PRESCRIPTION PATTERN AND FACTORS INFLUENCING THE PRESCRIBIN G PRACTICE AT PRIMARY HEALTHCARE CENTERS IN NATIONAL HEALT H INSURANCE FUND, SUDAN

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A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of Master of Science Program in Health Economics and Health Care Management

Faculty of Economics

Chulalongkorn University

Academic Year 2014

รูปแบบการสั่งจ่ายยาและปัจจัยที่มีอิทธิพลต่อแพทย์เวชปฏิบัติทั่วไปในหน่วยบริการสุขภาพปฐมภูมิของกองทุนประกันสุขภาพแห่งชาติ ประเทศซูดาน

นายแบเชอร์ โมฮัมเหม็ด เอลมาฮิ ยูซิฟ

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
สาขาวิชาเศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ
คณะเศรษฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2557

Thesis Title	PRESCRIPTION PATTERN AND FACTORS INFLUENCING THE PRESCRIBING PRACTICE AT PRIMARY HEALTHCARE CENTERS IN NATIONAL HEALTH INSURANCE FUND, SUDAN
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แบเชอร์ โมฮัมเหม็ด เอลมาฮิ ยูซิฟ : รูปแบบการสั่งจ่ายยาและปัจจัยที่มีอิทธิพลต่อแพทย์เวชปฏิบัติทั่วไปในหน่วยบริการสุขภาพปฐมภูมิของกองทุนประกันสุขภาพแห่งชาติ ประเทศซูดาน (PRESCRIPTION PATTERN AND FACTORS INFLUENCING THE PRESCRIBING PRACTICE AT PRIMARY HEALTHCARE CENTERS IN NATIONAL HEALTH INSURANCE FUND, SUDAN) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ศิริเพ็ญ ศุภกาญจนกันติ, 174 หน้า.

ABSTRACT in THAI

วัตถุประสงค์: การศึกษานี้มีวัตถุประสงค์เพื่อศึกษารูปแบบของใบสั่งยาและปัจจัยที่มีผลต่อการสั่งยาในหน่วยบริการสุขภาพระดับปฐมภูมิของกองทุนประกันสุขภาพแห่งชาติของรัฐเจซีรา ประเทศซูดาน

วิธีการวิจัย: การศึกษานี้ได้ยึดถือตามแนวทางปฏิบัติขององค์การอนามัยโลก โดยศึกษาย้อนหลังแบบตัดขวางในช่วงระยะเวลา 6 เดือน และมีการสำรวจโดยใช้แบบสอบถามในแพทย์เวชปฏิบัติทั่วไปจำนวน 197 ราย ซึ่งคิดเป็นร้อยละ 90 ของประชากรที่ศึกษาทั้งหมด โดยมีการสุ่มตัวอย่างของใบสั่งยาอย่างเป็นระบบจำนวน 100 ใบต่อแพทย์ 1 ราย โดยกำหนดให้หลักการสั่งยาเป็นตัวแปรตาม และแพทย์ การให้การรักษา ผู้ป่วย และปัจจัยที่เกี่ยวกับยาเป็นตัวแปรอิสระ จากนั้นนำข้อมูลมาวิเคราะห์ด้วยวิธีถดถอยแบบ Poisson, logistic, และ OLS โดยขึ้นกับชนิดของข้อมูล

ผลลัพท์: ค่าเฉลี่ยของปริมาณยาต่อผู้ป่วย 1 รายเท่ากับ 2.55±1.32 ชนิด เป็นยาสามัญร้อยละ 46.34 เป็นยากลุ่มปฏิชีวนะและยาฉีดร้อยละ 54.71 และ 12.84 ตามลำดับ และเป็นยาที่จัดอยู่ในรายชื่อของกองทุนประกันสุขภาพแห่งชาติร้อยละ 81.19 โดยมีตัวชี้วัดความสมเหตุสมผลของการใช้ยาในภาพรวมเท่ากับ 3.39 จาก 5 คะแนน และมีราคาเฉลี่ยต่อ 1 ใบสั่งยาเท่ากับ 40.57 ปอนด์ซูดาน ราคาต่อใบสั่งยามีความสัมพันธ์แบบตรงกันข้ามกับตัวชี้วัดความสมเหตุสมผลของการใช้ยาอย่างมีนัยสำคัญทางสถิติ ราคาต่อใบสั่งยาที่ลดลงยังมีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติกับระดับการศึกษาของแพทย์ ความเชี่ยวชาญเฉพาะทาง ประสบการณ์ระยะยาว ความพึงพอใจในงานที่ทำ และการได้มีการปรึกษากันทางการแพทย์ ในขณะที่แพทย์ที่สูงอายุมักมีแนวโน้มจะสั่งยาที่แพงกว่า นอกจากนี้ ลักษณะของแพทย์ ความต้องการของผู้ป่วย และสิ่งอำนวยความสะดวกทางด้านสุขภาพในชุมชนเมือง รวมถึงการมีรายการส่งเสริมการขายของบริษัทยาก็มีความสัมพันธ์กับการสั่งยาที่มีราคาสูงขึ้นอย่างมีนัยสำคัญทางสถิติ ผู้ป่วยที่มีอายุน้อยมีความสัมพันธ์กับราคาต่อใบสั่งยาที่ต่ำกว่า ในขณะที่โรคเรื้อรังจะมีราคาต่อใบสั่งยาสูงขึ้นถึง 2.6 เท่า

สรุป: การส่งเสริมการให้ความรู้แก่แพทย์เวชปฏิบัติทั่วไป ความเชี่ยวชาญเฉพาะทาง และการสอนเกี่ยวกับการใช้ยาอย่างสมเหตุสมผล การได้รับข้อมูลจากแหล่งข้อมูลที่ไม่มีอคติ การสับเปลี่ยนหมุนเวียนการทำงาน การเป็นเจ้าหน้าที่ประจำ และความพึงพอใจของแพทย์เกี่ยวกับระบบเบิกจ่ายทางด้านสุขภาพเป็นปัจจัยที่สำคัญในการพัฒนาคุณภาพของการสั่งยาและสามารถควบคุมค่าใช้จ่ายได้

สาขาวิชา เศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ ลายมือชื่อนิสิต .....

ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ปีการศึกษา 2557

5785686629 : MAJOR HEALTH ECONOMICS AND HEALTH CARE MANAGEMENT
KEYWORDS: PRESCRIPTION QUALITY, COST ESCALATION, INDICATORS, GENERAL PRACTITIONERS, INFLUENTIAL FACTORS, OVERUSE OF ANTIBIOTICS.

BASHIR MOHAMED ELMAHI YOUSIF: PRESCRIPTION PATTERN AND FACTORS INFLUENCING THE PRESCRIBING PRACTICE AT PRIMARY HEALTHCARE CENTERS IN NATIONAL HEALTH INSURANCE FUND, SUDAN. ADVISOR: ASSOC. PROF.SIRIPEN SUPAKANKUNTI, Ph.D., 174 pp.

Objectives: The study aimed to investigate the prescription pattern and its influencing factors in the NHIF, at Gezira State-Sudan.

Method: The study 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. Prescribing core indicators as dependents were regressed with the doctor, practice, patient, and drug-related factors as independent variables. Poisson, logistic, and OLS regression were conducted according to the indicator data type.

Results: The mean medication per patient was 2.55±1.32; the percentage of prescriptions prescribed by generic name was 46.34%, and percentage of prescriptions contained antibiotics and injections was 54.71% and 12.84%, respectively. The percentage of medicines prescribed from the NHIF medicine list was 81.19%. The overall Index of Rational Prescribing Indicator (IRDP) was 3.39, while the average cost per prescription was 40.57 SDG. The factors had a significant influence on the prescribing indicators, IRDP, and cost. The prescription cost was inversely and significantly proportional with IRDP.

The average prescription cost reduction significantly correlated with being a doctor with more education, more professional training, longer experience, job satisfaction, and exposure to peer contact and medical discussions. Moreover, older doctors tended to prescribe expensive medications. Doctor nativity, patient demand, and urban health facility were significantly correlated with prescription cost escalation. Pharmaceutical firms' promotion visits were significantly associated with prescription cost escalation. The younger patients and female patients had less prescription cost. The chronic diseases significantly escalated the prescription cost 2.6 times.

Conclusion: Promotion of general practitioners education, holding of professional and rational use of medicine training activities, providing unbiased information sources, rotation, permanent type of employment and doctor satisfaction payment mechanisms are crucial to improve the prescription quality and reduce the pharmaceutical costs.

Field of Study: Health Economics and Health Care Management — Student's Signature .....

Advisor's Signature .....

Academic Year: 2014

ACKNOWLEDGEMENTS

Firstly, I would like to express my sincere gratitude to my advisor Prof. Siripen Supakankunti for the continuous support, for her patience, motivation, and immense knowledge. Her guidance helped me in all the time of research and writing of this thesis.

My sincerest thanks also go to Dr. Talal Elfadil, Dr. Almoghirah Alamin, and Prof. Arbab, who provided me an opportunity to join this master program, conduct this study, and who gave access to the NHIF records and health facilities. Without their precious support it would not be possible to conduct this research.

I thank my fellows from Gezira State Executive Directorate of Health Insurance for their hard working on data collection, entry, and for the sleepless nights to finish before deadlines. Special thanks go to training and planning departments in NHIF at H.Q

A special thanks to my family. Words cannot express how grateful I am to my mother, wife, my daughter, and son for all of the sacrifices that you've made on my behalf. Your prayer for me was what sustained me thus far. I would also like to thank all of my brothers and friends who supported me in writing, and encouraged me to strive towards my goal. At the end, I would like express appreciation to my wife Ikhlas who spent sleepless nights to assist me and was always my support in the moments when there was no one to answer my queries.

Last but not the least, I would like to thank those advocates of virtue and the owners of the great souls, well-wishers and excellence for all the faithful of their own people. Sincere thanks to those who ask Allah strong back not a light load.

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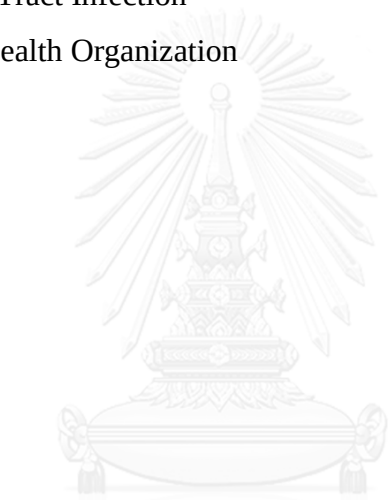
ADRs	Adverse Drug Reactions
ANOVA	Analysis of Variance
AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
CNS	Central Nervous System
DM	Diabetes Mellitus
EML	Essential Medicines List
Epi Info	Epidemiological Information Program
EU	European Union
FFS	Fee for Service
GDP	Gross Domestic Product
GIT	Gastro-Intestinal Tract
GP	General Practitioner
GPHA	Generic Pharmaceutical Association
HIV	Human Immunodeficiency Virus
IFPMA	International Federation of Pharmaceutical Manufacturers Associations
INRUD	International Network for the Rational Use of Drugs
INN	International Non-proprietary Name
IRDP	Index of Rational Drug Prescribing
LIMICs	Lower and Middle Income Countries
MOFNE	Ministry of Finance and National Economy
MRs	Medical Representatives
MSH	Management Science for Health
NGOs	Non-Governmental Organizations
NHA	National Health Account
NHIF	National Health Insurance Fund
OLS	Ordinary Least Square
PHCCs	Primary Health Care Centers
PPIs	Proton Pump Inhibitors

SDG	Sudanese Pound
SPSS	Statistical Package of Social Science
STATA	Statistical Software Package (Created by Stata Corp)
STGs	Standard Treatment Guidelines
THE	Total Health Expenditure
TPB	Theory of Planned Behavior
TPE	Total Pharmaceutical Expenditure
UK	United Kingdom
USA	United States of America
UTI	Urinary Tract Infection
WHO	World Health Organization



CHAPTER1
INTRODUCTION

1.1. Overview

1.1.1. Pharmaceutical Services and Practices

One of the prominent manifestations in the Sudanese health system and many developing countries is the irrational use of medicine. It represents wasting scarce resources. The need to improve the prescribing quality is imperative; we have to study the prescribing pattern and its influential factors. The World Health Organization (WHO) has defined that, "Rational use of drugs requires that patients receive medication appropriate to their clinical needs, in doses that meet their own individual requirement for an adequate period of time and at the lowest cost to them and their community"(WHO, 1985). Therefore, the efficient health provider delivers accessible, safe, and effective medicine for patients. According to WHO estimations, worldwide about two thirds of people have access to essential medication, and more than half of medicine is prescribed appropriately. Moreover, for patients who received right medications, more than half of them used the medicine in correctly. The component of medicines in the health services package is more variable and dynamic when compared with other service components particularly, in coverage, quality, and cost. Thus, the provision and financing of pharmaceutical services represents one of the major challenges for countries, particularly, developing ones. The pharmaceutical service is tangible medical intervention, resulting in prevention, cure, or suffering relief when used appropriately, otherwise, it is harmful, wastes resources, and the risks outweigh benefits. A consensus exists in almost all countries, that access to essential medicines is a right for all people (WHO, 2010). The achievement of sustainable, accessible pharmaceutical services and patient satisfaction and safety requires robust supply chains of medicine, which comprises selection, procurement, distribution and use. The reference organizations, for instance, WHO, has set a universal framework and measures to monitor and evaluate the quality, accessibility, and safety of pharmaceutical services using rational use of medicine measurements.

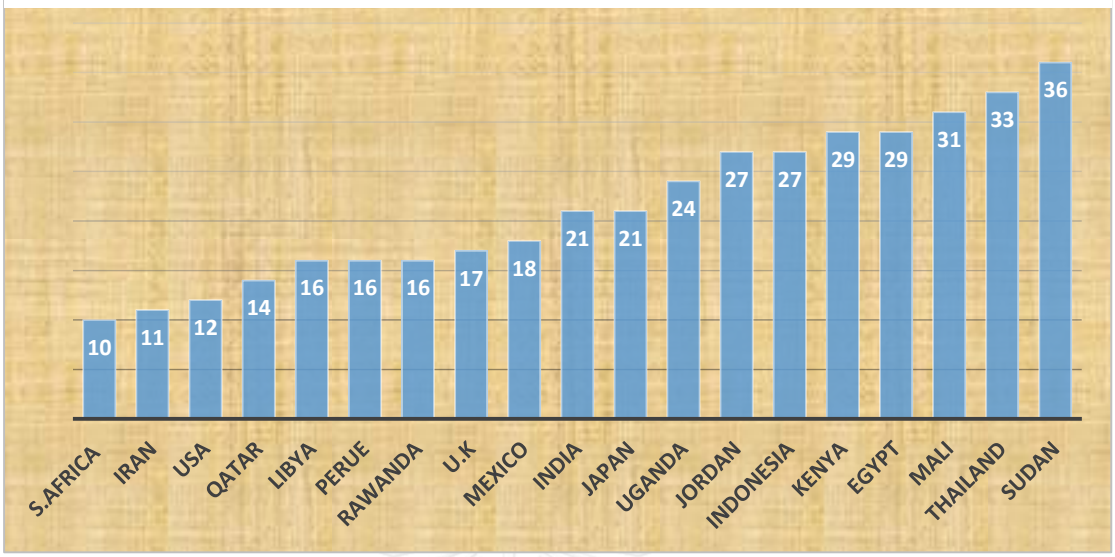
1.1.2. Global Pharmaceutical Expenditure

The Total Pharmaceutical Expenditure (TPE) in the last decades grew faster than all types of services, on average growth of about 2% annually, particularly from 2005 to 2009 in the USA (Blavin, Waidmann, Blumberg, & Roth, 2014). The growth of TPE is faster than the world economy; moreover, per capita pharmaceutical expenditures in 2005/2006 ranged from US $7.61 in low income countries to US $431.6 in high income countries, with considerable variation between different income groups within countries. Compared with 1995, the rate of increase is greater in middle and low income countries. Further, 16% of the world's population living in high income countries accounts for over 78% of global expenditures on medicine. The proportion spent on medicine is higher in low per capita income countries. On average, 24.9% of THE is spent on medicine, with a wide range from 7.7% to 67.6%.(WHO, 2011). The containment of the escalating pharmaceutical costs require intervention policies, mainly influencing the prescriber, which represents the supply side and indirectly affecting the demand side (Lee, Bloor, Hewitt, & Maynard, 2015).

In health care services, the pharmaceutical expenditure for patients has represented the main source of economic burden, and at the same time medicine is a crucial genuine intervention affecting whole medical processes. Hence, controlling and containing TPE is the main determinant of successful policy interventions in health system reform (Shi, Yang, Cheng, & Meng, 2014).

The price and quantity of medicine procured are the main variables of TPE. In developing countries, a high TPE per capita indicates an irrational use because the price of medicine is relatively low compared with industrialized countries. As a result, policies and interventions are required to curb the growth of TPE and ensure equitable accessibility to essential medicine (WHO, 2011). Figure 1-1 illustrates the percentage of TPE from the Total Health Expenditure for some countries from different economic groups. The comparison between countries based on Figure 1-1 should take into account other related factors, and costs of other services, for instance, diagnosis and surgical operations. In some countries particularly developed countries the cost of medicine compared with these services is modest.

Figure 1-1. The Percentage of Total Pharmaceutical Expenditure from Total Health Expenditure for Some Countries



Source: IFPMA, 2012

1.2. Sudan Setting (National Health Insurance Fund (Gezira-NHIF))

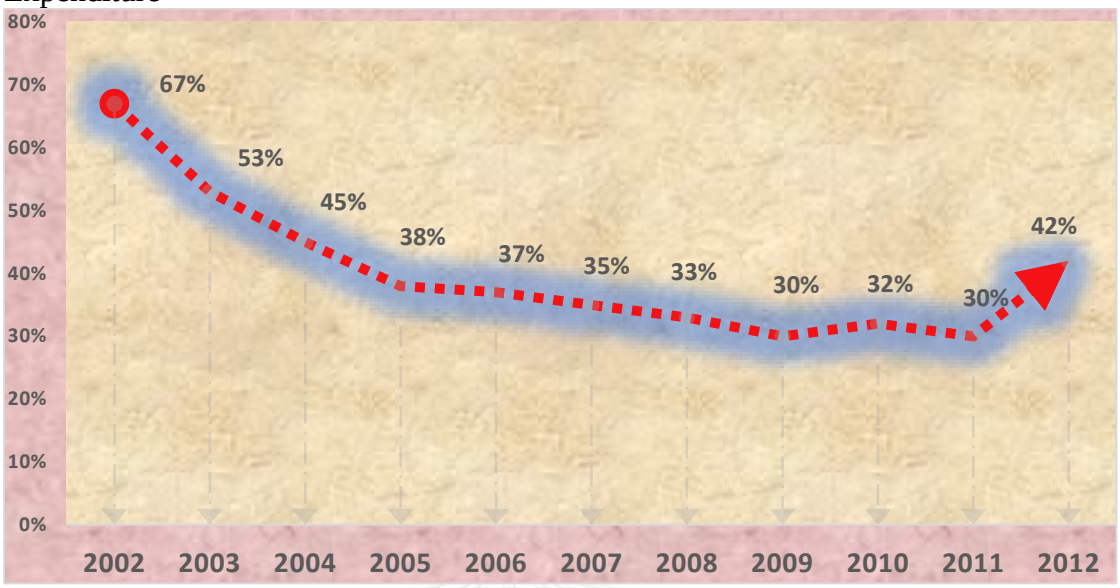
1.2.1. Total Pharmaceutical Expenditure (TPE)

The pharmaceutical expenditure in NHIF is calculated as a maximum of 30% of the total budget. The spending on pharmaceuticals reached the peak as a percentage of NHIF budget in 2002, i.e., 67%. The NHIF took substantial and influential interventions at that time in terms of decisions and policies as described below.

- Formulation of pharmaceutical package list
- Establishment and conducting of pharmaceutical group purchasing for all NHIF membership states
- Enforcement of drug rational use guidelines
- Training of personnel
- Implementing of active supervision

After these major interventions, the TPE for NHIF reduced from 2002 to 2009, but this improvement was followed by a consecutive increase from 2010 to 2013, i.e., 42% of the total NHIF expenditure in 2012.

Figure 1-2. The Percentage of Pharmaceutical Expenditure from Total NHIF Expenditure



Source: NHIF REPORT, 2013

1.3. Irrational Use of Medicine

Irrational use of medicine is a major problem worldwide, and represents the main source of wastefulness and harmfulness. Hopelessly, in developing and transitional countries just 40% and 30% of patients are treated in accordance with the standard guidelines at primary health care level in public and private sectors, respectively. The overuse and misuse of antibiotics is present in all continents with more severity in developing countries. Patient adherence to medication and professional instructions worldwide remains about 50% and less in developing nations. The implication of irrational use results in adverse drug reactions and development of antibiotic resistance causing extremely serious morbidity and costing billions of dollars globally. Effective intervention to promote the rational use of medicines requires the multidimensional involvement of stakeholders including providers, consumers, and regulators. In health consumption and demand, the prescriber is the main player and key factor in determining the inputs and outputs of medication process (WHO, 2011). Drugs are a final step in medication processes. Ensuring that the appropriate medicine is provided correctly to patient at low economic cost is the mandate of health systems as well as health providers and other concerned players.

1.4. Causes of Irrational Use of Medicines

The lessons learnt from countries on the way to achieve the universal health coverage are the wasting of resources and no satisfactory health outcomes, and this mainly attributed to irrational practice. These countries found that efficient use of health resources, ensuring the safe services, cost-effective medications, and horizontal and vertical expansion of health services. Thus, every country to realize this targeted efficiency has to know the causes and factors related to that malpractice to conduct the optimal interventions. The professionals on medical practice perspective, classified the main causes of irrational use of medicine into:

- Prescriber- related causes
- Patient- related causes
- Health system and facility -related causes
- pharmaceutical industry- related causes

1.5. The Patterns of Irrational Prescribing Practices

The prescribing pattern and prescriber clinical behavior has direct or indirect relation with his experience, knowledge, and his perception toward medicines origin and efficacy. In other words we can say the prescriber's inappropriate practice and his/her irrational prescribing associated with:

- Insufficient education, training, or both
- Incorrect or incomplete prescriber role
- Insufficient scientific based pharmaceutical information
- Practice based on wrong experience beliefs.
- Un-scientific judgment about drugs efficacy.

The irrational prescribing practice attributed to one or more of these above causes. For that the WHO and International Network for Rational Use of Drugs (INRUD) set specific benchmarks and standards to measure the prescribing practice and to detect the deviations from different aspects. The forms of irrational use could occur at any health facility level or even prescriber in terms of:

1. Under prescribing, that means the correct needed drug or drugs are not written on the encounter, or written as an inadequate dose or duration of medication.

2. Extra- prescribing, that means the prescriber prescribed unneeded medicine for the patient.
3. Incorrect prescribing, that means one or more drugs are prescribed wrongly to the patient.
4. Extravagant prescribing, that means the prescriber prescribing the expensive alternative in the presence of bioequivalent less cost choice, or treating the symptoms instead of the illness itself, so wasting resources and increasing morbidity and mortality.
5. Poly-pharmacy, means that the prescriber writing more drugs when the effect would be achieved with fewer number of drugs.

1.6. Consequences of Irrational Use of Medicines

The irrational medicines use has dangerous consequences on quality of treatment and this results in increased morbidity and mortality, and wasting of resources which affect the availability of other essential drugs and increased pharmaceutical expenditure. Moreover, the irrational use causes adverse drug reactions and develop antibiotic-drug resistance. The indirect impact of irrational drug use is precipitation of patient believes that there is a medicine for each human health complaint, resulting in increased demand and consecutively an increase of pharmaceutical expenditure(MSH, 2012)

The countries when encountered unjustifiable increasing in pharmaceutical spending, one of the main field should considered in cost containment is cost- effectiveness and rational prescribing practice among general practitioners. So in strategies to reduce the cost of the services, the rationalization of prescribing prior to all alternatives options.(Barry, 2008)

In European Union the multi-drug resistant bacteria kill 25,000 patient annually with associated cost 1.5 billion Euros. Meanwhile in USA, antibiotics resistant pathogens cost the health system 20 billion US $ per year as well as increased the hospital days by 8 million (Leung, Weil, Raviglione, Nakatani, & World Health Organization World Health Day Antimicrobial Resistance Technical Working, 2011).

1.7. Reduction of Irrational Prescribing Cost

No doubt rational prescribing saves resources more than the resources needed to tackle irrational prescribing practice. One of the strong argument is found in a study conducted in developing country (Ghana), it found that when the prescribers were following the

authorities' guidelines the reduction of cost was about 70% of the cost of irrational prescribing before that action. So the identification of the current practice of prescribing is crucial and so the assessment of the factors affecting this prescribing practice in order to determine the more influential factors on which the interventions will be based and prioritized. The evidence based intervention will has valuable impact on cost, patient care, and clinical outcomes, and health system reform.(WHO, 1998)

1.8. Importance and Measurement of Prescribing Practice

The irrational drug use is a chronic and prevalent global problem of developing countries where accompanied with scarce resources, less health coverage and miserable health situation. The monitoring and evaluation of prescribing practice is very important to develop the prescription quality to get it closer to rational practice. Ensuring rational prescribing practice saves lives and money for expanding the health services and improvement of service quality. There is a set of drug indicators developed by WHO and INRUD, which used to measure the performance in the three rational use of drug areas at primary health care level

1. Prescribing practice indicators
2. Patient care indicators in prescribing and dispensing practice
3. Facility rational drug use supporting activities indicators

The more influential area in the rational use of medicines is the prescribing practice area, because the prescriber is the main key player in medication processes and can affect directly the two other areas. Improvement of prescription pattern requires implementation of three phases:

- Assessment the current prescription pattern to identify the nature and magnitude of irrational prescribing.
- Study the factors affecting that prescribing practice.
- Conduct the factors based interventions to improve the prescribing practice.

1.9. Assessment of Prescription Pattern

To know the current situation of prescribing practice, the study has to use the prescribing indicators to answer these **questions:**

- What is the average number of drugs prescribed per encounter? So as to know the degree of poly-pharmacy.

- What is a percentage of drugs prescribed by generic name? To know the adherence to the required lower possible price.
- What is a percentage of encounters with antibiotic prescribed? To know the spread of use of antibiotic at PHCC
- What is percentage of encounters with injection prescribed? To know the degree of use of injections.
- What is a percentage of drugs prescribed from essential drug list? To know to what extent the prescribers stick to essential guidance to rational drug use. (WHO, 1993)
- What is the average cost of prescription? (Complementary indicators not one of core indicators) to compare between prescribers in order to intervene to contain pharmaceutical cost.

1.10. The Uses of Prescribing Indicators Results

- Describing the existent prescribing pattern
- Comparing the prescribing practice at health facility level or prescriber with standards.
- Regular monitoring of drugs use patterns (sometimes for specific drug), as overseeing for policy or clinical treatment guideline.
- Eliciting potential medication problems related to patient care or economic concerns.
- Evaluation the impact and outcomes of policies and an interventions
- Assistant tool to monitor and identify ADRs (Basger, Chen, & Moles, 2012)

1.11. Factors Affecting the Prescribing Practice

For the study to become more useful it has to explain the influencing factors of these indicators to determine the degree of effect of each factor to prioritize the future interventions in order to improve the rational drug use by improvement of prescribing practices So to know which factor is influential, the study should find which indicator has a significant relationship with the following factors

Prescriber-related factors (professional and socio-demographic variables)

Patient-related factors (socioeconomic variables)

Practice-related factors (financing, workload, conflict of interest…)

Drug-related factors (drug price and commercial promotion) (Wang et al., 2013)

1.12. Problems and Significance

The pharmaceutical services playing influential role in patient satisfaction and cost containment of services particularly, for insurance plans. The efficacy, safety, and quality of medications are determined mainly, by the prescriber. The degree of prescription quality specifies the patient clinical outcomes and prescription cost. The prescription is a technical decision of the doctor, to select the drug of choice among several alternatives, the selection of optimal choice should be based on evidence. The knowledge and practice related circumstances affect the prescribing decision.

NHIF uses to allocate around 35% of it is budget to finance the pharmaceutical services. Empirically, the cost of other components of NHIF benefit package have been steadily stable, but pharmaceutical expenditure has been growing (40-50% of total NHIF Expenditure)(NHIF, 2014). Thus the NHIF has to study in depth it is pharmaceutical patterns particularly, prescribing practice which is deemed a heart of this dilemma. The prescribing practice has direct potential effect on the quality of service and the cost containment. The anatomical study of prescribing practice has become more imperative than before.

Previous studies have been carried before the present study they talked the assessment of rational drug use indicators, most of these studies were done at Khartoum State level, which does not represents the NHIF (Khartoum not a member state in NHIF). One study was done at NHIF about the investigation of drug use patterns in terms of core indicators and recommended the promotion of rational drug use. The next station we have to know the factors affecting this poor prescribing practice. The previous study explained there is a problem and recommended that we have to solve it without determining the causes of irrational use patterns. Determination of factors influencing the prescribing practice, facilitate the setting of priorities to promote good quality prescription patterns. The assessment of factors that affecting the prescribing practice weren't done before neither in NHIF nor in Sudan as a whole. Thus, the importance and potentiality of the present study apparently emerged

The Motivations of Study

The study concerns about medicines use, which is directly related to:

1. Patient safety

2. Achievement of desired clinical outcomes
3. Improvement of pharmaceutical service quality
4. Pharmaceutical services cost containment
5. Promotion of universal health coverage.

1.13. Research Questions:

1. What is the prescription pattern of general practitioners at primary health care centers in the National Health Insurance Fund at Gezira State level?
2. Which factors influence the prescription quality indicators of general practitioners at primary health care centers in the National Health Insurance Fund at Gezira State level?

1.14. General Objective:

To investigate the prescription pattern of general practitioners at primary health care centers in National Health Insurance Fund at Gezira State by using the WHO guidelines, and to identify factors influencing that prescribing pattern.

1.15. Specific Objectives:

1. To determine the percentage of drugs prescribed by generic name to measure the subscribers' tendency to prescribe by generic drugs
2. To determine the average number of drugs per encounter to measure the degree of poly-pharmacy in prescribing practice.
3. To determine the percentage of encounters contain antibiotic(s) prescribed in order to identify the antibiotics use.
4. To determine the percentage of encounters contain injection(s) prescribed to measure the overall level of use of injectable dosage forms.
5. To determine the percentage of drugs prescribed from essential drugs list to measure the adherence of general practitioners to essential drug list.
6. To determine the average cost of prescription.
7. To identify factors influencing the prescribing practice or prescribers behavior.

1.16. Scope of the Study and Rationale

The study conducted in Sudan, in Gezira State in 2015. Which is state of complete required record for this study. Study covered general practitioners at the primary health care centers (PHCCs) who provide the health services for national health insurance subscribers. The study used descriptive retrospective and prospective primary data. According to 2014 NHIF report, Gezira State is the largest population state in NHIF states members. Moreover, it was the highest pharmaceutical expenditure 44%-51% from the total state health insurance budget. Gezira has 27% of the total NHIF services facilities network. It had a highest number of chronic diseases patients 25.1% from the total patients, the overall average of NHIF was 18.2% of patients, it had 15.1% of the total NHIF subscribers (1.27 million)(NHIF, 2014).

Figure 1-3. Figure 1 3. Sudan Map and the Location of Gezira

Source: Gezira State website, http://www.wdmadani.com/?cat=4

1.17. Hypotheses

- The prescription quality indicators are in accordance with WHO core prescribing indicators' guidelines.
- There is statistically significant influence of prescriber-related factors on GPs prescribing quality indicators.
- There is statistically significant influence of practice-related factors on GPs prescribing quality indicators.
- There is statistically significant influence of patient-related factors on GPs prescribing quality indicators.
- There is statistically significant influence of drug-related factors on GPs prescribing quality indicators.

CHAPTER2

COUNTRY BACKGROUND

2.1. Background

2.1.1. Socio-economics Characteristics

Sudan is a resourceful African State, one of the lower middle income countries. Gross Domestic product (GDP) per capita was1753 US$ in 2013. In 2013 the total population was 37.96million. The health expenditure per capita in 2008 was 111 US$ (NHA). Poverty prevalence 46.5% according to national survey baseline 2009 with severity 7.8%. The urban inhabitants in 2009 survey was 33.2%. Political and administratively, Sudan has 18 states with presidential governance regime. The historical civil wars and years of conflict hindered the development and achievement of good economic and social indicators(Annika Kjellgren, 2014).

2.2. Health System:

Sudan has fragmented health systems in all building blocks level. It has health infrastructure with remarkable disparities between rural and urban areas. There is a significant loophole in primary health services 14% of population without accessibility and 76% of them have uncomprehensive primary health care services. The health expenditure is 3.4% of the GDP with total of 3.7 billion US$ in 2013. After independence in 1956 health care was provided free of charge. During the early 1990s, the government has moved from the taxation to user fee financing system. In order to mitigate the impact of the introduction of the user fees, Social health insurance was introduced in 1995. Currently health care is financed through a mix of financing mechanisms (taxation, health insurances, and user fees, donations). Government is pushing to expand health insurance to achieve universal coverage. The financing sources are domestic funding 97%, and 3% a broad sources. In terms of spending, 67% out-of pocket, 30% government, and 3% others. The life expectancy at birth for both sex in 2012 was 63 years(WHO, 2015c).

2.3. Disease Pattern and Capabilities

According to Federal Ministry of health (FMOH) annual report 2012 the number of beds, doctors, and specialists per 100,000 of inhabitants was 82.5, 35.2, and 6.2 respectively. The total number of doctors was 12,352 and the general ratio of midwives 42.6/100,000. The beds occupancy 44.6%. The ten leading diseases to doctor visits represent 52% the total visits. The non-communicable diseases represent 13.6% of the health facilities patients. The table 2.1 below shows these ten diseases and their percentages.

Table 2-1. Top Ten Diseases Leading to Doctors' Visits

Seq	**Disease**	**The % from the total number of visits**
1	Pneumonia	10
2	Malaria	9
3	Acute Tonsillitis	6
4	Urinary Tract Infection	5
5	Diarrhea and GIT	4
6	Hypertension	4
7	Respiratory System	4
8	Diabetes Mellitus	4
9	Injuries	3
10	Acute Bronchitis	3
Total		52

Source: FMOH, Sudan

2.4. National Health Insurance Fund (NHIF)

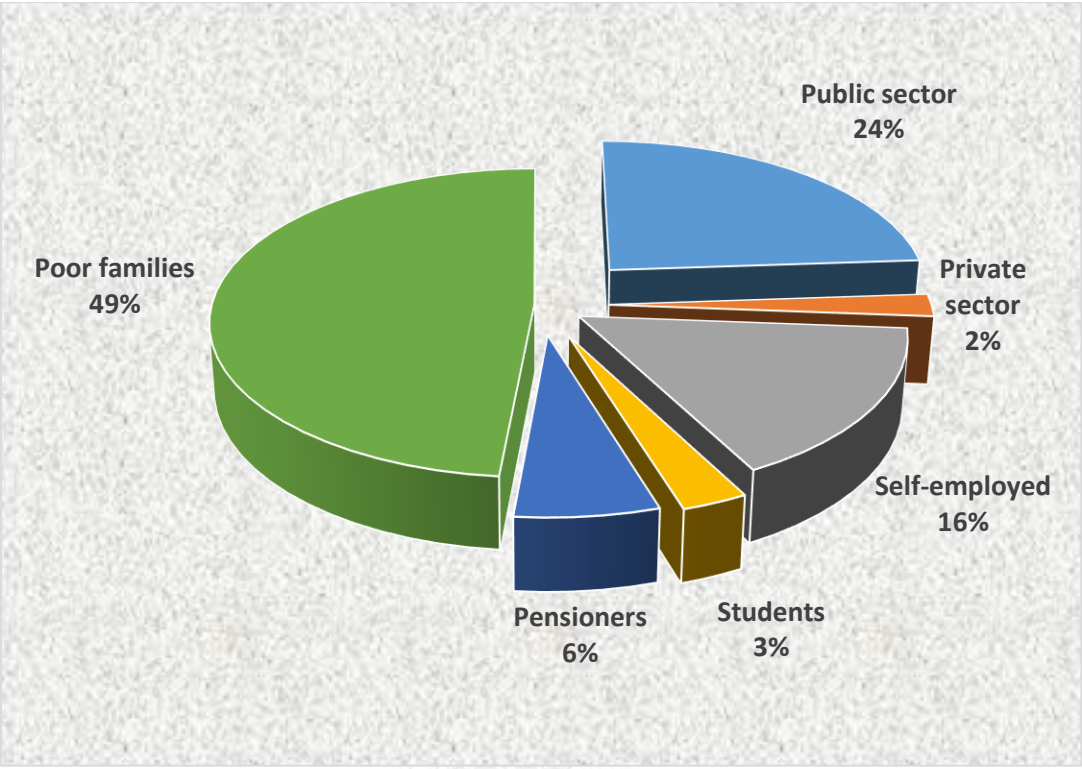
National health insurance fund is a national institution based on solidarity among different socio-economic groups, concerned with the improvement and promotion of beneficiaries' health by providing sustainable, equitable, and accessible health services and insuring the subscribers' satisfaction. The NHIF target the enrollment of all Sudanese citizens to realize the vision of universal coverage. The NHIF is governed by national Act of 1995, which was revised in late of 2003.The NHIF is governed by the National Health insurance Act of 1995, which was revised and mended in 2003. This

revised Act in terms of governance has made the NHIF de-concentration organization, centralized planning, policies, and unification of benefit package and decentralization of execution, enrollment, and funding management.

The main characteristics of NHIF are the national card or roaming services entitlement card and mandatory membership of formal sector (public and private employees). The unit of enrollment is a family, moreover it is allowable for the head of the family to cover his/ her parents. The health services are provided based on provider purchaser split perspective, meanwhile, NHIF has owned about 300 primary health centers of the1599 service outlets provided the services to the beneficiaries (MoFNE, 2014).

The financing of the fund services depends mainly on the subscribers contributions. The formal sector pay 10% of employees' salaries, 4% deduction from salaries and 6% from the employers. On the other hand, the NHIF has undergone couple of amendments on informal sector family monthly premium, eventually, decided whatever the family size the 40 SDG (6 US $) per family per month contribution. One of the main obstacle retards the rapid expansion of population and health services coverage is the generous arbitrary determined benefit package. The population coverage by the end of 2014 was 34.8% of the total population, was divided into the six socio-economic groups as illustrated in the figure(2.1)(NHIF, 2014)

Figure 2-1. The Percentages of Coverage of Subscribers by Sectors



Source: NHIF, 2014 Report

2.5. Pharmaceutical Services

The pharmaceutical services in Sudan is provided by public, private, and modest share of NGOs. The pharmaceutical governmental bodies are working independently, recently the Federal Ministry of Health has been trying to consolidate all these bodies in one drug supply entity. This unified body at least procure and distribute medicines for all public services outlets. Most of the medicines in pharmaceutical industry market in Sudan are imported. The domestic production of medicines not motivated enough to boom. The flow of medicines from federal level to the services outlets shown in figure (2.2). Most of medicines trade-named generic drugs, nevertheless, prescribers write most likely non-generics. The national pharmaceutical expenditure about 36%. The financing method mainly out-of-pocket and health insurance schemes.

The NHIF has 12.7 million subscribers across whole the country, provides the health services through 1599 outlets. These health facilities affiliated to ministries of health, private sectors, and NHIF. The utilization rate on average one per year. NHIF has benefit package contains broad spectrum of investigations, clinical intervention, and

medicines list covered all included disease. The prescribing entitlement based on for levels according specialization and health needs of patients. The NHIF undergoes periodical revision of it is benefit package. The services according to this benefit package provided with zero cost sharing except co-insurance 25% of the prescription cost from provider perspective view. The NHIF belongs about 19% of health facilities (300) nevertheless, provides about 40% of the services. NHIF uses to use the terminology of direct facilities for those it is own health facilities and indirect facilities for contracted ones. The disease pattern varies across the different states, the patients with non-communicable diseases represent 18% of the patients, 40% of them hypertensive patients (NHIF, 2014).

The pharmaceutical services represents the major component of the expenditure. In spite of high cost of drug service, it is remarkably growing up. The overuse of antibiotics is prominent manifestation, represents about 30% of pharmaceuticals cost. Spite that more than 70% of pharmaceutical services are dispensed by NHIF the cost remaining going up. So from economic view the NHIF to control of pharmaceutical cost within the common reasonable range depends mainly on the procurement and prescribing. The prescribing is the concern of the present study.

