Factors Influencing the General Practitioners' Number of Prescribed Drugs in National Health Insurance at Gezira State, Sudan

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Abstract

Objectives*: The study aimed to investigate the mean medication per encounter for General Practitioners (GPs) and its influencing factors in the NHIF, Sudan.* ***Method****: The study had followed WHO established guidelines. A cross-sectional retrospective study was carried out across six months. Controlled questionnaires were completed by 197 general practitioners representing 90% of the total study population. For each doctor, a systematic random sample of one hundred prescriptions were collected. Poisson regression was executed to detect the relationship between numbers of drugs per prescription as dependent variable the doctor, practice, patient, and drug-related factors as independent variables.* ***Results****: The mean medication per patient was 2.55±1.32.The low number of drugs significantly correlated with doctors who have higher education, younger, and exposure to peer contact and medical discussions. Doctor nativity, number of patients per day, and patients from urban areas were significantly associated with high number of drugs per encounter. The younger patients and patients with chronic diseases had high number of medications. The government employed GPs had prescribed lower number of drugs than others.* ***Conclusion****: Promotion of GPs education, permanent type of employment and reduction of chronic diseases' prevalence are crucial to reduce the poly-pharmacy practice among GPs.*

Introduction

Poly-pharmacy has several different definitions mainly depending on the cutoff point of the number of drugs per prescription. It is defined as prescribing of two or more drugs concomitantly to one patient [1, 2] while some studies considered the cut-off point as more than three drugs per one prescription for one patient[3]. In rare occurrences, poly-pharmacy is defined as more than five drugs prescribed concomitantly[4]. Multi or co- morbid conditions cause the need for prescription of many medicines and even with rational prescribing behavior, it will increase the probability of adverse drug reaction (ADR) and risk of drug-drug interaction (DDI)[5]. DDI occurrences are strongly associated with the increase in the number of drug per prescription [2]. Viktil (2007) showed that there was a relationship between drugs related problems and poly-pharmacy. Moreover, prescribing of unnecessary medications, beside the DDI and ADR, it is directly wastage of resources.

Thus, the quality of services, best clinical outcomes, and rational utilization of resources dictate minimal number of drugs prescribed (only necessary medications). The pharmaceutical cost of National Health Insurance Fund (NHIF) started going up since 2010. World Health Organization (WHO) has considered the average number of medicines per prescription as core indicator of rational prescribing [6]. Hence, many factors influence prescriber's behavior regarding number of drugs issued per encounter; some of these factors are related to prescribers' socio-demographic status, patient- related factors, and type of diagnoses [2, 7-9]. This kind of study has never been considered before in Sudan. The present study aimed to determine the degree of poly-pharmacy prevalence among GPs in NHIF and the factors affecting the number of drugs per prescription.

Methods and Materials

Study Design

GP based retrospective cross-sectional study was conducted. The study used primary and secondary data analysis. The targets was all general practitioners in Gezira State providing services to insured patients at primary health care centers (PHCCs), they were 220 GPs. The study had detected the relationship between number of drugs per prescription, as prescribing indicator, and influencing factors. After formulation of semi-structured controlled questionnaires, which was based on literature review and expert advisor, they were tested and manipulated and then completed by GPs. Some previous prescriptions for each respondent were reviewed on World Health Organization's (WHO) and International Network for Rational Use of Drugs (INRUD) prescribing indicators formats for analysis[6].

Study Sampling and Tools

To determine the prescribing performance for GPs in terms of number of drug prescribed, hundred prescriptions of each respondent has been taken as recommended by WHO/INRUD guidelines [6]. The reference period of the sample was six months, which was dictated by data completeness and availability and high turnover of GPs. The prescriptions had provided the number of drug per encounter, patients' information and diagnoses while questionnaires, completed by 197 respondents, had provided the GPs-related factors', practice-related factors', and drug-related factor's information.

