Drug Prescribing Patterns at Public Health Centres in Greater Wad Medani Locality, Gezira State, Sudan (2015)

Zeinab Mohamed Ibrahim Mohamed

MBBS University of ELImam ElMahdi, Kosti, Sudan (2010)

A Dissertation
Submitted to the University of Gezira in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Science
in
Family medicine

Department of Family and community medicine

Faculty of medicine

August, 2015
Drug Prescribing Patterns at Public Health Centres in Greater Wad Medani Locality, Gezira State, Sudan (2015)

Zeinab Mohamed Ibrahim Mohamed

Supervision Committee:

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ibtisam Mohamed ElBasheir</td>
<td>Main Supervisor</td>
<td>......................</td>
</tr>
<tr>
<td>Dr. Osman Hamid Abdolhamid</td>
<td>Co Supervisor</td>
<td>......................</td>
</tr>
</tbody>
</table>

Date 21/8/2015
Drug Prescribing Patterns at Public Health Centres in Greater Wad Medani Locality, Gezira State, Sudan (2015)

Zeinab Mohamed Ibrahim Mohamed

Examination Committee:

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Ibtisam Mohamed ElBasheir</td>
<td>Chair Person</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. SakhrBadawi Omer</td>
<td>External Examiner</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. Salwa El Sanousi Hussein</td>
<td>Internal Examiner</td>
<td></td>
</tr>
</tbody>
</table>

Date of Examination 21/8/2015
Dedication

*TO MY MOTHER AND FATHER*

*AND TO MY HUSBAND*
Acknowledgements

I am indebted to many individuals for their support and assistance in the conduction of this research. First, I wish to thank my supervisor Dr. Ibtisam Mohamed El Bashir for her inspiration, support and patience.

I want to thank doctors at health centres for their assistance:

Dr. Mahmoud Yasin – Banat health centre

Dr. Nisreen Abdalhafis – El keraiba Health Centre

Dr. Eman Abdalaatti – El Shokaba Health Centre

Dr. Enas Ali and Dr. Mazza – Fadasi El Halimab Health Centre

Dr. Ahmed Khedir and Dr. Safa - Fadasi El Amrab Health Centre

Dr. Salma Osman – Abo Haraz Sharg Fadasi Halimab Health Centre

Dr. Nada Dafa Allah – Um Sonut Health Centre

Dr. Hebialrahman – Erebab Health Centre

Dr. Heba EL Garrai - Arkawait Health Centre

Dr. Marwa – Gaziratalfeel Health Centre
Drug Prescribing Patterns at Public Health Centres in Greater Wad Medani Locality, Gezira State, Sudan (2015)

Zeinab Mohamed Ibrahim Mohamed

Abstract

Assessing drug use and prescribing patterns is the first step in developing an effective intervention aimed at enhancing rational use of drugs. This research aimed to assess prescribing pattern in Wad Medani Gezira State using World Health Organization\International Network for Rational Use of Drug prescribing indicators. A cross-sectional Study was carried out in a representative group of health centres. Twenty Health centres were selected by systematic random sampling. In each health centre, a number of 30 prescribing encounter were revised making a total of 600 encounter as recommended by the WHO. Data was analyzed using Microsoft excel 2013. The study revealed that percentage of drugs prescribed from National EDL was 68.9% which was low (optimal = 100%). Prescribing by generic names was poor, 43.1% (optimal = 100%). Antibiotic were over-prescribed, where 54.8% of prescription included an antibiotic(optimal≤ 30%), percentage of encounters with an injection prescribed was a little bit higher than optimal, (optimal ≤ 10%) and the average number of drugs prescribed per encounter was 2.5, within optimal level. Copy of essential drug list was not found in any health centre. We conclude that prescribing from essential drug list and prescribing by generic names need to be encouraged and clear criteria to control antibiotic prescription are needed.
نمط الوصفات الطبية في المراكز الصحية العامة بمحلية ود مدني ولاية الجزيرة - السودان (2015)
زينب محمد إبراهيم محمد
ماجستير طب الأسرة
كلية الطب
جامعة الجزيرة

ملخص الدراسة

وصفت وتقسيم طرق استخدام الدواء ونمط الوصفات الطبية هو الخطوة الأولى لتكوين تدخلات فعالة لتعزيز الاستخدام الرشيد للدواء. تهدف هذه الدراسة لتقسيم نمط الوصفات الطبية حسب مؤشرات منظمة الصحة العالمية/الشبكة العالمية للاستخدام الرشيد للدواء في محلية ود مدني-ولاية الجزيرة- السودان. وهي دراسة مقطعية على مجموعه ممثلة من المراكز الصحية بمحلية ود مدني. تضمنت الدراسة عشرين مركزا صحيا تم اختيارها بأخذ عينات عشوائية منتظمة. نتم مسح وصفات 600 وصفة طبية من أي مركز صحي ليكون المجموع 600 وصفة طبية حسب توصية منظمة الصحة العالمية.