Table 02-2. The Distribution of NHIF Health Facilities Network over States Level

States	Health centres		Hospitals		Total outlets
	Direct	Indirect	Direct	Indirect	
Khartoum	0	307	0	49	351
Sinnar	32	37	0	23	92
Gezira	**9**	**248**	**0**	**77**	**334**
Gadarif	18	70	0	28	116
Red Sea	5	24	0	15	44
River Nile	23	51	0	34	109
White Nile	28	12	3	23	67
North Darfur	29	3	1	12	48
Blue Nile	6	23	1	15	45
West Darfur	9	0	0	13	22
North Kordufan	40	10	6	18	74
North State	12	37	0	29	78
Kassala	19	19	0	15	53
South Kordufan	7	8	2	12	29
South Darfur	23	31	0	19	73
West Kordufan	20	7	1	8	36
Central Darfur	11	0	0	3	14
East Darfur	11	2	0	1	14

Source: NHIF, 2014

Table 2-3. Subscribers Groups and Health Services Utilization Rate

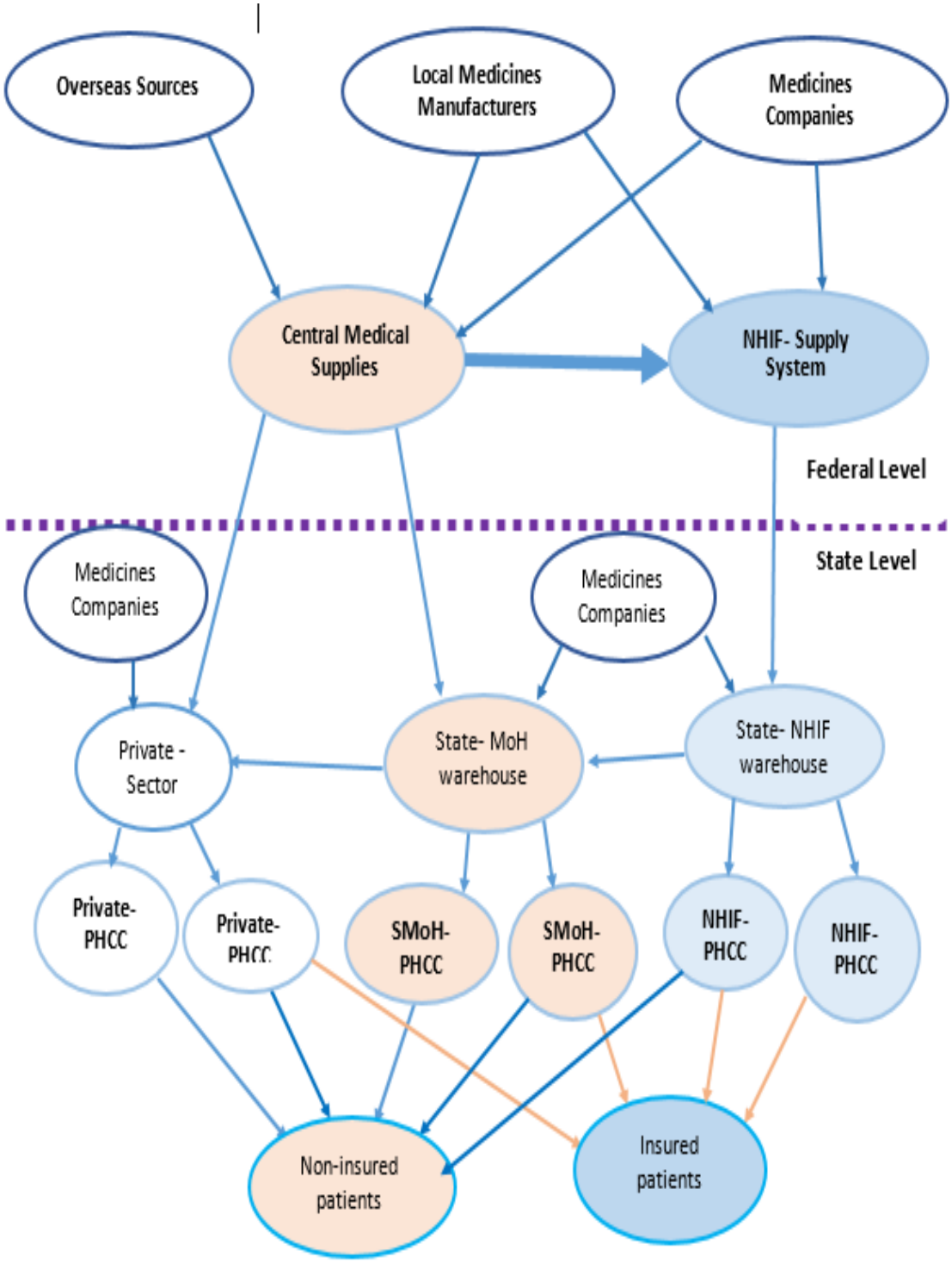
Subscribers group	**Number of Subscribers**	**Number of visits**	**Utilization rate**
Public sector	3,039,818	4,863,577	1.60
Private sector	292,535	217,716	0.74
Self-employed	2,047,744	1,053,975	0.51
Students	368,848	268,070	0.73
Pensioners	801,291	1,395,744	1.74
Poor families	6,168,669	5,096,208	0.83
Total	12,718,905	12,895,290	1.01

Source: NHIF, 2014

2.6. Provision of Health Services for Insured Patients

The insurers receive health services from three entities; National Health Insurance Facilities, State Ministry of Health, and Private sector, which represents NGOs, Universities health facilities, and individuals owned health facilities. Also, non-insured patients use the same entities' health facilities. Worthwhile, NHIF facilities provide services for both insured and non-insured. Some NHIF-facilities restricted for insured patients, and so do the two other entities with non-insured patients (Figure2-2).

Figure 2-2. The Flow of Pharmaceutical Services to Insured and Non-insured Patients in Sudan



CHAPTER3
LITERATURE REVIEW

3.1. Prescribing Indicators

3.1.1. Tools and Medicines Use Indicators

From the WHO conference held in Nairobi in 1985 to encounter the irrational use of medicine, the effort about the promotion of appropriate use of medicine have emerged apparently. WHO and INRUD have developed convenient tool to measure the drug use practice at health care facilities, which describes the pattern of medicines use and prescribing behavior. This method of using these indicators to evaluate the facilities drugs use performance or providers prescribing behavior has been tested and the way of use is standardized. This tool of assessment can be used efficiently to appraise the drug use performance and detect the potential problems types to categorize and prioritize the problems for efficient interventions. This technique is used mainly in drug use studies to achieve these objectives(Table3.1):(WHO, 1993)

- To describe the current drug use pattern
- Evaluating and comparing between health facilities and prescribers drug use performance
- Monitoring and evaluation of specific behaviors toward the drug use
- Assessing the policy and intervention impact on use of medicines

3.1.2. Prescribing Indicators

The situation of prescribing practice widely varies, the developed countries differs from developing and transitional countries. The seeking appropriate medication and economically efficient treatments require assessment of progress in prescribing practice. WHO recommends that every country has to evaluate and monitor the rational use of medicines, the prescribing pattern is the major one of core parameters. Rational prescribing is important issue, has direct implication on quality of service, cost, and utilization of health services. Many attempts to develop these factors to more than 400 indicators, to fight this prominent manifestation of irrational prescribing and improve the service.(Avery, 1998)

Table 03-1. Core Drug Use Indicators (WHO guidelines)

Category	Core Indicators
Prescribing	• Average number of medicines per encounter • percentage of medicines prescribed by generic name • percentage of encounters with antibacterial prescribed • percentage of encounters with an injection prescribed • .percentage of medicines prescribed from NHIF medicines list
Patient Care	• average consultation time • average Dispensing time • percentage of medicines actually dispensed • percentage of medicines adequately labeled • patients' knowledge of correct dosage
Health Facility	• Availability of copy of Essential Medicines List or Formulary • Availability of key medicines

Source: WHO/INRUD

3.1.3. Worldwide Prescribing Practices

The reviewing 1990 to 2009 prescribing indicators studies which were conducted in the six WHO regions at primary care level. The main objective of this study was to assess the improvement of prescribing practice over the time worldwide. Study had gone further in more classification of utilized studies results based on WHO regions, economic status of countries, primary health facilities ownership (Public, private, not-for profit). The reviewed studies 900 carried out in 104 countries and 1033 study groups from public, private, and households. They used the five prescribing indicators and the adherence to the standard treatment guidelines. The study results illustrated under satisfactory prescribing indicators with modest improvement across the reviewed period. The number of prescribed drugs per episode on average, moved from 2.1 to 2.8. Moreover, the percentage of encounters with antibiotic went up from 45% to 54%. The little improvement indicated that the various components interventions are more effective than a single intervention. So 40% of the improvement attributed to providers

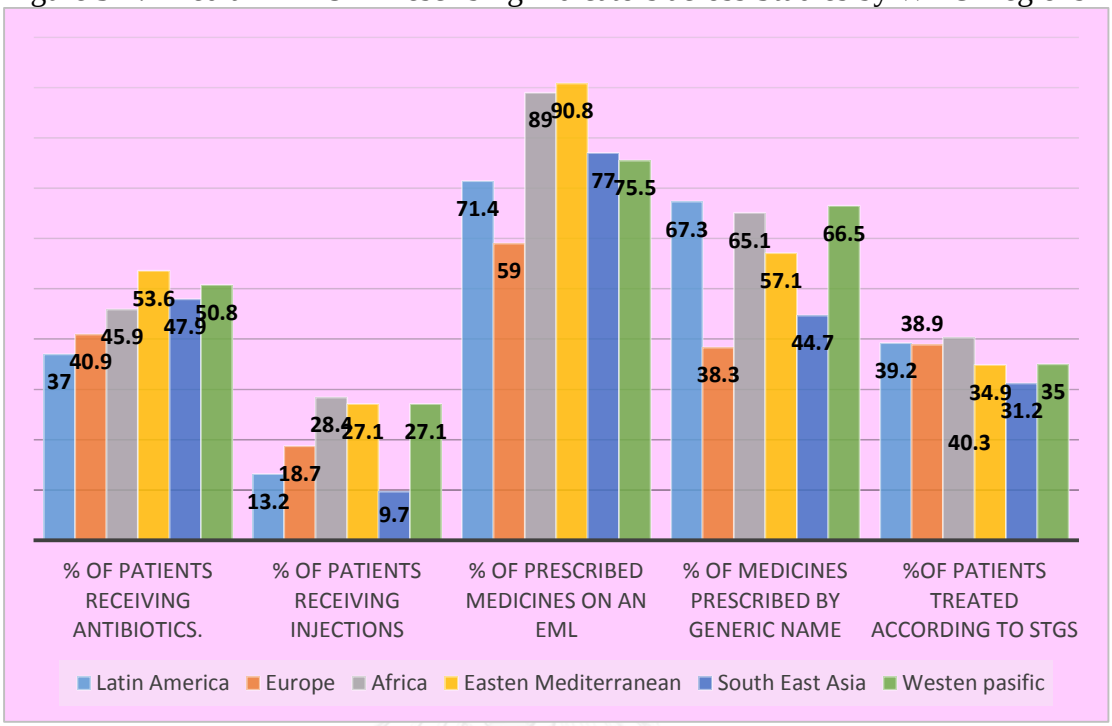
and consumers related interventions, 17% providers' education, and 8% for promotional printed material (Holloway, Ivanovska, Wagner, Vialle-Valentin, & Ross-Degnan, 2013).

The elicited prescribing indicators demonstrated vast disparities between the different WHO regions. The percentage of patients receiving antibiotics were highest in Eastern Mediterranean (53.6%), while the least in Latin America region (37%). In terms of generic drugs use, the highest using in Latin America (67.3), on the other hand the lower use in Europe (38.3%). The highest average number of drugs per encounter in West Pacific, 1.9, 2.1, 2.6, in Latin America, Europe, and Africa respectively. The providers more stick to essential drug list in Eastern Mediterranean and Africa and less in Europe. The lower income countries using the injectable, generic drugs, and follow EML more than upper and middle income countries. The private sector in accordance with rational prescribing indicators more than the private sector, and private not- for profit in the middle situation between both sectors. According to median of these studies the nurse and paramedics practicing closer to INRUD indicators standards. We could conclude from this study still now the use of medicines is poor with significant disparities among all region and in both public and private sector. Moreover, dictating that the concerned bodies have to use multi-component intervention to register appreciable progressing in prescribing indicators(Holloway et al., 2013). The figure3-1 shows the prescribing indicators by WHO regions.

3.1.4. The World Prescription Indicators (WHO/INRUD) Changing over Time

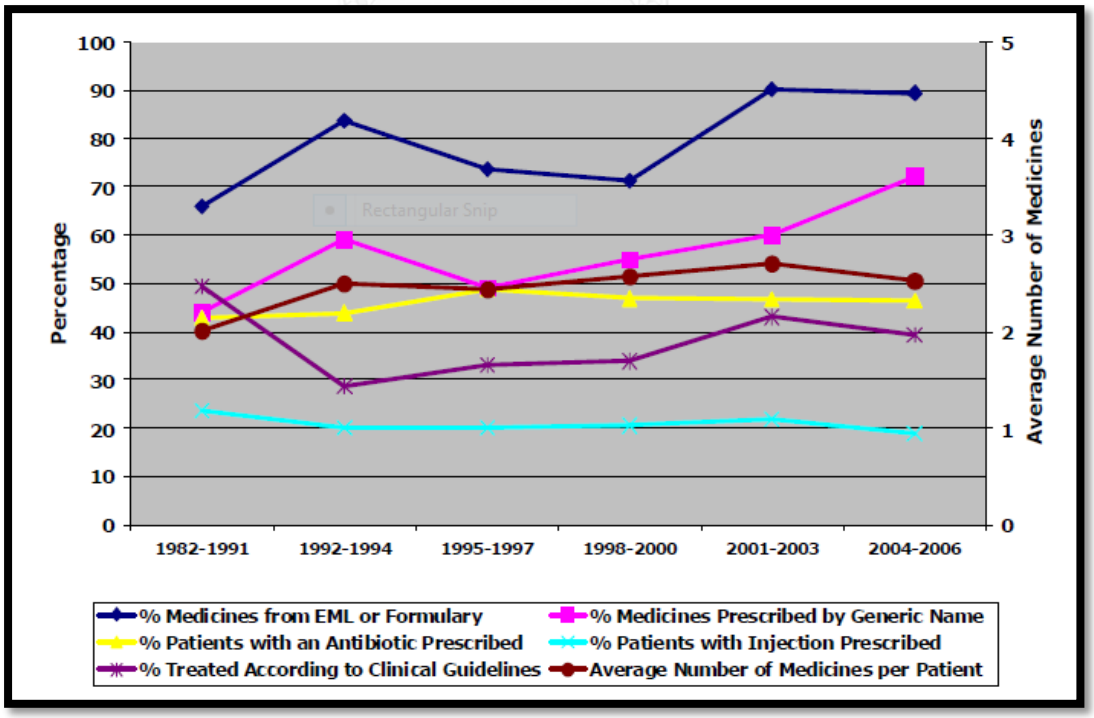
The global prescribing indicators studies illustrated the changes on these indicator across time. Calculation of indicators from studies datasets has followed the standardized and WHO/INRUD adopted technique and formats. The changes of these indicators most likely attributed to prescribers related factors and patients related factors. These factors can expressed in terms of factors influencing prescribing practice. The general trend of indicators over the time doesn't show consistency except relatively, the use of antibiotic and injectable. The adherence to essential drug list exhibited a significant progress over the time (25years).

Figure 3-1. Median INRUD Prescribing Indicators across Studies by WHO Regions



Source:(Holloway et al., 2013)

Figure 3-2. The WHO/ INRUD Prescribing Indicators over Time



Source: (WHO, 2009)

The percentage of medicines prescribed by generic registered remarkable increase, which realize more 70% in 2006. The trend of treatment of patient according to the clinical treatment guidelines had been going in inconsistent manner, across whole the period the just 50%, so it was under optimal levels. The use of antibiotic was continuing with the range of 40% to 50% over whole the period. The use of injectable not showed any trend over time, remained as base line. The average number of drugs per encounter was fluctuating between two and three, the minimum number was two and maximum number less than three(WHO, 2009). The figure2.2 illustrates the changes of prescribing indicators over time.

3.1.5. Asian Countries Prescribing Practice Indicators

There is great variation between countries when displayed the prescription patterns. The reviewed studies show at any prescribing indicator there were differences between public sector and private sector as well as the various prescribing level and professionals specialization. Some countries performed better on generic drug use, others on antibiotic utilization, and others on quantities in terms of an average number of drug per encounter. For instance;

3.1.5.1. Saudi Arabia

The assessment of prescribing indicators at primary health care level, study was conducted in ten PHCCs in eastern province with retrospective cohort of 1000 encounters, 100 from each. The data analyzed with index system of mathematical model. The results demonstrated that the percentage of injectable prescribed and average number of drugs per prescription with in the optimal level. The prescribers highly stick to the essential drug list, 99.2% prescribed from EML. On the other hand, the percentage of drugs prescribed by generic was 60.1%, too far from optimal value, the prescriptions with antibiotics slightly high than study proposed value. The study developed Index of rational drug prescribing, which was calculated as benchmark to rank the health centers according to the prescribing performance. (Mahalli, 2012)

3.1.5.2. Bahrain

A study conducted in ministry of health PHCCs by utilizing the cross-sectional prescriptions of one day in 2003, from 4 PHCCs out the total 20 health centers. Study purpose was to estimate the prescribing indicators. The prescriptions of family and general practitioners analyzed by Excel program according to WHO guideline of

prescribing indicators. The findings revealed that encounters with injectable and an average items per encounter 8.3% and 2.6% respectively, which within the range if compared with WHO benchmarks, but as general higher than European prescribing pattern indicators. Noteworthy, the prescribing by generic was very low 14.3%. The prescribing from EML (99.8%) was closer to the study proposed value. The antibiotics utilization 26.2 % less than the WHO threshold.(Tawfeeq A. Naseeb, 2005)

3.1.5.3. Yemen

A study of investigating the prescribing indicators of malarial patients in three malaria endemic districts, both public and private facilities was conducted. The data of public facilities collected retrospectively, while the private facilities data collected prospectively. The results revealed that the public prescribing practice is more rational than private practice. The average prescribed drug per prescription for public and private 3 and 4 respectively. The percentage of drugs prescribed by generic in public and private 67.1% and 35.8% respectively, while the percentage of encounters with injection 17.2 % - 33.5%. Study concluded that the prescribing practice irrational and public facilities significantly better than the private facilities. (Abdo-Rabbo, 2003)

3.1.5.4. Jordan

Retrospective study of evaluation physicians and patients use of pharmaceuticals carried out. 96 health centers in Irbid governorate stratified to nine sub-districts to select randomly 21 centers. The retrospective collection of 30 prescriptions from each center over a period of three months. The data analyzed with Epi Info program (low number of sample). According to WHO recommendation the 30 prescriptions sample not afford the study to compare between facilities. The results emphasized that the number of drug per prescription 2.3 on average, the percentage of drugs prescribed by generic 5.1% which was dominantly very low region wise or even worldwide. The percentage of encounters containing antibiotics and drugs prescribed from essential drug list 60.9% and 93% respectively. The more remarkable findings were overuse of antibiotics and underuse of generic drugs.(S.Otoom, 2002) Another study recently conducted ensured the same results 2.4 average number of drugs per encounter and so high percentage use of antibiotic 85%, although it was a prescribing pattern of children emergency hospital (Al-Niemat, 2014).

3.1.5.5. Turkey

The investigation of whether prescribing pattern at public health centers, and universities' hospitals, and private hospital rational or not was conducted. The study was based on random stratified sampling process, the health facilities included from 10 out of total population 81 provinces. The retrospective data from two months prescriptions collected and analyzed by Excel an SPSS. The results revealed that, on average the number of medicines per prescription was 2.83, and percentage of antibiotics and injectable dosage forms prescribed 39.1% and 10% respectively. The findings of study demonstrated a large disparities in an average cost of prescription at which the universities hospitals had the highest cost more than four times the cost in PHCCs.(Mollahaliloglu, Alkan, Donertas, Ozgulcu, & Akici, 2013). Another study confirmed that the use of antibiotics in turkey was high and in appropriate.(Usluer, Ozgunes, Leblebicioglu, & Turkish Antibiotic Utilization Study, 2005)

3.1.5.6. India

Evaluation of prescribing practice situation in the Madhya Pradesh, India was implement through cross- sectional consecutive randomized prescriptions of 26 PHCCs. The main findings were that, an average number of medicines per prescription 2.8 and the percentages of medicines prescribed by generic and encounters with antibiotics 48.5% and 60.9% respectively. Prescriptions contained injectable pharmaceutical forms and prescribed drugs from essential drug list were 13.6% and 66.9% respectively. The prescribing practice in this study showed significant irrational use of medicines, which was prominent in overuse of antibiotics and underutilization of generic medicines as well as lower adherence to EML.(Bhartiy, Shinde, Nandeshwar, & Tiwari, 2008). The private sector provides 80% of out-patient care in India, the results of this private study showed that the prescribing indicators away from the WHO standards. The number of drug per encounter was 2.63, the percentage of injectable and drugs prescribed from EML 4.13% and 33.5% respectively. The prominent manifestations the use of generic drug was 1.6%.(Roy, Gupta, Gupta, & Agarwal, 2013)

3.1.5.7. Thailand

Descriptive retrospective study to assess the physicians' generic prescribing practice in three of eight district hospital. The data was collected across 2008 out-patient prescriptions (10% of population). The number of medicine per encounter on average

was 2.85, and 73.9% of prescribed medicines by generic. This study revealed that there was room for further improvement in generic drugs prescribing (Plianbangchang P, 2010).

3.15.8. China

From 680 primary care clinics in ten provinces in china the prescriptions were collected to assess the prescribing practice across the village health outlets. The last 30 prescriptions from each clinic collected up to the end day of May of 2005, the Zhang and Zhi7 developed analytical mathematical model was used to measure the prescribing indicators. The drugs prescribed per encounter as average 2.36, the percentage of drugs prescribed by generic and encounter containing antibiotics 64.12% and 48.43% respectively. While the percentage of encounter prescribed with injectable and medicines from EML 22.93% and 67.7%. Collective, the prescribing practice performance was 3.32 out of 5 -Index of Rational Drug Prescribing(IRDP).(Dong, Yan, & Wang, 2011)

3.1.6. African Prescribing Practice Indicators

Poly pharmacy, overuse, and use of unnecessary drugs are the prevalent feature of most developing countries. The situation worsened by moving from public to private or out of pocket spending, which is leading cause of irrational use of medicine and self-medication implications. This situation required effective interventions and periodic monitoring and evaluation by using the recommended guidelines of WHO/INRUD.(HOGERZEI, 1995). As examples from the countries neighboring Sudan;

3.1.6.1. Egypt

Retrospective cohort study to assess the drug use pattern indicators across ten PHCCs randomized to represent the eight districts of Alexandria, Egypt. The sample was 100 prescriptions according to WHO guidelines from each health center. The data entered and was analyzed by SPSS to calculate the study statistics and ANOVA used to measure the statistical differences. The indicators with in optimal level or closer. Numbers of drugs per encounter was 2.5, while the percentage of encounters contained antibiotics and medicines prescribed by generics 39.2% and 95.4% respectively. On the other hand, the percentage of prescriptions with injections and the degree of accordance with

EML 9.9% and 95.4% respectively. The scored IRDP was very high compared with other countries performance.(Akl, El Mahalli, Elkahky, & Salem, 2014)

3.1.6.2. Ethiopia

For the purpose of measuring the prescribers' adherence to prescription writing principles, a study was conducted in PHCCs serves around 18,500 patient per year. The sample was based on assuming that the prevalence 50% and level of significance 5%, it was 384 prescriptions retrospectively collected across the 12 month randomly. The data was analyzed by SPSS. They showed that average drugs per prescription were 2.13, and 88.5% of medicines prescribed by generic names. Both of these readings were closer to the optimal level.(Sadikalmahdi H Abdella, 2012)

A study was conducted in Gondar university hospital showed very high level of prescribing performance and recommendable results, the use of generic drugs, the average number of drugs per encounter, and percentage of prescriptions contained antibiotics 99.16.6%, 1.76, 29.14% respectively. Hopelessly, 28.5% the prescriptions with injectable.(Endalkachew Admassie, 2013)

3.1.7. Comparison of Prescribing Indicators between Public and Private Sectors in Developing Countries:

The prescribing practice from numerous studies indicates that the performance of public sector is most likely better than the private sectors in all prescribing factors. The table 3.2 illustrates some studies results of prescribing indicators among some countries.

Table 03-2. Comparison between Public and Private Sector on Prescribing Practice Indicators

Country	Scope	Mean number of drugs		% Generic drugs		% Antibiotics		Citation
		Public	Private	Public	Private	Public	Private	
India	General	2.4	2.9	14.5	28.2	More	Less	(Patel V, 2005)
Mali	General	3.2	2.8	70.4	50	33.2	14.3	(Maiga D, 2006)
Tanzania	General	2.2	2.5	12.3	19.7	9.6	12.7	(Massele AY, 1997)
Pakistan	General	2.7	4.1	54	63	22	48	(S. Siddiqi, 2002)
Uganda	Partial	2.9	3.1	91.3	88	14.3	7.7	(Ogwal-Okeng JW, 2004)
Thailand	Partial	2.8	3.8	-	-	-	-	(Pongsupap & Van Lerberghe, 2006)
Malaysia	partial	2	1	-	-	-	-	(Tong et al., 2012)
Yemen	Partial	3	4	67.1	35.8	17.2	33.5	(Abdo-Rabbo, 2003)
Saudi Arabia	General	2.08	2.36	-	-	44	38	(Neyaz et al., 2011)

Source: Cited from the Literature Review

- General means about the whole medicines in EML
- Partial means specific group of medicine example; Malaria medicines

3.1.8. The Prescribing Quality Indicators in Health Insurance

Several studies revealed the health insurance or prepayment schemes as general have strong positive relationship between insured person and his utilization of health services. Well known in health services consumption curve is U-shaped related to age, that means the children and elders more utilized the services. There is study proved that the children access to primary care substantially improves by health insurance coverage. (Paulw. Newacheck, 1998). Health insured people use the prescription medications more than those non-insured or partially covered. In USA there was study conducted which showed that the part-year coverage used four less prescription than those whole year coverage people.(Karen P. Winters, 2010). The moral hazard from health services providers and patients are the prominent manifestations in health insurance schemes, likelihood we find the low prescribing performance among health insurance settings than other health financing systems. The following examples provide snapshots about prescribing practices how were being not closer to standards levels.

3.1.8.1. Nigeria

Research was carried out in Nigeria national health insurance scheme. This study was conducted in big university hospital with 530 beds. The data collected retrospectively and the sample of 10% outpatient prescriptions randomly distributed across the year. To get WHO indictors the data was analyzed by SPSS. The results demonstrated that the average number of drugs per prescription 3.4, and the percentages of antibiotic prescribed, the generic drugs prescribed, and the number of medicines in accordance EML were 56.2%, 51.5%, and 67.1% respectively. The percentage of encounters with injectable prescribed was within the optimal level. This pattern of prescription indicated remarkable irrational prescribing practice.(Okoro, 2013).

3.1.8.2. Iran

Retrospective survey to measure quality of prescribing practice among the specialists and general practitioners in social security insurance was conducted. Twenty cities of Isfahan province prescriptions collected, it were about eight million prescriptions. The data analyzed to determine the core WHO indicators and the average cost of prescription. The general practitioners practice was more poor quality than the specialists. For GPs, the average number of medicines per prescription, percentages of encounters with antibiotics, and generic drugs prescribed 3.34, 51.2%, and 49.2%

respectively. Noteworthy, more 61.76% of these prescriptions were issued by GPs, and all indictors were vastly under optimal level. The average prescription cost showed disparities between across specialties(Gholam- Hossein Sadeghiana, 2013).

3.2. Factors Affecting the Prescribing Practices

(MI Khan, 2011) The role of the rational medicines prescribers imperatively utilize all the capabilities and attempt to:

- Select the therapeutic choice that would maximize the clinical effectiveness
- Minimize the adverse drugs reaction and drug interactions as much as possible (minimize harms).
- A void wasting of scarce resources of health by get rid unnecessary prescribing.
- Respect actively the patient preferences to grantee the patient compliance.

The quality of prescription practice, improvement of patient care, and pharmaceutical services cost are directly related to the rational use of medicines. No doubtfulness, the main determinants of rational medicine use is the prescribers as well as patients and facilities related setting. The prescribers regulating drug use, because they are controlling the prescriptions. Thus, the prescribing practice deserves the studying of factors affecting the prescribing behavior of doctors. Numerous studies had shown there are objective and subjective factors influencing the prescribing practice. So, for rational practice we have to know these factors to work up to achieve that important objective for better health services quality and coverage. (WHO, 2003)

There are a lot of studies have proved a vast variation in prescribing practices in different health systems. If the medical factors influenced a lone, the prescribing practice might be explained by different patients' populations. But it is not the case, many factors have been found affecting the prescribing pattern in different health settings. For instance; education, experience, work conditions, peers, personality, and pharmaceutical advertising (Hemminki, 1975). A study done in England showed that the prescribers' sources of knowledge, 32% from their medical training, 28% from pharmaceutical firms, and 40% from other sources for instance, the Bosses advice, textbook, etc. Recently, qualified prescribers rely less on pharmaceutical industry information(Wilson et al., 1963) .In general there are different classification approaches

of that factors influencing prescribing, the present study going to take the following approach:

- Prescriber-related factors
- Practice-related factors
- Patient-related factors
- Drug-related factors

3.2.1. Prescriber-related Factors

3.2.1.1. Doctor's Characteristics and Job Satisfaction

The readiness to use recent introduced medicine or regimen is more common among those profession-oriented than other. In England from prescriptions records and doctors interviews revealed that just doctor personality affected about 15% of his prescription pattern(Joyce CR, 1967).

(Stolley et al., 1972) showed that in their study the fresh younger doctors more appropriate than other, but it is not generalizable. Another study after regression modelling demonstrated that the relation between doctor age and the quality of prescribing was significant and negative, the older doctors were more resistant to follow standard guidelines for rational prescribing than younger ones(Senior, Williams, & Higgs, 2003). (Ojo, Igwilo, & Emedoh, 2014) provided opposite results, study done in Nigeria showed that the poly-pharmacy prescribing and high use of non-generic drugs was significantly associated with younger prescribers. (Wang et al., 2013) study in china revealed the older doctors tended to use more antibiotics than younger ones. The study illustrated that the age, gender, and job satisfaction were not affecting the prescription quality indicators.(Kasliwal, 2013) found that across 431 Indian physicians' respondents the medical and psychosocial factors playing pivotal role in prescribing behavior. Meanwhile, the younger doctors more liable to these factors, particularly in response to pharmaceutical representatives' personalities and promotional activities and tools.(MELVILLE, 1980) evaluated the job satisfaction for 124 general practitioners and modelled a relationship with their prescriptions quality. Found the prescribers with better job satisfaction prescribed good quality prescriptions in compare with others with low satisfaction. Moreover, found the prescribers with low level of satisfaction permit sub-ordinate staff to write prescriptions.

3.2.1.2. Education and Training

The prescribers' education is the main source of basic medical science required to provide the essential therapeutic skills and maintains professional practice. The drug information quickly changeable from introduction of advanced medicines to obsoleted medicines. Thus continuation of education is important for better practice, for instance, in Finland the post-graduation compulsory for physicians. Many studies proved that the relationship between good education and good prescription quality of drugs (Balint, Hunt, Joyce, & Marinker, 2013). Another study found that education was more influential than experience according to the results of prescribing pattern of juniors' post-graduated prescribers in compared with seniors non- post-graduated from this study we can conclude that there is strong evidence supporting that the prescribing practice is largely determined by educational experience of prescriber. The younger recently post-graduated more appropriate. Peers and medical journal were the main sources of knowledge for general practitioners (Marshall H. Becker et al., 1972) . A study done in China to assess the effect of academic and administrative interventions on prescribing indicators. The study revealed that the effect of administrative interventions had short term effect, while the academic intervention had long lasting influence. The prescribing practice become more rational than before (Zou Jun1, 2011). (Kamarudin, Penm, Chaar, & Moles, 2013) conducted systematic review, included 47 studies about the effect of education on prescribing performance and competence. Some of these studies used WHO good prescribing practice guide, collectively there were positive results from these educational interventions.(Wang et al., 2013) among Chinese hospitals doctors sample proved that there was largely significant relation between final academic degree and specialty and rational prescribing practice, the differences significant in all five core WHO prescribing indicators. Moreover, the study showed strong relation between the education and training on rational drug use and rational prescribing performance.

Prospective study in North Carolina was done to explain the effect of lower education level or training on treated group of doctors. The treatment group showed lower prescription cost for out of pocket payment patient than the control group(Frazier et al., 1991). One of the famous studies about the effect of educational levels on prescribing practice was that study done in U.K at Keele University. The used repeated measures

data after education intervention among general practice of prescribing. The authors used control group and treated group to come up with the magnitude and nature of the six month educational effect. The study revealed a significant positive effect of education on prescribing quality indicators (Sithole & Jones, 2002).

3.2.1.3. Colleagues and Doctor Experience

In medicinal practice colleagues and bosses of doctors have influential power on their prescribing practice. Some junior doctors follow their bosses and consider their practice trend as instructions. A study showed that the doctors have access to contact with their colleagues introduced new drugs and change their prescribing patterns before those isolated ones(Marshall H. Becker et al., 1972). (Tsiantou et al., 2013) interviewed private and public general practitioners one of the main elicitations was the large effect of pharmaceutical companies' representatives on prescribing trend and implicating the cost of medications and clinical outcomes. Indirectly, the pharmaceutical firms advertising alter the patient expectations and changes his drug demand and spontaneously influencing the prescribing practice. Greece primary health care general practitioners study showed potential influence of GPs colleagues and consultation of specialists on GPs prescribing practice. Moreover, it revealed that public health authorities had influential effect (Tsiantou et al., 2013). The Greek and Cypriot physicians assured that the list of information sources were peer-reviewed journal, textbooks, conference, and pharmaceutical companies representatives (Theodorou et al., 2009).

The experience of doctor or the number of work year in many studies affected the prescription quality indicators. In Nigeria study to assess the factors affecting the prescribers in management of secondary infertility was conducted. This study has shown the years of experience affecting strongly the prescribing practice of doctors in terms of generic drugs prescribing and the source of medical information that they relied on(Rebecca Soremekun, 2014). A study done in Iran to assess the factors affecting the family physicians. Physicians' characteristics used as independents and their prescription outputs used as dependents and poison regression was run, the significant relation was found between the number of generic prescribed drugs per prescription and physician age and years of practicing i.e. experience(Arab et al., 2014).

3.2.2. Practice-related Factors

3.2.2.1. Demand from Society and Patients

In real life we find that the patients' families or employers have some sort of expectations imposed on doctors. Doctors interact differently with these expectations to get varied prescribing patterns. (Stolley et al., 1972) observed that the hurried practice with short time to patient and also low percentage of patients' visits to health outlet associated with appropriate prescribing practice. Study done in Greece across private and public primary health care providers revealed that the patient request and his family expectations were influential factors on prescribing practice, as well as the limited available time of patient. The third person prescribing potentially affect the prescription contents, for instance, person described specific drug to the patient or drugs previously sold over the counter by the patient (Tsiantou et al., 2013). Promoting the effect of patient demand Nigerian study, which found that the patients demand and their beliefs about the injectable more potent than ingestible, these patients behavior potentially influencing the prescribing pattern (Ojo et al., 2014).

(Joyce CR, 1967)conducted study on England National Health Service in three industrial towns. The prescription patterns differences were steadily consistent for a long time. The raised question was, what "are causes of this prescription patterns". The study linked the general practitioners prescriptions with information elicited from 93 randomly selected GPs. From sex tested factors the significant effect found related to quality of the practice, whole general practitioners orientation, and educational qualification.

3.2.2.2. The Prescribing Practice in Urban and Rural Areas

Study of systematic review of antibiotic utilization in China. Fifty seven included studies results indicated that the irrational utilization of antibiotics was significantly dominant in less developed area and excessive in low level hospital. The prescribing pattern differed largely across geographical regions and hospital capacities or levels(Yin et al., 2013). The geographical place urban or rural has most likely correlation with the crowd and workload. Nigerian study proved that there was significant positive relation between the irrational prescribing and the heavy workload in outpatients' outlets (Ojo et al., 2014). On average people live in rural areas less income than those in urban areas, the prescribers deal with them differently in

prescribing practice, and often they prescribe expensive prescriptions for those well-off. (Alex Y. Chen, 2002)conducted study in USA proved that the poor-families children prescriptions expenditures less than other economic status groups.

(Fernandez Urrusuno, Montero Balosa, Perez Perez, & Pascual de la Pisa, 2013) studied the relationship between the prescription quality indicators with the financial incentives. The authors found that the accordance with indicators based on prescribing related to financial incentives was higher than that of indicators not related to financial incentives.

3.2.2.3. Supervision, Guidelines and Essential Medicines List (EML)

Availability of standard treatment guidelines and EML has been recommended by WHO, to promote and enforcement of rational drug use. Study done in China for assessing effect of reform of using national essential medicine system in four provinces. The main results of this intervention were the reduction of drug prices in compare with the situation before the reform, and supporting the health system to encounter the financing challenges(Yan Song, 2014). (Wang et al., 2013) found that from 437 doctors surveyed, those more prescribing the generic drugs were those doctors adherent to essential drug list, so the relationship was significant.

(Yousefi, Majdzadeh, Valadkhani, Nedjat, & Mohammadi, 2012)carried qualitative study to investigate the reasons behind the irrational prescribing of corticosteroids in Tehran- Iran. The study revealed the main cause were lack of knowledge, patient-doctor relationship in terms of monetary cost, poor availability of alternatives, and week technical authorities' supervision. The proposed solutions from doctors were setting of forcing clinical guideline, essential drug list and activation of supervision, as well as improvement of professional knowledge.

(Atchessi, Ridde, & Haddad, 2013) have done study in Burkina Faso, to assess the prescribing quality cost containment in combination of interventions. User fee exemption policy introduced and simultaneously, training and regular monthly supervision were held. The three used quality indicators used showed significant reduction, in antibiotics usage, prescription of injectable, and mean number of drug per encounters.

A study done in Turkey to assess the effect of antibiotics restriction use policy in hospitals. The study revealed that the application of the policy reduce the antibiotics

use rate from 52.7% to 36.7% and reduced the antibiotics expenditure by 18.5% (Ozkurt et al., 2005).

3.2.2.4. Payment Mechanism

The payment mechanism affects directly the financial status of health facilities. Some reimbursement mechanism move the financial risk to the provider (Capitation) not like fee-for-service in which the payer encounters the risk. All patients involved in this study were insured by one of the insurance schemes. In study conducted in four district hospital to explain the effect of payment mechanism on the prescription cost. The study used logistic regression to assess the relationship between the payment mechanism and prescription cost if other factors (sex- age-diagnosis) were controlled. The authors found that the cost of fee for service patients prescription significantly higher than those capitated patients. The difference mainly attributed to the prescribing expensive drugs, no variation in the mean number of medicines per prescription(Bryant & Prohmmo, 2005).

(Dickstein, 2014) found that from the USA health data set analysis. The method of demand-side or supply-side incentives undertaken affected the prescription pattern. Capitation and co-payment encourage the prescriber to shift from his popular choice to the common cheap alternative. High co-payment on the demand-side would cause cost-sensitive patient and push him to quit the recommended choice with less compliance.

A study done in England to compare between the prescriptions cost among fond holders general practitioners and those non-fund holders (1990-1996). The study revealed that the cost was by 6% among fund holders than those non-fund holders(Harris & Scrivener, 1996). Fund holder physicians prescribe cheap choices of generic more than non-fund holder ones(R. P. Wilson, Buchan, & Walley, 1995).

3.2.3. Patient-related Factors

3.2.3.1. Patients' Socio-economics and Demographic Characteristics

(Roberts & Harris, 1993) studied the effect of patient sex, age, and permanent or temporary residency on prescribing pattern in England. The study revealed the highest volume and costs of prescriptions belonged to middle years both sex, age from 35 to 64 years. The under five children received numbers of prescriptions items twice those 5-14 years band, but less prices and accordingly less cost. The cost for female patients with ages 75 years and over was higher than male patients in the same age band.