Study Variables

Number of medicines prescribed per prescription was considered as dependent variable, which was elicited from doctors' prescriptions. The independent variables were extracted from both prescriptions and questionnaires and were considered as possible influential factors on study dependent. These independent variables on which the questionnaires were based, were selected from literature review and NHIF services setting [7, 8]. The GP-related factors includes; age, sex, final academic degree, palace of graduation, and the job satisfaction. While patient-related factors comprises of age, sex, residence area, and diagnosis. The practice independents were exposing to peer contact and discussion, doctor's nativity regarding work stations, doctor being government employee, average patients per day, and doctor's daily working hours. The number of visits by medical representatives to pharmaceutical firms was implied as drug-related factor dependent.

Data Analysis

Data was reviewed and entered and re-entered into excel sheet before imported to Stata-12 analysis program. Descriptive statistics was summarized in table 1. A 19,690 prescriptions from 19,700 were valid representing the number of observations. Then 197 questionnaires were integrated with prescriptions. The Poisson regression was used to execute the multivariate analysis at confidence interval 95%.

Results

Overall average number of drugs across 19,690 prescriptions was 2.55 drugs. Highest number of drugs prescribed per prescription was 15 drugs and minimum ones was 1 drug. Interestingly, no patient exited from doctor consultation without prescription or referral to specialist. Thus, number of prescriptions containing zero number of drugs was zero. The type of dependent data was count without zero values, therefore, we used Zero-truncated Poisson regression analysis model.

Table 2 at level of significance 5% demonstrates doctor's age and final qualification degree had statistically significant influence on the number of drugs prescribed per encounter. In terms of patient-related factors, patient age, residence area, and type of diagnosis had a significant effect on mean medications prescribed. Moreover, practice environment significantly affected the prescribed number of drugs per encounter, particularly, doctors' exposure to peer contact and discussion, working in his/ her original residence locality, being government employee, and number of patient per day. Surprisingly, the pharmaceutical firms' promotional visits had no statistically significant effect. The sign of co-efficient or average marginal effect illustrates that the positive sign is indicated by an increase of continuous independent or when compared with reference group in dummy variables, the number of drug per prescription is expected to increase, and vice versa in negative sign. The marginal effect's magnitude indicates a discrete change in number of drug per prescription when the factor or independent increase by one unit from the base level. For instance, one more year of doctor age would increase the number of prescription drugs by 0.0188 drugs when other factors were controlled.

Medical doctors with master and higher diplomas in family medicine significantly prescribed drugs in prescriptions less than those without that qualification by 0.163 drugs. Doctors, who discuss with and contact,their colleagues had prescriptions predicted to have 0.22 fewer drugs than those who did not. An increase in the average of daily patients by one was predicted to increase the number of drugs per prescription by 0.004drugs while each year more of the patient'sage would increase the number of prescribed medications by 0.007 drugs per prescription on average. In terms of disease diagnosis, prescriptions for patients with chronic diseases would contain 0.87 more drugs than patients with acute diseases.

Table 1: Descriptive Statistics of the independents

	Independents	**Statistics**
1	Doctors' Gender	60.4% Female
2	Average Doctor Age	32.6 years
3	Percentage of Main University Graduates	29.40%
	Doctors with Bachelor or above	71.1%, 28.9% respectively
4	Job Satisfied	35.5% high, 41.6% average, 22.9% un-satisfied
5	Average age of patients	36.74673
6	Patients' Sex	66% Females, 34% Males
7	Patient Residence	49.41% Urban
8	The Percentage of Chronic Diagnoses	21.37%
9	Who exposed to Peer Contact and Discussion	13.70%
10	Who work in his/her original residence locality	57.40%
11	Government employees	75.60%
12	Average Number of Patients per Day	38.43Patients
13	Average working hours	7.04 Hours per day
14	Average Number of Pharmaceutical Promotion Visits	2.02 Visits per year

Table 2: Truncated Poisson regression results of influencing factors on the number of drugs per prescription