حللت البيانات باستخدام مايكروسفت أكسيل 2013. كشفت الدراسة أن نسبة الأدوية الموصوفة من القائمة القومية للأدوية الأساسية هي 69% وهي نسبة متدنية (الأمثل 100%)، كتابة الأدوية بالاسم الجنسي (غير محدد الملكية) كانت ضعيفة وهي 43%، يوجد أفرط في وصف المضادات الحيوية حيث أن 54.8% من الوصفات الطبية تحتوي على مضادات حيوية (الأمثل ≤ 30%)، نسبة الوصفات الطبية التي تضمنت ادوية عن طريق الحقن تجاوزت الحد الأمثل بنسبة طفيفة (الأمثل ≤ 10%) وان متوسط عدد الأدوية في الوصفة الطبية هو 2.5 ضمن الحد الأمثل (≤ 3). كما ان القائمة القومية للأدوية الأساسية لم توجد في أي من المراكز الصحية. نوصي بتشجيع الكتابة من القائمة القومية للأدوية الأساسية والكتابة بالاسم الجنسي ووضع مواصفات واضحة لضبط وصف المضادات الحيوية.
# Table of Contents

CHAPTER ONE INTRODUCTION ......................................................................... 1

1.1 General Introduction.................................................................................. 14

1.2 Problem identification and Justification.................................................. 16

1.3 Objectives of the study: ........................................................................... 18

1.3.1 General Objective: ............................................................................. 18

1.3.2 Specific Objectives: ............................................................................ 18

CHAPTER TWO LITERATURE REVIEW .......................................................... 19

2.1 Background Information: ......................................................................... 20

2.1.1 Definition of rational use of medicines: ............................................. 20

2.1.2 Irrational use of medicines................................................................. 20

2.1.3 Factors Underlying Irrational Use of Drugs........................................... 20

2.1.4 Impact of Inappropriate Use of Drugs: .............................................. 22

2.1.5 Assessing the problem of irrational use: ............................................. 22

2.1.6 The concept of essential medicines: .................................................... 24

2.1.7 Sudan National Essential drug List: .................................................... 25

2.1.8 International Nonproprietary Names: ................................................. 26

2.2: Similar Studies: ...................................................................................... 27

CHAPTER THREE MATERIALS AND METHODS ............................................ 31

3.1 Study Design: .......................................................................................... 32

3.5 Sample size: ............................................................................................ 33

3.6 Sampling methods: ................................................................................... 34

3.6.1 Sampling of health centres: ............................................................... 34

3.6.2 Sampling of prescribing encounters: .................................................. 34

3.7 Preparation for field work ........................................................................ 35

3.7.2 Scheduling of data collection visits: .................................................. 35

3.7.3 Drug reference lists and data collection tools: .................................... 35

3.7.4 Training of data collectors: ............................................................... 35

3.7.5 Pilot study ........................................................................................... 36

3.8 Data collection in the field ....................................................................... 36

3.9 Data analysis: .......................................................................................... 37
3.9.1 Average number of drugs per encounter (C) ........................................ 37
3.9.2 Percentage of drugs prescribed by generic name (E) ............................. 37
3.9.3 Percentage of encounters with an antibiotic prescribed (G) ....................... 37
3.9.4 Percentage of encounters with an injection prescribed (I) ......................... 37
3.9.5 Percentage of drugs prescribed from essential drugs list or formulary (K) .... 38

3.10 Graphic displays of results ........................................................................ 38

CHAPTER FOUR RESULTS AND DISCUSSION ............................................ 39
4.1 Results: .................................................................................................... 40
4.2 Discussion: .............................................................................................. 53

CHAPTER FIVE CONCLUSIONS AND RECOMMENDATIONS .................... 55
CONCLUSIONS: ........................................................................................... 56
RECOMMENDATIONS: ............................................................................... 56