Nationwide study was conducted in Korea comprised all administrative districts (250). The purpose was to assess the factors affecting the antibiotics and injection prescribing pattern. The 2006 and 2007 drug utilization data analyzed by using multivariate regression. The overuse of antibiotics or not and overuse of injection or not as dependent variables and the service demand and supply factors as independent variables. Study revealed the supply factors more influential than demand factors. The over use of antibiotic associated with greater sex ratio, total population, educational level, unemployment, and greater ratio of specialists to general practitioners. While the overuse of injections associated with areas with aged population and greater number of physicians in primary health care.(Choi, Park, Lee, & Kwon, 2012). In previous study conducted in USA found that in diarrhea management the physicians prescribing attitude more related to the patients expectations and the caretaker perception role more than professional instructions.(PATRICIA PAREDES, 1996)

3.2.4. Drug-related Factors

3.2.4.1. Pharmaceutical Promotion and Advertising

Whether prescribers like or not, the medical representatives of pharmaceutical companies' visits alter the prescribing practice. Many prescribers their main source of information is drug firm's representative. Some prescribers have no time to forego in pharmaceutical representative visit, but about 85% of general physicians do, whatever, there is value from the visit, information about efficacy, safety, and price of medicine are essential. Introduction of new drug let prescribers more keen to meet pharmaceutical representatives.(Richard Day, 2000)

Advertising in drug industry is debatable over a long time, the drugs firms allocate around 20% of sales for advertising and rivalry activities. Health systems everywhere think about how can rationally reduce the pharmaceutical cost and do good prescribing practice, on the other hand drugs firms work to increase medicines consumption. Thus, they work to change prescriber attitude to rely on attributes beside his therapeutics knowledge. A study conducted demonstrated that the Finnish doctors 64% of them considered the information given by medical representative drug firms useful, while 14% considered it useless. For that doctors with appropriate prescribing practice more critical of drug firms' information(Marshall H. Becker et al., 1972). Although another study showed the influence of medical journal was more than drugs firms'

representatives information(Seidenberg, 1971). Now a day the pharmaceutical promotional activities expanded to involve finance, post-gradational educational, research, and medical journals themselves. The business perspectives behind these activities(PARISH, 1973).

(Saad Shamim-ul-Haq, 2014) carried out study in Karachi among physicians, authors ran regression analysis to detect the relationship between prescription behavior of physicians and set of factors related to prescribing of branded drugs. The study found that the effect of new drugs, pharmaceutical promotional tools, and free samples of drug had a major significant effects on prescribing decision.

(Muijrers, Grol, Sijbrandij, Janknegt, & Knottnerus, 2005) conducted study in Netherlands to evaluate the impact from pharmaceutical industry representatives visits on the prescription quality indicators. Cross sectional survey was undertaken of 1434 general practitioners. The study found there was a significant negative relation between the prescription quality of solo GPs and number of visits from pharmaceutical representatives.

A study done in Sudanese teaching hospital, covered all respondent attendant doctors in the period of data collection, showed that 91.6% of respondent doctors perceived the medical representative information is valuable. Meanwhile 99.5% of respondent use the information of representatives of new registered medicines. Moreover, 79.1% of them confirmed that the discussion with medical representatives influences their medical practice(Liela Hussein1, 2012).

In 2011 the European union reported that the pharmaceutical advertising collectively in their member states, affect the pharmaceutical twofold: first, due to promotion of prescribing branded drugs and may unnecessary drugs, second the money spent on pharmaceutical promotion could be spent on research and development to get better health outcomes(Kanavos et al., 2011). A study was conducted in Iraq to assess the influence of medical representatives on physicians prescribing pattern. The study showed strong relationship between the physicians interaction with MRs and the irrational prescribing as well as the increase of prescription cost(MIKHAEL, 2014).

3.2.4.2. The Drug Price

The literature review demonstrated that the irrational prescribing directly inflating the prescription price, as well as affecting clinical outcomes. But the effect of drug price

on the prescribing behavior is more controversial according to the many published studies.(Tsiantou et al., 2013) found that among Greece Gps the price of medicine had large effect on prescribing, when the doctor was meeting the patient, according to his economic status decided which alternative is suitable to him. This is more detectable among pensioners who were using regularly many medicines.

On the other hand, study of systematic review about the physicians' awareness about drug cost. The study showed that the physicians had lower level of knowledge about the drug cost and medicines prices. Furthermore, they underestimated the cost of expensive medicines and overestimated the cost of inexpensive ones. This explicit the lack of appreciation of large cost disparities between the same therapeutic outcomes of different origin medicines. The consequences of low awareness is increasing of pharmaceutical expenditure and wasting of already scarce health resources. One of the prominent recommendations was introducing of medicine cost information in physicians training or education syllabus.(G. Michael Allan1, 2007)

In study conducted among physicians' sample from Greece and Cyprus in 2008 showed that in both country about 50% of respondents considered the drug cost important, meanwhile 15.95% and 11.4% of Greek and Cypriot physicians respectively, considered the drug cost highly important in their prescribing decisions. The importance of drug price effect was assured by 69.97% and 64.77% of physicians take into their account the patient insurance condition in Greece and Cyprus respectively (Theodorou et al., 2009). A study done in Nigeria showed that the effectiveness of drugs, daily dose and the cost of secondary infertility management drugs were the major factors influencing the prescription quality indicators(Rebecca Soremekun, 2014).

(Rizwan Raheem Ahme, 2012) studied the factors affecting the generic drug prescribing in Karachi, the study comprised both physicians and general practitioners, and found that there was a significant relation between the generic drugs prescribing and the cost of the drug and pharmaceutical promotion that provided by generic drugs sales representatives who were visiting the doctors frequently.

(Hassali et al., 2014) were studying systematically the literature to know the perception of physicians in lower and middle income countries toward generic drugs prescribing. The study found amazing result, in high incomes countries the physicians had positive

perception, the physicians in LMICs working in health systems with financing shortage, and nevertheless, they had mixed views toward the generic drugs use.

Capping or ceiling of reimbursement in medicines in health insurance plan reduced the drug expenditures particularly for multi-drugs users. Introduction of policy of co-payment in many studies reduced the medicines use even though the payment of patient out of his pocket is modest. Introducing a constant co-payment policy with a ceiling reduced all drug use and drug expenditures. (Austvoll-Dahlgren A, 2008)

(Dana P. Goldman, 2007) reviewed 132 articles relevant to the effect of cost sharing on prescription drug expenditures. Found that on average an increase of cost sharing by 10% the prescription drugs spending reduced by 2%-6% with therapy discontinuation and poor patient adherence particularly, those not well-off patients.

The continual information of prescribers with drugs prices and feed them back about the prices of different choices affect directly the cost of prescription in compare those don't the prices doctors. Some study recommended that the theme of medicines prices and prescription cost should be included in doctors' syllabus of university(Frazier et al., 1991)

3.3. The Previous Studies of Sudan Prescribing Quality Indicators

Clinically inappropriate, ineffective, and economically inefficient use of pharmaceuticals is commonly observed in health care systems throughout the world, especially in developing countries. The systematic review of Sudan conducted studies indicate there was irrational prescribing practice in all areas of studies concerns. The studies done in Sudan showed varieties in the health service levels of study, study scope, or methodology. The majority of done studies at Khartoum State. One study conducted in NHIF, it is about investigation of drug use in NHIF in 2012. The author revealed there was irrational use of medicines according to WHO/INRUD indicators. Collectively, we can say these studies about the rational use indicators assessment. Some conducted studies took qualitative and other quantitative methodology, some was using retrospective and other prospective data. Absolutely, no study about factors affecting that practice pattern of medicine use. The table 3.3 shows the prescribing indicators among studies were conducted in Sudan.

Table 3-3. Review of Studies of Sudan Prescribing Indicators

Year	Area	Level	Mean No of drug	% of generic	% of antibiotics	% of injectable	% from EML	Author (s)
1991	N-Province	PHCCs	1.4	63	63	36	-	(Bannenberg et al., 1991)
1996	Kh-State	PHCCs	1.9	48	73	22	98	(Abdelmoneim LA, 1999)
1998	Kh-State	Hospital+PHCCs	2.1	41	59	29	99	(GKALI, 2000)
2004	Kh-State	Teaching-H (2)	1.9	43	65	10.5	-	(Awad & Himad, 2006)
2007	(6) States	PHHCs	2.3	44.6	66	27	73.5	(Cheraghali & Idries, 2009)
2010	Kh-State	PHCCs	2	43.2	71.8	13.7	92.7	(SARA H.ELSALAHI, 2014)
2010	Kh-State	4 paed-hospital	2	49.3	81.3	3.5	-	(Ahmed & Awad, 2010)
2012	5NHIF-States	PHCCs	2.6	54.2	64	14	99.3	(Mustafa, 2013)
2012	Kh-State	Hospitals+ Pharmacies	2.8	37.3	54..3	38.6	72.8	(Mahmoud, Ali, & Kheder, 2014)

Source: Cited from the Literature Review

3.4. Measures for Improving the Prescribing Behaviors in EU

In EU the pharmaceutical expenditure represents 16% of the total health expenditure and 1.6% of the GDP. No doubt the prescribing behavior of doctors modifiable. The many different measures and interventions can affect the prescribing pattern directly and the total pharmaceutical cost as a consequence for those measures. The strong arguments are those measures used by the European Union States. The measures are vary from education to financial sanctions as well as incentives and obligatory of generic prescribing. Some Countries used the target budget for pharmaceuticals and others used prescription quotas. Moreover, some countries focusing more on information and knowledge. The following table shows the different policies taken by EU States to improve the prescribing behavior in order to contain the pharmaceutical cost. The generic drug use and substitution play pivot role in pharmaceutical cost containment without compromising health objective. For instance the obligatory pharmacist generic substitution applies in seven countries (Germany), and the substitution is indicative fifteen (France), and disallowed in five countries of EU Member States (Ireland). In terms of volume 43% of the pharmaceutical applied as generic and 18% as value. The increase of generic drug utilization to become as a volume 80% in all EU-States, will make saving in pharmaceutical cost 33% equivalent to 43 billion Euros (Giuseppe Carone, 2012). The table 3-4 shows EU policies of TPE cost containment.

Table 0-4. EU Policies to Improve the Prescribing Behavior for Cost Containment

The policy	**Description**	**Example**
Prescription monitoring	Annually conducted in most of the countries	U.K
Prescription guidelines	In 6 countries obligatory and in 18 indicative	Greece
Generic(INN) prescribing	Obligatory in 6 countries and in 17 indicative	Italy
Target budget	Used in 10 countries	France
Financial incentive	Incentives, sanctions, or both in 11 countries	Germany
Prescription Quotas	Used in 6 countries	Spain
Education & information	Used in 20 countries	Sweden
Pharmacists right in generic substitution	Obligatory in 7 countries, indicative in 15, and disallowed in 5.	Obligatory in Finland

Sources: GÖG 2010, EGA 2011, Esprin and Rovira (2007), Commission services (DGECFIN).

3.5. Generic Medicines and Cost Containment of Pharmaceuticals

Generic medicines are defined as the medicines clinically interchangeable with their counterparts' brands after the expiration of patency. The World Health Organization (WHO) defines the generic pharmaceutical product as(WHO, 2015a):

- Is usually intended to be interchangeable with an innovator product,
- Is manufactured without a license from the innovator company, and
- Is marketed after the expiry date of the patent or other exclusive rights.

A study was conducted in USA 1997-2000 for estimating the potential saving by using generic drugs. This cross-sectional study showed that if in 2000 all the out-patients prescriptions substituted totally by generic it would have been saved 5.9 billion or 11% of drug expenditure(Haas, Phillips, Gerstenberger, & Seger, 2005). The using of generic medicines in USA from 2002 to 2011 saved one trillion dollars(GPHA, 2012). In cost minimization analysis found that shifting from brands medicines to generic ones in 17 developing countries private sector would have been saving 60% of the cost. The savings of 17 medicines from 9% to 89%. Moreover, switching of just four medicines in China public sector could save US $ 370 million, saving 65% on average (Cameron et al., 2012). Study done USA showed that among HIV-AIDS patients if they switched from brand to generic ART medications, they could save US $ 920 million just in the first year (Walensky et al., 2013). In India a study bout economic comparison between the generic medicines use and branded ones of cancer chemotherapy conducted, it revealed that the use of generics save about us $ 843 million and expand the services to include non-covered patients (Lopes Gde, 2013). The generic products have societal value more than the cost saving through potentially reduced prices. These additional values for instance, increase of access to medications, stimulation of innovation by originators and generics producers, and in good circumstances have positive effect on medication adherence(Dylst, Vulto, & Simoens, 2015). In South Africa PPIs accounted for 21.5% of the total prescriptions. The use of available generics were less than brands by 36% to 68%. The authors concluded that the policies to enhance the use of generic were working in European countries(Truter et al., 2015)

3.6. The Summary of Literature Review

The irrational use of medicines is chronic prominent problem worldwide prevalent in the developing countries. The main implications of this malpractice are reduction of patient care, safety, and wasting resources for the individuals and community. The prescriber dominantly dictating the type and quantity of specific medicines for certain patient according to the doctor knowledge, beliefs, and other factors related to patient, practice, and drug. Thus the prescriber is the main determinant of prescribing practice and rationality of medicine use, more than health facility and patient factors. So the monitoring and evaluation of prescribing practice recommended from WHO and many reference technical bodies.

The prescribing performance assessment studies were done widely worldwide. Most of the studies had used the WHO tested and adopted formats to review the information of prescriptions. Some studies used prospective data and other utilized retrospective data across different intervals of times from one month to twelve month. The unit of analysis for the majority of reviewed studies was the prescription. The prescribing indicators calculation is so simple in average or percentage form. The surveyed studies used different analysis tools to get the indicators results and other descriptive statistics, for instance, Excel, SPSS, STATA, and Epi Info program. The results showed vast disparities between the different countries and between the private and public sectors as well as health insurance prescribing indicator too far from the WHO standards and mainly attributed to moral hazard and adverse selection. From literature the low and middle income countries indicators worsen than the developed countries widely and the percentage of pharmaceutical expenditures reflect that. Actually, some developing countries realized improvement in prescribing practice particularly in the average of drug prescribed per prescription and generic medicine use, but still there is lagging behind in antibiotic use rationalization.

The Sudan prescribing practice studies showed fluctuated indicators and big inconsistent variation across the time and states where the studies were conducted. The core indicators results illustrated in the table 2.3.

In terms of factors affecting the prescribing practice, worldwide few studies were done and most of these studies concerned about specific factors not comprehensive

assessment. The highly coverage of factors study was that carried in China recently and it was assessed the relationship between the prescribers practice and their socio-demographic experience, specialization, satisfaction, and qualifications(Wang et al., 2013). Other studies showed varied degrees of relationship and diversified potentiality of influence, but we can conclude that there are some factors related to the prescriber, practice, patient, and drug itself have statistical relation with the prescription quality indicators. These studies took the prescription or the prescriber as a unit of analysis to find the relation. Those used the prescription as a unit of analysis, they had run the Logistic, Poisson, and Multi-linear regression according to the dependent variable (indicator) binary, discrete, or continuous data respectively(Ward, Noyce, & St Leger, 2005) (Arab et al., 2014). On the other hand those used prescriber as a unit of analysis they ran the OLS and all the dependents have become continuous(Saad Shamim-ul-Haq, 2014) .

In terms of prescribing influential factors study hasn't done in Sudan before the present study. From the literature review I found just one quantitative study about the effect of medical representatives of medicines companies on the behavior of physicians(Liela Hussein1, 2012). Thus, this study will has policy implication in NHIF so as to expand the services horizontally and vertically as well as the containment of pharmaceuticals cost. Moreover, the present study will represent appreciable contribution to the rational use of medicines and medical services.

CHAPTER4

CONCEPTUAL FRAMEWORK

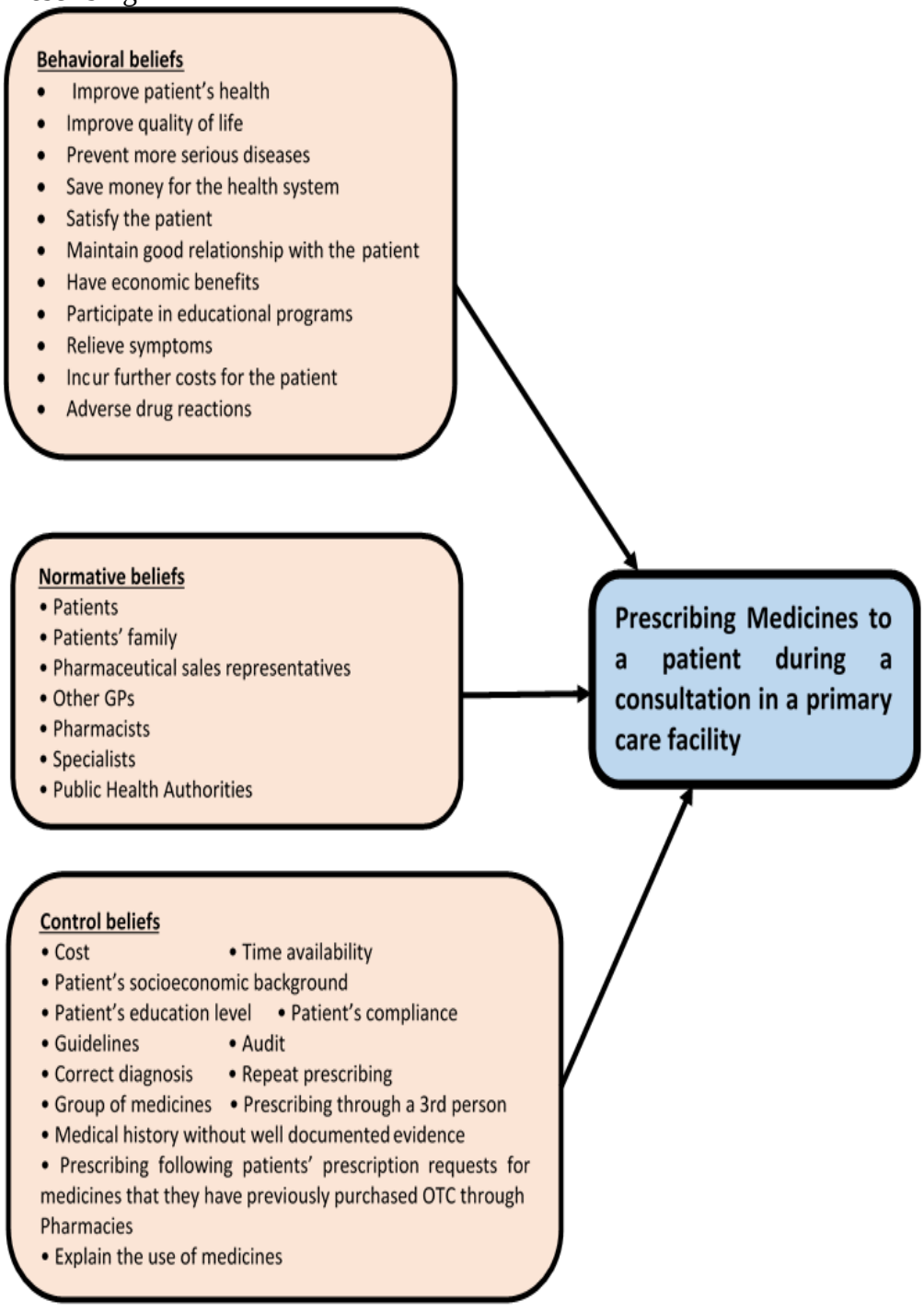
4.1. Prescription and Prescriber Behavior, Factors, and Beliefs

Prescription is a prescriber decision at the end of medical consultation. Decision means judgment based on multi-factorial behavior. According to the theory of planned behavior (TPB), the human behavior is guided by three main considerations (Tsiantou et al., 2013);

1. Behavioral beliefs related to the consequences of the decision, which represent the expected results, outputs, or impacts.
2. Normative beliefs related to the partners' expectations, which represent the stakeholders' pressures.
3. Control beliefs related to the factor that can facilitate or hinder the good performance. Figure 4-1 illustrates these categories of prescriber beliefs.

The prescriber behavior is empirical context more than theoretical, because it result in physical measurable product, will be benchmarked with standards. Thus the model which is more fitting our present study is the model that evaluates the demand-side and supply-side and the circumstances of the practice with in scientific empirical adopted measures. For that the study considered the interrelation between the prescribing pattern and the key factors that from literature we supposed affecting that pattern, these factors directly related to the prescriber, patient, practice conditions, or the product itself. According to WHO/INRUD there are adopted indicators to measure the prescription practice performance. Moreover, these performance indicators should be linked to these influential factors that related to the different factors groups. The study took this classification to set below framework design.

Figure 4-1. Behavioral, Normative and Control Beliefs of General Practitioners in Prescribing



Source: V. Tsiantou et al., 2013

4.1.1. The Prescribing Performance indicators

Core indicators:

- Average number of medicines per encounter
- Percentage of medicines prescribed by generic name
- Percentage of encounters with antibacterial prescribed
- Percentage of encounters with an injection prescribed
- Percentage of medicines prescribed from NHIF medicines list

Complementary:

- The average cost of prescription

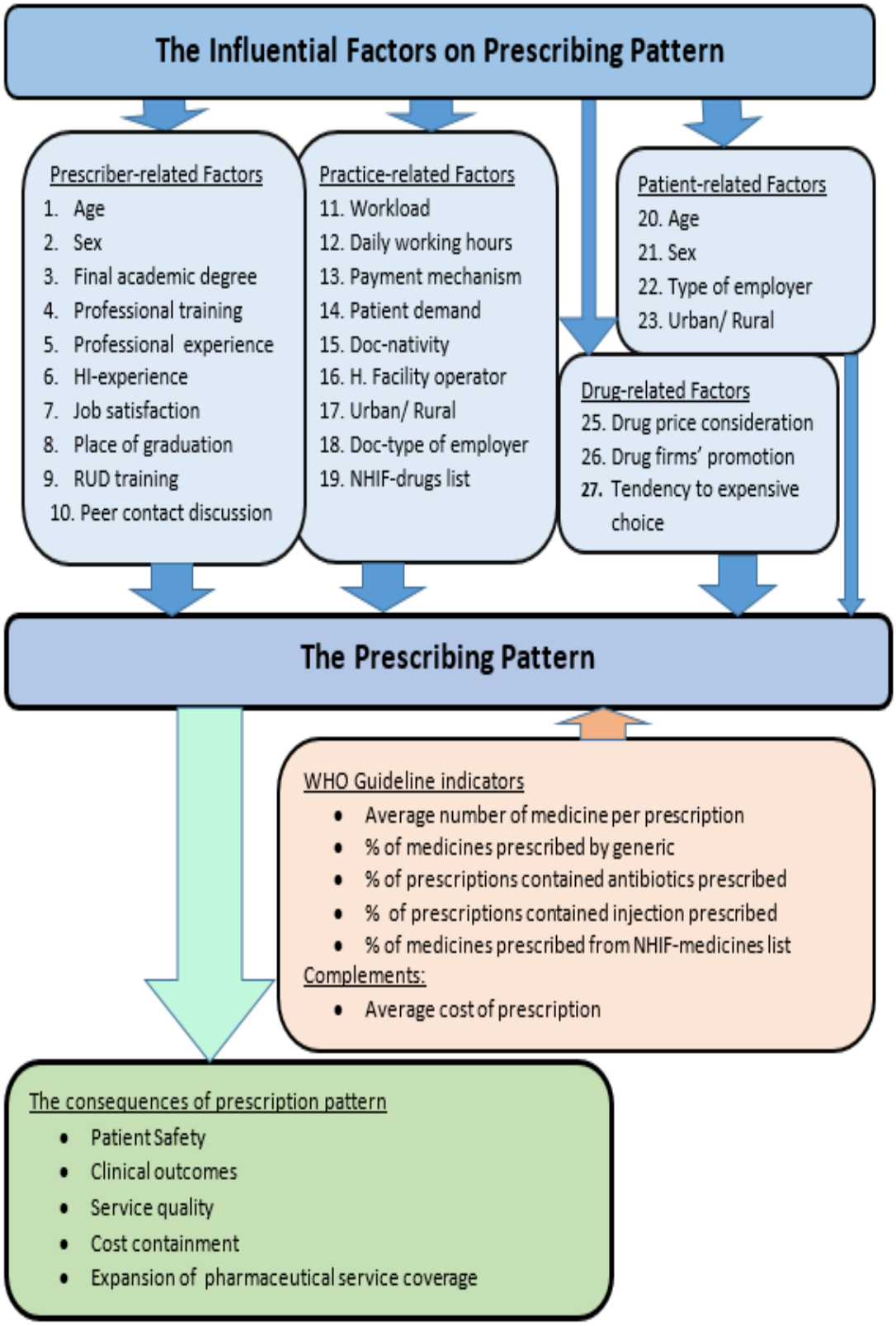
4.1.2. The Factors Influencing the Prescribing Practices

1. Prescriber-related factors
2. Practice-relate factors
3. Patient-related factors
4. Drug related factors

The conceptual framework in figure 4.2 illustrates the hypothetical relationship between prescribing quality indicators (dependents variables) and those factors affecting this prescribing performance or factors (independent variables). Moreover, it demonstrates the consequences of prescribing practice on the prevalent problem of irrational use of medicines. These implications of the rational prescribing practice translated in this conceptual framework as motivations of this study.

For more clarification of factors influencing the prescribers' behaviors or attitudes toward prescribing practice and prescription pattern, we presented the figure 4-1. From the previous the studies and literature there is wide overlapping between the prescriber characteristics, attitudes, beliefs, and attributes, so this figure will complete the picture at least the levels and types of beliefs of prescribers.

Figure 4-2. Conceptual Framework of Prescribing Practice and Related Factors



CHAPTER5
METHODOLOGY

5.1. Research Methodology

5.1.1. Study Design

The study design was observational descriptive cross-sectional. The data type was combined quantitative primary and secondary data. The study was based on WHO/INRUD experienced tested technique of prescribing core indictors investigation. Moreover, in last three decades it has been worldwide used technique of rational drug use assessment. The reference of this technique is "How to investigate drug use in health facilities" manual(WHO, 1993). In order to answer the research question this study comprised two datasets:

1. Retrospective cross-sectional data of prescriptions to conduct secondary analysis to get the prescribing performance indicators for each study unit (GP).
2. Primary data to provide the information about the proposed factors that might affecting the prescribing practice, these information hasn't been recorded in prescriptions. So we collected information through semi-structured controlled questionnaire, the interviewees were the general practitioners in PHCCs. Thus, we provided the GPs outputs as indicators of prescribing as well as factors related to the practice as information, these factors classified as:
    - Prescriber-related factors from GPs questionnaire
    - Practice-related factors from GPs questionnaire
    - Drug-related factors from questionnaire
    - Patient-related factors from the retrospective data of prescriptions

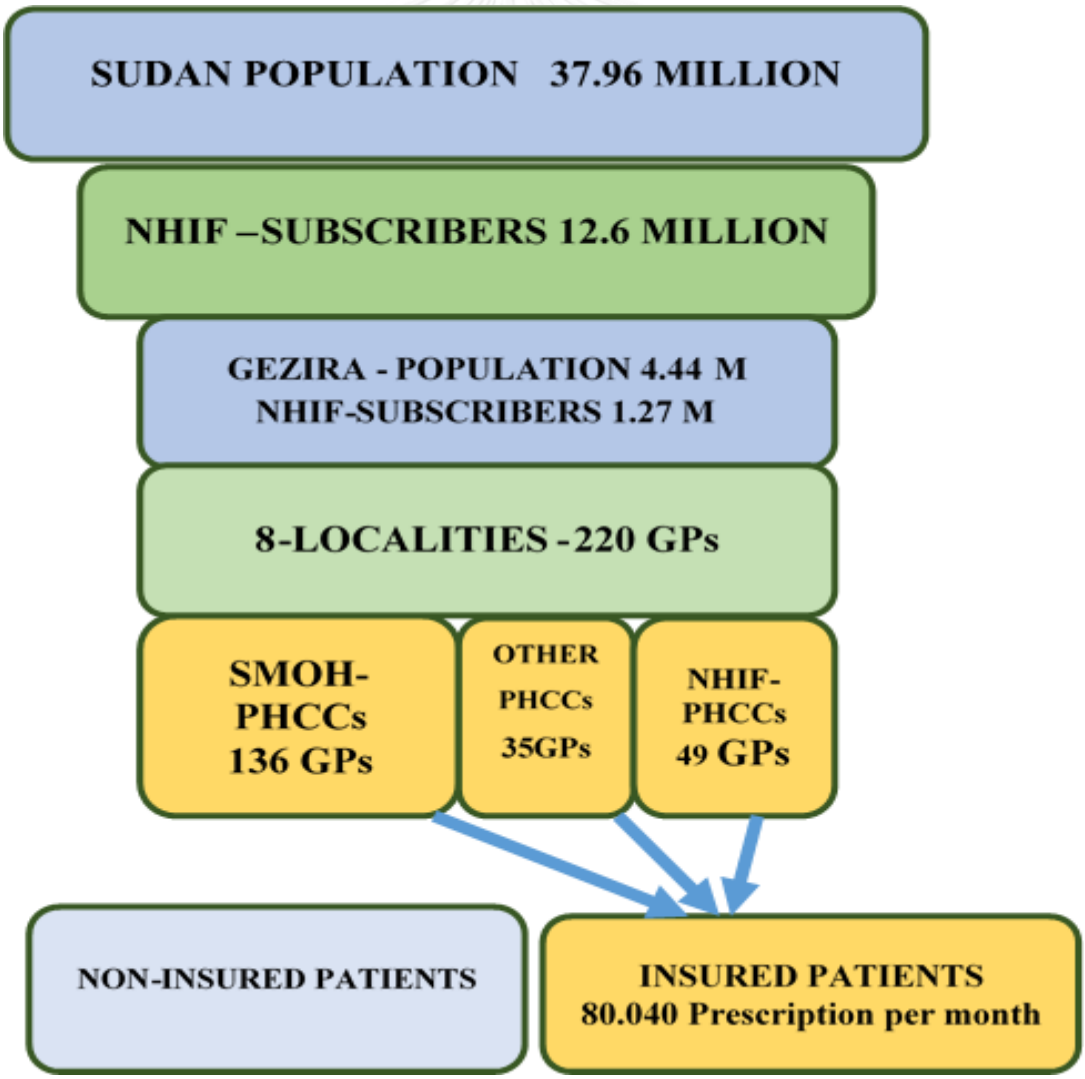
In other words, the retrospective prescriptions data to get prescribing indicators and patient-related factors that affecting the prescribing practice. The prospective data to provide the prescriber, practice, drug-related factors.

So, the study has two level of datasets, first, dataset of prescribers and the practice circumstances. Secondly, the data of prescriptions information to represent the prescribers' performance in the terms of prescribing practice quality. The retrospective data should be collected from the respondent GPs to questionnaires.

5.1.2. Study Location and Reference Period

The study was conducted in central region of Sudan in Gezira State. Gezira represents more organized prescription record and the largest population and subscribers for NHIF. Has a highest services consumption and pharmaceutical expenditure. The GPs provide about 80% of the health services. The data was collected in May 2015 and the retrospective data was collected over the last quarter in 2014 and first quarter in 2015. The questioners' completeness by GPs implemented at the beginning of that data collection period. The study covered the eight localities of Gezira State, which represents the whole primary health centers belong to NHIF, SMOH, and private sectors, which provide the services for insured patients.

Figure 5-1. The Study Population and Scope



5.1.3. Study Unit

The general practitioner is the study unit of this thesis, who provided the health services for insured patients in SMOH, NHIF, and private Facilities. GPs provide more than 80% of health insurance subscribers' health services.

5.1.4. Sampling Technique

The purpose of this study to assess the prescribing quality indicators and factors affecting that prescribing practice. The WHO/INRUD guidelines of rational drug use indicators investigation recommended that, if the purpose just to get the indicators without conducting of comparison between the different health facilities or prescribers, the sample should be at least 30 prescriptions from each one of at least 20 health facilities or prescribers. Otherwise, in case to evaluate the indicators and carrying comparison at least 100 prescriptions from each unit of study minimum ten health facilities or prescribers. This study to investigate prescribing practice among GPs and conduct comprehensive comparison between their characteristics and practice circumstances with their prescribing performance. Thus, according to the WHO manual and our case we had to take at least 100 prescriptions for each study unit (GP) to compare between these units. Moreover, it is possible to use retrospective or prospective prescriptions. WHO stated that the prescribing practice of prescriber is consistent whatever the sample taken at specific time or across long reference period (WHO, 1993).

5.1.5. Sample Size

The population of GPs in Gezira State and have provided primary health care for NHIF subscribers were 220 GPs. They were distributed over NHIF, SMOH, and other facilities. The sample according to the sampling formula:

$$\mathbf{n} = \frac{\mathbf{Nz^2pq}}{\mathbf{Nd^2+z^2pq}}$$

If we assume z = 2 (1.96 for the 95% level of reliability), then

$$\mathbf{n} = \frac{\mathbf{N}}{\mathbf{1+Nd^2}}$$

n = Sample Size

N = Population Size (220)

d = Precision (0.05)

z = Reliability Coefficient

p = Proportion of the population that has a particular attribute, by using the prevalence of 50%= 0.5

q = 1-p= 1-0.5=0.5

Sample size equal 141.9= 142 GPs

The total population is relatively small number. If we considered the expected non-respondents and the design effect almost the sample get closer to the total population for that;

The sample size = total population= 220 GPs

The total number of prescriptions should be = 100 encounters per general practitioner= 220*100= 22000 prescriptions

The questionnaire respondents 197 GP, with valid prescriptions or observations 19,690. The respondents 90% of the total population

1.1.1.1 Inclusion Criteria:

Every general practitioner in Gezira state and who had been working over all reference period of study (6 months),

- Had Provided primary health care services for health insurance subscribers,
- Had prescriptions in NHIF records and complied with study data collection criteria, and
- Completed the questioner

1.1.1.2 Exclusion Criteria:

Every general practitioner who

- Had no sufficient valid prescriptions
- Fulfilled the requirement but not-responded to the questionnaire.

5.2. Sample Procedures

The sample should covered all general practitioners in Gezira state, who fulfilled the inclusion criteria. They was working in three types of health facilities according to the ownership State Ministry of Health, NHIF, Private sector facilities.

Table 5-1. Distribution of General Practitioners among the Localities of Gezira State

Locality	Number of PHCCs	Number of GPs	Prescriptions per month
Madani	46	46	35,794
S.Gezira	46	46	10,071
Hasahisa	32	32	9,068
East-Gezira	17	17	4,546
Alkamleen	36	36	10,552
Almanagil	27	27	10,068
Algorashi	5	5	632
Omalgoraa	12	12	2,309
Total	221	221	83,040

Source: NHIF-Gezira report 2014

5.3. Data Collection

5.3.1. Retrospective Data

Prescriptions data for secondary analysis was collected retrospectively over the six months (October-2014 to March-2015). Firstly, the total prescriptions for each GP sorted out, then counted, the interval for systematic random sampling calculated, and lastly the first sample prescription determined by lottery.

- Interval = Total number of prescriptions divided by100 prescriptions.

Total number of prescriptions of specific GPs divided by 100, the result equal the interval between the observation and the next one.

Information of the hundred prescriptions of each GP was elicited in WHO modified format. The prescription contained information of six prescribing quality indicators, diagnosis and patient information for instance, age, sex, employer, and residence. This format is attached as appendix A.

5.3.2. Primary Data

The semi-structured questionnaire formulated to cover the required information of factors affecting the prescribing practice, prescriber information as well as practice related factors and drug related factors information. The questionnaires completed by controlled method. The questionnaire format is attached as appendix B

5.4. Quality Management

Piloting: We piloted the questionnaires among 12 GPs working in excluded facilities with similar characteristics.

Prescriptions testing: We tested the prescriptions collection and data entry following the same procedures after research assistants training and before conducting the study.

Revision of data collection tools: The formats after piloting underwent a revision and reformulation to accomplish the purposes.

Data entry: The study implemented double format reviewing and data entry for more accuracy and completeness.

Table 5-2. Data Collection Tools and Purposes

Data	Tools	Number	The Purpose
primary	Questionnaires completed by GPs	197 GPs	To provide the information about factors might affect the prescribing practice as independents in terms of; 1. Prescriber-related factors 2. Practice-related factors 3. Drug-related factors
Retrospective	reviewing Prescriptions of those respondent GPs in specific formats (appendix A	Equal the respondents of 197 GPs *100 prescriptions =19,690 prescription	Secondary analysis of prescriptions to get: 1. **Prescribing quality indicators:** • Average number of medicines per encounter • percentage of medicines prescribed by generic name • percentage of encounters with antibiotics prescribed • percentage of encounters with an injection prescribed • .percentage of medicines prescribed from NHIF medicines list • Average cost of prescription 2. **Patient-related Factors:** Age- Sex – Residence- employer

5.5. Study Variables

5.5.1. Dependent Variables:

For evaluating the prescribing performance for each GP we had to know these variables as outputs of prescribing practice and represent the dependent variables, which are;

1. Average number of medicines per prescription
2. Percentage of medicines prescribed by generic
3. Percentage of encounters with antibiotics prescribed
4. Percentage of encounters with an injection prescribed
5. Percentage of medicines prescribed from NHIF medicines list

Complementary:

6. The average cost of prescription 7. IRDP

5.5.2. Independent Variables:

These variables represent the factors expected influence the prescribing practice of those general practitioners, these factors were:

1. Prescriber-related Factors

1-Age 2- Sex 3- Professional Experience 4- Education level 5- Professional training 6-Health insurance experience 7- Job Satisfaction 8- Place of graduation 9- RUD training 10-Peer contact or discussions

2. Practice- related Factors

11- Type of employment 12- Native or nonnative 13- Workload (Number of patient per day) 14- Working hours per day 15-Payment mechanism 16- Patient demand 17- Health facility operator 18- Facility location (Urban/ Rural) 19- Availability of NHIF medicines List

3. Drug-related Factors

20-Drug price effect 21-Drug firms' promotion 22- Tendency to the expensive choice

4. patient- related factors

23-Age 24-Sex 25- Employer (insured patient) 26- Urban/ Rural 27-Diagnosis

5.6. The Study Assumptions

- Each episode or patient has only one prescription, because it possible to find two prescriptions for one patient, but it rare occurs, so it is negligible.
- All prescriptions information was intentionally written by the prescribers.
- The prescribing behavior is consistent overtime.

5.7. Operational Definitions

Synonyms: Encounter and prescription. Medicines and drugs

The prescribing indicators:

1. Percentage of drugs prescribed by generic name.

- Calculation: Percentage, calculated by dividing the total number of drugs prescribed by generic name, by the total number of prescribed drugs multiplied by 100.
- % of drugs prescribe by generic= Number of generic drugs/ number of prescribed drugs*100

2. The average number of medicines per prescription

- Calculation: Average, calculated by dividing the total number of drugs prescribed, by the total number of prescriptions
- Average number of drug per prescription= total number of prescribed drugs/ number of prescriptions

3. Percentage of prescriptions with an antibiotics prescribed.

- Calculation: percentage, calculated by dividing the number of prescriptions with antibiotic prescribed, by the total number of prescriptions.
- % of Prescriptions with antibiotic= number of prescriptions with antibiotic/ total number of prescriptions*100

4. Percentage of prescriptions with an injection prescribed.

- Calculation: percentage, calculated by dividing the number of prescriptions with an injection prescribed by the total number of prescriptions surveyed.
- % prescriptions with injectable= number of prescriptions with injectable/number of prescriptions*100

5. Percentage of drugs prescribed from essential drug list.

- Calculation: percentage, calculated by dividing the number of drugs prescribed and on the essential drug list by the total number of drugs prescribed.

- % drugs prescribed and on the list = number drugs prescribed on the list/number of drugs prescribed *100 (WHO, 1993)

5.8. Strengths and Weakness of this Methodology

The core prescribing indicators study method and data formats and technique was previously tested and adopted by WHO and have been used worldwide in large number of studies of that concerns. The sample we took the sample the total population. No available patient data about economic status. The reference period of study was six months, if it was twelve months would more better to avoid any possible seasonal variation, but the WHO guideline mentioned that the prescribing practice in terms of core indicators is consistent whatever the period of study data even prospective data(WHO, 1993).

5.9. Research Assistants

Twenty medical professionals and twenty statisticians were hired and trained on data collection, and excel sheet use for data entry, after enlightening them about the research objective and importance. Professionals worked in data collection, reviewing of prescriptions, and re-entry. Statisticians worked in data collection and data entry.

5.10. Top Leading Diagnoses in NHIF

Prescribing is doctor decision which should be based on the type and severity of the disease. It is human decision liable to be affected by many factors and perceptions, particularly, in antibiotic use. A study done in Lesotho revealed the negative relationship between the prescribing of antibiotics and utilization of laboratories diagnosis of sensitivity and microscopic testes (Adorka, 2013). Symptoms based antibiotics prescribing exposes more than 50% of UTI women to unnecessary antibiotics (Mishra, 2012) .Whatever, the diagnosis has determinant effect on the prescribing behavior. Definitely, the disease pattern varies from country to country and even inside one country differs from state to another. From literature review and studies done before I found that there were eleven diagnosis represent about 90% of the total diagnosis in NHIF. The following table 5.3 shows the diagnosis and the percentage of each:

Table 5-3. The Leading Diagnoses in NHIF

Seq	The Diagnosis	The percentage
1	Respiratory Infection	28.20
2	Malaria	15.60
3	Urinary Tract Infection	11.50
4	Gastro-Intestinal Tract	10.70
5	Hypertension+ Cardiovascular	8.40
6	Typhoid Fever	3.90
7	Diabetes Mellitus	3.70
8	Gynecological +Obstetric	2.20
9	Rheumatoid Arthritis	1.80
10	Diabetes + Hypertension	1.70
11	Central nervous system	0.20
Total		87.90

Source:(Mustafa, 2013)

5.11. Data Analysis

5.11.1. Pre-analysis Standard Operations Procedures:

- Sampling and preparing of tools and formats
- Hiring and training of data collectors
- Piloting and tools testing.
- Revision of tools and format contents according to the piloting and testing results.
- Reconciling the presence of GPs with availability of their prescription records.
- Collecting the prescriptions of all study units (GPs) retrospectively and separately.
- Completeness of questionnaires
- The data of prescriptions collected, encoded, and reviewed in specific formats for each GP, and so we did with GPs questionnaire information.
- Then the data was entered on computer Excel sheets.
- The process of entering was be doubled for more accuracy and completeness.
- The data cleaning to address the gaps, missing, and formulate it in ready formats and convenient for the several models of analysis.
- Upload of Excel file in statistical program for analysis (STATA-12)
- Data cleaning and classification
- Conducting the analysis.