Number of drugs	**Co-efficient**	**Std. Err.**	**z**	**P>|z|**	**dy/dx**
Doctor Sex (Male)	0.0097	0.013	0.750	0.4540	0.0221
Doctor Age	**0.0083**	**0.001**	**10.020**	**0.0000*** **	**0.0188**
Place of Graduation (Main University)	- 0.0146	0.012	-1.200	0.2310	-0.0331
Doctor Qualification (Above Bachelor)	**- 0.0715**	**0.013**	**-5.450**	**0.0000*** **	**-0.1628**
High Job Satisfaction	- 0.0123	0.014	-0.870	0.3840	-0.0281
Average Job Satisfaction	- 0.0197	0.014	-1.360	0.1750	-0.0448
Patient Age	**0.0031**	**0.000**	**11.830**	**0.0000*** **	**0.0070**
Patient Sex (Male)	- 0.0138	0.011	-1.260	0.2090	-0.0314
Patient Residence (Urban)	**0.0333**	**0.012**	**2.860**	**0.0040*** **	**0.0758**
Disease Chronicity (Chronic)	**0.382**	**0.013**	**29.860**	**0.0000*** **	**0.8706**
Peer Contact Discussion (On contact)	**- 0.1176**	**0.017**	**-7.080**	**0.0000*** **	**-0.2679**
Work in Home Locality (Native)	**0.0289**	**0.011**	**2.560**	**0.0100*** **	**0.0659**
GOV-EMPL (Governmental)	**- 0.0428**	**0.013**	**-3.250**	**0.0010*** **	**-0.0976**
Number of Patients per Day	**0.0018**	**0.000**	**7.480**	**0.0000*** **	**0.0040**
Doctor's Working Hours per Day	- 0.0030	0.004	-0.740	0.4590	-0.0068
Drugs Firms' Promotional Visits	0.002	0.001	1.160	0.2450	0.0039
_cons	- 0.043	0.048	-0.900	0.3700	

Table 3: The average number of drugs per prescription in Sudanese previous studies

Author (s)	*Year*	Area	Level	Number of drug per encounter
Bannenberg et al.)[10]	*1991*	Nile Province	PHCCs	1.4
(Abdelmoneim LA,)[11]	*1996*	Khartoum State	PHCCs	1.9
(GKALI,)[12]	*1998*	Khartoum State	Hospital+PHCCs	2.1
(Awad&Himad,)[13]	*2004*	Khartoum State	Teaching-H (2)	1.9
(Cheraghali&Idries)[14]	*2007*	(6) States	PHHCs	2.3
(SARA H.ELSALAHI)[15]	*2010*	Khartoum State	PHCCs	2
(Ahmed &Awad)[16]	*2010*	Khartoum State	4 paed-hospital	2
(Mustafa)[17]	*2012*	(5) States (NHIF)	PHCCs	2.6
(Mahmoud, Ali, &Kheder)[18]	*2012*	Khartoum State	Hospitals+ Pharmacies	2.8

Discussion

The study revealed that the overall average number of medicines per encounter was 2.55. The average for acute and chronic diseases cases was 2.33 and 3.39, respectively. This average number of medications per encounter represents irrational prescribing practices in terms of poly-pharmacy. According to the definition of poly pharmacy "the prescribing of more than two medicines concomitantly on one prescription" [1].The average number of drug prescriptions was 2.55, much close to 2.6, a result of the study conducted in NHIF in 2012 in another five states [17]. This number of drugs was valued more than any result of any study conducted in Sudan before except two studies (1.4, 1.9, 2.1, 1.9, 2.3, 2, 2, 2.6, and 2.8)[10-18]. This result when compared with some developing countries' studies results was higher than some of their results and lower than others. For instance, in Egypt, Ethiopia, Mali, Yemen, Uganda, Thailand, Pakistan, India, Tanzania, Saudi Arabia, and Malaysia, i.e., had 2.5, 2.13, 3.2, 3, 2.9, 2.85, 2.7, 2.4, 2.2, 2.08, and 2 drugs respectively [19-29].

