Table 1). When compared with those of neighboring countries, the percentage of generic drugs per prescription in Sudan (46.34 %) was lower than in Egypt (95.4 %), Ethiopia (99.16 %), Mali (70.4 %), Uganda (91.3 %), and Yemen (67.1 %) [19–21, 29, 30]. However, the percentage of generic drugs prescribed was remarkably higher in Sudan than in Bahrain (14.3 %) and Jordan (5.1 %) [29, 30]. GPs in NHIF facilities prescribed considerably fewer generics (38.47 %) than those in SMOH (48.96 %) and other facilities (49.28 %). The implications of low generic use are primarily the wastage of scarce health resources and a decrease in access to pharmaceuticals because of an affordability barrier.

The percentage of prescriptions containing antibiotics was 54.71 %, a considerably high result according to the WHO guideline benchmark of ≤ 30 % antibiotic use. It was consistent with percentages assessed previously in other states of Sudan (Table 1). The percentage in the WHO

Eastern Mediterranean region was 53.6 %, slightly less than found for Sudan in the current study [28]. The use of antibiotics was lower in NHIF facilities (45.91 %) than in SMOH (57.24 %) and other facilities (56.84 %). Antibiotic overuse can have a devastating impact in terms of the development of multi-drug-resistant bacteria, which can lead to unmanageable infectious diseases.

The percentage of prescriptions containing injections was 12.84 %, which is considered relatively over the optimal level, although no strict standard exists, as the WHO benchmark is < 10 %. The average prevalence of injection use in the Eastern Mediterranean Region is higher (27.1 %) [28]. Studies conducted in Sudan reveal progress in the rational use of injections (Table 1). This reduction is attributable to a new malaria management protocol that focuses strongly on ingestible formulations rather than injection, which was the initial dominant medication formulation.

The overall percentage of medications prescribed from the EML was 81.19 %, whereas the prescribing quality indicator standard is 100 %. EML adherence seems high; however, in actuality, this figure is misleading because the best achievement in core prescribing indicators was this indicator worldwide. According to the WHO prescribing database, on average, the Middle Eastern Mediterranean region's percentage of medicines prescribed from the EML was 90.8 % [28]. Previous studies in Sudan have often found this prescribing core indicator to be higher than observed in this study (Table 1). Interestingly, we found EML adherence was lower in NHIF facilities (72.65 %) than in SMOH (82.97 %) and other facilities (89.27 %).

The study revealed overall IRDP to be 3.39, whereas the standard is 5. A total of 197 GPs reported an IRDP of 2.1–4.88, which is relatively low compared with other neighboring countries. For instance, ten health facilities in Saudi Arabia reported an IRDP of 4.37–5 [12]. In Egypt, the same processes were conducted in ten PHCCs and revealed high IRDP rankings, ranging from 3.92 to 4.88 [31]. Although the IRDP was not high, it was higher than the 3.32 reported in China [6]. The index values for NHIF

facilities (3.08) were lower than for SMOH (3.46) and other (3.75) facilities (Table 3).

The current study revealed that the average prescription cost was 40.57 SDG, almost double the proxy 20.31 SDG. A study conducted in five states in 2012 reported an average prescription cost of 20.5 SDG, almost half that observed in the current study [7]. The primary cause of the cost increase is attributed to the devaluation of the national currency, particularly over the last 4 years. When comparing average costs with those in other countries, proper economic adjustment of currency values is essential. Prescriptions from NHIF facilities cost more than those from other facilities, with the average prescription costing 59.54 SDG (NHIF), 36.07 (SMOH), and 31.69 SDG (other facilities). These disparities were attributed to the relatively high percentage of patients with chronic diseases in NHIF facilities (36 %), with SMOH facilities having fewer such patients (18 %).

The authors consider the main cause of the observed sub-optimal prescription quality to be low adherence to prescribing guidelines. NHIF facilities performed worse than other facilities, which could be attributed to the accountability of non-NHIF facilities (all services provided by these facilities are reimbursed according to adherence to regulations), while the NHIF facilities have not been subjected to that review.

5 Conclusion

Appropriate medicine use is essential to the provision of quality health services, patient safety, and the rational use of health resources. The present study used the largest sample to date and a unique study unit to investigate prescribing rationality among GPs at different types of health facilities providing health services for insured patients in Gezira State, Sudan. The study revealed that the overall IRDP score for GPs was less than optimal and characterized by significant disparities between GPs at different health facilities, with NHIF facilities receiving a lower index. Further studies should be conducted to determine the factors causing the considerable discrepancies (2.1–4.88 IRDP) between GPs at health facilities owned by the NHIF, the SMOH, and others (private interests, universities, and NGOs).

Author Contributions S. Supakankunti and BME Yousif designed the study. BME Yousif collected and analyzed the data and drafted the manuscript. S. Supakankunti and BME Yousif revised and provided final approval of the manuscript.

Compliance with Ethical Standards

The NHIF Federal Technical and Ethical Committee in Sudan provided ethical approval for the research before the study commenced. Data were treated with full confidentiality.

Conflict of interest The authors have no conflicts of interest in connection with this paper. The opinions expressed by the authors do not necessarily reflect the opinions of the Chulalongkorn University, Thailand, or the National Health Insurance Fund, Sudan.

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