5.11.2. Measurements and Standards

There are no standards fit all countries, but WHO has generic standards as well as worldwide studies provided convenient results as benchmarks for comparison;

- The average number of medicine per prescription , from literature there are many definitions, but the minor threshold to define the situation as a poly-pharmacy is a concomitant more than two drugs at least prescribed in one encounter (Viktil, 2007).

Study benchmark 2

- Percentage of medicines prescribed by generic 100%
- Percentage of prescriptions prescribed with antibiotics <=30%
- Percentage of prescription prescribed with injections <=10%
- Percentage of medicines prescribed from essential drug list 100%

(WHO, 1993)

Complementary indicator:

- Average cost of prescription is determined approximately: NHIF used to allocate 30% of it is budget for medicines service, meanwhile the average monthly contribution per family is about 40 SDG, the average number of family member is 4.5 persons, and the targeted utilization rate per year (1.3--2 visits). Thus the expected prescription spending should be with this assumptions:
- Every health patient comes to physician consultation has prescription.
- The prescriptions of all prescribers have same average cost whatever the specialty.

Average prescription spending standard= 40SDG*12 month* medicines budget/ (family member*utilization rate) = 40*12*0.3/ (4.5*1.3 or 2) = 16----24.62 SDG (proxy)

- The Index of Rational Drug Prescribing has maximum value 5.

5.11.3. Study and Analysis Unit

The study directly used the patients' prescriptions as analysis units.

5.11.4. Data Analysis Phases

5.11.4.1. First Phase of Analysis

Firstly, after data cleaning, we used the STATA to analyses the 19,690 observation (prescriptions secondary analysis) we got:

1. The descriptive statistics of variables, for instance, means, standard deviations, differences between the different groups of independent, as well as diagnoses.
2. Ratios of drugs prescribed by generic names and drugs prescribed from NHIF-list.
3. The prescribing quality indicators for each general practitioner (6 indicators) as average of 100 prescriptions indicators.
4. The average prescribing indicators to describe the overall general prescriptions pattern.
5. The Index of Rational Drug Prescribing (IRDP)

5.11.4.2. Second Phase of Analysis

Independently, assessment of the relationship between the factors related to patient, physician, practice, and drug and prescribing indicators separately (19,690 observation) by using these regression models:

- Logistic regression modelling with dependents of antibiotics use and injectable prescribed.

- Poisson regression modelling with dependent of number of drug per prescriptions
- Multi-linear regression modelling with dependents of the prescription cost, the number of drug prescribed by generic, number of drugs prescribed from NHIF drugs list, and IRDP

5.11.4.3. Third Phase of Analysis

Lastly, we compiled all factors or independents together and conduct the analysis versus the different types of dependents (indicators). Thus we again have run three different types of regression. These phases of analysis can be summarized as in table 5-4.

Table 5-4. The Analysis Phases and Methods

Phase	Observations	Process	Method of analysis	Purpose
Phase One	Prescriptions of all respondent GPs	Descriptive statistics Determinant statistics	Using STATA Descriptive	• Means-ranges-Standard deviation- differences and significances • Calculation of prescribing indicators for each GP. • The comparison between different health facilities • Determination of prescription pattern-IRDP • Descriptive statistics of diagnosis
Phase two	Prescriptions and questionnaire information 19,690 Observation	Inferential statistics	• Poisson, logistic, and multi-linear regression four groups 7 dependents	• Assessing the relatedness of four different groups of factors separately to the 7 dependents of prescribing quality indicators.
Phase three	Prescriptions and questionnaire information 19,690 Observations	Inferential statistics	• Poisson, logistic, and multi-linear regression	• The collective determination of the factors that affecting the prescribing practice

5.12. Dependent Variables

1. Average number of medicines per encounter
2. The percentage of medicines prescribed by generic
3. The percentage of encounters contain antibiotics
4. The percentage of encounters contain injectable
5. The percentage of Medicines prescribed from EML
6. The average cost of prescription
7. IRDP

Table 05-5. Prescriptions Dependents Categories

No	Prescribing indicators at prescriptions level	Dependent category	Regression models
1	Number of medicines per encounter	Discrete (count) (1, 2...)	Poisson regression
2	Ratio of medicines prescribed by generic per prescription	Continuous (cost)	Multi-linear regression
3	The encounter contained antibiotics	Binary (Yes / No)	Logistic regression
4	The encounter contained injections	Binary (Yes/ No)	Logistic regression
5	Ratio of medicines from NHIF – EML ratio at prescription level	Continuous (cost)	Multi-linear regression
6	Cost of prescription	Continuous (cost)	Multi-linear regression

5.13. Independent Variables

- **Prescriber-related Factors:**

1. X_1 : Age =The age of general practitioner
2. X_2 : Gen = The prescriber gender : =1 if male = 0 if female
3. X_3 : Edu = The education of prescriber =0 if Bachelor degree = 1 if more
4. X4: Train= The professional training in last two years =1 if got training = 0 if didn't get
5. X_5: Expert = The professional experience in years
6. X_6: HI-experience = The number of months
7. X_7: JS1 = High job satisfaction. = 1 if high =0 otherwise
8. X8: JS2 = Average job satisfaction. = 1 if average =0 otherwise

9. X_9 : PG1 = Place of graduation = 1 if graduated in Gezira = 0 if not Gezira
10. X10 : PG2 =1 if Khartoum =0 if not Khartoum
11. X_{11}: RUD = Exposed to rational use of drug training = 1 if exposed =0 if not
12. X_{12} : PCD = Exposure to peer contact and discussion =1 if exposed =0 if not

- Practice- related Factors

13. X13: Gov-Employ, Governmental employee =1 if governmental = 0 otherwise
14. X_{14} Cont-Employ=, Contracted employee =1 if contracted = 0 otherwise
15. X_{15}: NAT = Working in his/ her original locality =1 if yes =0 if No
16. X_{16}: NPD= The average number of patients per day
17. X_{17}: WHR = The average daily working hours.
18. X_{18} : PM1 = The payment mechanism = 1 if salary plus incentive =0 if salary
19. X_{19} : PD= percentage of patients demand specific drug name
20. X_{20} : NHIF-list= Presence NHIF-list = 1 if available =0 if not-available
21. X_{21} : HFO1 =Health facility ownership =1 if SMoH =0 otherwise
22. X_{22} : HFO2: Health facility ownership =1 if NHIF =0 otherwise
23. X_{23} : HFL= Health facility location =1 if Urban = 0 if Rural

- Drug-related Factors

24. X_{24} : DPR = The drug price =1 if the drugs price consider =0 if not
25. X_{25} : DFP= Drugs firms promotion, average number of MR
26. X_{26} : HPT: Tendency to high price= 1 if tending to =0 if not

- patient- related factors

27. X_{27} : P. Age = The age of patient
28. X_{28} : P. Sex = patient sex =1 if male =0 if female
29. X_{29} : P. Emp1 = The employer = 1 if of affiliated public sector =0 if not
30. X_{30}: P. Emp2 =1 if private sector =0 if not private sector
31. X_{31} : P. Emp3 =1 if affiliated to supported families =0 if not supported families
32. X_{32} : P. Emp4 = 1 if affiliated to pensioners = 0 if not pensioners
33. X_{33} : P. Emp5 = 1 if affiliated to self-employment sector =0 if not self employed
34. X_{34}: P. Resd = Patient residence =1 if urban =0 if rural.
35. X_{34}: Chronicity: 1 if chronic diagnosis =0 if Acute

5.14. The Dependents Variables and Explanatory Variables

Table 05-6. Grouping of Dependent Variables

Dependent variables	Group
1. The average number of drug per encounter	**Group-A**
2. Percentage of encounters with an antibiotics prescribed.	
3. Percentage of encounters prescribed with injection.	
4. The average cost of prescription	
5. Percentage of drugs prescribed by generic	**Group-B**
6. Percentage of drugs prescribed from essential drug list	
7. IRDP	

Group-A represents the prescribing quality indicators, in which almost their increases indicate the prescribing practice getting closer to irrational use practice. So elevation of the value of these indicators significant symptoms of malpractice or low quality prescribing practice. **According to standards should be =<2, <30, <10, and** < 16---24.6 SDG respectively.

Group-B represents the indicators of prescribing which as much as their percentages increases as much as the prescribing practice get closer and closer to the rational practice. Should be 100% both generic use and EML adherence, and 5 for IRDP.

Table 05-7. The Independent Variables of the Factor Groups

Factors	**The independents**	**The number**
Prescriber-related Factors	Age, Gen, Edu, PRO- Train, Pro-Expert ,HI-expert, HJS, AJS, PG1, PG2, RUD, PCD	12
Practice-related Factors	NPD, WHR, PM1, PD, NHIF-LIST, HFO1, HFO2, HFL, Emp1, Emp2, NAT	11
Drug-related Factors	DPR, DFP, HPT	3
Patient-related Factors	P. Age, P. Sex, P. Emp1, P. Emp2, P. Emp3, P. Emp4, P. Emp5, P. Resd, Chronicity	9
Total		35

Table 5-8. The Expected Signs of Independents Coefficients

Independents	**Measurement**	**Gr-A**	**Gr-B**	**Citation**
The prescriber age	Years	+	-	(Senior et al., 2003)
The prescriber sex	Male/ Female	+/-	+/-	(Lai et al., 2009)
The education of prescriber	Bachelor/ Above	-	+	(Frazier et al., 1991)
The professional training	Yes/ No	-	+	(Wang et al., 2013)
The professional experience	Years	-	+	(Kanavos et al., 2011)
The job satisfaction	High, Middle, Un	-	+	
Place of graduation	Gezira, Kh, Others	+/-	+/-	
Rational use of drug training	Yes, No	-	+	(Hilmer SN, 2009)
Peer contact and discussion	Yes, No	-	+	(Bennett, Quick, & Velásquez, 1997)
The original residence to work place	Native, nonnative	+	-	(Marshall H. Becker et al., 1972) (Arab et al., 2014)
The type of employers	Public, Private, Others	+/-	+/-	(Arab et al., 2014)
The average number of patients per day	Number of patients	+	-	(S. Siddiqi, 2002)
The average daily working hours	Hours	-	+	(Ojo et al., 2014)
The payment mechanism	Salary, FFS, S+ bonus	+/-	+/-	
Patient demand of medicines	Percentage of patients	+	-	(Bryant & Prohmmo, 2005)
Availability NHIF-medicines list	Yes, No	-	+	(Stolley et al., 1972)
Health facility ownership	SMOH, NHIF, Private	+/-	+/-	(WHO, 2015b)
Health facility location	Urban, Rural	+/-	+/-	(Maiga D, 2006)
The drug price	Affect , not affect	-	+	(Yousefi et al., 2012)
Drugs firms promotion	Number of MRs visits	+	-	(G. Michael Allan1, 2007)
Tendency to expensive drug	Yes /No	+	-	
The patient age	years	+	-	(Liela Hussein1, 2012; MIKHAEL, 2014)
The patient sex	Male/Female	-	+	(Roberts & Harris, 1993)
The patient employer	Public, private…	+/-	+/-	
Patient residence	Urban/Rural	+/-	+/-	(Bhardwaja Dineshkumar, 1995; Kumari Indira K.S, 2008)

5.15. Hypothesis and Equations

Null Hypothesis:

$$H_o : \beta_1 = \beta_2 = \ldots = \beta_p = 0$$

Alternative Hypothesis:

H_A : At least no one of Betas equal ZERO

Multi-regression equations:

1. **$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots + \beta_k X_k + \varepsilon$ ……Multiple Linear**
2. **$\text{Ln}(P/1\text{-}P) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots + \beta_k X_k + \varepsilon$ ……Multiple Logistic**
3. **$\text{Ln}(\text{mean}Y) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots + \beta_k X_k + \varepsilon$ …Multiple Poisson**

Table 5-9. Prescribing Indicators and Regressions Coefficients Interpretation

Indicator	**Regression**	**Interpretations**
Continuous • Prescription cost	Linear	• β is the average change in Y per one unit increase in X, the rate of change
Binary (P= proportion) Prescription containing: • Antibiotics • Injections	Logistic	• Exp (β)=eβ=odds ratio (OR) for a one unit increase in X
Discrete (positive integers) • Number of drugs • Number of generic ones • Number of drugs from EML	Poisson	• Exp(β)= Incidence rate ratio (MR) for a one unit increase in X • Positive coefficients indicate higher rate; negative = lower rate

CHAPTER6
RESULTS

The targeted population of medical doctors in Gezira completed the semi-structured questionnaires, which had been tested and manipulated before. One hundred prescriptions for each doctor were retrospectively collected, reviewed and analyzed using STATA-12 program to answer the study questions and test its hypotheses. The results are presented below. The first section is the descriptive statistics of the sample, and the second is the prescription pattern and prescribing quality indicators. The third section is the factors affecting the prescribing practice.

6.1. Summary of Sample Characteristics

197 of the 220 medical doctors (90%) completed the questionnaire and had valid prescriptions over the six months reference period of retrospective data collection, which represents the last quarter of 2014 and the first quarter of 2015. The total valid number of observations was 19,690 prescriptions, one hundred prescriptions for each one of the 197 medical doctors. Each observation contained patient characteristics and clinical diagnosis.

6.1.1. Medical Doctors Characteristics

The distribution of medical doctors over the health facilities operators revealed that 63.96% of them were affiliated with the State Ministry of Health (SMOH), and the mean age of doctors was 32.6 years (Table 6-1). The majority of medical doctors were females (60.4%) similar to the female ratio among medical schools graduates recently.

Table 06-1. Medical Doctors Distribution and Characteristics

PHCC Operator	Mean Age	Number of GPs	Males	Females	%Females
SMOH	32.56	126 (63.96%)	47	79	62.70
NHIF	34.00	43 (21.83%)	17	26	60.47
Others	30.70	28 (14.21%)	14	14	50.00
Total	32.61	197(100.00%)	78	119	60.41

Others = (Private, Universities, NGOs)

6.1.2. Patients' Sex:

Almost two thirds of prescriptions enrolled in the study sample were from females (Table 6-2) although the Sudan 2008 census found that the ratio of males to females was approximately the same. The ratio of insured females' health utilization compared with males' was similar to this sample ratio 2:1.

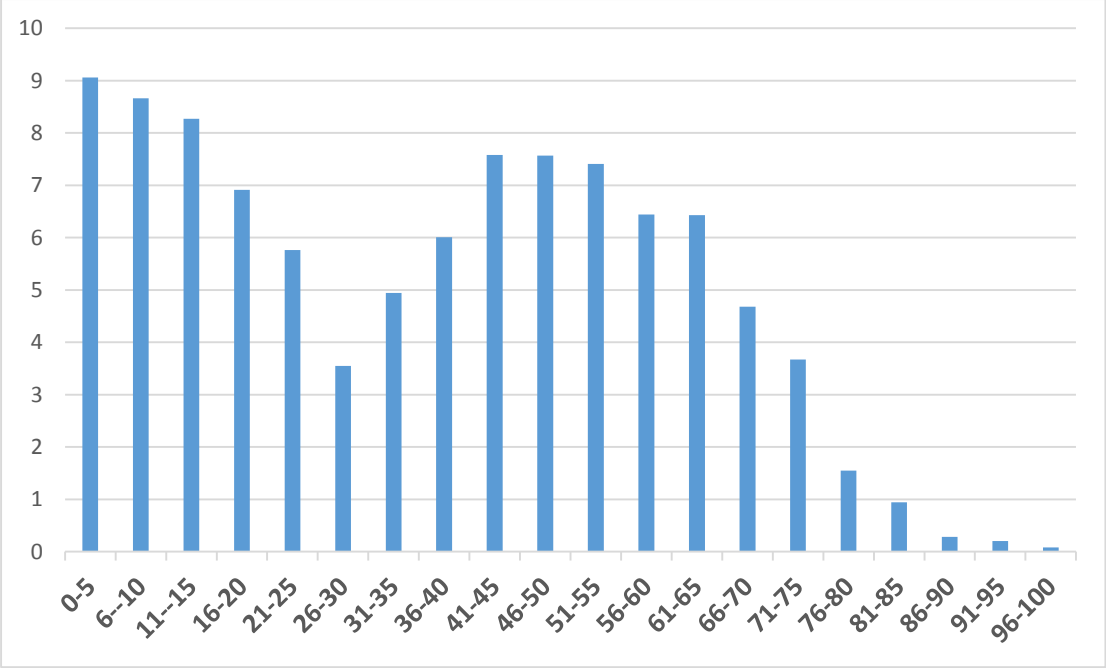
Table 6-2. Patients' Sex

Patients' sex	Freq.	Percent	Cum.
Female	12,994	65.99	65.99
Male	6,696	34.01	100
Total	19,690	100	

6.1.3. Patients' Age

The patients' ages distribution showed a U-shaped, which was similar to age based health utilization pattern worldwide (Figure 6-1). The under-five years patients represent 9% then decreased to the lower level at age range 26-30 years, and again went up to the more than 7% at age 51-55 years. Life expectancy at birth for both sex in 2012 was 63 years (WHO, 2015c)

Figure 06-1. Patients' Age Groups



Generally, in rural areas the people within 0-15 years represent a high percentage of health utilization compared with their counterparts in urban areas, which is expected in developing countries where child health in rural areas is worse than in urban ones (Appendix D). Moreover, females utilize health services significantly higher in the reproductive age (21-50 years) than other ages. Males' health utilization pattern showed high use of health before 15 years and between 51-65 years (Appendix E).

6.1.4. Residence Based Patients' Distribution

Almost 50% of prescriptions or patients was from rural and the second half from urban areas (Table6-3). According to the households' survey in 2009, urban inhabitants comprised 33.2% of the total population and so was the health insurance coverage. The reason for low rural health utilization is most likely low health services accessibility compared with urban areas.

Table 06-3. Residence Based Distribution of Patients

Patient Residence	Freq.	Percent	Cum.
Rural	9,962	50.59	50.59
Urban	9,728	49.41	100.00
Total	19,690	100.00	

6.1.5. Employer Based Patients' Distribution

The patients insured through the public sector represented 39.23% of the total population, while those insured by social funds as poor families' member totaled 27.13% of our patients (Table 6-4). The portion of private sector patients was modest and so was the self-employed sector. The percentage of each sector was consistent with the health insurance employer classified coverage. The majority of pensioners, students, and private sector affiliated patients were urban residents. In the other extreme, the majority of poor families and self-employed patients were rural residents, while the public sector patients were relatively equally distributed between rural and urban areas (Appendix F).

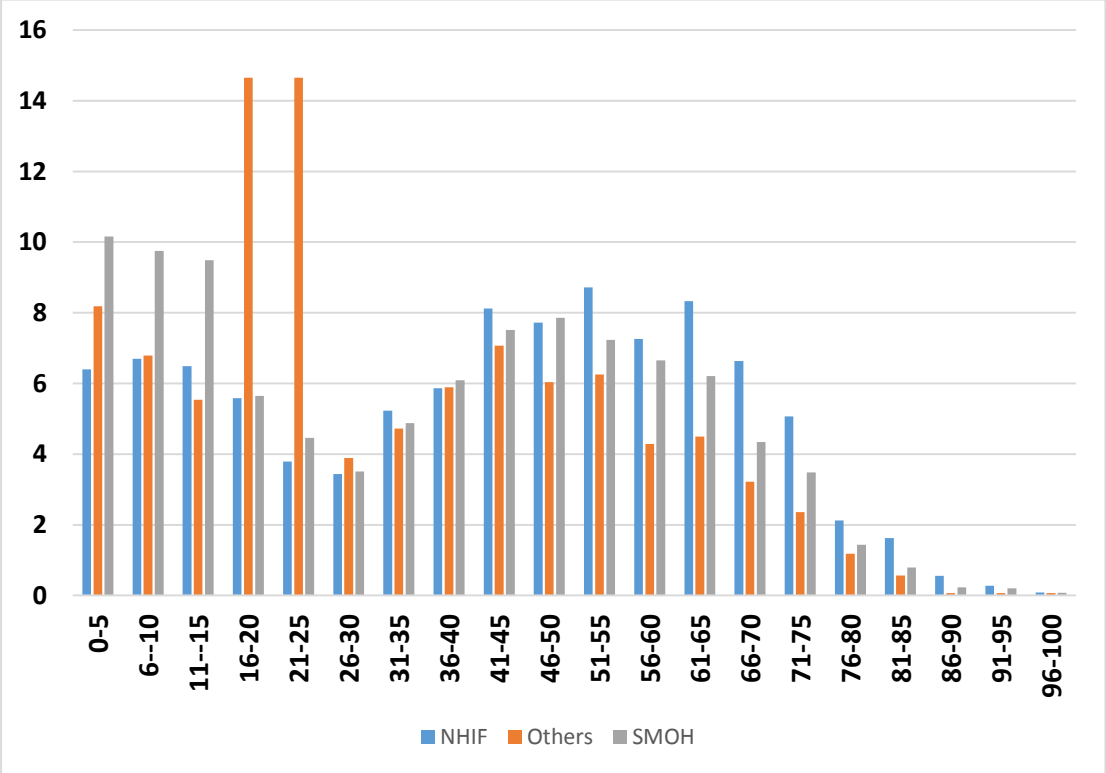
Table 06-4. Employer Based Patients Distribution

Employer Sector	Freq.	Percent	Cum.
Public	7,725	39.23	47.5
Poor Families	5,342	27.13	73.08
Pensioners	3,721	18.9	92.82
Self-employed	1,414	7.18	100
Student	1,322	6.71	6.71
Private	166	0.84	73.92
Total	19,690	100	

6.1.6. Health Facilities Operator Based Patients' Distribution

Dominantly, the SMOH provides health services for children; on the other hand, the NHIF focuses more on peoples from 45 to 75 years. Others providers' patient distributions are consistent with a dramatic increase at university ages, which is justified and attributed to the universities' PHCCs (Figure 6-2).

Figure 06-2. Patients' Distribution Based on Age and Health Facility Type



6.1.7. Diagnoses

Patients with infectious diseases were more frequently attended for medical consultations. Respiratory infection represented almost one quarter of the cases followed by malaria cases, 21.93%. However, central nervous disorders comprised less than 1% of the total medical doctor visits (Table 6-5). The acute cases represented about 79% while the chronic ones about 21%. The major chronic diseases were hypertension and cardiovascular diseases (10.13%), and diabetes mellitus (DM) (6.32%) (Table 6-6). The chronic diseases among urban patients were higher than among rural patients by 5% and vice versa regarding acute diseases (Table 6-7). This confirmed that chronic diseases related more with affluent communities while infectious diseases were more dominant in rural areas than chronic ones.

Table 6-5. The Cases Diagnoses

DIAGNOSIS	Freq.	Percent	Cum.
Respiratory Infection	4,973	25.26	25.26
Malaria	4,319	21.93	47.19
Hypertension + Cardiovascular	1,994	10.13	57.32
Urinary Tract Infection	1,372	6.97	64.29
Diabetes Mellitus	1,244	6.32	70.60
Gastro-intestinal Tract	1,245	6.32	76.93
Rheumatoid Arthritis	615	3.12	80.05
Typhoid Fever	357	1.81	81.86
Diabetes+ Hypertension	351	1.78	83.65
Gynecological and Obs	193	0.98	84.63
General Nervous System	124	0.63	85.26
Others	2,903	14.74	100.00
Total	19,690	100	

Table 06-6. Diseases' Types

Disease Type	Freq.	Percent	Cum.
Acute	15,482	78.63	78.63
Chronic	4,208	21.37	100
Total	19,690	100	

Table 06-7. Disease Types by Residence

Patient Residence	Disease Type		Total
	Acute	Chronic	
Rural	7,986 (51.58%)	1,976 (46.96%)	9,962 (50.59%)
Urban	7,496 (48.42%)	2,232 (53.04%)	9,728 (49.41%)
Total	15,482 (100%)	4,208 (100%)	19,690 (100%)

6.1.8. Health Facilities Operators and Distribution of Diseases Types, and Patients' Residence:

Most of those who received health services from NHIF facilities were urban dwellers (59.21%), while the majority of those treated in SMOH facilities were rural dwellers (61.84%). Private, NGO, and university facility patients were mainly urban (84.89%) (Figure 6-3). Furthermore, more than one third of NHIF health facilities patients had chronic diseases, while chronic disease patients of SMOH comprised 18.28% (Table 6-8).

Figure 06-3. Health Facilities Operators and Patients' Residence

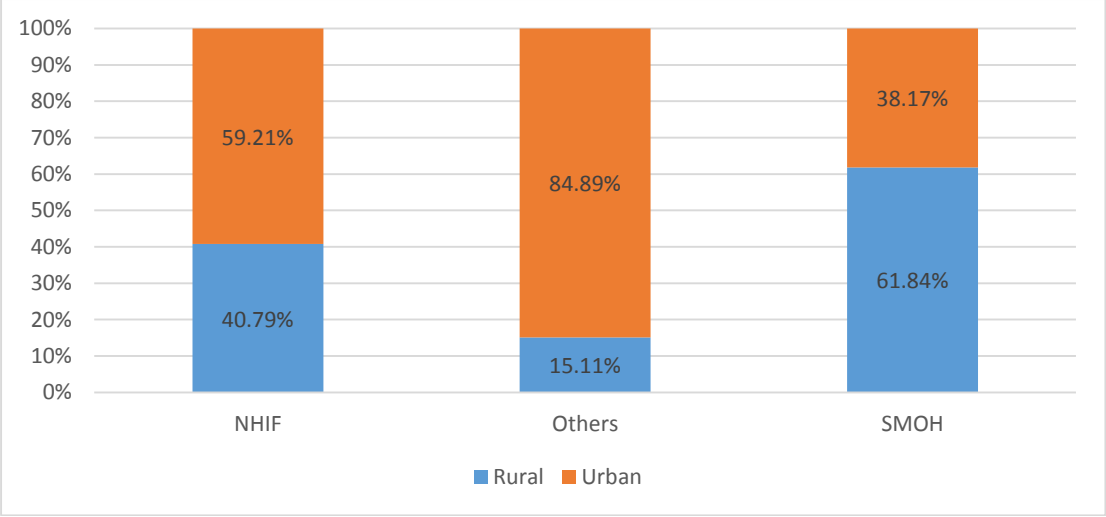


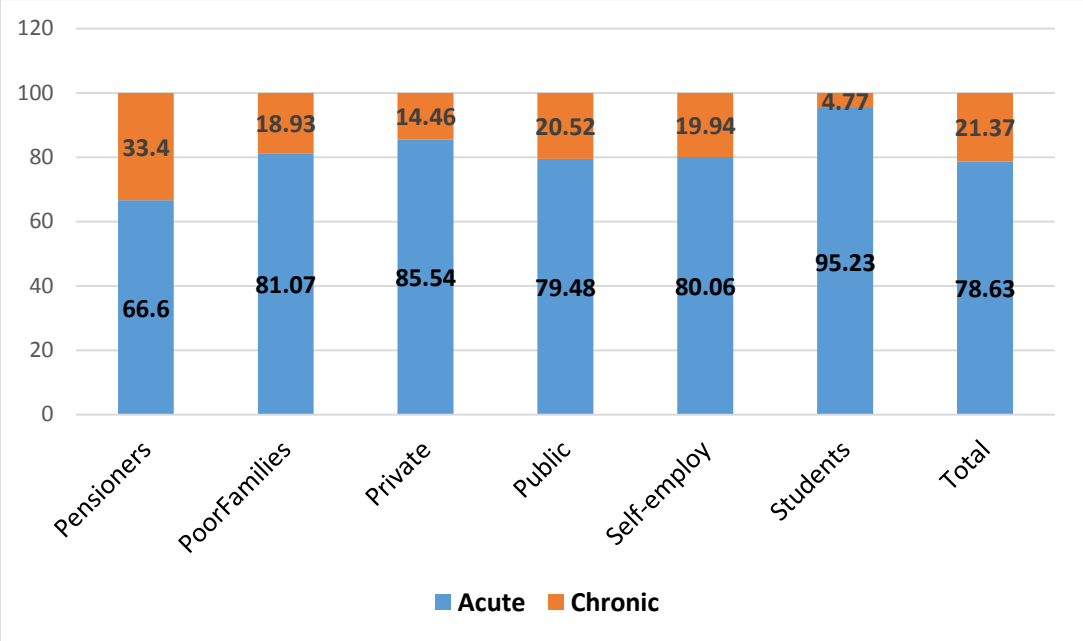
Table 6-8. Health Facilities Operators and Disease Type

Disease Type	Health Facility Operator			Total
	NHIF	Others	SMOH	
Acute	2,736(63.63%)	2,457 (87.78%)	10,289 (81.72%)	15,482 (78.63%)
Chronic	1,564(36.37%)	342 (12.22%)	2,302 (18.28%)	4,208 (21.37%)
Total	3,400 (100%)	2,799 (100%)	12,591 (100%)	19,690 (100%)

6.1.9. Employer Sector and Patients' Diseases types Distribution

The prevalence of chronic diseases among the pensioners sector was large (33.4%), while the public, poor families, and self-employed were relatively similar in the percentage of patients with chronic diseases, roughly 20% (Figure 6-4)

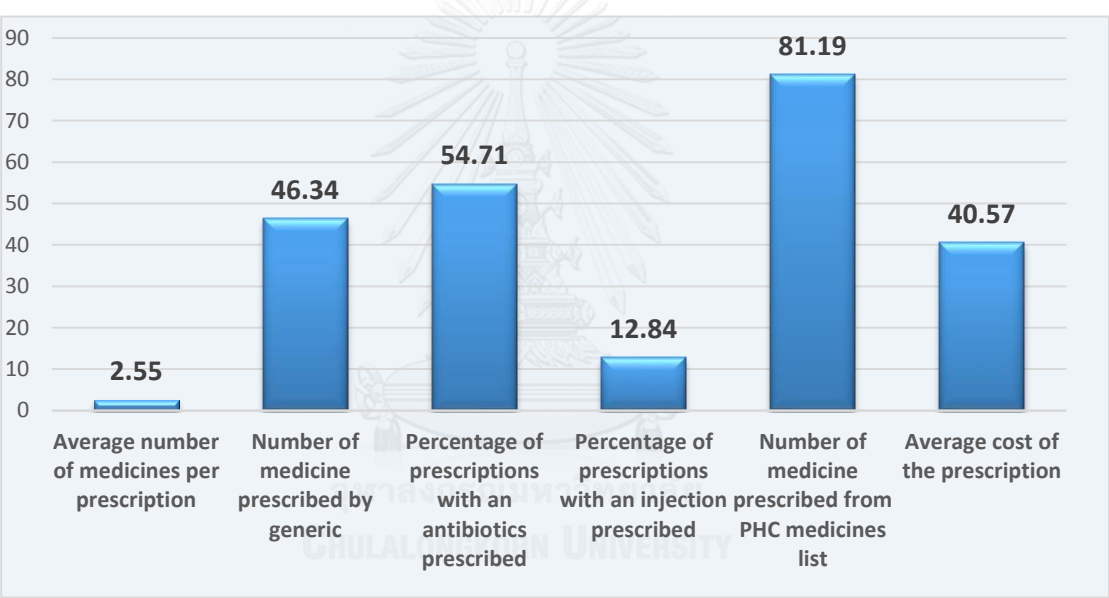
Figure 06-4. Employer Sector and Diseases Types



6.2. Prescription Pattern and Prescribing Quality Indicators

The overall results and evaluation of prescribing quality indicators revealed significant irrational prescribing practice. The average number of medicines per prescription, 2.55, represented a poly-pharmacy pattern, while the use of antibiotics and injections were 54.71% and 12.84%, respectively. The percentage of medicines prescribed from the medical doctor medicine list and medicines prescribed by generics were 81.19% and 46.34%, respectively, far from the optimal required level of 100%. The average cost per prescription was 40.57 SDGs (Figure 6-5).

Figure 06-5. Prescribing Core Quality Indicators

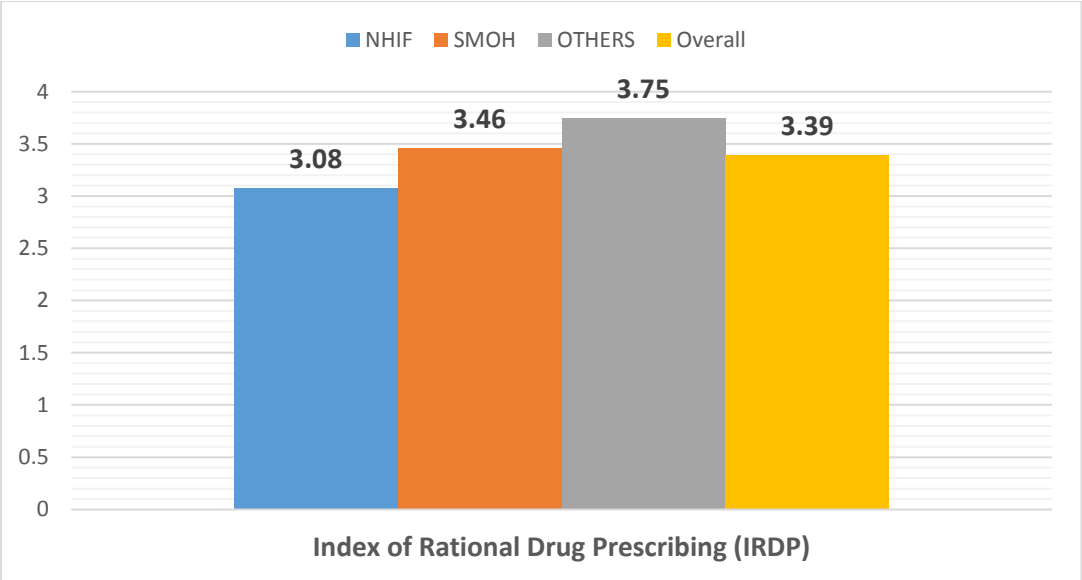


6.2.1. Index of Rational Drug Prescribing (IRDP)

The study used Dong et al.'s method of Index of Rational Drug Prescribing (IRDP) (Dong et al., 2011). The index was calculated by compounding the indices of the five prescribing indicators. The optimal index value for each indicator should be 1. For instance, the index of antibiotics prescribing is 30% divided by the study antibiotics prescribing as well as safety of injections use (30% of the maximum percentage determined in the WHO guidelines and 10% for injections). The percentages of medicine use from EML and generic drugs prescribed were converted to ratios. The index of the average number of drugs per prescription was calculated by adopting the

maximum rational number of 2 drugs per encounter. This number was divided by the average number found in our study to yield the index. The IRDP for this study was 3.39 for all medical doctors ranging from 2.1 to 4.8, and the optimal index was 5. The prescribing quality indices revealed the prescribing practice was not closer to the optimal index of 5 and the NHIF facilities showed a lower index compared with the other two entities of insured patient health services providers, in which the SMOH and others showed 3.46 and 3.75, respectively.

Figure 06-6. Index of Rational Drug Prescribing



6.2.2. The Prescribing Quality Indicators by Health Facility Operators

Collectively, the NHIF facilities had worse prescribing indicators than SMOH and other health facilities except for the percentage of prescriptions containing antibiotics, which was 45.91% and for SMOH and others, 57.24% and 56.84%, respectively (Figure 6-6). The calculated average cost per prescription was for just acute diseases (30.25) 32SDG, 30 SDG, and 28 SDG for NHIF, SMOH, and others, respectively (Figure 6-8).

Figure 6-7. Prescribing Quality Indicators by Health Facilities' Operators

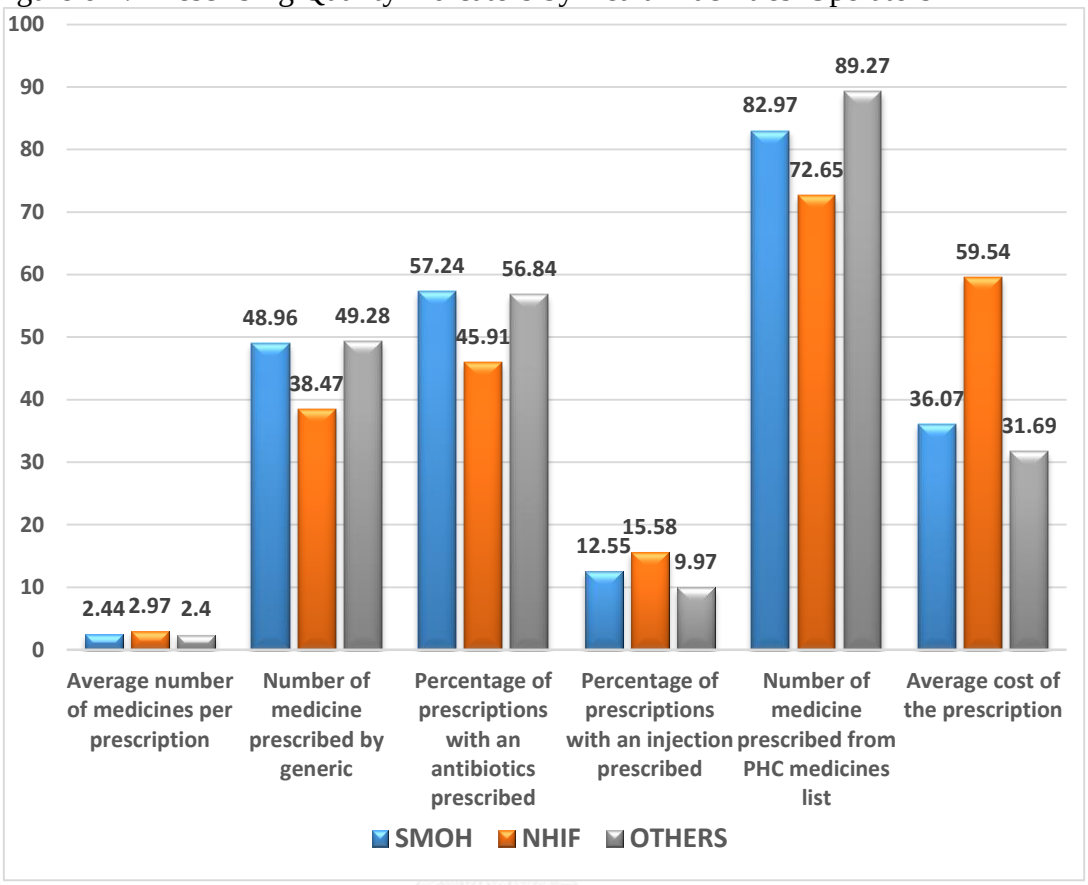
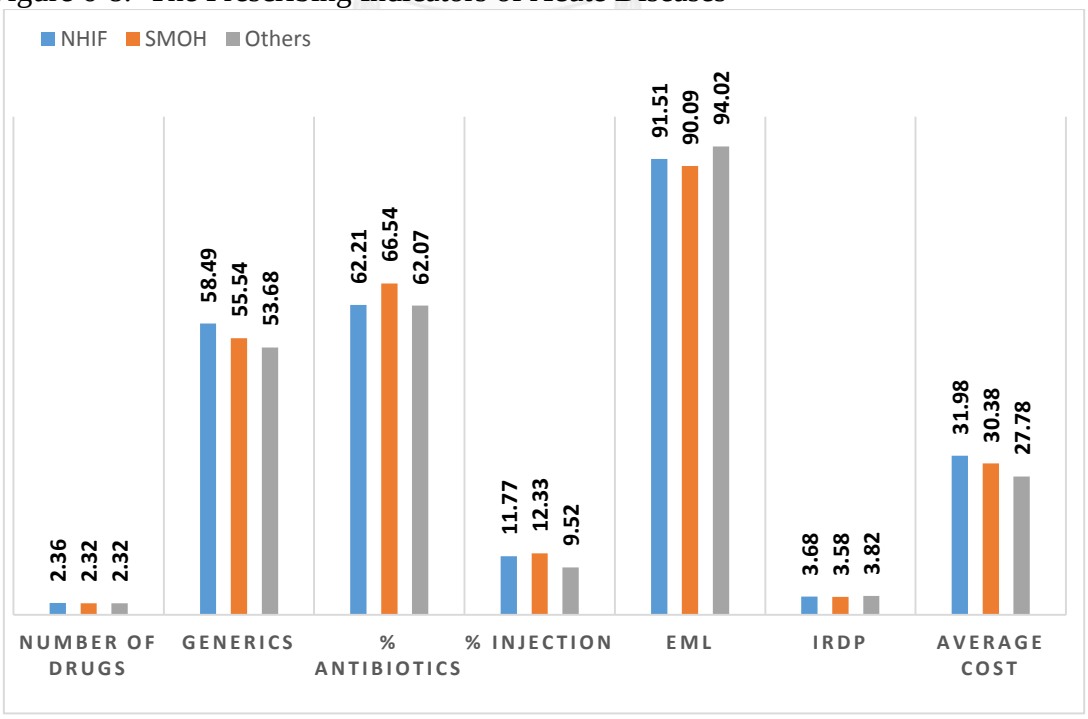


Figure 6-8. The Prescribing Indicators of Acute Diseases



6.2.3. Prescribing Quality Indicators by Diagnoses

In terms of the average number of medications per encounter, the highest average was prescribed for patients with DM and those with hypertension. The highest percentage of generic drugs prescribed was allocated for patients with malaria and gastro-intestinal tract diseases. The largest percentages of antibiotics overuse were for patients with bacterial infections, urinary tract infections, typhoid fever, and respiratory infections. The highest accordance with the NHIF medicine list was for gynecological and obstetrics cases and rheumatoid arthritis. The more expensive prescriptions were for CNS, DM, and hypertensive patients: 114, 102, and 79 SDGs, respectively, Table 6-9.