The study revealed a strong significant positive relationship between doctor age and prescribed number of drugs; younger doctors have less average medications per prescription than older ones. Stolley et al., (1972) found that younger doctors prescribed more appropriately than others[30]. Another study revealed that the relation between doctor age and quality of prescribing was significantly negative, i.e., older doctors were more resistant to following standard guidelines for rational prescribing than younger ones [31]. The Sudan context was consistent with the study result, there were no regular programs of continuous professional training for medical doctors, and fresh graduates to have better knowledge than older medical doctors.

The final academic degree also has influence on the mean medication per encounter. A study conducted in China proposed as that education qualification was upgraded, the co-efficient of the number of drugs per prescription acquired more negative values [8]. Marshall H. Becker et al., (1972) found that junior postgraduates' prescribing practices were more appropriate than non-postgraduate senior prescribers, which was typically the case in this study[32]. A study conducted in China revealed that the effect of education was significant and long lasting [33]. Peer contact and discussion exhibited considerable reducing effects on the average number of medications per prescription or per patient. Professional colleagues represent scientific information sources. Peers and medical journals were the main sources of knowledge for general practitioners [32]. In Greece, primary health care general practitioners were studied revealing potential influence of general practitioners, colleagues and consultations with specialists on prescribing practices [34].

Doctors who work in their home locality prescribed higher numbers of drugs for their patients than nonnatives. In Sudan, the social context is reasonable because specifically in services, relatives and friends affect the rational technical behavior of professionals particularly in health services. A study in Iran found a strong relationship between the mean number of drugs prescribed for patients and doctors being natives [7]. The study found that workload or the average patient number negatively affects the prescriber behavior toward the number of drug prescribed per prescription. A Nigerian study proved a significant positive relation existed between irrational prescribing and the heavy workload in the outpatient department [35]. The type of doctor employment affected doctor prescribing behavior. A doctor being a government employee reduced the number of drugs per encounter more than the reference group. A study conducted in Iran found that employment had no significant effect [7].

The employment type was associated with job satisfaction, professional training and job security, and could affect the number of drugs prescribed. The study found that an increase of patient age increases the number of drugs prescribed which is more justifiable as age increases the probability of patients having more than one disease and will increase until reaching elderly, who has higher prevalence of multi-morbidities. Urban dwellers received prescriptions with more medication than rural ones, this could be attributed to prevalence of chronic diseases in urban than rural, i.e. 57% of patients with chronic diseases in this study were from urban areas. On average people live in rural areas earns less income than those in urban areas, hence, prescribers deal with them differently in prescribing practice, and often they prescribe expensive prescriptions for those well-off. A Study conducted in USA found that children from poor-families have prescriptions less expenditures than other economic status groups [36].Chronic diseases report signified a strong influence on the mean medication prescribed to the patient with the largest magnitude of marginal effects. Chronic disease patients most probably presented a higher prevalence of multi-morbidities than those of acute diseases. Scientifically, the use of medicines over a long period of time causes desensitization, and can be solved by switching to more supportive medicines. Moreover, the use of medicines excessively over a long time likely causes adverse drug reaction, morbidity leading to requirement of more medication. Therefore, poly-pharmacy is related with an increase of patient risk and pharmaceutical services cost [37]. The ADR, medication errors, patient medication compliance are most probably related with poly-pharmacy [38].

Conclusion

This study revealed there was a poly-pharmacy practice among GPs particularly for patients with chronic diseases. The younger doctors with diploma or master in family medicine are related to prescribing more medications for patients. High number of drugs per prescription is related with patients being older, urban dweller, and with chronic diseases. Presence of peer contact and medical discussion between GPs and government-employed physicians are associated with lower medications per prescription. While native GPs with higher number of patients are correlated with higher number of drugs per encounter.

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