Table 06-9. Prescribing Quality Indicators by Diagnosis

Diagnosis	Average number of medicines per encounter	% of medicines prescribed by generic name	% of encounters with an Antibiotics prescribed	% of encounters with an Injection	%of medicines prescribed from NHIF list	Average cost of prescription
RI	2.28	53.94	83.73	12.07	94.52	26.76
MLRIA	2.54	59.87	46.93	15.81	90.89	32.45
HTN	3.58	18.63	14.37	5.67	49.27	79.94
UTI	2.38	56.02	89.50	6.78	92.40	34.83
DM	3.57	20.27	17.28	36.90	58.22	102.24
GIT	2.28	56.69	61.04	7.47	90.10	25.11
RA	2.26	53.17	23.74	18.05	94.60	25.22
TF	2.19	45.72	88.52	9.52	89.14	40.15
GO	2.94	42.15	80.83	5.18	94.71	32.77
CNS	2.38	19.32	4.84	5.65	27.80	114.07
Other	2.06	55.43	48.81	10.54	86.85	28.12
Average	2.55	46.34	54.71	12.84	81.19	40.57

6.3. The Factors Affecting the Prescribing Practices

The study had seven dependent variables: 1) the number of medications per prescription, 2) the generic ratio (drugs prescribed by generic name divided by the number of drug prescribed (range 0 to 1)), 3) prescriptions containing antibiotics or not, 4) prescriptions containing injections or not, 5) the number of drugs prescribed from the NHIF general practitioner medicines list (ratio), 6) the IRDP, and 7) prescription cost. The study independent variables (35 factors) were classified in four groups and diagnoses as a complementary group (1 independent). Four groups comprised prescriber-related factors (12 independents), practice-related factors (11 independents), patient-related factors (8 independents), and drug related factors (3 independents).

6.3.1. The Number of Medicines per Prescription

Across the total sample of prescriptions (19,690), the maximum number of drugs per encounter was 15 and minimum was 1. The number of prescriptions with one drug represented 19% of the total prescriptions, and those containing two and three drugs were 38% and 26%, respectively (Appendix G). The average number of medications prescribed for patients with acute disease was 2.33 and 3.39 for patients with chronic diseases (Appendix H). The average number of drugs per encounter according to patient sex was similar. The average number of drugs per prescription for rural and urban residents was 2.48 and 2.63, respectively. The social groups with the highest and lowest average number of drugs per prescription comprised pensioners and students, 2.8 and 2.11, respectively. The overall average was 2.55 drugs.

6.3.1.1. The Effect of Factors on the Average Number of Drug per Prescription

The number of drugs per prescription ranged from 1 to 15 drugs the average was 2.55 drugs. Which is count data dependent. So to detect the effect of factor on it we had to use Poisson regression. But no prescription with zero number of drugs, thus we used two types of Poisson regression:

1. Zero-truncated Poisson Regression

In which we used the data as it was without zero values and executed the regression. The regression results illustrated in table 6-10.

2. Non-Zero-truncated Poisson Regression

In which we subtracted one from each value of dependent variable to get some zero values. Thus the values became ranged from 0 to 14 drugs instead of 1 to 15 drugs then the regression has been executed. The table 6-14 showed this model results.

1. Zero-truncated Poisson Regression and Predicting of Factors Affecting the Number of Drugs per Encounter

To understand the factors affecting the number of drugs prescribed per prescription Poisson's regression was used to detect the relatedness between the number of drugs the prescription contained and all four group factors. Table 6-10 illustrates the results comprehensively, indicating which factors had and which ones had no effect on the number of drugs per prescription. The average marginal effect for each independent variable or factor reflected the magnitude and sign of influence.

The results of Poisson's regression showed that many factors significantly affected the prescribing behaviors on the number of medications per prescription. The study revealed that medical doctor age influenced the number of prescription drugs significantly at level of significance 1%. One more year of doctor age would increase the number of prescription drugs by 0.033 drugs when other factors were controlled. The factor, working at home locality, had significance (p-v<0.05), in which those working in a home locality had prescriptions predicted to have 0.058 drugs more than those working outside the home locality or the reference group. Doctors exposed to professional training significantly revealed their prescriptions (P-V <0.01) contained 0.078 more drugs than those not exposed to training, holding other factors constant.

In terms of practice related factors, the average number of patients per day has positive significant effect on the number of drugs per encounter, an increase in the average of daily patients by one was predicted to increase the number of drugs per prescription by 0.0024 at P< 0.01. Moreover, the patient demand for a specific drug name increased the number of drugs prescribed significantly. As the percentage of patients demanding particular drugs increased by 1% the prescribed drug was expected to increase by 0.074 at confidence interval 99%. Patient age had a positive influential effect on prescription drug number at significance level, 1%. Each year more of the patient would increase the number of encountered medications by 0.005 drugs.

Table 6-10. Zero-truncated Poisson Analysis of Factors Effect on Number of Medicines per Prescription

Number of Drugs	Coefficient	Std.Err	z	P>|z|	dy/dx
Patient Age	0.00189	0.000	8.42	0.0000***	0.00484
Patient Sex	-0.01612	0.009	-1.70	0.0890*	-0.04115
Public Sector	0.11419	0.021	5.31	0.0000***	0.29152
Poor Families	0.09705	0.022	4.37	0.0000***	0.24777
Private Sector	0.09850	0.053	1.85	0.0650*	0.25147
Pensioners Sector	0.13914	0.023	6.04	0.0000***	0.35520
Self-employment	0.12887	0.027	4.84	0.0000***	0.32898
Patient Residence	0.01885	0.014	1.34	0.1800	0.04813
Doctor Sex	0.01026	0.012	0.86	0.3910	0.02620
Doctor Age	0.01277	0.002	7.57	0.0000***	0.03260
Place of Graduation G	-0.02000	0.011	-1.81	0.0710*	-0.05106
Place of Graduation Kh	0.04556	0.024	1.89	0.0590*	0.11632
Doctor Qualification	-0.05645	0.012	-4.61	0.0000***	-0.14410
Professional Training	0.03045	0.010	2.97	0.0030***	0.07772
Professional Experience	-0.01057	0.002	-5.42	0.0000***	-0.02698
HI Experience	0.00014	0.000	0.73	0.4650	0.00036
High Job Satisfaction	-0.01481	0.013	- 1.12	0.2640	-0.03780
Average Job Satisfaction	-0.01189	0.013	-0.94	0.3460	-0.03035
RUD Training	-0.00617	0.012	-0.53	0.5940	-0.01574
Peer Contact Discussion	-0.08615	0.015	-5.68	0.0000***	-0.21994
Work in Home Locality	0.02256	0.010	2.25	0.0250**	0.05760
GOV-EMPL	-0.04712	0.017	-2.76	0.0060***	-0.12030
CONTRACT-Empl	-0.04888	0.020	-2.44	0.0150**	-0.12478
Number of Patients	0.00095	0.000	4.32	0.0000***	0.00243
Working Hours	-0.00020	0.004	-0.06	0.9550	-0.00052
Salary Plus Incentive	0.00415	0.013	0.32	0.7510	0.01059
Patient Demand	0.00087	0.000	3.33	0.0010***	0.00222
NHIF Drug List	-0.02878	0.010	-2.78	0.0050***	-0.07347
SMOH Facility	-0.02115	0.017	-1.24	0.2140	-0.05399
NHIF Facility	0.05342	0.019	2.80	0.0050***	0.13637
Facility Location	0.01281	0.015	0.84	0.4010	0.03271
Drug Price	-0.06050	0.013	-4.65	0.0000***	-0.15445
Drugs Firms Promotion	0.00104	0.001	0.74	0.4600	0.00266
High Price Tendency	-0.03374	0.014	-2.40	0.0160**	-0.08615
Disease Chronicity	0.28977	0.012	25.06	0.0000***	0.73977
_cons	0.10823	0.066	1.64	0.1010	

Number of Obs 19,690 LR chi2(35)= 1901.05 Log likelihood= -32017.954
Prob > chi2 = 0.0000 Pseudo R2 = 0.0288 ***:significant at 1% (P=<0.01) **:significant at

Note: dy /dx for factor levels is the discrete change from the base level

Patients of different social groups had positive significant effects on drug numbers at P < 0.01 compared with their reference group (students) except for private sector patients. Pensioner, self-employed, public, and poor family sector prescriptions had 0.36, 0.33, 0.29, and 0.25 more drugs than the student prescription (reference or baseline) group. All the above mentioned factors positively influenced the encounter number of drugs according to the coefficient signs.

The following factors affected the average number of drugs per encounter negatively. Peer contact and discussion with colleagues led to reduced numbers of drugs significantly at P<0.01. Doctors who discussed with and contacted his colleagues had prescriptions predicted to have 0.22 fewer drugs than those who did not. One year of medical professional experience would reduce the prescribed number of drugs by 0.027 at P<0.01. Medical doctor qualification significantly reduced the number of drugs per prescription. Medical doctors with master and higher diplomas in family medicine significantly prescribed drugs in prescriptions less than those without that qualification by 0.0144 drugs (P<0.01). The types of doctor employment had strong significant effects on prescription drug numbers. Medical doctors of governmental and contractual employment had prescriptions averaging 0.12, and 0.125 fewer drugs than medical doctors of mandatory service employment and cooperators at P <0.01 and P<0.05, respectively. The consideration of drug price and beliefs that expensive drugs were more potent than cheaper ones had a significant influence on the number of drugs prescribed. General practitioners, who considered the medicine price in his prescribing decision, would prescribe fewer drugs than those who did not consider the price in his decision by 0.15 at a level of significance of 1%. On the other hand, regarding medical doctors who believed that expensive drugs were more potent than cheaper ones, on average prescriptions were expected to contain fewer numbers of drugs by 0.086 than those who without that belief at P< 0.05.

A significant difference was found in prescribed number of drugs among patients with chronic diseases and others with acute diseases at P <0.01. Prescriptions of patients with chronic disease would contain 0.74 more drugs than patients with acute diseases. The prescriptions in NHIF had 0.14 more drugs than any prescription in other health facilities (reference group) at P< 0.01, when controlling other variables.

6.3.1.2. The Effect of Prescriber-related Factors on the Number of Drugs

To detect model robustness and provide a more critical explanation of the effect of prescriber-related factors on the number of drugs prescribed per patient or encounter, Poisson's regression was performed. The associations between these factors and the dependent variables were significant for all factors except doctors' health insurance experience (Table 6-11).

Table 6-11. Prescriber-related Factors Effects on Prescription Drugs Number

Number of Drugs	Coef.	Std.Err	z	P>|z|	dy/dx
Doctor Sex	-0.02644	0.010	-2.56	0.0100***	-0.06751
Doctor Age	0.017798	0.002	11.66	0.0000***	0.045436
Place of Graduation G	-0.03463	0.010	-3.38	0.0010***	-0.08841
Place of Graduation Kh	0.041835	0.023	1.85	0.0640*	0.106801
Doctor Qualification	-0.0405	0.012	-3.52	0.0000***	-0.1034
Professional Training	0.023332	0.010	2.38	0.0170**	0.059566
Professional Experience	-0.01405	0.002	-7.57	0.0000***	-0.03587
HI Experience	-0.00023	0.000	-1.24	0.2160	-0.00058
High Job Satisfaction	0.025432	0.012	2.03	0.0420**	0.064926
Average Job Satisfaction	0.033027	0.012	2.76	0.0060***	0.084316
RUD Training	-0.02547	0.011	-2.36	0.0180**	-0.06502
Peer Contact Discussion	-0.08204	0.014	-5.85	0.0000***	-0.20943
_cons	0.505055	0.041	12.38	0.0000***	

Number of Obs 19,690 LR chi2(12)= 268.85 Log likelihood= -32834.053

Prob > chi2 = 0.0000 ***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05) *:significant at 10% (P=<0.1)

The difference in the number of drugs prescribed regarding the medical doctor's sex was a significant. The prescription of male medical doctors was expected to contain 0.026 drugs less than female doctors at P<0.05. The place of medical doctor graduation (university) had a significant effect on the number of drugs per encounter. The medical doctor, who graduated from G University, would prescribe 0.035 fewer drugs than doctors of other universities, when other factors were controlled (P<0.01). Doctors exposed to a rational drug use workshop would prescribe 0.065 fewer drugs than those

not exposed at P <0.05. The highly satisfied medical doctors' prescriptions on average had a greater number of drugs than doctors unsatisfied with their jobs. The highly satisfied doctor prescriptions had 0.084 fewer drugs than doctors unsatisfied with their jobs at P 0.01, holding other factors constant.

6.3.1.3. The Effect of Practice- related Factors on Prescription Number of Drugs

The results from Poisson's regression analysis of the main components of practice circumstances revealed a significant effect on the number of medications prescribed except the payment mechanism (Table 6-12).

Table 6-12. The Effects Of Practice-related Factors on Number of Drugs

Number of Drugs	Coef.	Std.Err	z	P>|z|	dy/dx
Work in Home Locality	0.02362	0.010	2.45	0.0140**	0.06029
GOV-EMPL	-0.03732	0.016	-2.29	0.0220**	- 0.09529
CONTRACT-Empl	-0.04435	0.019	-2.31	0.0210**	- 0.11323
Number of Patients	0.00071	0.000	3.49	0.0000***	0.00180
Working Hours	-0.00805	0.003	-2.37	0.0180**	- 0.02055
Salary Plus Incentive	0.01252	0.012	1.07	0.2850	0.03196
Patient Demand	0.00057	0.000	2.42	0.0160**	0.00146
NHIF Drug List	-0.01941	0.010	-1.96	0.0500***	- 0.04954
SMOH Facility	0.04564	0.016	2.87	0.0040***	0.11651
NHIF Facility	0.22121	0.017	13.36	0.0000***	0.56474
Facility Location	0.04044	0.011	3.69	0.0000***	0.10324
_cons	0.87725	0.035	24.74	0.0000***	

Number of Obs 19,690 LR chi2(11)= 448.55 Log likelihood= -32744.207

Prob > chi2 = 0.0000 ***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05) *:significant at 10% (P=<0.1)

Facilities location, in rural or urban areas, affected the number of drugs prescribed per encounter, prescriptions in urban health facilities were expected to have 0.1 more drugs than rural area facilities at P <0.01. The medical doctor who has NHIF medicine list is expected to prescribe 0.05 more drugs than those who do not have the medicines list (P <0.05). An additional working hour for medical doctors was expected to decrease the number of drugs per prescription by 0.021 (P<0.05, holding other factors constant). The average marginal effect of SMOH facilities on number of prescribed drugs was 0.12. The prescriptions of SMOH health facilities was expected to contain 0.12 more drugs than the prescriptions of the reference groups, i.e., universities, NGOs, and private sector facilities.

6.3.1.4. The Effect of Drug-related Factors on the Prescription Number of Drugs

Using Poisson's regression of drug-related factors with the number of drugs per prescription, we found that the pharmaceutical firms' promotion and the consideration of drug price in prescribing decision affected the prescribing behavior of medical doctors. The interpretation of the results illustrates that medical doctors who consider the drug price would prescribed 0.185 fewer drugs than those ignoring the price component in prescription decision (P<0.01). Moreover, an additional medical representative visit for pharmaceutical promotion was expected to increase the number of medical doctor prescribed drugs by 0.022 (P<0.01) (Table 6-13)

Table 06-13. The Effects of Drug-related Factors on the Prescription Drugs Number

Number of Drugs	Coef.	Std.Err	z	P>|z|	dy/dx
Drug Price	-0.07236	0.012	-6.07	0.0000***	-0.18472
Drugs Firms Promotion	0.00866	0.001	7.74	0.0000***	0.02211
High Price Tendency	-0.00138	0.013	-0.11	0.9130	-0.00351
_cons	0.97965	0.011	89.25	0.0000***	
Number of Obs 19,690 LR chi2(3)= 86.16 Log likelihood= -32925.4					
Prob > chi2 = 0.0000 ***:significant at 1% (P=<0.01)					

6.3.1.5. Non Zero-truncated Poisson Regression and Predicting of Factors Affecting the Number of Drugs per Encounter

After the number of drugs per encounter has been manipulated to contain the zero values by subtracting of one from each observation, we executed the regression analysis. The results of this manipulated model (Table 6-14) are quiet similar to that non-manipulated one (Table 6-10) or zero-truncated model. All statistically significant independents conserved as it was in terms of co-efficient sign and nominal modest change in the average marginal effect magnitudes and co-efficient values. For that the interpretation of Zero-truncated Poisson regression analysis results is satisfactory.

Table 6-14. Non Zero-truncated Poisson Analysis of Factors Effect on Number of Medicines per Prescription

Number of Drugs	Coef.	Std.Err.	z	P>|z|	dy/dx
Patient Age	**0.00321**	**0.000**	**10.990**	**0.0000*** **	**0.00498**
Patient Sex	**-0.02780**	**0.012**	**-2.290**	**0.0220** **	**-0.04317**
Public Sector	**0.20682**	**0.029**	**7.080**	**0.0000*** **	**0.32117**
Poor Families	**0.17812**	**0.030**	**5.910**	**0.0000*** **	**0.27661**
Private Sector	**0.18272**	**0.070**	**2.620**	**0.0090*** **	**0.28374**
Pensioners Sector	**0.24458**	**0.031**	**7.890**	**0.0000*** **	**0.37982**
Self-employment	**0.23015**	**0.036**	**6.480**	**0.0000*** **	**0.35741**
Patient Residence	**0.03057**	**0.018**	**1.700**	**0.0880***	**0.04747**
Doctor Sex	**0.01610**	**0.015**	**1.050**	**0.2960**	**0.02501**
Doctor Age	**0.02068**	**0.002**	**9.740**	**0.0000**** **	**0.03211**
Place of Graduation G	**-0.03235**	**0.014**	**-2.250**	**0.0240** **	**-0.05023**
Place of Graduation Kh	**0.07383**	**0.031**	**2.390**	**0.0170** **	**0.11465**
Doctor Qualification	**-0.09511**	**0.016**	**-6.050**	**0.0000*** **	**-0.14769**
Professional Training	**0.05536**	**0.013**	**4.180**	**0.0000*** **	**0.08597**
Professional Experience	**-0.01686**	**0.002**	**-6.890**	**0.0000*** **	**-0.02618**
HI Experience	**0.00019**	**0.000**	**0.770**	**0.4440**	**0.00029**
High Job Satisfaction	**-0.02330**	**0.017**	**-1.350**	**0.1760**	**-0.03619**
Average Job Satisfaction	**-0.01780**	**0.016**	**-1.090**	**0.2770**	**-0.02765**
RUD Training	**-0.00750**	**0.015**	**-0.510**	**0.6140**	**-0.01164**
Peer Contact Discussion	**-0.14504**	**0.020**	**-7.300**	**0.0000*** **	**-0.22524**
Work in Home Locality	**0.03725**	**0.013**	**2.870**	**0.0040*** **	**0.05784**
GOV-EMPL	**-0.07862**	**0.022**	**-3.620**	**0.0000*** **	**-0.12208**
CONTRACT-Empl	**-0.08134**	**0.025**	**-3.220**	**0.0010*** **	**-0.12631**
Number of Patients	**0.00159**	**0.000**	**5.650**	**0.0000*** **	**0.00246**
Working Hours	**0.00083**	**0.005**	**0.180**	**0.8560**	**0.00129**
Salary Plus Incentive	**0.00715**	**0.017**	**0.430**	**0.6690**	**0.01111**
Patient Demand	**0.00140**	**0.000**	**4.200**	**0.0000*** **	**0.00218**
NHIF Drug List	**-0.04856**	**0.013**	**-3.640**	**0.0000*** **	**-0.07542**
SMOH Facility	**-0.03618**	**0.022**	**-1.640**	**0.1000**	**-0.05619**
NHIF Facility	**0.07664**	**0.025**	**3.130**	**0.0020*** **	**0.11902**
Facility Location	**0.02151**	**0.020**	**1.100**	**0.2730**	**0.03340**
Drug Price	**-0.10309**	**0.017**	**-6.240**	**0.0000*** **	**-0.16010**
Drugs Firms Promotion	**0.00168**	**0.002**	**0.930**	**0.3510**	**0.00261**
High Price Tendency	**-0.05766**	**0.018**	**-3.180**	**0.0010*** **	**-0.08954**
Disease Chronicity	**0.44627**	**0.014**	**31.060**	**0.0000*** **	**0.69302**
_cons	**-0.91812**	**0.084**	**-10.870**	**0.0000*** **	

LR chi2 (35) = 3044.80 Prob > chi2 = 0.0000 Log likelihood = -29368.591
Pseudo R2 = 0.0493 ***: significant at 1% (P=<0.01) **: significant at 5 %(P=<0.05) *: significant at 10% (P=<0.1)

Note: dy /dx for factor levels is the discrete change from the base level

6.3.2. The Use of Generic Names

The percentage of generic drugs used is one of the core prescribing quality indicators. The indicator was influenced by many factors related to the medical practice; the benchmark 100% of prescribed drugs at PHCCs should be generics. To assess this indicator at prescription level ratios divided the number of generic drugs prescribed by the total number of drugs prescribed on the same prescription and these ratios ranged from 0 to 1. OLS regression assessed the relatedness between these dependent variables and independent variables.

6.3.2.1. The Effect of Whole Factors on the Use of Generic Names

Table 6-14 shows the direction and magnitude of different factors affecting the ratio of generic drugs prescribed, i.e., the number of generic drugs prescribed divided by the number of prescribed drugs on the prescription. All independent groups had a significant effect on that ratio.

Positive Effect

The payment mechanism and employment method had significant effects on the generic ratio. Medical doctors working with salary plus incentive payment mechanism had a generic ratio increased by 0.027 over those working just by salary at $P < 0.01$, holding other factors constant. However, the generic ratio of contracted medical doctors was 0.048 ($P<0.01$) more than the reference group. The doctors who have NHIF medicines list were most likely have generic ratios 0.025 more than those without the list at $P<0.01$. Doctors exposed to rational drug use training had higher generic ratios than those not expose by 0.018 at $P<0.05$. The professional experience had positive effect on generic ratios at co-efficient 0.039 at $P<0.01$. The doctors who considered the drug price in their prescribing decision had higher generic ratios 0.047 than those who did not at $P < 0.01$.

Negative Effect

The factors which had significant negative effect on the generic ratio included number of patients, place of graduation G, patient residence, doctor age, patient age, social group of patients, and disease chronicity.

Table 06-15. The Effects of Whole Factors on the Use of Generic Drugs

Generics Ratio	Coef.	Std. Err.	t	P>|t|
Patient Age	-0.00202	0.000133	-15.19	0.0000***
Patient Sex	-0.00273	0.005656	-0.480	0.6290
Public Sector	-0.05648	0.01192	-4.740	0.0000***
Poor Families	-0.0335	0.012366	-2.710	0.0070***
Private Sector	-0.07135	0.031138	-2.290	0.0220**
Pensioners Sector	-0.05531	0.013023	-4.250	0.0000***
Self-employment	-0.07271	0.015185	-4.790	0.0000***
Patient Residence	-0.01781	0.008488	-2.100	0.0360**
Doctor Sex	-0.00757	0.007112	-1.060	0.2870
Doctor Age	-0.00523	0.001044	-5.010	0.0000***
Place of Graduation G	-0.01344	0.006492	-2.070	0.0380**
Place of Graduation Kh	-0.02235	0.014532	-1.540	0.1240
Doctor Qualification	0.038753	0.007324	5.290	0.0000***
Professional Training	0.007803	0.006088	1.280	0.2000
Professional Experience	0.003596	0.001209	2.970	0.0030***
HI Experience	-0.00038	0.00012	-3.200	0.0010***
High Job Satisfaction	-0.01013	0.007812	-1.300	0.1950
Average Job Satisfaction	0.003977	0.00741	0.540	0.5910
RUD Training	0.017626	0.00694	2.540	0.0110**
Peer Contact Discussion	0.005798	0.008793	0.660	0.5100
Work in Home Locality	-0.00887	0.005952	-1.490	0.1360
GOV-EMPL	0.025503	0.010351	2.460	0.0140**
CONTRACT-Empl	0.047631	0.012288	3.880	0.0000***
Number of Patients	-0.00029	0.000134	-2.190	0.0290**
Working Hours	-0.00902	0.002142	-4.210	0.0000***
Salary Plus Incentive	0.027369	0.007858	3.480	0.0000***
Patient Demand	0.000139	0.000157	0.880	0.3770
NHIF Drug List	0.025023	0.006163	4.060	0.0000***
Facility Location	-0.00839	0.009125	-0.920	0.3580
Drug Price	0.047207	0.007889	5.980	0.0000***
Drugs Firms Promotion	0.001177	0.000848	1.390	0.1650
High Price Tendency	-0.00472	0.008328	-0.570	0.5710
Disease Chronicity	-0.27587	0.007435	-37.110	0.0000***
_cons	1.141373	0.039859	28.640	0.0000***

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared = 0.1383
***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05

For instance, an increase in the number of patients on average by one patient per day reduced the generic ratio by 0.00029 at P <0.01, holding other factors constant. Doctors

who graduated from university G were expected to have a generic ratio 0.034 higher than reference group doctors (P<0.05).

On average, the prescriptions of patients from urban areas had a generic ratio 0.018 lower than rural area patient prescriptions at P <0.05.

6.3.2.2. The Effect of Drug-related Factors on the Generic Ratio

When we executed the OLS regression for drug related factors separately, we found all factors had significant effects on the generic ratio. The medical doctors who considered the drug price in prescribing practice on average had 0.0488 more generics than those not considering the price at P <0.01. One more pharmaceutical promotion visit per year decreased the generic ratio on average by 0.0488 at P< 0.01. On average, doctors who believed that expensive drugs were more potent than cheap ones had a prescribed generic ratio lower by 0.021 at P <0.05.

Table 6-16. The Effects of Drug-related Factors on the Generic Ratio

Generics Ratio	Coef.	Std.Err.	t	P>|t|
Drug Price	0.04879	0.007817	6.24	0.0000***
Drugs Firms Promotion	-0.00387	0.000747	-5.18	0.0000***
High Price Tendency	-0.02062	0.008096	-2.55	0.0110**
_cons	0.537724	0.007234	74.33	0.0000***

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared = 0. 0.0032

*******:significant at 1% (P=<0.01) ******:significant at 5%(P=<0.05

6.3.3. Antibiotics Use Pattern and Affecting factors

From logistic regression we found most of the factors statistically had a significant effect on prescriptions containing antibiotics. The overall percentage of prescriptions containing antibiotics of all prescriptions was 54.71%.

6.3.3.1. The Factors Affecting the Antibiotics Use Patterns

The study found that the probability of the prescription containing antibiotics was influenced by several factors according to the average marginal effect of logistic regression analysis of all factors (Table 6-16). All groups' factors had a significant influence on the antibiotics prescribing pattern except for drug related factors. The place of graduation, job satisfaction, doctor age, social group of patients, doctor experience, patient sex, patient age, health facility operator, and disease diagnosis significantly affected the antibiotics prescribed at P <0.05.

Table 06-17. The Factors Affecting the Antibiotic Use Pattern

With Antibiotics	Coef.	Std. Err.	z	P>|z|	dy/dx
Patient Age	-0.0080	0.000766	-10.45	0.0000***	-0.00164
Patient Sex	-0.1392	0.033438	-4.16	0.0000***	-0.02844
Public Sector	0.3545	0.067141	5.28	0.0000***	0.07244
Poor Families	0.2898	0.069879	4.15	0.0000***	0.05922
Private Sector	0.1536	0.179145	0.86	0.3910	0.03140
Pensioners Sector	0.3638	0.074363	4.89	0.0000***	0.07433
Self-employment	0.2731	0.087167	3.13	0.0020***	0.05580
Patient Residence	-0.0293	0.050634	-0.58	0.5630	-0.00599
Doctor Sex	-0.0306	0.041854	-0.73	0.4640	-0.00626
Doctor Age	0.0385	0.006295	6.12	0.0000***	0.00788
Place of Graduation G	0.1455	0.038207	3.81	0.0000***	0.02973
Place of Graduation Kh	0.3780	0.088233	4.28	0.0000***	0.07723
Doctor Qualification	0.0001	0.043518	0.00	0.9990	0.00001
Professional Training	0.1500	0.035913	4.18	0.0000***	0.03066
Professional Experience	-0.0421	0.007322	-5.75	0.0000***	-0.00860
HI Experience	0.0026	0.000722	3.54	0.0000***	0.00052
High Job Satisfaction	0.0860	0.045859	1.88	0.0610*	0.01757
Average Job Satisfaction	0.0501	0.043364	1.15	0.2480	0.01023
RUD Training	-0.0427	0.041242	-1.04	0.3010	-0.00872
Peer Contact Discussion	-0.0559	0.051612	-1.08	0.2790	-0.01142
Work in Home Locality	0.0923	0.034995	2.64	0.0080***	0.01886
GOV-EMPL	0.1535	0.060703	2.53	0.0110**	0.03136
CONTRACT-Empl	0.1446	0.073306	1.97	0.0490**	0.02955
Number of Patients	-0.0006	0.000786	-0.80	0.4240	-0.00013
Working Hours	-0.0094	0.012534	-0.75	0.4550	-0.00191
Salary Plus Incentive	0.0234	0.046261	0.51	0.6130	0.00478
Patient Demand	0.0025	0.000918	2.69	0.0070***	0.00050
NHIF Drug List	0.0910	0.036352	2.50	0.0120**	0.01859
SMOH Facility	-0.1451	0.058832	-2.47	0.0140**	-0.02966
NHIF Facility	-0.1892	0.067361	-2.81	0.0050***	-0.03866
Facility Location	-0.1292	0.054114	-2.39	0.0170**	-0.02641
Drug Price	0.0187	0.04679	0.40	0.6900	0.00382
Drugs Firms Promotion	-0.0056	0.004976	-1.12	0.2630	-0.00114
High Price Tendency	0.0650	0.049236	1.32	0.1870	0.01328
Disease Chronicity	-2.0777	0.049002	-42.40	0.0000***	-0.42453
_cons	1.7447	0.234863	7.43	0.0000***	

Number of Obs =19,690 LR chi2(35) = 3668.65 Prob > chi2 =0.0000 Log likelihood = -11726.33

***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05) *:significant at 10% (P=<0.1)

The Factors with Positive Effect

Doctors who graduated from University G and Kh were more likely to prescribe antibiotics than the reference group doctors by 2.97% and 7.7% at P <0.01, respectively. The doctors with high job satisfaction prescribed antibiotics more than unsatisfied doctors by 1.76% at a 5% level of significance. One doctor year more increased the probability of prescribing antibiotics by 0.79% (P <0.01).The patient from pensioners, public, poor families, and self-employed sector their prescriptions most probably contained antibiotics than reference group by 7.43%, 7.24%, 5.92%, and 5.58%, respectively, at 1% level of significance. Surprisingly, the doctors who had the NHIF medicine list had more probability to prescribe antibiotics than those without the list by 1.86% (P<0.05). Doctors working in their locality were more likely to prescribe antibiotics than those working outside their locality by 1.89% (P-V<0.01)

The Factors with Negative Effect

One extra year of professional experience decreased the number of doctors prescribing antibiotics by 0.86% (P-v< 0.01). The prescriptions from urban health facilities were less likely to contain antibiotics than rural facilities by 2.6% (P<0.05). An increase of patient age by one year decreased the probability of having prescriptions containing antibiotics by 0.164% (P-V< 0.01). Male patients were less likely to have antibiotic prescriptions than female patients by 2.8% (P<0.01).The NHI facilities' prescriptions were less likely to contain antibiotics than the reference group by 3.8% (P<0.01). The prescriptions of people with chronic diseases were less likely to contain antibiotics than those with acute diseases by 42.5% (P<0.01).

6.3.4. Injections Use Pattern and Affecting Factors

The results of binary logistic regression z values indicated that the four groups' factors had significantly different influences on the prescribing of injection with different signs of marginal effects and co-efficients (Table 6-17).

Factors Reduces the Probability of Prescribing Injections

Doctors exposed to rational drug use training were less likely to prescribed injections than those not exposed by 2.8% (P<0.01). Medical doctors with professional academic degrees higher than bachelor level were less likely to prescribe injections than the reference group by 1.6 % (P<0.05). Regarding place of graduation, medical doctors who graduated from university G were less likely to prescribe injection than the

reference group by 2.8% (P<0.01). Medical doctors with one month more NHIF experience reduced the probability of injection by 0.04% (P<0.01). In terms of job satisfaction, doctors with high job satisfaction and average job satisfaction were less likely to prescribe injections than unsatisfied doctors by 1.9% and 2.1%, respectively (P<0.01). Male patients were less likely to have injections than females by 1.96% (P<0.01). Regarding the method of employment, the contracted and government employed doctors were less likely to prescribe injection than the reference group by 3.3% and 3.4%, respectively (P<0.01). The doctors who considered the price of medicine when prescribing were predicted to prescribe injections less than those not considering the price by 2.7% at P<0.01.

Factors Increasing the Probability of Prescribing Injections:

At level of significance 1%, male doctors were more likely to prescribe injections the female doctors by 1.65% and for doctors with one year more of age probability of prescribing injections increased by 0.15%. An increase of patient age by one year increased the probability of receiving injection by 0.04% (P<0.01). To receive health services in NHIF facilities increased the probability of having injections by 3.13%, more than accessing reference group health facilities. One more working hour for medical doctor increased the probability of prescribed injections by 0.74% (P<0.01). Medical doctors with the payment mechanism, salary plus incentive, were more likely to prescribe injections than those working with salary merely (P<0.01).

Doctors who believed that expensive drugs were more efficacious than cheap drugs of the same chemical entity were more likely to prescribe injections than those who did not by 1.5% (P<0.01). Medical doctors were more likely to prescribe injection for chronic diseases than acute by 3.4% (P<0.01).

Table 6-18. The Factors Affecting the Prescribing of Injections

With Injection	Coef.	Std.Err	z	P>|z|	dy/dx
Patient Age	**0.0037**	**0.001**	**3.4**	**0.0010*** **	**0.00040**
Patient Sex	**-0.1796**	**0.047**	**-3.86**	**0.0000*** **	**- 0.01967**
Public Sector	**-0.1808**	**0.098**	**-1.84**	**0.0660***	**- 0.01980**
Poor Families	**-0.1359**	**0.101**	**-1.34**	**0.1800**	**- 0.01489**
Private Sector	**-0.2789**	**0.268**	**-1.04**	**0.2990**	**- 0.03055**
Pensioners Sector	**-0.0823**	**0.106**	**-0.77**	**0.4390**	**- 0.00901**
Self-employment	**0.1218**	**0.119**	**1.02**	**0.3060**	**0.01334**
Patient Residence	**-0.0410**	**0.068**	**-0.6**	**0.5460**	**- 0.00449**
Doctor Sex	**0.1505**	**0.057**	**2.65**	**0.0080*** **	**0.01648**
Doctor Age	**0.0139**	**0.008**	**1.75**	**0.0790***	**0.00152**
Place of Graduation G	**-0.2579**	**0.054**	**-4.78**	**0.0000*** **	**- 0.02825**
Place of Graduation Kh	**-0.2129**	**0.115**	**-1.85**	**0.0640***	**- 0.02332**
Doctor Qualification	**-0.1444**	**0.061**	**-2.36**	**0.0180** **	**- 0.01582**
Professional Training	**0.0478**	**0.050**	**0.96**	**0.3350**	**0.00524**
Professional Experience	**0.0084**	**0.009**	**0.92**	**0.3580**	**0.00092**
HI Experience	**-0.0033**	**0.001**	**-3.46**	**0.0010*** **	**- 0.00036**
High Job Satisfaction	**-0.1745**	**0.063**	**-2.75**	**0.0060*** **	**- 0.01911**
Average Job Satisfaction	**-0.1947**	**0.060**	**-3.24**	**0.0010*** **	**- 0.02132**
RUD Training	**-0.2566**	**0.057**	**4.52**	**0.0000*** **	**0.02810**
Peer Contact Discussion	**0.1039**	**0.072**	**1.44**	**0.1490**	**0.01139**
Work in Home Locality	**0.0624**	**0.048**	**1.31**	**0.1900**	**0.00684**
GOV-EMPL	**-0.3145**	**0.078**	**-4.02**	**0.0000*** **	**- 0.03445**
CONTRACT-Empl	**-0.2991**	**0.094**	**-3.19**	**0.0010*** **	**- 0.03276**
Number of Patients	**-0.0003**	**0.001**	**-0.31**	**0.7550**	**- 0.00004**
Working Hours	**0.0674**	**0.017**	**3.99**	**0.0000*** **	**0.00739**
Salary Plus Incentive	**0.1910**	**0.065**	**2.93**	**0.0030*** **	**0.02092**
Patient Demand	**-0.0008**	**0.001**	**-0.64**	**0.5230**	**- 0.00009**
NHIF Drug List	**0.3561**	**0.052**	**6.87**	**0.0000*** **	**0.03901**
SMOH Facility	**0.1071**	**0.085**	**1.26**	**0.2090**	**0.01173**
NHIF Facility	**0.2855**	**0.095**	**3.01**	**0.0030*** **	**0.03127**
Facility Location	**-0.0023**	**0.073**	**-0.03**	**0.9750**	**- 0.00025**
Drug Price	**-0.2425**	**0.062**	**-3.94**	**0.0000*** **	**- 0.02657**
Drugs Firms Promotion	**-0.0070**	**0.008**	**-0.93**	**0.3530**	**- 0.00077**
High Price Tendency	**0.1347**	**0.066**	**2.05**	**0.0400*** **	**0.01475**
Disease Chronicity	**0.3133**	**0.056**	**5.56**	**0.0000*** **	**0.03432**
_cons	**-3.1788**	**0.314**	**10.13**	**0.0000*** **	

Number of obs = 19690 LR chi2(35) =411.4500 Prob > chi2=0

Log likelihood = -7343.6559 ***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05) *:significant at 10% (P=<0.1)

6.3.5. The Factors Affecting the Number of Drugs Prescribed from NHIF Medicines List

The ratio of medications prescribed from the NHIF medicine list of medical practitioners was significantly affected by many factors, with different co-efficient signs and magnitudes (Table 6-18). The ratio of EML equaling the number of drugs prescribed from the EML was divided by the total number of drugs prescribed at prescription level.

Factors with Positive Effect

The payment mechanism, place of graduation, doctor age, peer contact and discussion, professional training, availability of the medicine list, pharmaceutical promotion visits, and the types of doctor employers significantly affected the EML ratio at 1% level of significance.

The government and contracted medical doctors were expected to increase the EML ratio more than the reference group by 0.033 and 0.025, respectively (P<0.01). Doctors working with salary plus incentive were expected to increase the EML ratio more than those working by salary by 0.016 (P<0.01). The presence of the NHIF medicine list was expected to increase the ratio of prescribing drugs from the list by 0.015.

Doctors exposed to professional training increased the EML ratio by 0.012 over than those not exposed (P<0.01). Doctors who had graduated from University Kh were expected to increase the EML ratio of the reference group by 0.033 (P<0.01). An increase in doctor age by one year was expected to increase the ratio of adherence to EML by 0.003 (P<0.01). Surprisingly, one extra pharmaceutical promotion visit to the doctor was expected to increase the adherence ratio by 0.0016 (P<0.01).

Factors with Negative Effect

The working in home locality, the preference for expensive drugs, doctor age, patient age and sex, pensioner sector, working hours, disease chronicity, and health facility operator had negative significant effects on the adherence to EML in prescribing at confidence interval 99%. Doctor believing in expensive brands had more potency and were expected to have lower EML ratios than those not believing by 0.031 (P<0.01). Doctor working the home locality were expected to have lower EML ratios than working outside the locality by 0.014 (P<0.01).

Table 06-19. The Factors Affecting the Number of Drugs Prescribed from NHIF Medicine List

EML RATIO	Coef.	Std. Err.	t	P>|t|
Patient Age	-0.00092	0.000	-10.1100	0.0000***
Patient Sex	-0.02182	0.004	-5.6200	0.0000***
Public Sector	-0.01999	0.008	-2.4400	0.0150**
Poor Families	-0.01819	0.008	-2.1400	0.0320**
Private Sector	-0.01988	0.021	-0.9300	0.3520
Pensioners Sector	-0.03108	0.009	-3.4800	0.0010***
Self-employment	-0.02607	0.010	-2.5000	0.0120**
Patient Residence	-0.00919	0.006	-1.5800	0.1150
Doctor Sex	-0.01450	0.005	-2.9700	0.0030***
Doctor Age	0.00296	0.001	4.1200	0.0000***
Place of Graduation G	0.00645	0.004	1.4500	0.1480
Place of Graduation Kh	0.03324	0.010	3.3300	0.0010***
Doctor Qualification	-0.00134	0.005	-0.2700	0.7890
Professional Training	0.01156	0.004	2.7700	0.0060***
Professional Experience	-0.00203	0.001	-2.4400	0.0140**
HI Experience	0.00001	0.000	0.1100	0.9090
High Job Satisfaction	-0.00106	0.005	-0.2000	0.8430
Average Job Satisfaction	0.00531	0.005	1.0400	0.2970
RUD Training	0.00154	0.005	0.3200	0.7470
Peer Contact Discussion	0.02226	0.006	3.6900	0.0000***
Work in Home Locality	-0.01408	0.004	-3.4500	0.0010***
GOV-EMPL	0.03272	0.007	4.6100	0.0000***
CONTRACT-Empl	0.02453	0.008	2.9100	0.0040***
Number of Patients	0.00018	0.000	1.9400	0.0520**
Working Hours	-0.01064	0.001	-7.2400	0.0000***
Salary Plus Incentive	0.01628	0.005	3.0200	0.0030***
Patient Demand	0.00007	0.000	0.6800	0.4950
NHIF Drug List	0.01455	0.004	3.4400	0.0010***
SMOH Facility	-0.04650	0.007	-6.7300	0.0000***
NHIF Facility	-0.04695	0.008	-5.9800	0.0000***
Facility Location	0.01020	0.006	1.6300	0.1030
Drug Price	0.01304	0.005	2.4100	0.0160**
Drugs Firms Promotion	0.00159	0.001	2.7400	0.0060***
High Price Tendency	-0.03052	0.006	-5.3400	0.0000***
Disease Chronicity	-0.28338	0.005	-55.5300	0.0000***
Cons	1.24504	0.027	45.5100	0.0000***

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared = 0.2169

***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05) *:significant at 10% (P=<0.1)

A one hour increase in working hours per day was expected to reduce the EML ratio or adherence by 0.011 (P<0.01). Encounters prescribed in SMOH and NHIF facilities were expected to have similarly less EML ratios than the reference group (private sector, NGOs, universities and facilities) by 0.047 (P<0.01). Male doctors were expected to have EML ratios 0.015 less than female doctors meaning the females had greater adherence to EML in prescribing than males (P<0.01). A male patient prescription was expected to have a 0.022 lower EML ratio than a female prescription (P<0.01). An increase of patient age by one year decreased the doctor adherence or EML ratio by 0.00092 (P<0.01). A chronic disease prescription was expected to be 0.031 lower than acute disease prescriptions (P<0.01) ceteris paribus.

6.3.6. Factors Affecting the Index of Rational Drug Prescribing (IRDP)

The IRDP is the vector of all prescribing quality indicators for each medical doctor, ranging from 0 to 1. OLS regression revealed a significant relationship with 29 factors at 5% level of significance (Table 6-19).

Factors Having a Positive Effect on the IRDP

Rational use of medicine training, experience, and job satisfaction, place of graduation, doctor qualification, peer contact and discussion, employment methods, availability of the NHIF medicine list, patient demand, drugs firms' promotion, and drug price consideration on the prescribing decision had significantly positive effects on the IRDP. Medical doctors with qualifications beyond bachelor degree were expected to increase the IRDP 0.117 more than those with bachelor degrees (P<0.01). Doctors exposed to peer contact and discussion were expected to increase IRDP by 0.072 (P<0.01). Doctors exposed to rational drug use training were expected to have IRDP 0.03 more than those not exposed (P<0.01). One year professional experience more was expected to increase the doctor IRDP by 0.014 (P<0.01). One month more experience in provision of services for insured patients was expected to increase the doctor IRDP by 0.00033 (P<0.05). Those who graduated from University G were expected to have IRDP with 0.049 more than the reference group. Medical doctors with high and average job satisfaction were expected to have greater IRDP than those unsatisfied by 0.02 and 0.04, (P<0.05) and (P<0.01), respectively.

Table 06-20. The Factors Affecting the Index of Rational Drug Prescribing (IRDP)

IRDP	Coeff.	Std. Err.	t	P>|t|
Patient Age	**- 0.00031**	**0.000**	**-2.000**	**0.04500****
Patient Sex	**- 0.00972**	**0.007**	**-1.480**	**0.14000**
Public Sector	**- 0.12366**	**0.014**	**-8.920**	**0.00000*****
Poor Families	**- 0.14398**	**0.014**	**-10.010**	**0.00000*****
Private Sector	**- 0.18104**	**0.036**	**-5.000**	**0.00000*****
Pensioners Sector	**- 0.17339**	**0.015**	**-11.440**	**0.00000*****
Self-employment	**- 0.18697**	**0.018**	**-10.580**	**0.00000*****
Patient Residence	**- 0.01880**	**0.010**	**-1.900**	**0.05700***
Doctor Sex	**- 0.08381**	**0.008**	**-10.130**	**0.00000*****
Doctor Age	**- 0.02190**	**0.001**	**-18.030**	**0.00000*****
Place of Graduation G	**0.04922**	**0.008**	**6.520**	**0.00000*****
Place of Graduation Kh	**0.01664**	**0.017**	**0.980**	**0.32500**
Doctor Qualification	**0.11680**	**0.009**	**13.710**	**0.00000*****
Professional Training	**0.00642**	**0.007**	**0.910**	**0.36500**
Professional Experience	**0.01350**	**0.001**	**9.600**	**0.00000*****
HI Experience	**0.00033**	**0.000**	**2.330**	**0.02000****
High Job Satisfaction	**0.01988**	**0.009**	**2.190**	**0.02900****
Average Job Satisfaction	**0.03671**	**0.009**	**4.260**	**0.00000*****
RUD Training	**0.02968**	**0.008**	**3.680**	**0.00000*****
Peer Contact Discussion	**0.07229**	**0.010**	**7.070**	**0.00000*****
Work in Home Locality	**- 0.09692**	**0.007**	**-14.000**	**0.00000*****
GOV-EMPL	**0.13325**	**0.012**	**11.060**	**0.00000*****
CONTRACT-Empl	**0.16672**	**0.014**	**11.660**	**0.00000*****
Number of Patients	**- 0.00065**	**0.000**	**-4.200**	**0.00000*****
Working Hours	**- 0.02025**	**0.002**	**-8.120**	**0.00000*****
Salary Plus Incentive	**0.00782**	**0.009**	**0.860**	**0.39200**
Patient Demand	**0.00065**	**0.000**	**3.570**	**0.00000*****
NHIF Drug List	**0.09492**	**0.007**	**13.240**	**0.00000*****
SMOH Facility	**- 0.03613**	**0.012**	**-3.080**	**0.00200*****
NHIF Facility	**- 0.16164**	**0.013**	**-12.150**	**0.00000*****
Facility Location	**0.01358**	**0.011**	**1.280**	**0.20100**
Drug Price	**0.21032**	**0.009**	**22.910**	**0.00000*****
Drugs Firms Promotion	**0.00440**	**0.001**	**4.460**	**0.00000*****
High Price Tendency	**- 0.06001**	**0.010**	**-6.190**	**0.00000*****
Disease Chronicity	**- 0.10475**	**0.009**	**-12.110**	**0.00000*****
Cons	**4.42797**	**0.046**	**95.480**	**0.00000*****

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared = 0.1833

*******:significant at 1% (P=<0.01) ******:significant at 5%(P=<0.05) *****:significant at 10% (P=<0.1)

Contracted and government employed doctors were expected to have greater IRDP than the reference group by 1.67 and 0.133 (P<0.01), respectively. The availability of NHIF medicines was expected to increase the doctor IRDP by 0.09 (P<0.01). Surprisingly, an increase of the percentage of patients demanded specific medicines by one percent was expected to increase IRDP by 0.00065 (P<0.01). Moreover, an increase in pharmaceutical promotion visits by one was expected to increase IRDP by 0.0044 (P<0.01). With a confidence interval of 99%, doctors who considered the drug price in their prescribing behavior had greater IRDP than those not considering the price by 0.21.

Factors Having a Negative Effect on the IRDP

The number of patients per day, working hours, and working in home locality, health facilities operators, doctor age and sex, doctor tendency to prefer expensive drugs, disease chronicity, patient age and the social groups of patients had significantly negative effects on IRDP.

An increase in the number of patients by one was expected to decrease the IRDP of doctors by 0.00065 (P<0.01). Doctors working in their home locality had lower IRDP than those working outside their home locality by 0.097 (P<0.01). One more working hour was expected to reduce the doctor IRDP by 0.0203 (P<0.01). Male doctors were expected to have lower IRDP than females by 0.084 (P<0.01) ceteris paribus. The increase of doctor age one year was expected to reduce IRDP by 0.022 (P<0.01). Doctors who believed in high priced had lower IRDP than those didn't believe by 0.06 (P<0.01). Chronic disease was expected to have lower IRDP than acute disease by 0.1 (P<0.01) holding other factors constant. The SMOH and NHIF facilities were expected to have lower IRDP than the reference group by 0.036 and 0.162, respectively (P<0.01). One more year of patients was expected to reduce IRDP by 0.00031 (P<0.05). The pensioners, poor families, private, self-employed, and public sector were expected have lower IRDP than the reference group (students) by 0.173, 0.144, 0.181, 0.187, and 0.124, respectively (P<0.01).

6.3.7. The Influential Factors of Prescription Cost

On average, the prescription cost was 40.57 SDG. The prescription cost as a complementary prescribing quality indicator was affected by many factors of different groups at 1% level of significance (Table 6-21). Some factors increased the cost and

others reduce it. We investigated disease chronicity as an independent variable to consider the large cost of chronic disease compared with acute ones.

Factors Reducing the Prescription Cost

Medical doctor qualification, professional training and experience, peer contact and discussion, job satisfaction, payment mechanism, and doctor employment method significantly affected the prescription cost. Medical doctors with qualification higher than bachelor degree (diploma, master of family medicine) were expected to have lower prescription costs by 3.81 SDG at P <0.01, ceteris paribus. Doctors exposed to professional training had lower prescription cost by 1.49 SDG than those not exposed (P <0.05). An increase of professional experience of one year reduced the prescription cost by 0.63 SDG (P <0.01) holding other factors constant. Doctors with peer contact and medical discussion had lower prescription costs by 3.91SDG than doctors without peer contact (P <0.01).

Medical doctors with high and average job satisfaction had lower prescription cost than those unsatisfied by 2.4 SDG, 1.8 SDG, (P <0.05) and (P =0.05), respectively. Doctors with income proportional to the number of patients (salary + incentive) had lower prescription cost by 1.89 (P <0.1) than those with constant income regardless of the number of patients (salary). General practitioners who were government or contractual employees encountered lower cost on average than the reference group by 8.87 SDG, and 6.48 SDG, respectively at 1% significance level.

Factors Increasing the Prescription Cost

Working in home locality, patient demand, the doctor's experience in providing services for health insurance patients, pharmaceutical companies' promotion, doctor age, patient age and sex, the social groups of patients, health facility operator, and disease types had significant effect on prescription cost escalation.

Those working in their home localities had more expensive prescriptions than nonnative doctors by 3.99 SDG (P <0.01).

Table 6-21. The Factors Affecting the Prescription Cost

Prescription Cost	Coef.	Std. Err.	t	P>|t|
Patient Age	**0.2396**	**0.0165**	**14.51**	**0.0000*** **
Patient Sex	**3.6482**	**0.7036**	**5.18**	**0.0000*** **
Public Sector	**4.7891**	**1.4828**	**3.23**	**0.0010*** **
Poor Families	**5.2704**	**1.5383**	**3.43**	**0.0010*** **
Private Sector	**4.4903**	**3.8735**	**1.16**	**0.2460**
Pensioners Sector	**8.4601**	**1.6200**	**5.22**	**0.0000*** **
Self-employment	**12.3024**	**1.8890**	**6.51**	**0.0000*** **
Patient Residence	**1.6987**	**1.0559**	**1.61**	**0.1080**
Doctor Sex	**1.3890**	**0.8848**	**1.57**	**0.1160**
Doctor Age	**0.4112**	**0.1299**	**3.17**	**0.0020*** **
Place of Graduation G	**-1.2667**	**0.8076**	**-1.57**	**0.1170**
Place of Graduation Kh	**-1.6387**	**1.8078**	**-0.91**	**0.3650**
Doctor Qualification	**-3.8115**	**0.9111**	**-4.18**	**0.0000*** **
Professional Training	**-1.4854**	**0.7573**	**-1.96**	**0.0500** **
Professional Experience	**-0.6307**	**0.1504**	**-4.19**	**0.0000*** **
HI Experience	**0.0412**	**0.0149**	**2.76**	**0.0060*** **
High Job Satisfaction	**-2.4245**	**0.9717**	**-2.50**	**0.0130** **
Average Job Satisfaction	**-1.8033**	**0.9218**	**-1.96**	**0.0500** **
RUD Training	**-0.8442**	**0.8633**	**-0.98**	**0.3280**
Peer Contact Discussion	**-3.7097**	**1.0938**	**-3.39**	**0.0010*** **
Work in Home Locality	**3.9920**	**0.7404**	**5.39**	**0.0000*** **
GOV-EMPL	**-8.8715**	**1.2876**	**-6.89**	**0.0000*** **
CONTRACT-Empl	**-6.4764**	**1.5286**	**-4.24**	**0.0000*** **
Number of Patients	**0.0164**	**0.0166**	**0.98**	**0.3250**
Working Hours	**0.0016**	**0.2664**	**0.01**	**0.9950**
Salary Plus Incentive	**-1.8937**	**0.9775**	**-1.94**	**0.0530***
Patient Demand	**0.0716**	**0.0195**	**3.67**	**0.0000*** **
NHIF Drug List	**0.1021**	**0.7666**	**0.13**	**0.8940**
SMOH Facility	**6.2177**	**1.2529**	**4.96**	**0.0000*** **
NHIF Facility	**15.6716**	**1.4229**	**11.01**	**0.0000*** **
Facility Location	**3.8092**	**1.1352**	**3.36**	**0.0010*** **
Drug Price	**-1.4024**	**0.9814**	**-1.43**	**0.1530**
Drugs Firms Promotion	**0.1923**	**0.1054**	**1.82**	**0.0680***
High Price Tendency	**1.1948**	**1.0360**	**1.15**	**0.2490**
Disease Chronicity	**37.5079**	**0.9248**	**40.56**	**0.0000*** **
Cons	**-36.5938**	**4.9584**	**-7.38**	**0.0000*** **

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared = 0.1860

***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05) *:significant at 10% (P=<0.1)

An increase of percentage of patients demanding specific drugs by 1% was expected to increase the average the cost of prescription by 0.072 SDG (P <0.01). The exposure of medical doctors to one more pharmaceutical promotion visit was expected to increase prescription cost by 0.19 SDG (P <0.1). One year more of doctor age was expected to increase prescription cost by 0.41 SDG (P <0.01). Increase of doctor's experience in health insurance by one month increased prescription cost by 0.04 SDG (P <0.01). Prescriptions in NHIF or SMOH facilities were more expensive on average than the prescriptions in reference group facilities by 6.22 SDG, and 15.67SDG, respectively, at confidence interval 99%. On average, male patients had higher costs than female patients by 3.65 SDG per prescription (P <0.01). An increase of patient age by one year increased the cost by 0.24 SDG (P <0.01), holding other factors constant. In comparing the average of student prescriptions with other social group member prescriptions, self-employed, pensioner, poor families, public sector prescriptions were expected to have higher cost by 12.3SDG, 8.5SDG, 5.3 SDG, and 4.8 (P <0.01) than student prescriptions (reference group). On average, chronic disease had higher prescription costs by 37.51 SDG than acute disease prescriptions at 1% level of significance.

6.3.8 The Effect of Prescribing Quality Indicators on the Prescription Cost

The study found that the core indicators of prescribing had a significant effect on the average prescription cost. The prescribing behavior was much closer to the optimal level of prescribing practice core indicators much less in cost than under optimal level pattern of prescribing, at confidence interval 99% (Table 6-21).

Table 6-22. The Effect of prescribing Quality Indicators on Prescription Cost

Prescription Cost	Coef.	Std.Err.	t	P>|t|
Number of Drugs	16.785	0.240	69.870	0.0000***
Generics Ratio	-19.354	0.813	-23.820	0.0000***
With Antibiotics	-6.795	0.578	-11.760	0.0000***
Containing Injection	14.589	0.823	17.720	0.0000***
EML Ratio	-47.407	1.061	-44.700	0.0000***
_cons	50.416	1.182	42.650	0.0000***

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared = 0.4629

***:significant at 1% (P=<0.01)

6.3.8.1. Cost Escalation

Increased numbers of drugs per encounter and the presence of injection on the prescription were both expected to significantly increase the cost of prescription. On average, an increase of prescribed medicine by one drug increased the average cost of prescription by 16.79 SDG at 1% level of significance, holding other factors constant. A prescription with injection on average cost 14.59 SDG more than the average cost of prescription without injection ($P < 0.01$), when all other factors were controlled.

6.3.8.1. Cost Containment

The adherence to generics prescribing and from medical doctors' medicine list were expected to contain the prescription cost dramatically at 1% level of significance. On average, a prescription totally of generic names cost less than prescriptions by non-generic drug names (brand name or trade name) by 19.35 SDG at 1% level of significance, ceteris paribus. The expected difference in cost on average between the prescriptions from the medical doctors' list and the prescription outside the list was 47.41 SDG at 1% significance level, holding other factors constant.

Antibiotic medicine are relatively on average lower in price than other prescription medicines because the presence of antibiotics in prescriptions most likely reduced the overall cost of the prescription. The average cost of prescriptions with antibiotics was less than the average cost of those without antibiotics by 6.80 SDG at confidence interval 99%, holding other factors constant.

6.3.9. The Diseases Types Effect on the Prescription Cost

Table 6-22 shows that the major communicable and non-communicable diseases prescription costs differed significant from the average cost of minor diseases prescription costs (31.70 SDG).

Table 6-23. The Disease Type Effect on the Prescription Cost

Prescription Cost		Coef.	Std.Err.	t	P>|t|
Respiratory Infection	(25.24%)	-4.996	1.029	4.850	0.0000***
MALARIA	(21.93%)	0.751	1.059	0.710	0.4790
Hypertension	(10.13%)	38.398	1.297	29.620	0.0000***
Urinary Tract Infection	(6.97%)	3.123	1.467	2.130	0.0330**
Gastro-intestinal Tract	(6.32%)	-6.589	1.518	4.340	0.0000***
Diabetes Mellitus	(6.32%)	70.540	1.519	46.440	0.0000***
Rheumatoid Arthritis	(3.12%)	-6.483	2.002	3.240	0.0010***
Typhoid Fever	(1.81%)	8.445	2.538	3.330	0.0010***
Diabetes+ Hypertension	(1.8%)	103.625	2.544	40.730	0.0000***
_cons		31.704	0.802	39.540	0.0000***

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared= 0.2218

***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05)**

The non-communicable diseases prescriptions on average were so much higher than communicable and minor (prevalence less than 1%) diseases, holding other factors constant. The average cost of minor diseases or diseases of prevalence less than 1% were 31.70 SDG. The prescriptions of DM patients was on average 70.54 SDG higher than the prescriptions of the reference group (minor diseases) at 1% level of significance. On average, the prescription of hypertensive patients was 34.40 SDG higher than reference group prescriptions at $P < 0.01$. Moreover, the prescriptions of patient with both DM and hypertension were 103.63 SDG higher than the reference group at $P < 0.01$, ceteris paribus. The rheumatoid arthritis patient prescriptions were on average 6.48 SDG lower than the reference group at $P < 0.01$, controlling all variables.

In terms of communicable diseases, patients with respiratory diseases had prescription costs 5.00 SDG lower than the reference group prescription costs on average at $P < 0.01$. However, the patients with urinary tract infection had prescription costs 3.12 SDG higher than the reference group at $P < 0.05$. The prescription costs of patients with gastro-intestinal tract infections were 6.59 SDG lower than the reference group prescription costs at $P < 0.01$. Lastly, the prescription of communicable disease typhoid fever was 8.45 SDG higher than the reference group cost at $P < 0.01$, holding other factors constant.

CHAPTER7
DISCUSSION

The importance of this study stemmed from its main purposes, i.e., to describe the general practitioners prescribing patterns and the factors influencing those pattern simultaneously. This model of study represents the first one conducted in Sudan to achieve these two purposes simultaneously. The accomplishment of the purposes required the study to answer the research questions specifically sated below.

- What is prescription pattern of general practitioners at primary health care centers in the National Health Insurance Fund at Gezira State level?
- Which factors influence the prescription quality indicators of general practitioners at primary health care centers in the National Health Insurance Fund at Gezira State level?

This study was designed to answer these questions through the coverage of study objectives, including seven objectives, six about prescribing quality indicators and the seventh about the influential factors of the prescribing pattern. The results analysis and interpretation were taken consequentially according to the objective ordering after the descriptive statistics of subjects and study population. Thus, we used the same method in results, discussion and argumentation.

7.1. Primary Health Care and Service Utilization Patterns

7.1.1. Patients' Sex

Two thirds of the prescriptions used in this study belonged to females although population wise the distribution of both sexes was almost the same, 1:1. The ratio in the sample represents the real health utilization for insured patients and the study was conducted among insured patients in 2012 in 5 states confirming the ratio of females to males was 2:1 (Mustafa, 2013). The may be according to the Sudan culture and context where female employment is very low compared with males. They stay at home and have more spare time to visit health facilities for consultation even when not so necessary in some cases. The second factor could include reproduction health visits, as the family size in Sudan according to census 2008 was 5.99. Thus, females need many visits to the doctor particularly within the reproductive age. Figure 6-1 shows the health utilization pattern by ages. Moreover, the adult males might have tolerated simple

sicknesses particularly RI representing 25% of the cases. Moreover, they didn't visit the health facilities except in severe cases so that the cost of male prescriptions on average were more than those for females.

7.1.2. Patients' Ages

The distribution of patients ages creates a U-shape, and consistent with the normal utilization patterns of health. Children under ten years highly utilize health services, then the utilization pattern decreases with age until reaching a significant level of increase at reproductive ages and then reaching the maximum utilization level after 50 years when both males and females need health services particularly for chronic diseases (Appendix E).

7.1.3. Rural versus Urban

Although the 2008 census and health insurance database show two thirds of insured people are in rural areas, the sample population shared their observations almost equally. The causes could be the health accessibility discrepancies, where rural areas dramatically lower than urban areas, and the chronic disease cases in urban areas are relatively higher than rural areas, 53% and 47%, respectively. Moreover, in the country context on average the awareness and education is relatively higher among urban people. More than 30% of rural patients were children while the children in urban patients represent 20% (Appendix D).

7.1.4. Health Facilities Operators

Of the NHIF facilities located in urban areas, health visitors comprise 59% while SMOH visitors serve 38% of urban patients (Figure 6-3). Of the NHIF patients, 36% have chronic diseases, while in SMOH the patients with chronic diseases represent just 18% (Table 6-8). The visitors of NHIF facilities comprise 19.59% and were less than 15 years while these ages represent 29.4% of SMOH facilities visitors (Appendix H). This indicates that the NHIF facility settings attract (pushing or pulling unknown) patients with chronic diseases more than other facilities. Furthermore, this setting justifies the high cost of NHIF facility prescriptions on average.

7.1.5. Patients' Employers or Social Groups

Public, poor families, private, pensioners, and self-employment sector represents 29.41%, 30.57%, 0.85%, 8.33%, and 26.37% of the population with health insurance coverage, and 39.23%, 27.135, 0.84%, 18.9%, and 7.18% of the sample distribution, respectively (Table 6-4) (Gezira-NHIF, 2014). The inconsistency of population coverage with sample representation of each social group is to a large extent justified. The public sector or civil servants utilize the health services relatively more than other groups in terms of acute disease according to the NHIF annual report and is most likely attributed to the better attitudes toward health consumption than other social groups (NHIF, 2014). Poor families have nearly the same proportion with little difference due to the proportion of poor families in rural areas with less health accessibility. The private sector has almost typical proportions. Pensioners utilized the health services significantly more, 2.2 times the coverage proportion, with the justification of the high prevalence of elderly and patients with chronic diseases among pensioners' families. Patients with chronic diseases have to visit the doctor every month according to NHIF regulations for medicine checkup and medication dispensing. The large disparity between the self-employed population coverage and its representation in the sample is unjustifiable; coverage sustainability could be a problem in this sector. The absolute highest prescription cost of self-employment patients indicated a passive adverse selection in this sector, i.e., the risky members were retained and those with low risk opted out of the scheme or were unsustainable members.

7.1.6. Diagnoses

Eleven diagnoses represented 85.26% of the total cases. The chronic diseases represented 21.37% and infectious diseases represented more than 62% of the patient population. Respiratory infections and malaria alone comprised 47.19% of the cases (Table 6-5). These values suggested the main challenges of NHIF to contain pharmaceutical cost. Surprisingly, two infectious diseases almost caused about half of the doctors' consultation visits, which are manageable and controllable in terms of prevention and health promotion. The reduction of non-communicable diseases prevalence takes time and constitutes a matter of life style change.

7.2. The prescribing pattern

7.2.1. The Average Number of Medicines per Prescription

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 represent irrational prescribing practices in terms of poly-pharmacy. According to the definition of poly pharmacy involves "the prescribing of more than two medicines concomitantly on one prescription" (Viktil, 2007). The average number of drug prescriptions was 2.55, much closer to 2.6, a result of the study conducted in NHIF in 2012 in another five states (Mustafa, 2013). 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) (Table 3-3). To benchmark this result with our neighboring countries we found that Ethiopia indicated 2.13 and Egypt indicated 2.5. Our study result was lower than the optimal level than both countries (Sadikalmahdi H Abdella, 2012) (Akl et al., 2014).

In terms of comparison with other developing countries, we found 2.55 less than several studies results of the average number of drugs prescribed in Mali, Yemen, Uganda, Thailand, and Pakistan, i.e., had 3.2, 3, 2.9, 2.85, and 2.7, respectively (Table 3-2). On the other hand, it was higher than the number drugs prevalent in India, Tanzania, Saudi Arabia, and Malaysia, i.e., 2.4, 2.2, 2.08, and 2, respectively.

Health insurance schemes worldwide revealed poly-pharmacy prescribing practices even more than the private sector on average, an impact of moral hazard. For instance, Thailand health insurance schemes, Iranian health insurance programs, and Nigerian national health insurance show the average number of drugs per encounter was 2.8, 3.34, and 3.4, respectively. These were dramatically higher than the NHIF average drugs per encounter.

Furthermore, to compare between the different facilities in terms of average number of medicines per prescription, NHIF facilities (2.96) had the highest average compared with SMOH (2.44) and reference group facilities (2.4) (private, NGOs, and universities) (Figure 6-7). The significant discrepancies between NHIF facilities and SMOH are attributed to the high percentage of chronic disease patient among those using NHIF facilities compared with the percentage of health status among SMOH patients, i.e.,

36% and 18% of chronic diseases patients for NHIF and SMOH, respectively (Table 6-8). The calculated average with exclusion of chronic diseases produced figures close to each other, i.e., 2.36, 2.32, and 2.32 for NHIF, SMOH, and other facilities, respectively. The main causes of poly-pharmacy could stem from misdiagnoses and multi-morbidity cases. The major implications of poly-pharmacy are the addition of avoidable costs and increased probability of drug to drug interactions. These implications inflate the costs, deteriorate the quality of health services, and devalue clinical outcomes.

Remark: In our comparison between the different countries we ignored the percentage of the prevalence of chronic diseases among the populations of these studies.

7.2.2. The Percentage of Medicines Prescribed by Generic Names:

The study found that the percentage of medicines prescribed by generic name was 46.34%, which is considerably lower than the standard of 100%. The calculated percentage represents severe underuse of generic medicines. The total of 46.34% generic medicine use was lower than the Middle Eastern Mediterranean region average use of generics, 57.1% (Figure 3-1). The result is consistent with previous studies conducted in different districts in Sudan, i.e., 63%, 48%, 41%, 43%, 44.6%, 43.2% 49.3%, 54.2%, and 37.3% (Table 3-3).

The comparison of study generics used percentage with neighboring developing countries, which was very low, for instance, in Egypt, Ethiopia, Mali, Uganda, and Yemen, the use of generics was 95..4%, 99.16%, 70.4%, 91.3%, and 67.1, respectively (Table 3-2) (Sadikalmahdi H Abdella, 2012). On the other hand, when comparing our use of generics with relatively well-off countries the percentage was remarkable high, for example, Bahrain, 14.3%, and Jordan, 5.1%. However, other middle income countries have accomplished higher percentages in generics utilization, for instance, Saudi Arabia, Thailand, and China, 60.1%, 73.9%, and 64.12%, respectively (Sadikalmahdi H Abdella, 2012).

The NHIF prescribed generics considerably less than SMOH, and other facilities, namely. 38.47%, 49.28%, and 48.96%, respectively. One justification could be the percentage of chronic patients was higher in NHIF (36%) and on average the prescribing of generics for chronic diagnosis was very low at just 19%, possibly due to patient pressure and their insistence on specific names.

Although generics prescribed in public facilities have been regulated for many years, still the percentage of generics use remains low. The main causes could be the absence of enforcement of these regulations and influential pharmaceutical firm promotions. The implications of the low use of generics mainly includes wasting scarce health resources and decreasing the degree of pharmaceutical accessibility by creating an affordability barrier, even for those insured up to 25% of non-generic medications, most likely less than the full value of generic choices. Hopelessly, the presence of branded medicine is so rare in the Sudan pharmaceutical market that the majority are trade names produced after the patency period of innovation, and doctors insist upon prescribing these trade names frequently. The main argument for prescribing is the absence of bioequivalent tests as prerequisite for pharmaceutical marketing of medicines. For that they arbitrary based their prescribing decision on their experience and possibly biased information.

7.2.3. The Percentage of Prescriptions Containing Antibiotics

The percentage of prescriptions containing antibiotics was 54.71%, considerably high according to WHO guideline benchmarks of antibiotics use, which is less or equal to 30%. The percentage of antibiotics used which the study revealed was higher than ever discovered before in studies at the primary health care level except for two studies. These studies reported that the percentages of prescriptions with antibiotics comprised 64%, 63%, 48%, 41%, 44.6%, 43.2%. A study of 64% antibiotics use was conducted in other states of health insurance and was considerably higher than this study result (Table 3-3).

To benchmark the antibiotics percentage of use with developing countries, we found many countries above and others below with this study result. Regarding the WHO Eastern Mediterranean region, the percentage was 53.6%, slightly less than this study result. The group of countries with lower percentages include China, Saudi Arabia, Bahrain, Egypt, Ethiopia, Mali, Uganda, Yemen, and Turkey, with 48.43%, 44%, 26.2%, 39.2%, 29.14%, 33.2%, 14.3%, 17.2%, and 39.1%, respectively. On the extreme, a group of countries overusing antibiotics included Jordan, India, and Pakistan, with 85%, 60.9%, and 76%, respectively.

The comparison between the different types of health facilities operators revealed the NHIF had the lower use of antibiotics than SMOH and other facilities, namely, 45.91%,

57.24%, and 56.86%, respectively. The justification for the reduced use of antibiotics in NHIF facilities is the clients of NHIF facilities are mainly elderly with a lower percentage of children compared with other facilities. Helping to confirm that is the prescribing of antibiotics for less than ten-year-old children was 70% while for the elderly 60 years and over was just 36.7%.

The catastrophic overuse of antibiotics is an old phenomena in the Sudan health setting as with many other developed and undeveloped countries health systems. The devastating impact of antibiotics is the development of multi-resistant bacteria that might cause unmanageable infectious diseases. Interestingly, no patient will exit without a prescription except those referred for further specialized consultation, and thus, the doctor sometimes has to prescribe to satisfy patient desire (patient pressure) even for the common cold or any other viral or self-limiting bacterial infections. On average, the price of antibiotics is less than other choices. The distribution of diagnosis confirms the irrational prescription of antibiotics and respiratory infections more than 25% of the total diagnoses. Definitely, many common cold cases and viral infection were diagnosed. A modest amount of the huge antibiotics budget of health insurance would be better allocated for culturing, raising patient awareness, and promoting of rational use of antibiotics and health education to achieve patient safety and cost containment.

7.2.4. The Percentage of Prescriptions Containing Injections

The percentage of prescriptions containing injections was 12.84%, considered relatively high, and although no strict standard exists, the WHO benchmark is less than 10%. Region wise the average prevalence of injection use in the Eastern Mediterranean Region, is higher, at 27.1%. The studies conducted in Sudan revealed progress in injection utilization, 36%, 22%, 29%, 27%, 13.7%, 14%, and 38.6%. The reduction in injection use is attributed to the new protocol of malaria management \focusing strongly on ingestible dosage forms over injection, which was dominant before.

Although the use of injection (12.84%) is slightly higher than optimal level, many studies have revealed a lower use of injection than in our setting. For instance, Nepal, Saudi Arabia, Kuwait, Egypt, Turkey, and Bahrain, showed a prevalence of 1%, 2% 9.1%, 9.9%, 10%, and 8.3%, respectively. Other countries have revealed higher level of injection use than this study. Likewise, Pakistan, China, Yemen, and Ethiopia, have

shown the percentages of injection use at 74%, 22.93%, 17.2%, and 28.5%, respectively.

The use of injections in NHIF, SMOH, and other health facilities was 15.58%, 12.55%, and 9.97%, respectively. NHIF facilities were considerably higher than other facilities because the prescribing of injections for under five-year-old children was 5.5% while among patients over 60 years was 13.2%. This last group represented a larger percentage in NHIF facilities than other facilities. The implication of overuse of injections reduces patient safety, and increases the prescription cost, because the injectable form manufacturing techniques are more sophisticated and costly than other dosage forms. This study revealed that prescriptions with injection were on average more expensive by 14 SDG than prescriptions without injection.

7.2.5. The Percentage of Medicines Prescribed from the Medicines List (EML)

The overall percentage of medications prescribed from the medical doctor list was 81.19%. The standard of this prescribing quality indicator is 100%. The percentage of EML adherence seems high, but in reality was not true, 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 percentage of medicines prescribed from EML was 90.8%. This prescribing core indicator in Sudan from previous studies was mostly higher than the findings of this study, 98%, 99%, 92.7%, and 99.3%. In contrast, two studies revealed EML adherence values lower than this study, i.e., 73.5%, and 72.8% (Table 3-3).

The judgment based on the neighboring countries' EML adherence indicator values explicitly confirms the NHIF indicator was considerably low. For instance, Egypt, Saudi Arabia, Bahrain, and Jordan, had indicator values of 95.4%, 99.2%, 99.8%, and 93%, respectively. However, this percentage is better than the situation of EML adherence in many countries, namely, Nepal (39.6%), China (67.7%) and Pakistan (70%).

We found EML adherence in NHIF facilities was worse than SMOH and other facilities, 72.65%, 82.97%, and 89.29%, respectively. The discrepancies between NHIF and other facilities in prescribing according to EML is vast. The main supporting argument is the different proportions of chronic disease patients; NHIF has double that of SMOH (36% to 18%). However, it cannot explain the entirety of the cause. The

effects of provider purchaser splitting and existence of accountability promotes better adherence in SMOH and other facilities and has been practiced more perfectly than in NHIF facilities.

What are the benefits of good adherence to EML in prescribing practice? When doctors follow the EML they better access the drug of choice for that specific diagnosis. Moreover, the medications in the EML are accompanied with bias free information. The responsible technical authorities of EML have formulated the list based on clinical and economic studies and follow the risk benefit ratio rule. That means the medicines have been in the EML are clinically needed, safer, more effective, and more cost effective.

7.2.6. The IRDP

Describe the prescribing quality indicators in specific health settings is simple and easy using one figure (Index) instead of five figures. Moreover, one figure facilitates the comparison between different prescribing settings in terms of prescribing quality because the achievement of the five prescribing indicators in different settings most probably varies, and some indicators are better in one setting while some indicators are better in other settings and so on.

The study revealed overall IRDP was 3.39, the standard was 5. A total of 197 medical doctors have reported 2.1 to 4.88 IRDP, which is relatively low compared with other neighboring countries. For instance, in Saudi Arabia ten health facilities were ranked, revealing reported IRDP from 4.37 to 5 (Mahalli, 2012). In Egypt, the same processes were conducted in 10 PHCCs and revealed high IRDP rankings from 3.92 to 4.88 (Akl et al., 2014). Even though a high IRDP was not achieved, the IRDP was higher than that reported in China, 3.32 (Dong et al., 2011).

The NHIF facilities showed lower index value than SMOH, and other facilities, 3.08, 3.46, and 3.75, respectively (Figure 6-6). Compiling the performance in the five prescribing quality indicators in one index eases the comparison between the different health facilities and even prescribers. This index is useful to be used in claim management and payment for performance.

7.2.7. The Average Cost of Prescription

The study has revealed that on average the prescription cost was 40.57 SDG, almost double the proxy of 16 to 24.62 SDG. A study conducted in five states in 2012 reported

an average prescription cost of 20.5 SDG, almost half. The main cause of this cost inflation is from the devalued Sudanese currency particularly in the last four years. Comparing the average cost with other country setting is unacceptable without economic adjustment of the currencies values.

The prescription cost is proportional to an increase of patient age; on average, the under 5 years patient prescription cost was 24.01 SDG, patients 6 to 59 years had prescription costs of 36.86 SDG, and patients 60 years and over had prescription costs of 61.54 SDG. The justification could be that younger patients need simple medications and most likely their diagnoses include simple common diseases. As age increases, health deterioration occurs, and the need for sophisticated medication and higher numbers and quantities are required particularly for chronic diseases. The study found on average the prescription cost of males was higher than females, 43.48SDG, and 39.07SDG, respectively. The justification of the study revealed the ratio of consultation visits between females and males at 2:1 while their ratio in the population was 1:1 that means the females more frequently visit doctors than males even when they are in the same circumstances. We could infer that the males visit the doctor most likely with more severe situations than females, and thus require more medicines.

The average cost of prescriptions in rural areas are lower than urban areas, 37.38SDG, and 43.83 SDG, respectively. The main cause is that in health settings in Sudan, the capabilities of laboratory investigation in rural areas is considerably less than that of urban areas, so patients with severe situations go directly to the nearest urban health center. In other words, on average the patients in rural health facilities have simpler diagnoses than urban ones. Moreover, the prevalence of chronic diseases was relatively high in urban than rural areas, 53% to 47%, respectively.

The employer based evaluation of patient prescription costs reported a noteworthy difference. The average prescription cost for the patients of public, poor families, private, pensioners, and self–employment were, 39.25SDG, 38.23SDG, 37.13SDG, 50.68 SDG, and 45.03SDG, respectively. Pensioners and self-employed patient prescriptions costs were inconsistent with other social groups average prescription costs. The pensioners' prevalence of chronic diseases was higher than other group and self-employed patients have voluntarily opted for the health insurance umbrella.

Therefore, they have entered the most likely risk group with chronic diseases and multi-morbidity health status.

The NHIF facilities prescriptions showed higher costs than other facilities. The average prescription cost in NHIF, SMOH, and others were 59.54SDG, 36.07SDG, 31.69SDG, respectively. These disparities were due to the relatively high percentage of chronic disease patients in NHIF facilities (36%) and with less percentage in SMOH (18%). Moreover, the majority of other facility visitors comprised students and younger adults.

7.3. The Influential Factors of Prescribing Quality Indicators

7.3.1. Factors Influencing the Prescription Number of Medicines

7.3.1.1. Prescriber-related Factors Effect

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) confirmed that younger doctors prescribed more appropriately than others. 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 (Senior et al., 2003). Contradicting results from a Nigerian study reported that poly-pharmacy was significantly associated with younger prescribers and that older doctors prescribed fewer medications than younger ones (Ojo et al., 2014). The Sudan context was consistent with our study result because no regular programmed continuous professional training is available among medical doctors, and fresh graduates have better knowledge on average than older medical doctors.

Professional training showed a significant increase in the number of drugs prescribed. Other studies did contradict this result because training is related to improve prescribing behavior. The authors used control and treated groups to determine the magnitude and nature of six months education effect. The study revealed a significantly positive effect of education on prescribing quality indicators (Sithole & Jones, 2002). The justification of abnormal results could have resulted from the health system with a low doctor-population ratio. In our case, the training encouraged doctors to reduce their referrals to upper level care by prescribing more medications.

The places of graduation made significant differences in the mean medication prescribed per patient. Medical doctors who graduated from university G showed lower means of prescribed medications per encounter than the reference group, while the graduates of KH showed a significantly higher number of drugs per prescription than reference group graduates.

The final academic degree had influence on the mean medication per encounter. The study found that the doctors who had academic degrees higher than bachelor level prescribed fewer drugs per patient. A study conducted in China proposed as the education qualification was upgraded, the co-efficient of the number of drugs per prescription acquired more negative values (Wang et al., 2013). Moreover, (Marshall H. Becker et al., 1972) proved that juniors postgraduate prescribing practices were more appropriate than non-postgraduate senior prescribers, which was typically the case in this study. A study conducted in China revealed the effect of education was significant and long lasting (Zou Jun1, 2011). For instance, a six-month education program in the U.K was repeated and evaluated with control groups, resulting in improved prescribing practices in terms of prescribing indicators (Sithole & Jones, 2002).

The doctors' professional experience was reported to have significant effects, as the experience in years increased the mean medication of patients. A study in Nigeria reported that the prevalence of poly-pharmacy was significantly related to doctors with fewer years of clinical experience (Ojo et al., 2014). Definitely, practice makes perfect. 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 (Marshall H. Becker et al., 1972). In Greece, primary health care general practitioners were studied revealing the potential influence of general practitioners, colleagues and consultations with specialists on prescribing practices (Tsiantou et al., 2013).

7.3.1.2. Practice-related Factors Effect

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 (Arab et al., 2014).

The study found that workload or the average patient number affected the prescriber behavior negatively 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 (Ojo et al., 2014). (Stolley et al., 1972) observed that a hurried practice with short patient visits and a low percentage of patient visits to health outlets were associated with inappropriate prescribing practice. A large number of patients can exhaust doctors and making them less precise when prescribing the least appropriate number of medications to treat a diagnosed case.

Patient demand or pressure on the doctor to prescribe specific medicines or brands significantly influenced prescriber behavior. A study conducted in Greece across private and public primary health care providers revealed that patient request and family expectations were influential factors on prescribing practice, as well as the limited available time to spend with patient (Tsiantou et al., 2013).

The health facility operators showed different effects on the prescribed number of drugs, for instance, the NHIF facilities prescribed more drugs than other health facilities. In this setting, no third party existed, rather, the second and third parties consolidated into one and the accountability carrot and stick were removed, resulting in no provider purchaser split.

The type of doctor employment affected doctor prescribing behavior. A doctor being a government employee or contractual employee reduced the number of drugs per encounter more than the reference group; doctors of mandatory national services or co-operative employees. A study conducted in Iran used Poisson's regression to investigate the effect of doctor employment, age, nativity, and years of practice on the number of drugs prescribed. The study revealed that employment had no significant effect (Arab et al., 2014). The employment type was associated with job satisfaction, professional training and job security, and could affect the number of drugs prescribed.

An increase of doctor working hours had a significant effect on the number of prescribed drugs; as hours increased the number of drugs prescribed decreased. This might be attributed to the sufficient time for clinical diagnoses allowing the doctor to specify the patient health problems properly. Interestingly, (Stolley et al., 1972) found

that a hurried practice with short time spent with patients and a low percentage of patient visits to health outlets were associated with inappropriate prescribing practices. The availability of the NHIF medicine list has been reported to have a considerable effect on reducing the number of prescribed medications. The presence of the list provides doctors important information related directly to rational prescribing practices. The EML encourages doctors to adhere to the list and select the drug of choice from among many alternatives.

A study conducted in China assessed the effect of reform using a national essential medicine system in four provinces. The main results of this intervention were a reduction of drug prices compared with the situation before the reform; the reduction of cost was related to the number of drugs and selection of the most cost-effective drugs (Yan Song, 2014)

7.3.1.3. Drug-related Factors

Doctors who consider the drug price when prescribing have reported fewer medications prescribed per patient. In developing countries, the price of medicine is the main determinant of patient compliance. Thus, doctors who acknowledge that prescribing the least number of medications will most probably solve the patient's health problem. Considering drug price in prescribing practice reduces the number of medicines prescribed per patient.

Doctors who believe expensive drugs are more potent than less costly choices and similar ingredients, prescribe less mean medications per prescription than those who don't believe the expensive alternative is more potent. Those doctors prescribe the potent alternative as they believe and regard the patient affordability (even the insured pay 25%)' They have to prescribe fewer medications to synchronize the two sides of the equation in a developing country

7.3.1.4. Patient-related Factors

The study found that an increase of patient age increases the number of drugs prescribed. Which is more justified, as the age increases the probability of patients having more than on disease will increase until reaching elderly with a high prevalence of multi-morbidities. The study revealed that the sex of patient influenced the number of medicines prescribed; males had more drugs prescribed than females. Females need analgesics routinely particularly those in reproductive ages.

All social groups' of patients reported a significant effect on the number of drugs prescribed compared with the reference group (students). The main causes of the multi-morbidity and the high prevalence of chronic diseases among those insured, stemmed from the percentage of elderly subscribers and passive adverse selection.

7.3.1.5. The Drug Chronicity

The chronic diseases reported 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, which requires more medication.

7.3.2. Factors Influencing Generic Names Prescribing Behavior

The study revealed that the different groups' factors had different signs and magnitudes and several factors influenced the generics prescribing behavior.

7.3.2.1. Prescriber-related Factors

The study revealed that doctor qualification, professional experience and rational drug use training reported positive effects on the use of generic medicines.

Doctors who were more educated and had final academic degrees higher than others prescribe more generics. The justification could be that more education and training helped the prescriber to know more about generic names, than through the other biased promotional information sources. Moreover, the rational use training most likely briefed about generics and the real benefits behind their use scientifically. More years of experience let the doctors to know the empirical differences between generic drugs and other brand choices, particularly in our health setting where the dominant majority are traded names and few numbers of brands are available in the pharmaceutical market. Rationally, if two similar choices produce the same results, but differ in prices, absolutely, the logical choice is the cheapest one. Interestingly, a study conducted in China found that education and training had a negative effect on the percentage of generic drugs use, but it found the effect of qualification and the final academic degree

affected positively; higher degrees were associated with a high use of generics, which was similar to this study result (Wang et al., 2013)

The doctor age, place of graduation G, and doctor health insurance experience reported significant effects on the reduction of generics used. The doctors from this place of graduation reduced the number of drugs per prescription but most likely prescribed medicines by brand name. Clinical knowledge, skills and attitudes are required for safe and effective prescribing associated with teaching techniques (Hilmer, 2009).

Interestingly, an increase in doctor age reduced generics drug use; we expected positive signs of co-efficient. The main cause could be that for older doctors the main source of medicine information was medical representatives, done for promotional purposes.

Surprisingly, the increase of doctor experience in provision of services for insured patients negatively influenced the use of generic medicines. The argument behind that may be they know practically to what extent the health insurance can bear the cost of medication and the real affordability of health insurance, get sure there is a body on behalf of patient pay the cost. Also may be by experience they got sure no administrative implication on them if they not follow guideline of rational prescribing.

7.3.2.2. Practice-related Factors

Government and contractual employed doctor, the payment mechanism, and availability of NHIF medicines list have reported considerable positive influence on prescribing of generic medicines.

The effect of these types of employment are justified by these methods of employment more stable and secured than reference group method. So, loyalty rose up and the prescribers become keener on the scheme sustainability and follow the rational practice guidelines. The group of doctors who work with salary and performance based payment more satisfied than those paid by constant salary. For instance, study conducted in Thailand found that the prescription cost of fee for service paid doctor more expensive than the prescription of capitation paid doctor, because capitated doctor prescribe generics medicines more than FFS doctor (Bryant & Prohmmo, 2005)

The availability of NHIF medicines list promotes the prescribing of generic medicines significantly. The presence of the list on the doctor clinic table desk remembers the doctors to follow the rational prescribing guidelines and directives, furthermore, provides un-biased information and the generic name for each medicine entity.

Increasing of patient number, working hours, and the doctor being native significantly reduce the percentage of drugs prescribed by generics. As the number of patient increase the generic use of medicine indicator getting more worse, may be when the number of patient large, the doctor in need to prescribe hurry, thus use the trade name more than generic because on average the brand or trade names shorter than generic particularly in combination formula dosage form. An increase of number of working hours reduce the number of drug prescribed by generic, could be when the doctor offer more consultation time to the patient and the co-patient may pressure the doctor to prescribe specific brand by convincing the doctor with good experience with that brand name or something similar. (Stolley et al., 1972) observed that the hurried practice with short time to patient and also low percentage of patients' visits to health outlet associated with appropriate prescribing practice.

The native doctors reported less prescribing of generics than non-native. It could be the natives are influenced by their relatives' demand which is more influential than the normal patient demand, and they request specific experienced brand or trade name, whatever the social dimension may affect the prescribing decision potentially. Study conducted in Iran showed the number of generic drug prescribed on the prescription influenced by the doctor nativity (Arab et al., 2014).

7.3.2.3. Drug-related Factors

When the drug independents regressed separately together revealed considerable effect on the generic drugs prescribing. The doctors who consider the drug price in their prescribing decision prescribed more generic than the others. Which simply justified because the generic choice definitely less than brand name, thus they prescribe more generics. As the doctor expose to more pharmaceutical promotional visits his behavior change to prescribe less generic. One of the more explicit causes is that the hammering on specific trade name let it more memorable than the generic one. Moreover, the oriented promotional information created conviction on that branded medicines. Study done in Netherlands found there was a negative correlation between quality of prescribing and pharmaceutical representative visits (Muijrers et al., 2005)

Noteworthy, the doctor who believes in the expensive choice is better, they prescribe less generic considerably, because generics always cheaper than branded or traded medicines, sometimes the generic represents 10 % of the branded one

7.3.2.4. Patient-related Factors

The patient age, the different social groups, and patient residence have reported considerable negative influence on the generic drugs prescribing. The doctors changed their prescribing behavior to worse as the patient age increase. This can be interpreted by the patient influence positively proportional with patient age, older one apply more pressure to receive more branded than youngers. Other argument is patient compliance, the elders with chronic diseases most likely believe in experienced branded than patients with acute disease and the prevalence of chronic diseases more among the elders than Youngers.

All employers' patients comparing to student as a reference group reported considerably less percentage of generic drug prescribed on their prescriptions. The justification would be the same; the chronic diseases prevalence, the age effect and multi -morbidity are accumulated in these social groups, all these factors reduce the use of generics as mentioned above. Students are free from these health problems and they receive more generics.

The patient residence made sense on the prescribing by generics. The patient who live in urban influence the prescriber prescribing behavior to write less generic name. Which confirmed the effect of patient socioeconomic characteristics on the prescriber, moreover the patient pressure and the workload of course have effect. The geographical place urban or rural has most likely correlation with the crowding and workload. Nigerian study proved that there was significant positive relation between the irrational prescribing and the heavy workload in outpatients' outlets(Ojo et al., 2014). On average people live in rural areas less income than those in urban areas, the prescribers deal with them differently in prescribing practice, and often they prescribe expensive prescriptions for those well-off. (Alex Y. Chen, 2002)conducted study in USA proved that the poor-families children prescriptions expenditures less than other economic status groups.

7.3.2.5. Disease Chronicity Factor

The type of disease has dramatic effect on the prescribing by generic. Chronic diseases influence the doctor prescribing behavior to prescribe branded drugs more the in the case of acute diseases. The argument could be the patients with chronic diseases more aware about medicines names than other, for that they most likely insist to use specific

names or brands. This insistence pushes the doctor to prescribe accordingly to guarantee the patient compliance and satisfaction.

7.3.3. Factors Influencing the Antibiotic Prescribing Behavior

The antibiotic overutilization is the concern of health partners and community everywhere. The study shows the different factors have significant effect on the antibiotic utilization.

7.3.3.1. Prescriber-related Factors

Doctor age, place of graduation, professional training, and the experience in health insurance have reported increase the prescribing of antibiotics considerably. An increase of doctor age increases significantly the antibiotics prescribing. Most likely there is no correlation between the age of doctors and his knowledge, because the professional training or academic upgrading program not compulsory, for that you can find some medical doctors of age over 50year and not exposed to any scheduled program. Study conducted in Netherlands about prescribing antibiotics for RTI and prescriber characteristics, it revealed that the longer age prescriber with little Knowledge prescribed antibiotics more than younger Gps (Annemiek E Akkerman, 2005). Another study done in Netherlands revealed that the younger medical doctors collectively more rational than older medical doctors (Haayer, 1982). Study done in China shows doctors under 45 years old prescribed fewer antibiotics than those over 45 years old, and doctors with bachelor's degree prescribed more antibiotics than those with master's degree or above(Wang et al., 2013).

Interestingly, the study found that the professional training increases use of medicine significantly. The justification may be after professional training the medical doctor tries to treat more complicated cases than before and reduces the referrals, the management of these retained cases to succeed the doctor prescribes more antibiotics particularly the bacterial culturing rare prevalence among Sudanese health setting.

The places of graduation G and Kh have significant influenced on the antibiotics prescribing, we found the graduates of these both universities prescribed antibiotics more the other universities graduates (reference group). In average of drugs prescribed and generics drugs prescribing the graduate of both universities more in accordance with rational prescribing guide than the reference group.

The longer doctor had practiced in provision of services for insured patients, prescribed more antibiotics than those recently joined the delivery of services. This indicates the absence of measures to rationalize the antibiotics use.

Noteworthy, the study found the professional experience reduces the antibiotic prescribing rate. Which is logic and agreed with study conducted in Holland, which revealed the doctor with longer experience prescribed the antibiotics with less percentage than doctors with fewer years of experience, particularly if the experience is accompanied with education or training (Annemiek E Akkerman, 2005)

7.3.3.2. Practice-related Factors

The study found that doctor nativity, type of employment, patient demand, availability of NHIF medicines list have promoted the use of antibiotics considerably.

The doctors who work in their localities (natives) prescribe antibiotics more than those non-natives. This is consistent with their performance in the previous prescribing quality indicators. The justification could be the relatives and friends insistent to receive antibiotics and the doctor may sometimes obey them.

The government and contracted employee doctors show high percentage of antibiotics prescribing than the reference group, this group of doctors has reported rational practice in generics and mean medication per prescription, but in antibiotic prescribing they are prescribing more than the reference group. Which is questionable, may be they were more loyal to health insurance, for that they treat the more complicated and severed cases to reduce the rate of referring to the consultants to contain cost for that they used to prescribe more antibiotics.

Surprisingly, the presence of NHIF medicines list influence the medical doctor to prescribe more antibiotics. In reality the national health insurance fund medicines list according to international expert is generous and contains large number of drugs than should be, this reason could be encourage the prescriber to prescribe antibiotics and the list remember them " this drug included in the list and covered by health insurance". Existence of body bears the cost on behalf of the patient in developing countries, itself affect the prescriber behavior toward the antibiotic and other medicines, moral hazard. The patient demand reported significant effect on the use of antibiotics. The more percentage of demanding patients more prescribing of antibiotics. Which is justifiable, commonly the patients used to demand antibiotics for simple or viral infection.

The factors reduce the antibiotics prescribing revealed in this study are the health facility location, NHIF, SMOH facilities. The antibiotics less prescribed in urban areas than rural areas. From the descriptive statistics of this study, the percentage of children among the patients in rural areas dramatically more than urban areas, and the use of antibiotics in children more than adults. Moreover, the percentage of chronic disease patients was relatively high in urban (53% to 47%), so less use for antibiotics. For these reasons the NHIF and SMOH showed less prescribing of antibiotics than the reference group, the urban dwellers receive less antibiotics. The rural dwellers less educational level than urban dweller for that they need more antibiotics. Study conducted in China found that the high use of antibiotics was in less developed Western China (rural) (Yin et al., 2013). In India the study of antibiotics use found that the doctors who in rural and governmental health facilities had prescribed more antibiotics than urban and facilities private, which typical to this study result in this terms (Kumari Indira K.S, 2008).

7.3.3.3. Patient-related Factors

The study revealed that patient age, sex and social groups have influenced the prescribing of antibiotics significantly. The younger patients received antibiotics more than older patients, the highest rate between 4 to 12 years (69%), in patient over 60 years (36%). Which is justified, because more than 25% of diagnosis was respiratory infection which is more common among children. Study done in India showed the highest rate was for children aged between 6 and 18year (Kumari Indira K.S, 2008).

The study found the males received fewer antibiotics than females. In Sudan the ladies receive more antibiotics at reproductive age, at which the men use less antibiotics, at the rest of life years they are both approximately the same. Which is similar to the results of study conducted in Spain to assess the expose to antibiotics and differences between sex and age, the study found the children and women had used the antibiotics more than adults and men (Serna et al., 2011).

The study found the public, poor families, pensioners, and self-employed reported high antibiotics use than the reference group. Which is consistent with the age effect on the antibiotics use, these families have children where the reference group has no children at all they are most of them universities students.

7.3.3.4. Disease Chronicity Factor

The disease chronicity influenced the use of antibiotics negatively and significantly. The probability of prescribing antibiotics for chronic disease patients is dramatically less than for acute disease patients, less likely prescribing antibiotics for chronic disease.

7.3.4. Factors Influencing the Injection Prescribing Behavior

7.3.4.1.Doctor-related Factors:

The pattern shows overuse of injections collectively. Study revealed there were many factors influence the injection prescribing. The negative implication of overuse of injection not only the wasting of resources, but also the time consuming of staff, unnecessary use of medical equipment, and expose the patient to infection particularly hepatitis and HIV AIDS.

The doctor age influences the injection prescribing; older doctors prescribe injection more than younger doctors. Which so consistent with many studies which revealed the younger doctors have mare rational prescribing practice (Haayer, 1982). The study found female doctors prescribe injection less than male doctors, may be due to female sense less acceptance to harmful intervention than male.

The place of graduation has reported significant effect on the injection prescribing behavior. The different syllabus of universities has effect on the doctor practice rationality (Hilmer, 2009). Doctor qualification reported significant effect on injection prescribing; those who had professional degree higher than bachelor degree prescribed less injection than those with bachelor degree. Which is consistent with the positive effect of education on the rationality of prescribing although it contradicting the result of study done in China, which found the doctor with merely bachelor degree prescribed more antibiotics and fewer injection than those with higher academic degree (Wang et al., 2013)

The job satisfied doctors prescribed injection less than job un-satisfied doctors. The satisfied keener than unsatisfied in perfection. Study conducted in U.K found the unsatisfied less serious than satisfied general practitioners, sometime permit the technical sub-ordinate to prescribe medicines (MELVILLE, 1980). The rational drug use training reported significant effect on the reduction of injection prescribing.

7.3.4.2. Doctor-related Factors

Increase of day working hours, doctor work by salary and incentive, and availability of NHIF medicines list have increased the injection prescribing rate significantly. The study found that the malaria represented about 22% of total diagnosis. In Sudan the second line of malaria management is Artemether injection, the prescriber used to jump to the second line frequently for that prescription with injection was high12.84%. The patients who believe in injection when there is more consultation time they pressure and insist to receive injection not tablets, for that may be the increase of working hours increases the injection prescribing. Doctors who work with incentives based on the number of patient try to attract the patient to increase the daily average number to get more income, for that they would response more to the patient demand of injection. Interestingly, the availability of NHIF medicines list increases the injection prescribing. Could be due to it contains many injection dosage forms, and it is presence encourage them to prescribe injections, noteworthy, the malaria management injections included in the list for specialist level but no high adherence to the list particularly in malaria management.

The type of employment reported significant influence on the injection prescribing. The governmental and contracted employment doctors reported less prescribing of injection than reference group. These types of employment showed more rational performance in terms of prescribing indicators. As we said before the loyalty, job security, satisfaction and stability are the main reasons behind that.

7.3.4.3. Drug-related Factors

The doctors who considered the drug price in their decision, they prescribe less injections than others those feel indifferent with drug price. The study revealed on average cost of prescription increases by 14.6 SDG If the prescription contained injection. More consistency, the study found the doctors who have tendency to the expensive drugs and brands prescribed more injections than those neutral.

7.3.4.5. Patient-related Factors

The increase of patient age increases the rate of prescribing injection significantly. In Sudan context the prescribers and community have propensity to avoid injection in small children than in older patients and it attributed to avoid any probability of getting infection and complications may result in. Moreover, the study found males patients

less received injection females that means the doctors prescribed injection for female more than male patients. This is so acceptable, ladies exposes more for injection particularly in reproductive age. Study conducted in Korea revealed in the aged population the over use of injection more prevalence in aged population, and found that the greater sex ratio areas less likely to over prescribed injections (Choi et al., 2012)

7.3.4.6. Disease Chronicity Factor

The study found that the patient who infected with chronic diseases most likely the doctor prescribed for the injections. The aged patients most likely have co-morbidity or even multi- morbidity than youngers, so the probability of their prescription to contain injection more than younger of acute cases. The prevalence of chronic diseases is high among elders than younger, as we mentioned above the increase of age increase the injection prescribing probability. Moreover, The Korean stud reported the aged population areas associated with overuse of injections(Choi et al., 2012)

7.3.5. Factors Influencing the Prescribing from NHIF Medicines List

The essential drug list or health insurance pharmaceutical benefit package is a policy recommended from the different level of authorities in order to rationalize the services for patient safety and cost containment. The adherence to the list or the policy implementation is influenced by many factors.

7.3.5.1. Doctor-related Factors

An increase of doctor age, professional training, peer contact and discussion, and place of graduation exerted positive influence on the adherence to the NHIF medicine list and increase the percentage of medicines prescribed from the list. The doctor longer doctor age means has been exposed to the list more than younger, so easy to mind the included from non-included medicines. Could be younger doctors more updated and tended to prescribe the new drugs more, for that their adherence NHIF list less. The peer contact and discussion coin with two faces, the would contact and discuss the medical issues, the drug list of NHIF definitely one of these issue, so can remember each other about the included drugs and facilitate the list adherence. On the other hand may discuss about the recently introduced medicines and their advantages, so they push each other to prescribe drugs outside the list. Even though and whatever, the co-efficient significant and positive.

The professional training increases the adherence to the list, most likely the scientific talk focus on the essential medicines, the standard treatment guidelines, the prescribing quality indicators, and patient safety. Any medicines list is based on these values and themes.

The study revealed the doctor sex influenced the prescribing accordance to NHIF medicines list. Male doctors less adherence to the list than female doctors. Interestingly, the longer years of experience prescriber less percentage of prescribing from NHIF list. The justification of this point may be related to qualitative administrative issue which we lost in this study and represents one of the study limitation. The medicines list is a policy the accountability enforce its implementation, long experience without accountability with availability of excluded drugs choices facilitate the violation. Moreover the experience without continuous professional training lead to unscientific technical beliefs.

7.3.5.2. Practice-related Factors

The study found that the doctors who work with salary plus number of patient base incentives, availability of NHIF medicines list, type of employment, and number of patient have reported significant positive effect on the adherence to NHIF list. The performance based incentive improves the prescribing quality indicators as revealed by the Spain study (Fernandez Urrusuno et al., 2013). The availability of the list minds the prescribers which medicines included and the commitment of list adherence. The increase the number of patients encourages the prescriber to prescribe the most frequently used choices, which are almost included in the list.

In the second extreme, the doctor nativity, the increase of work hours, and type of operator have reported a significant negative influence on the list adherence. Doctor who works in his locality considerably less adherence to NHIF medicines list in his prescribing practice. Which is consistent with his low performance in previously mentioned prescribing quality indicators. The reason could be relatives and friends expose him to pressure to prescribe specific drugs and may not the drug of choice for the case and spontaneously would prescribe one of excluded choices. The more hour of working entitle the patient to spend more time doctor consultation; hence the patient pressure would exert influence to change the prescriber behavior toward the list adherence by prescribing the patient demanded choice. Interestingly, the NHIF

facilities less adherence than the reference group and so did the SMOH facilities. More surprisingly, the reference group main component was the universities health centers, which provide the services on average more educated than the clients of both NHIF and SMOH facilities, the expected patient pressure and demand would be in reference group facilities, but hopelessly not the case. Administrative issues behind could be behind that.

7.3.5.3. Drug-related Factors

The study revealed that the consideration of drug price in prescribing decision, and pharmaceutical firms promotional visits reported significant positive effect on the NHIF medicines list adherence. The consideration drug price is expected to increase the adherence, because any drug list should be formulated based on specific criteria the cost effective on of these measures. Interestingly, an increase of pharmaceutical promotional visits increases the percentage of medicines prescribed from NHIF list. In Sudan health setting the pharmaceutical firms represents one of the main sources of drug information. Study done in Sudan found that 91.6% of study doctors believe that information provided by medical representatives are valuable.79.1% of doctors stated that they are influenced by discussion with medical representatives, 98.6% of those are positively influenced (Liela Hussein1, 2012). Moreover, in health facilities provide the services for insured patients most likely the medical representative focus on the enlisted medicines or the medicines already has been included in the list.

The doctors who believe in expensive drugs are more potent less adherent to NHIF medicines list. Those concentrate more on the branded names and recently introduced choices.

7.3.5.4. Patient-related Factors

Patient sex, patient age, the social groups reported a significant negative effect on list adherence. The doctors prescribed from NHIF medicines list for male patient less than females. The increase of patient age is expected to reduce the number of drugs prescribed from the list. These results prove the theory patient pressure on prescriber prescribing behavior. The social groups in compare to reference group have more prevalence of chronic diseases for that they know about drugs names more for that exert effect more.

7.3.5.5. Disease Chronicity

Chronic disease significantly influenced the prescribing in accordance with NHIF list. The patients with chronic diseases are aware about medicines in general and specific medicines names. For that the long use even un-enlisted medicines makes them insistent to receive that medicines even the enlisted is clinically better. Patient demand, pressure, and the keenness of doctor to satisfy the patients led to fewer adherences to the NHIF list in chronic diseases. Moreover, sometimes the NHIF gives the general practitioners more technical authority to prescribe some medicines from the specialists list.

7.3.6. Factors Influencing the Index of Rational Drug Prescribing (IRDP)

The IRDP is a compound of the five core prescribing indicators. The different factors affect differently with each indicator, for that the IRDP reflect the influence vector of each factor on the five indicators. Definitely, the influence of each factor could be significantly negative or positive on all indicators, and most probably positive on some, negative on other, the net effect represented in the effect of the factor on the IRDP Appendix W. The positive and negative mentioned below in terms of effect not the co-efficient or marginal effect signs.

7.3.6.1. Doctor-related Factors

The study found that the influence of doctor qualification on IRDP was significantly positive; doctors with higher academic degree had larger IRDP than those with bachelor degree Appendix X. Professional experience reported as the years of increased the IRDP increases significantly. Noteworthy, the rational use of drug training performed Positive effect on the four indicators, for that revealed a significant positive effect on IRDP. The study found that the peer contact and discussion reported significant positive effect on the IDRP. Moreover, the job satisfaction showed considerable positive influence on the IRDP. The professional experience had Positive effect on three indicators, thus influenced IRDP positive and dramatically. The place of graduation G exhibited Positive effect on three indicators and negative effect on one, thus reported collective significant positive effect on the IRDP. Overall, the doctor health insurance experience reported slight positive effect on IRDP.

Interestingly, the professional training vector of influence was insignificant, performed Positive in one indicator, negative in two and two insignificant effect. Thus, collectively had no effect on the IRDP and β equal zero, and so did the place of graduation KH.

On the other hand, doctor sex and age reported negative significant influence on the IRDP. The male doctors significantly had on average small IRDP than female doctors. They had negative performance on two indicators and insignificant effect on three. Thus, they illustrated significant negative effect on IRDP. Older doctors performed negative than younger doctors in four indicators and good than them in one, so collectively the increase of age had significant negative effect on IRDP, of course other factors held constant and it is the situation in all comparisons (ceteris paribus).

7.3.6.2. Practice-related Factors

The types of employment illustrated positive significant influence on the IRDP. The contracted and governmental employed doctors reported better performance in four indicators and worse in one indicator than reference group. Thus, they have positive and significant influence on IRDP. The availability of NHIF medicines list reported Positive effect in three indicators and negative performance in two so, collectively it had significant influence on IRDP. Interestingly, the patient demand influenced the IRDP significantly but slightly positive. The patient demand performed negative in two indicators, positive in one, and insignificant effect on two. Thus, the patient demand illustrated positive effect. The patient demand influence positively just in injections prescribing indicators, no patient demand will be on injections medicines, thus its influence dramatically significant in reduction of injection.

The doctor nativity reported dramatic significant negative influence on the IRDP. The doctor working in his locality influence three indicators significantly negative (Appendix X) regarding to those working out their localities. The effect on the rest two indicators was insignificant. An increase of patient number reported negative significant influence on the IRDP. More patients, influenced two indicators negatively, two indicator insignificant, and influence the prescribing from essential medicines list positively. So collectively it illustrated significant negative effect on IRDP. Working hours increase influenced significantly IRDP negative. Which reported negative effect on three indicators and insignificant on two. NHIF facilities reported negative significant effect on IRDP and so did SMOH facilities regarding the reference facilities. The NHIF facilities performed negatively in three indicators and positive merely in antibiotic prescribing. Thus they illustrated significant effect on IRDP. The SMOH facilities performed negatively in one and positively in one and other insignificant, so

reported slightly negative significant effect. The facility location and payment mechanism reported insignificant influence on IRDP.

7.3.6.3. Drug –related Factors

The doctor drug price consideration had significant positive effect on the IRDP. This factor performed Positive in four indicators and insignificant in one indicator. At the other extreme the expensive drug tendency of doctors reported significant negative influence on the IRDP. They performed negatively in two indicator and Positive on the number of drugs per prescription indicator. So, collectively they showed negative effect on the IRDP.

Interestingly, the pharmaceutical promotion number of visits significantly influenced the IRDP positively. They illustrated insignificant effect on four indicators and Positive performance on one indicator, which was the prescribing from the medicines list.

7.3.6.4. The patient- related Factors

The study revealed that an increase of patient age significantly influence the IRDP negatively. Performed negatively in four indicators and performed Positive just in antibiotic use. The patient sex and private sector patients reported insignificant effect on IRDP, performed negatively in some indicators and Positive in some, but the overall effect insignificant.

The public, poor families, pensioners, and self-employment sector patients, reported significantly negative effect on the IRDP regarding to reference group (students). They performed negatively on most of the indicator and collectively the net effect dramatic negative effect on IRDP.

7.3.6.5. Disease Chronicity

The study illustrated that the disease chronicity reported dramatic negative effect on the IRDP. The chronic disease cases influenced prescriber to prescribe more irrationally and perform negatively in four prescribing indicators and Positive in antibiotics prescribing indicators.

7.3.7. Factors Influence the Prescription Cost

The cost containment is crucial for any health system and insurance scheme. Anywhere, health resources scarcity one of the main challenges for services sustainability, accessibility, and expansion particularly in developing countries. Thus, the study of factors influence the cost so important for setting the influential interventions to contain

pharmaceutical cost, the prescription is a unit of analysis and measurement. This study investigated the factors related to different component of prescribing behavior of medical doctors, who have been providing more than 80% of the total services delivered to insured patients in Gezira state. The study revealed that many factors correlated with cost containment and escalation.

7.3.7.1. Doctor-related Factors

The study found that the doctor qualification or final academic degree, professional training, job satisfaction, and peer contact and discussion have reported significant influence on the prescription cost, they are expected potentially reduces the prescription cost. For instance, postgraduate and above doctors, on average reduce the number of drug per prescription, increase the prescribing by generics, reduce injection use, and more adherent to the NHIF medicines list. So they reduce the prescription cost. The study revealed that the professional training correlated with reduction medication per patient, increase of antibiotics prescribing, and increase of prescribing from NHIF medicines list. Interestingly, the study revealed on average the antibiotics cost was less than any other non- antibiotics choice. The doctors, who exposed to peers' contact and medical discussion, prescribe prescription on average less cost than those not exposed to contact and discussion. In study, those doctors their average number of drugs per prescription was less and more adherent to the drug list.

On the other side, the doctor age and their experience in health insurance reported negative effect on the prescription cost and significantly correlated with cost escalation. The study illustrated that by increased of doctor age the average number of drugs per encounter increases, the percentage of generics reduces, and the prescribing of antibiotics increases. Noteworthy, the adherence to the medicines list increases. The longer practicing in health insurance patients correlated with less prescribing of generic medicine sand more prescribing of antibiotics, but less prescribing of injections.

7.3.7.2. Practice-related Factors

The type of payment mechanism and type of employment have reported significant reduction effect on the prescription cost. The study demonstrated that the doctors of income based on the number of patients their prescription less than those salaried doctors. They have prescribed more generics and they were more adherences to

medicines list. The study clarified that the governmental and contracted employed doctors prescribed less cost prescription than reference group doctors. They were more adherence to medicines list, prescribed less mean medication, more generic ratio, and fewer injections. Hopelessly, the have prescribed more antibiotics.

On the other hand, doctor nativity, patient demand, health center location, and health facilities operator type have reported significant influence on prescription cost escalation. The study illustrated that the medical doctors who work in their localities their prescription cost more than those work outside their localities by about 10%. They were fewer adherences to the drug list, prescribed more drugs, less generic ratio, and more antibiotics. The increase of patient demand increases the number of drugs prescribed and antibiotics utilization. Hopefully, increase of patient demand significantly correlated with increase of drugs list adherence. Interestingly, the health center location reported influential correlation with prescription cost, the urban dwellers prescription on average more than rural dwellers prescription by 9.4%.More surprisingly; the significant difference was the percentage of prescription with antibiotics was higher in rural facilities than urban ones, and relatively the antibiotics cheaper than non-antibiotics medicines on average.

NHIF and SMOH facilities reported higher prescription cost than reference group, the performance of these high cost facilities had lower prescribing quality indicators or IRDP.

7.3.7.3. Drug-related Factors

Increase of medical representatives' promotional visits increases the prescription cost significantly. Although when was regressed with all factors or independents together the coefficient of this factor reported insignificant correlation except in the promotion of medicines list adherence. But when we regressed the drug-related factors separately result in increase the number pharmaceutical firm promotional visits significantly correlated with increased number of drug per prescription, reduced the generic ratio and antibiotics.

The consideration of drug price in the prescribing decision, and the tendency high drug price revealed insignificant effect on prescription cost.

7.3.7.4. Patient-related Factors

The patient sex, age and social groups have reported significant escalating effect on prescription cost. The older patients received antibiotics less than younger patients and the doctor less adherent to drug list in older patients. As the patient age increased on average the number of drug increases, prescribing of generic decreases, and adherence to the medicines list decrease, for that prescription cost escalating as the patient age increased. The public, poor families, pensioners, and self-employed sectors patients received prescription more expensive than reference group. Because the prevalence of chronic disease more, co-morbidity, and relatively have high patient demand and pressure.

7.3.7.5. Disease Chronicity

The study revealed the chronic diagnosed case received more expensive prescription than acute diagnosed cases by 90% of overall prescription cost. The patient with chronic disease most likely have co-morbidity or multi, less probability of antibiotics prescribing, more injection use, and less doctor adherence to drug list as the study demonstrated.

7.4. The Study Limitations

- The study didn’t take in account the facility size and diagnostic capabilities, which may affect the doctor behavior toward the prescribing choices.
- The study didn’t consider the accessibility of the second services level, which might affect doctor prescribing decisions.
- We didn’t take the other patients socioeconomic predisposing factors in account (No information)
- The study took WHO guidelines and standards, the Sudan context may differ qualitatively and quantitatively in health services than that setting on which the WHO based the standard. The better condition for NHIF to develop its standards by itself.

CHAPTER8

CONCLUSION AND RECOMMENDATIONS

This chapter displays the conclusion which reaffirms the thesis statement and displays the evidence based findings. Followed by, recommendations part, which illustrates the thesis policy implications and recommendations. Lastly, suggested researches, clarifying the detected research gaps after which the picture will be completed and become comprehensive.

8.1. Conclusion

The study was set out to investigate the prescribing pattern of medical doctors according to WHO guidelines of prescribing core indicators. The study has sought to determine the influential factors on those prescribing quality indicators in NHIF- Gezira state at primary healthcare centers. This study answered two generalized questions:

1. What is the prescribing pattern of medical doctor or general practitioners?
2. What are the factors that influence the prescribing pattern of general practitioners?

The health setting and health services partners comprise the prescribing practice context and circumstances, which represent the factors expected to affect the prescribing quality indicators. These factors are overlapping and correlated with each other, for simplification the study has bundled the similar factors together into four groups; doctor-related factors, practice-related factors, patient-related factors, and drug-related factors.

The importance of this study lies in it about prescribing quality and cost containment of pharmaceutical services, which are directly related to patient safety, services quality, expansion, and sustainability. These issues represent the main challenges of national health insurance in terms of cost containment and subscribers' satisfaction, which are the main pillars to achieve the universal health coverage, particularly in current pharmaceutical cost escalation.

The study revealed on average there was irrational prescribing pattern among general practitioners (IRDP 3.39), who work in primary health centers. In terms of the average number of drugs per prescription, there was poly-pharmacy and more prevalent among chronic diseases patients (3.39). The use of generic medicines was found have under-

optimal use associated with over use of antibiotics and injections. The study illustrated low doctors adherence to NHIF medicines list 81% but in comparison with neighboring countries (Ethiopia, Egypt) it was modest. The average cost per prescription was doubled the proxy value (16-24.62 SDG) or the anticipated value. The study has reduced the five core prescribing indicators into Index of Rational Drug prescribing (IRDP). Finally, we have gotten two indicators for performance assessment of prescribing quality and cost-containment of pharmaceutical services; IRDP and prescription cost.

Whole factors were regressed with each prescribing indicators individually, the results demonstrated significant influence of these factors groups on these indictors, which were discussed in detail in chapter VI & VII. The net effect on these factors on prescribing quality indicators is consistent with the effect on IRDP. OLS regression created significant relationship between prescription cost and IRDP, and they inversely proportional.

The IRDP significantly influenced by several factors increasingly and decreasingly. Firstly, in terms of doctor related factors, medical doctor being female and younger had significant relationship with IRDP reduction. On other hand, the medical doctor being post-graduated, more professional experience, job satisfied, exposed to rational drug use training, and have peer contact and discussion have significant correlation with an increase of IRDP.

Secondly practice-related factors, the doctor works in his locality, number of patient increase, more working hours, and health facilities operated by NHIF or SMOH had significant association with IRDP decrease. On other side, the medical doctor being government or contracted employee, and availability of NHIF medicines list had reported significant relation with IRDP increase. Interestingly, the increase of percentage of patient demanded specific medication of medicines significantly correlated with IRDP increase.

Thirdly drug-related factors, the consideration of medicines price in doctor prescribing decision significantly had relationship with IRDP increase, while the doctor being believe in expensive drug choice is more potent than the less price choice had significant correlation with IRDP reduction. Surprisingly, the increase of pharmaceutical promotional visits significantly had relatedness with IRDP increase.

Fourthly, patient-related factors, increase of patient age, the patient being urban dweller, and the patient being insured by public sector or poor families or pensioners sector or self-employment sector had significantly relationship with IRDP reducing. Lastly, the disease being chronic had significantly correlation with IRDP reduction.

The average cost indicators after controlling the confounding factors was influenced by four groups of factors.

Firstly, doctor related factors, an increase of doctor age and longer practicing years, in health insurance patients had significant effect on prescription cost escalation. In contrast, doctor with post-graduate education, exposed to professional training, longer professional experience, job satisfaction, exposed to rational use training, and available peer contact and discussion have significant individual effect on prescription cost reduction.

Secondly, practice related factors, a doctor working in his home locality, the health center in urban area, increase the percentage of demanding patients, and the health facilities controlled by NHIF or SMOH have significant individual effect on prescription cost escalation. In contrast, the number of patient based doctor payment, and the doctor being governmental or contracted employee have significant reduction effect on prescription cost.

Thirdly, an increase of pharmaceutical firms' promotional visits has significantly effect on the escalation of prescription cost. Fourthly, the patient being aged, male, insured through public sector or poor families program or pensioners sector or self-employed households have significantly individual effect on escalation of prescription cost.

Finally, the chronic disease prevalence had significant effect on prescription cost escalation.

The prescribing pattern of general practitioners in primary healthcare centers was under the optimal level and dramatically was influenced by doctor, practice, patient, disease chronicity, drug related factors.

8.2. Policy Implication and Recommendations

The study has elicited number of hidden crucial issues, which have direct implications on the rational use of medicines and pharmaceutical cost containment. These issues

concern the health system as general and NHIF more directly. The recommendations would address these influential factors on rational use of medicines and the cost containment, in order to mitigate the negative effect of these factors and to maximize the benefits of these factors. The recommendations are divided into two levels; policies level and executive level.

8.2.1. Recommendations for Policies Level

1. Based on this study the post-graduation of medical doctors influences positively on the drug prescribing quality and prescription cost containment. The difference in prescription cost between medical doctor who has bachelor as final academic degree and those with diploma or master of family medicines, on average 9.4%. Imperatively therefor, the NHIF to coordinate with concerned partners and encourage these programs effectively.
2. The professional and rational use of medicine training have dramatically improved the rational use of medicines and reduced the cost of prescription. NHIF has to ensure the carrying out of mandatory regular training programs, which are scientifically formulated and adopted at least for the medical doctors who provide the service for insured patients.
3. In terms of payment mechanism, the NHIF has to develop the payment methods, which lead to performance improvement and risk sharing. This study found that the doctors with number of patient based income, significantly better in prescribing quality and cost than salaried ones.
4. The doctor who work in their original residence zone has less performance than other in terms of rational medicines use and average prescription cost (9.8% more). The consideration of these issues influential and conducting of regular rotation should be adopted.
5. Noteworthy, the peer contact and medical discussion have influential impact on the prescribing quality and cost containment of prescription. The weekly clinical seminar and workshop should be held regularly. The general practitioners rotation program will solve the problem of those in remote areas.
6. The NHIF medicines list availability has potential effect, NHIF has to ensure the availability of the list on any prescriber desk permanently, and definitely the active

dissemination of list and promotion will maximize the impact. The conducting regular awareness activities is very crucial particularly, for those prescribe irrationally and costly prescriptions. One of the causes of irrationality attributed to their beliefs about the expensive medicines choice more potent than the cheaper choice.

7. The patients who demand particular medicines, medications, and trade names their prescription cost higher than other, which referred to their pressure on the doctor. The awareness and health education activities effective should be formulated in academic syllabus and added to the educational regimes.
8. The pharmaceutical promotion has positive effect on prescribing quality and negative effect on prescription cost, thus adoption of effective unbiased medical information modes very important.
9. Malaria and respiratory infections represent about 47% of prescriptions, both are preventable, RI diagnosis most likely common cold and viral infection which are self-lasting. Malaria morbidity more controllable, NHIF has to support prevention programs and health promotion activities.
10. The aged population and patients with chronic diseases dramatically increase the prescription cost and worse the prescribing quality. Patient being with chronic disease the prescription on average higher than those with acute diseases by 2.6 times, they represent 21% of the doctors' consultation visitors. The NHIF has to react actively than merely health financer. The interventions which mitigate the prevalence of chronic diseases are very important even they have long run impact. Prevention, health promotion, health education programs (primary healthcare) should be organized effectively and NHIF ensures the sustainability of these programs even by capitated its subscribers.
11. The study revealed that the self-employment sector insurers have the higher prescriptions cost which indicate the passive adverse selection among these group. Thus NHIF has to facilitate the enrollment of large number of them to dilute this risky group among massive membership.
12. The study evidenced that, type of employment affects prescribing quality and average prescription cost. The governmental and contracted employee doctors have prescribing quality and prescription cost less than mandatory national service and

co-operative prescribers by 22% and 16% respectively. The focus on relatively permanent doctors should be priority in NHIF subscribers' services providers.

13. The different social sectors illustrated different health utilization patterns, those dominantly in remote rural areas exhibited less utilization rate, which significantly indicates the have less health services accessibility. This dictates NHIF has to coordinate and work to provide equitable services and it is inevitable.
14. The youngest population has reported the minimal average prescription cost. The under five children had mean prescription cost 41% less than the overall prescription mean. So these significant disparities in pharmaceutical cost should be considered in enrollment to differentiate between risky and non-risky groups.

8.2.2. Recommendations for Executive Level

1 The prescribing patterns of different medical doctors and facilities had demonstrated significant discrepancies and not consistent. The introductions of mandatory measures have become more inevitable. The claims management practical indicators should be developed and unified for all direct and indirect providers. The assessment by IRDP important and should be conducted quarterly.

2 Prescribing performance based accountability, like pay for performance (P4P) will improve the quality of prescription and reduces the cost.

3 The NHIF and SMOH facilities performed less than the reference group in prescribing quality indicators and mean prescription cost. So NHIF owned facilities should be given more independency, and to be treated within the context of provider purchaser split. The enforcement of claim management regulations and directives should be applied on all facilities equally to facilitate the equitable assessment.

4 The availability of NHIF medicines list and rational medicines use training had reported significant correlation with the services quality and prescription mean cost. So regular rational drug use promotion activities should be held.

5 The overloaded work and excess number of working hours have illustrated negative effect on cost and IRDP, thus synchronization between the number of patients and working hours is imperative.

6 Job satisfied doctors performed better than those un-satisfied, NHIF in employment and reimbursement should consider the doctor job satisfaction.

8.3. Future Research

1. Similar study should be conducted simultaneously for insured and non-insured patient to compare between them.
2. The health utilization patterns among the different social groups were inconsistent and illustrated considerable disparities, to explain the nature of the utilization patterns and to detect reasons behind these discrepancies research is needed.
3. Study to assess scientifically the relationship between prices and medicines effectiveness of medicines alternatives, to know the inevitability of bioequivalent test as a requirement.

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APPENDIX

Appendix A

Prescribing Indicators Form

	Prescribing Indicators						**Patient information**				**Diagnosis**
Seq No	No of drug	No of generic	Antibio(0/1)	Inject(0/1)	No of from EML	R.price	Pt-age	Sex(1/0)	Employer(1-6)	Rural/urban	
1											
2											
3											
4											
98											
99											
100											
Total											
Avage											
%											

Appendix B

Researcher Name ……Date……Signature……..

Data Collector Name……Date of collection……Serial No of Q……

Locality……PHCC……Type ……

The doctor Name ……Date……

---

1. Are you general practitioner GP and provided primary health care for health insurance subscribers in last three months?

☐ Yes ☐ No (If no please stop, you're not a target of study)

What is the age of the doctor? …… ☐ Male ☐ Female

2. What is your final professional academic degree?

☐ Bachelor ☐ Diploma, Master,

3. Are you got professional training in last two year? ☐ Yes ☐ No

4. How many years you have been practicing medicine profession.....and

How many years you have been providing services for NHIF……..

5. Are you satisfied with your work?

Strongly satisfied ☐ Satisfied ☐ Average ☐

Unsatisfied ☐ Strongly unsatisfied ☐

6. Which university you graduated in? ☐ Gezira ☐ Khartoum ☐ Others

7. Did you expose to any rational use of medicines training? ☐ Yes ☐ No

8. Did you have contact and conduct professional discussion with your peers?

☐ Yes ☐ No

9. Is your work place within your original home area? ☐ Yes ☐ No

10. Who is your employer? ☐ Public sector ☐ Private sector

☐ Other Specify……

11. What is the average number of patients per day……..

12. What is your daily working hours in health services? ……

13. Which type of payment mechanism you do enjoy?

☐ Salary ☐ Salary + performance based Incentive

Other specify……

14. The percentage of patients demand specific drug name? .....

15. Do you have NHIF drugs list on your office desk? ☐ Yes ☐ No

16. Who is the owner of PHCC? ☐ SMOF NHIF ☐

☐ Private

17. Is the drug price alter your choice? ☐ Yes ☐ No

18. How many medical representatives' visits you received last 12 months? .....

19. Do you believed that the expensive choice potent choice? ☐ Yes ☐ No

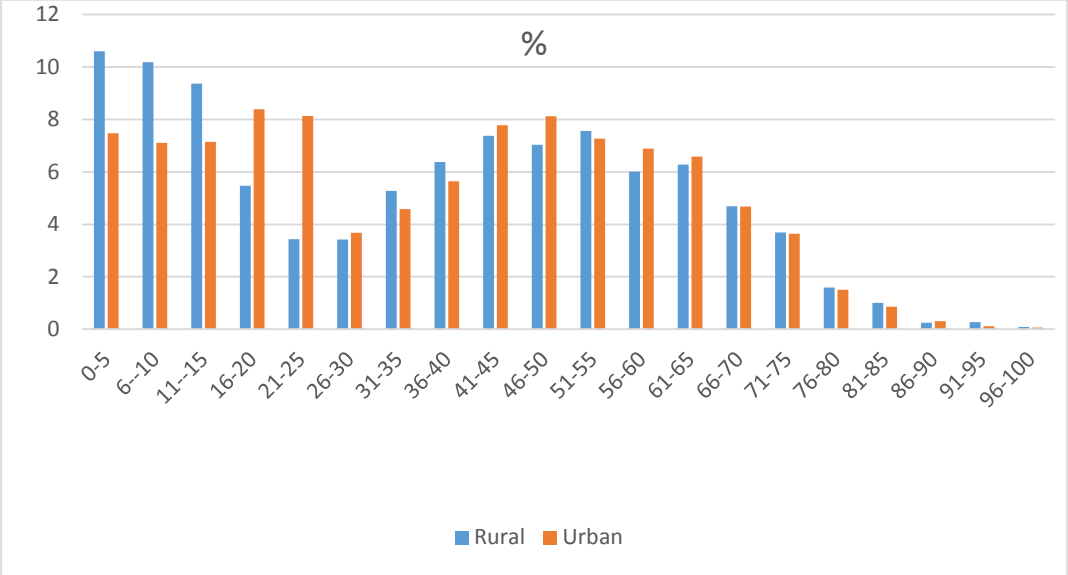
Appendix C

Independents Statistics

	Independents	**Statistics**
1	Average age of patients	36.74673
2	SEX	66% Females, 34% Males
3	Public Sector Patients	39.23% of patients
4	Poor Families' Patients	27.13% of patients
5	Private Sector Patients	0.84% of patients
6	Pensioners Sector Patients	18.9% of patients
7	Self-employed Patients	7.18% of patients
8	Patients Residence	49.41% Urban
9	Doctors' Gender	60.4% Female
10	Average Doctor Age	32.6 years
11	Percentage of G1 Graduates	29.40%
12	Percentage of G2 Graduates	6.10%
13	Percentage of others Graduates	64.50%
14	Doctors with Bachelor or above	71.1%, 28.9%
15	Exposed to professional training	60.40%
16	Average Professional experience	6.73years
17	Average Health Insurance Experience	30.23 Months
18	Job Satisfied	35.5% high, 41.6% average, 22.9% un-satisfied
19	Who exposed to RUD Training	73.10%
20	Who exposed to Peer Contact and Discussion	13.70%
21	Who work in his/her original residence locality	57.40%
22	Government employees	75.60%
23	Contracted employees	15.23%
24	Average Number of Patients per Day	38.43Patients
25	Average working hours	7.04 Hours
26	(Salary + Incentives) and Salary	69% and 31%
27	average percentage of demanding patients	18.67%
28	Availability of Health Insurance Drug List	60.40%
29	Health Facilities Types Affiliations	63.9% SMOH, 21.8% NHIF, 14.3% OTHERS
30	Health Facilities Locations	53.3% Urban 46.7% Rural
31	percentage of doctors considering the drug price in their decision	83.70%
32	Average Number of Pharmaceutical Promotion Visits	2.02 Visits
33	The Percentage of Doctors believing in Expensive Drug Alternatives	14.70%
34	The Percentage of Chronic Diseases	21.37%

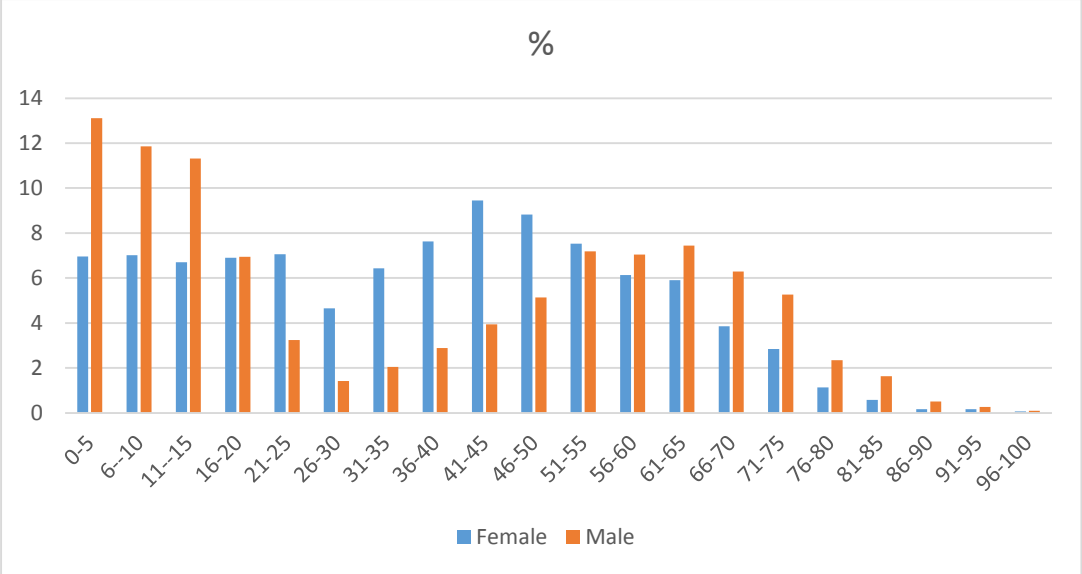
Appendix D

Patients' age based distribution over residence types



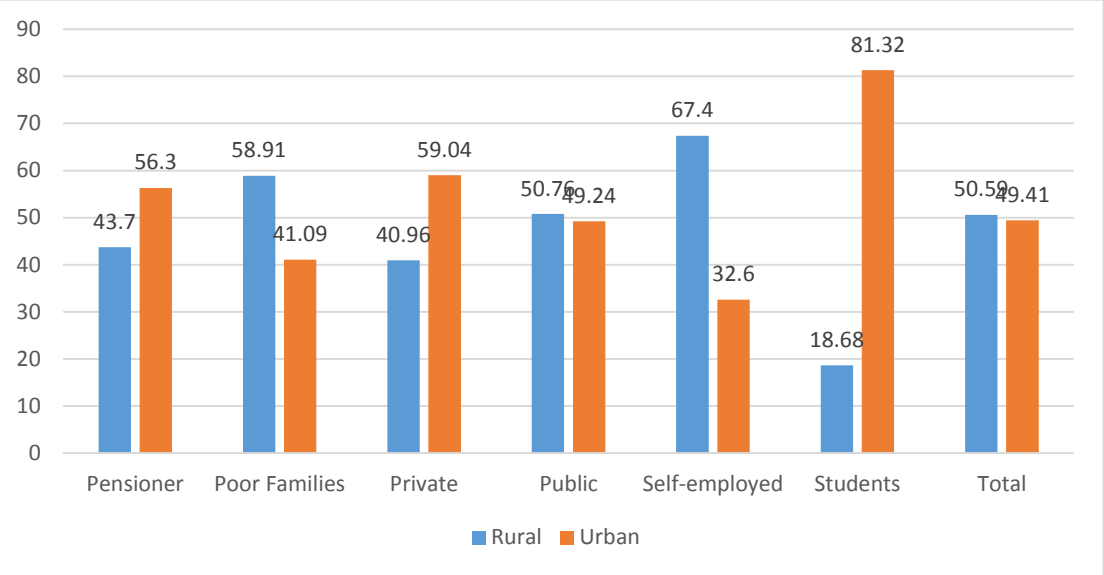
Appendix E

Sex based distribution of patients



Appendix F

Distribution of social groups' patients according to the residence



Appendix G

Patients' sexes and residence

	Patient Residence		
Patients sex	Rural	Urban	Total
Female	6,579	6,415	12,994
Male	3,383	3,313	6,696
Total	9,962	9,728	19,690

Appendix H

Age based distribution of patients over the health facilities

	Health Facility Owner			
Patients age range	NHIF	Others	SMOH	Total
0-5	275	229	1,279	1,783
	6.4	8.18	10.16	9.06
6--10	288	190	1,228	1,706
	6.7	6.79	9.75	8.66
11--15	279	155	1,195	1,629
	6.49	5.54	9.49	8.27
16-20	240	410	711	1,361
	5.58	14.65	5.65	6.91
21-25	163	410	561	1,134
	3.79	14.65	4.46	5.76
26-30	148	109	442	699

	3.44	3.89	3.51	3.55
31-35	225	132	615	972
	5.23	4.72	4.88	4.94
36-40	252	165	767	1,184
	5.86	5.89	6.09	6.01
41-45	349	198	945	1,492
	8.12	7.07	7.51	7.58
46-50	332	169	990	1,491
	7.72	6.04	7.86	7.57
51-55	375	175	910	1,460
	8.72	6.25	7.23	7.41
56-60	312	120	837	1,269
	7.26	4.29	6.65	6.44
61-65	358	126	782	1,266
	8.33	4.5	6.21	6.43
66-70	285	90	547	922
	6.63	3.22	4.34	4.68
71-75	218	66	438	722
	5.07	2.36	3.48	3.67
76-80	91	33	181	305
	2.12	1.18	1.44	1.55
81-85	70	16	99	185
	1.63	0.57	0.79	0.94
86-90	24	2	29	55
	0.56	0.07	0.23	0.28
91-95	12	2	25	39
	0.28	0.07	0.2	0.2
96-100	4	2	10	16
	0.09	0.07	0.08	0.08
Total	4,300	2,799	12,591	19,690
	100	100	100	100

Appendix I

Number of drugs frequencies

Drugs	Freq.	Percent	Cum.
1	3,680	18.69	18.69
2	7,514	38.16	56.85
3	5,101	25.91	82.76
4	1,954	9.92	92.68
5	773	3.93	96.61
6	349	1.77	98.38
7	179	0.91	99.29
8	87	0.44	99.73
9	27	0.14	99.87
10	12	0.06	99.93
11	6	0.03	99.96
12	5	0.03	99.98
14	2	0.01	99.99
15	1	0.01	100
Total	19,690	100	

Appendix J

Diagnoses type

Disease Type	Number of Patients	Percent	The Average Number of Patient
Acute	15,482	78.63	2.33
Chronic	4,208	21.37	3.39
Total	19,690	100	

Appendix K

Patient employer based average number of drug per encounter

Employer Sector	The average number of drugs per prescription
Pensioners	2.80
Public	2.56
Self-empl	2.55
Poor Families	2.49
Private	2.48
Students	2.11

Appendix L

Poisson regression, number of drugs versus patient-related factors

Number of Drugs	Coef.	Std.Err.	z	P>|z|	dy/dx
Patient Age	0.00464	0.000	23.25	0.0000***	0.01186
Patient Sex	- 0.00755	0.009	-0.8	0.4240	-0.01928
Public Sector	0.14649	0.021	7.08	0.0000***	0.37397
Poor Families	0.13831	0.021	6.49	0.0000***	0.35309
Private Sector	0.13669	0.053	2.59	0.0100***	0.34897
Pensioners Sector	0.18579	0.022	8.42	0.0000***	0.47430
Self-employment	0.17560	0.026	6.83	0.0000***	0.44830
Patient Residence	0.06444	0.009	7.07	0.0000***	0.16450
_cons	0.59295	0.024	24.55	0.0000***	

Number of Obs 19,690 LR chi2(8)= 808.64 Log likelihood= -32564.158
Prob > chi2 = 0.0000 ***:significant at 1% (P=<0.01)

Appendix M

OLS regression, Generic ratio versus patient-related factors

Generics Ratio	Coef.	Std.Err.	t	P>|t|
Patient Age	-0.00421	0.000125	-33.79	0.0000***
Patient Sex	-0.00589	0.005867	-1	0.3160
Public Sector	-0.06107	0.011856	-5.15	0.0000***
Poor Families	-0.03763	0.012251	-3.07	0.0020***
Private Sector	-0.06919	0.03209	-2.16	0.0310**
Pensioners Sector	-0.07118	0.0129	-5.52	0.0000***
Self-employment	-0.08346	0.01521	-5.49	0.0000***
Patient Residence	-0.03902	0.005686	-6.86	0.0000***
_cons	0.803645	0.01422	56.51	0.0000***

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared = 0.0672
***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05

Appendix N

OLS regression, Generic ratio versus prescriber-related factors

Generics Ratio	Coef.	Std.Err.	t	P>|t|
Doctor Sex	-0.00312	0.006584	-0.47	0.6350
Doctor Age	-0.00746	0.001029	-7.24	0.0000***
PlaceofGraduation1	-0.00175	0.006503	-0.27	0.7870
PlaceofGraduation2	0.002205	0.014733	0.15	0.8810
Doctor Qualification	0.02161	0.007372	2.93	0.0030***
Professional Training	0.021118	0.006243	3.38	0.0010***
Professional Experience	0.005039	0.001236	4.08	0.0000***
HI Experience	-0.00018	0.000121	-1.47	0.1410
High Job Satisfaction	-0.01851	0.007946	-2.33	0.0200**

Average Job Satisfaction	-0.02084	0.007608	-2.74	0.0060***
RUD Training	0.023576	0.006961	3.39	0.0010***
Peer Contact Discussion	-0.00642	0.008714	-0.74	0.4610
_cons	0.766905	0.027217	28.18	0.0000***

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared =0.0071
***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05

Appendix O

OLS regression, Generic ratio versus prsctice-related factors

Generics Ratio	Coef.	Std.Err.	t	P>t
Work in Home Locality	-0.015909	0.00614	-2.59	0.0100***
GOVEMPL	0.0262416	0.010551	2.49	0.0130**
CONTRACT	0.039363	0.012688	3.1	0.0020***
Number of Patients	-0.000099	0.000133	-0.74	0.4570
Working Hours	-0.0056188	0.002174	-2.58	0.0100***
Salary Plus Incentive	0.0140857	0.007539	1.87	0.0620*
Patient Demand	0.0001961	0.000153	1.28	0.2010
NHIF Drug List	0.0287119	0.006326	4.54	0.0000***
SMOH Facility	-0.0260499	0.010025	-2.6	0.0090***
NHIF Facility	-0.0954966	0.010692	-8.93	0.0000***
Facility Location	-0.0354048	0.006984	-5.07	0.0000***
_cons	0.6200394	0.022552	27.49	0.0000***

Number of obs = 19690 Prob > F = 0.0000 Adj R-squared = 0.0116
***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05

Appendix P

Logistic regression, antibiotic prescribing versus patient-related factors

Containing ntibiotics	Coef.	Std.Err.	z	P>|z|	dy/dx
Patient Age	-0.02171	0.00068	-31.93	0.0000***	-0.00506
Patient Sex	-0.13587	0.031346	-4.33	0.0000***	-0.03166
Public Sector	0.238348	0.062111	3.84	0.0000***	0.055533
Poor Families	0.165191	0.064219	2.57	0.0100***	0.038488
Private Sector	0.08688	0.170096	0.51	0.6100	0.020242
Pensioners Sector	0.146948	0.067659	2.17	0.0300**	0.034238
Self-employment	0.11425	0.08024	1.42	0.1540	0.026619
Patient Residence	-0.14882	0.030251	-4.92	0.0000***	-0.03467
_cons	1.077961	0.075191	14.34	0.0000***	

Number of obs =19690 LR chi2(8) =1197.6 Prob>chi2 =0.0000 Log likelihood =-12961.852
***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05) *:significant at 10% (P=<0.1)

Appendix Q

Logistic regression, antibiotic prescribing versus prescriber-related factors

With antibiotics	Coef.	Std.ErR	z	P>|z|	dy/dx
Doctor Sex	0.06755	0.033017	2.05	0.0410**	0.0166
Doctor Age	0.01593	0.005185	3.07	0.0020***	0.00392
PlaceofGraduation1	0.1739	0.03268	5.32	0.0000***	0.0428
PlaceofGraduation2	0.28481	0.075427	3.78	0.0000***	0.0701
Doctor Qualification	0.0076	0.037028	0.21	0.8360	0.0019
Professional Training	0.14690	0.031317	4.69	0.0000***	0.0362
Professional Experience	-0.02218	0.006253	-3.55	0.0000***	-0.005
HI Experience	0.00290	0.00062	4.68	0.0000***	0.0007
High Job Satisfaction	-0.01646	0.040011	-0.41	0.6810	-0.004
Average Job Satisfaction	-0.09985	0.038183	-2.62	0.0090***	-0.025
RUD Training	0.02037	0.034956	0.58	0.5600	0.0050
Peer Contact Discussion	-0.01585	0.043696	-0.36	0.7170	-0.0039
_cons	-0.4865	0.137023	-3.55	0.0000***	

Number of obs =19690 LRchi2(12)=136.16 Prob >chi2=0 Log likelihood=-13492.575 ***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05) *:significant at 10% (P=<0.1)

Appendix R

Logistic regression, antibiotic prescribing versus practice-related factors

With Antibiotics	Coeff.	Std.	Err.	z	dy/dx
Work in Home Locality	0.033276	0.031051	1.07	0.2840	0.008121
GOVEMPL	0.299006	0.053148	5.63	0.0000***	0.072976
CONTRACT	0.199981	0.064088	3.12	0.0020***	0.048808
Number of Patients	-0.0008	0.000672	-1.19	0.2340	-0.0002
Working Hours	0.002554	0.010959	0.23	0.8160	0.000623
Salary Plus Incentive	0.149754	0.037984	3.94	0.0000***	0.036549
Patient Demand	-0.00112	0.000773	-1.45	0.1460	-0.00027
NHIF Drug List	0.074819	0.031952	2.34	0.0190**	0.01826
SMOH Facility	-0.25892	0.050736	-5.1	0.0000***	-0.06319
NHIF Facility	-0.52694	0.054012	-9.76	0.0000***	-0.12861
Facility Location	-0.19586	0.03523	-5.56	0.0000***	-0.0478
_cons	0.185074	0.113671	1.63	0.1030	

Number of obs =19690 LR chi2(11)=296.04 Prob >chi2 = 0 Log likelihood = -13412.632 ***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05) *:significant at 10% (P=<0.1)

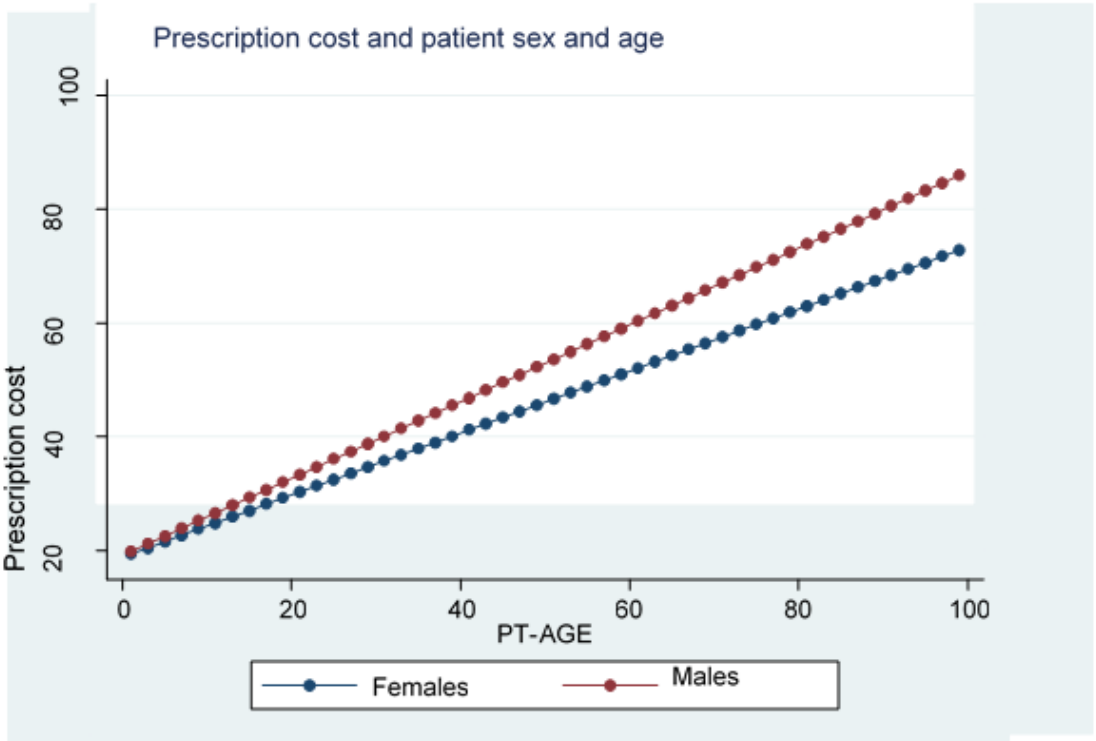
Appendix S

Logistic regression, antibiotic prescribing versus drug-related factors

With Antibiotics	Coef.	Std.Err	z	P>|z|	dy/dx
Drug Price	0.02758	0.039	0.71	0.4800	0.00683
Drugs Firms Promotion	-0.01923	0.004	-5.17	0.0000***	- 0.00476
High Price Tendency	-0.04788	0.040	-1.19	0.2360	- 0.01185
_cons	0.21197	0.036	5.87	0.0000	

Number of obs = 19690 LRchi2(3) =28.04 Prob >chi2=0
Log likelihood=-13546.633 ***:significant at 1% (P=<0.01) **:significant at 5%(P=<0.05)
*:significant at 10% (P=<0.1)

Appendix T



Appendix U

The Average Cost of Prescription by Social Group Patients

Patient Group	Average Cost of Prescription	Std.Err.
Pensioners	50.703	0.5801
Self-employment	45.02709	1.806525
Public Sector	39.2476	1.003076
Poor Families	38.23455	3.686736
Private Sector	37.1259	0.660725
Students	24.92395	0.54521

Appendix V

The Average Cost of Prescription by Diagnosis

	Diagnoses	Average Cost of Prescription	Std.Err.
1	DM+HTN	135.33	5.961738
2	DM	102.24	2.51162
3	HTN	70.10	1.575069
4	TF	40.15	1.887389
5	UTI	34.83	1.288499
6	Malaria	32.45	0.38638
7	Other	31.70	0.79811
8	RI	26.71	0.326118
9	RA	25.22	0.735148
10	GIT	25.11	0.748758

Appendix W

The factors and their effect on the prescribing quality indicators

Number of Drugs	Number of drugs	Generic ratio	Antibiotics	Injections	EML ratio	IRDP	PRESCRIPTION COST
Patient Age	**0.002**	**-0.002**	**-0.008**	**0.004**	**-0.001**	**0**	**0.24**
	0.000* **	**0.0000*** **	**0.0000*** **	**0.0010*** **	**0.0000*** **	**0.04500** *	**0.0000*** **
Patient Sex	**-0.016**	**-0.003**	**-0.139**	**-0.18**	**-0.022**	**-0.01**	**3.648**
	0.089*	**0.629**	**0.0000*** **	**0.0000*** **	**0.0000*** **	**0.14**	**0.0000*** **
Public Sector	**0.114**	**-0.056**	**0.355**	**-0.181**	**-0.02**	**-0.124**	**4.789**
	.000* **	**0.0000*** **	**0.0000*** **	**0.0660***	**0.0150*** *	**0.00000*** **	**0.0010*** **
Poor Families	**0.097**	**-0.034**	**0.29**	**-0.136**	**-0.018**	**-0.144**	**5.27**
	.000* **	**0.0070*** **	**0.0000*** **	**0.18**	**0.0320*** *	**0.00000*** **	**0.0010*** **
Private Sector	**0.099**	**-0.071**	**0.154**	**-0.279**	**-0.02**	**-0.181**	**4.49**
	0.0650*	**0.0220****	**0.391**	**0.299**	**0.352**	**0.00000*** **	**0.246**

Pensioners Sector	**0.139**	**-0.055**	**0.364**	**-0.082**	**-0.031**	**-0.173**	**8.46**
	0.000* **	**0.0000*** **	**0.0000*** **	**0.439**	**0.0010*** **	**0.00000*** **	**0.0000*** **
Self-employment	**0.129**	**-0.073**	**0.273**	**0.122**	**-0.026**	**-0.187**	**12.302**
	0.000* **	**0.0000*** **	**0.0020*** **	**0.306**	**0.0120** *	**0.00000*** **	**0.0000*** **
Patient Residence	**0.019**	**-0.018**	**-0.029**	**-0.041**	**-0.009**	**-0.019**	**1.699**
	0.18	**0.0360** **	**0.563**	**0.546**	**0.115**	**0.05700***	**0.108**
Doctor Sex	0.01	-0.008	-0.031	0.151	-0.015	-0.084	1.389
	0.391	0.287	0.464	0.0080***	0.0030***	0.00000***	0.116
Doctor Age	0.013	-0.005	0.039	0.014	0.003	-0.022	0.411
	0.0000***	0.0000***	0.0000***	0.0790**	0.0000***	0.00000***	0.0020***
PlaceofGraduation1	-0.02	-0.013	0.146	-0.258	0.006	0.049	-1.267
	0.0710*	0.0380**	0.0000***	0.0000***	0.148	0.00000***	0.117
PlaceofGraduation2	0.046	-0.022	0.378	-0.213	0.033	0.017	-1.639
	0.059*	0.124	0.0000***	0.0640**	0.0010***	0.325	0.365
Doctor Qualification	-0.056	0.039	0	-0.144	-0.001	0.117	-3.812
	0.0000***	0.0000***	0.999	0.0180**	0.789	0.00000***	0.0000***
Professional Training	0.03	0.008	0.15	0.048	0.012	0.006	-1.485
	0.003***	0.2	0.0000***	0.335	0.0060***	0.365	0.0500**
Professional Experience	-0.011	0.004	-0.042	0.008	-0.002	0.014	-0.631
	0.000***	0.0030***	0.0000***	0.358	0.0140**	0.00000***	0.0000***
HI Experience	0	0	0.003	-0.003	0	0.00033	0.041
	0.465	0.0010***	0.0000***	0.0010***	0.909	0.02000**	0.0060***
High Job Satisfaction	-0.015	-0.01	0.086	-0.175	-0.001	0.02	-2.425
	0.264	0.195	0.0610*	0.0060***	0.843	0.02900**	0.0130**
Average Job Satisfaction	-0.012	0.004	0.05	-0.195	0.005	0.037	-1.803
	0.346	0.591	0.248	0.0010***	0.297	0.00000***	0.0500**
RUD Training	-0.594	0.018	-0.043	-0.257	0.002	0.03	-0.844
	0.006	0.0110**	0.301	0.0000***	0.747	0.00000***	0.328
Peer Contact Discussion	-0.086	0.006	-0.056	0.104	0.022	0.072	-3.71
	0.000***	0.51	0.279	0.149	0.0000***	0.00000***	0.0010***
Work in Home Locality	0.023	-0.009	0.092	0.062	-0.014	-0.097	3.992
	0.025**	0.136	0.0080***	0.19	0.0010***	0.00000***	0.0000***
GOV-EMPL	-0.047	0.026	0.154	-0.315	0.033	0.133	-8.872
	0.006***	0.0140**	0.0110**	0.0000***	0.0000***	0.00000***	0.0000***
CONTRACT-Empl	-0.049	0.048	0.145	-0.299	0.025	0.167	-6.476
	0.0150**	0.0000***	0.0490**	0.0010***	0.0040***	0.00000***	0.0000***
Number of Patients	0.001	0	-0.001	0	0.00018	-0.001	0.016

	0.000***	0.0290**	0.424	0.755	0.0520**	0.00000***	0.325
Working Hours	0	-0.009	-0.009	0.067	-0.011	-0.02	0.002
	0.955	0.0000***	0.455	0.0000***	0.0000***	0.00000***	0.995
Salary Plus Incentive	0.004	0.027	0.023	0.191	0.016	0.008	-1.894
	0.751	0.0000***	0.613	0.0030***	0.0030***	0.392	0.0530**
Patient Demand	0.001	0	0.003	-0.001	0	0.001	0.072
	0.001***	0.377	0.0070***	0.523	0.495	0.00000***	0.0000***
NHIF Drug List	-0.029	0.025	0.091	0.356	0.015	0.095	0.102
	0.005***	0.0000***	0.0120**	0.0000***	0.0010***	0.00000***	0.894
SMOH Facility	-0.021	0.024	-0.145	0.107	-0.047	-0.036	6.218
	0.214	0.015	0.0140**	0.209	0.0000***	0.00200***	0.0000***
NHIF Facility	0.053	0.027	-0.189	0.286	-0.047	-0.162	15.672
	0.005***	0.019	0.0050***	0.0030***	0.0000***	0.00000***	0.0000***
Facility Location	0.013	-0.008	-0.129	-0.002	0.01	0.014	3.809
	0.401	0.358	0.0170**	0.975	0.103	0.201	0.0010***
Drug Price	-0.061	0.047	0.019	-0.243	0.013	0.21	-1.402
	0.000***	0.0000***	0.69	0.0000***	0.0160**	0.00000***	0.153
Drugs Firms Promotion	0.001	0.001	-0.006	-0.007	0.002	0.004	0.192
	0.46	0.165	0.263	0.353	0.0060***	0.00000***	0.0680**
High Price Tendency	-0.034	-0.005	0.065	0.135	-0.031	-0.06	1.195
	0.0160**	0.571	0.187	0.0400***	0.0000***	0.00000***	0.249
Disease Chronicity	0.29	-0.276	-2.078	0.313	-0.283	-0.105	37.508
	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.00000***	0.0000***
_cons	0.108	1.141	1.745	-3.179	1.245	4.428	-36.594
	0.101	0.0000***	0.0000***	0.0000***	0.0000***	0.00000***	0.0000***

Appendix X

The net effect of each factor

Number of Drugs	Number of drugs	Generic ratio	Antibiotics	Injections	EML ratio	IRDP
Patient Age	Negative	Negative	Positive	Negative	Negative	Negative
Patient Sex	Positive	Negative	Positive	Positive	Negative	0
Public Sector	Negative	Negative	Negative	Positive	Negative	Negative
Poor Families	Negative	Negative	Negative	Positive	Negative	Negative
Private Sector	Negative	Negative	0	0	0	0
Pensioners Sector	Negative	Negative	Negative	Positive	Negative	Negative
Self-employment	Negative	Negative	Negative	0	Negative	Negative
Patient Residence	0	Negative	0	0	0	Negative
Doctor Sex	0	0	0	Negative	Negative	Negative

Doctor Age	Negative	Negative	Negative	Negative	Positive	Negative
PlaceofGraduation1	Positive	Positive	Negative	Positive	0	Positive
PlaceofGraduation2	Negative	0	Negative	Positive	Positive	0
Doctor Qualification	Positive	Negative	0	Positive	0	Positive
Professional Training	Negative	0	Negative	0	Positive	0
Professional Experience	Positive	Positive	Positive	0	Negative	Positive
HI Experience	0	Negative	Negative	Positive	0	Positive
High Job Satisfaction	0	0	Negative	Positive	0	Positive
Average Job Satisfaction	0	0	0	Positive	0	Positive
RUD Training	0	Positive	0	Positive	0	Positive
Peer Contact Discussion	Positive	0	0	0	Positive	Positive
Work in Home Locality	Negative	0	Negative	0	Negative	Negative
GOV-EMPL	Positive	Positive	Negative	Positive	Positive	Positive
CONTRACT-Empl	Positive	Positive	Negative	Positive	Positive	Positive
Number of Patients	Negative	Negative	0	0	Positive	Negative
Working Hours	0	Negative	0	Negative	Negative	Negative
Salary Plus Incentive	0	Positive	0	Negative	Positive	0
Patient Demand	Negative	0	Negative	Positive	0	Positive
NHIF Drug List	Positive	Positive	Negative	Negative	Positive	Positive
SMOH Facility	0	0	Positive	0	Negative	Negative
NHIF Facility	Negative	0	Positive	Negative	Negative	Negative
Facility Location	0	0	Positive	0	0	0
Drug Price	Positive	Positive	0	Positive	Positive	Positive
Drugs Firms Promotion	0	0	0	0	Positive	Positive
High Price Tendency	Positive	0	0	Negative	Negative	Negative
Disease Chronicity	Negative	Negative	Positive	Negative	Negative	Negative

Appendix Y

List of definitions

Generic Name	A pharmaceutical product that is intended to be interchangeable with the originator branded or traded product. Generic products are usually less costly than originator brand sometimes equal 10% of the brand price. Which used to be describe by International Non-proprietary Name (INN).
Brand Name	Products manufactured by the company who first marketed a product. (Note: referred to as originator brands in WHO/HAI price measurement manual) Brand name products are usually higher priced than generic products.
General Practitioner	Medical doctor who graduated in medicines school and not yet be specialized in particular minor medicines discipline.
SDG	The local Sudanese Currency, the Exchange rate in 1st of January, 2015. 1 US Dollar= 5.9573 SDG

Appendix Z

NO/NHIF/rd/TC/2015 Date 1/05/2015

Certification

This is to certify that the National Health Insurance Fund is accepting the Request of **Dr: Bashir Mohamed Elmahi from the** University of Chulalongkorn-Thailand to undertake the study entitled **(ESCRIPTION PATTERN AND ITS INFLUENCING FACTORS AMONG GENERAL PRACTITIONERS AT PRIMARY HEALTHCARE CENTERS IN NATIONAL HEALTH INSURANCE IN GEZIRA ASTATE – SUDAN)** to be carried in Sudan.

Prof: Abdullah Elkhawad

Chair of committee

VITA

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