References ...................................................................................................... 57
Appendices: ..................................................................................................... 59
List of Figures

Figure 1: Drug Prescribing Indicators at Facility No. (1) .................................................. 40
Figure 2: Drug Prescribing Indicators at Facility No. (2) .................................................. 41
Figure 3: Drug Prescribing Indicators at Facility No. (3) .................................................. 41
Figure 4: Drug Prescribing Indicators at Facility No. (4) .................................................. 42
Figure 5: Drug Prescribing Indicators at Facility No. (5) .................................................. 42
Figure 6: Drug Prescribing Indicators at Facility No. (6) .................................................. 43
Figure 7: Drug Prescribing Indicators at Facility No. (7) .................................................. 43
Figure 8: Drug Prescribing Indicators at Facility No. (8) .................................................. 44
Figure 9: Drug Prescribing Indicators at Facility No. (9) .................................................. 44
Figure 10: Drug Prescribing Indicators at Facility No. (10) .............................................. 45
Figure 11: Drug Prescribing Indicators at Facility No. (11) ............................................. 45
Figure 12: Drug Prescribing Indicators at Facility No. (12) ............................................. 46
Figure 13: Drug Prescribing Indicators at Facility No. (13) ............................................. 46
Figure 14: Drug Prescribing Indicators at Facility No. (14) ............................................. 47
Figure 15: Drug Prescribing Indicators at Facility No. (15) ............................................. 47
Figure 16: Drug Prescribing Indicators at Facility No. (16) ............................................. 48
Figure 17: Drug Prescribing Indicators at Facility No. (17) ............................................. 48
Figure 18: Drug Prescribing Indicators at Facility No. (18) ............................................. 49
Figure 19: Drug Prescribing Indicators at Facility No. (19) ............................................. 49
Figure 20: Drug Prescribing Indicators at Facility No. (20) ............................................. 50

Figure 1: Average results of all health centres in Wad Medani locality ............................. 50
Figure 2: Percentage of drugs prescribed from National EDL in health centres in Wad Medani locality ...................................................... 51
Figure 3: Percentage of drugs prescribed by generic name in health centres in Wad Medani locality.

Figure 4: Percentage of encounters with an antibiotic prescribed in health centres in Wad Medani locality.

Figure 5: Percentage of encounters with an injection prescribed in health centres in Wad Medani locality.

Figure 6: Average number of drugs per encounter in health centres in Wad Medani locality.
List of abbreviations

ATC  THE ANATOMICAL THERAPEUTIC CHEMICAL CLASSIFICATION

DDD  THE DEFINED DAILY DOSE

EDL  ESSENTIAL DRUG LIST

INN  INTERNATIONAL NONPROPRIETARY NAMES

INRUD  INTERNATIONAL NETWORK OF RATIONAL USE OF DRUG

PHC  PRIMARY HEALTH CARE

WHA  WORLD HEALTH ASSEMBLY

WHO  WORLD HEALTH ORGANIZATION

HIV  Human Immuno Deficiency Virus

AIDS  Acquired Immuno Deficiency syndrome
CHAPTER ONE
INTRODUCTION
1.1 General Introduction

The Conference of Experts on the Rational Use of Drugs, convened by the World Health Organization in Nairobi in 1985, stated that:

“Rational use of drugs requires that patients receive medicines appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community.”(1)

Irrational use of medicines is an extremely serious global problem that is wasteful and harmful. In developing and transitional countries, in primary care less than 40% of patients in the public sector and 30% of patients in the private sector are treated in accordance with standard treatment guidelines.(2)

WHO estimates that more than half of all medicines are prescribed, dispensed or sold inappropriately, and that half of all patients fail to take them correctly. The overuse, underuse or misuse of medicines results in wastage of scarce resources and widespread health hazards. Examples of irrational use of medicines include use of too many medicines per patient "poly-pharmacy"; inappropriate use of antimicrobials, often in inadequate dosage, for non-bacterial infections; over-use of injections when oral formulations would be more appropriate; failure to prescribe in accordance with clinical guidelines; inappropriate self-medication, often of prescription-only medicines; non-adherence to dosing regimens.(3)

Lack of access to medicines and inappropriate doses result in serious morbidity and mortality, particularly for childhood infections and chronic diseases, such as hypertension, diabetes, epilepsy and mental disorders. Inappropriate use and over-use of medicines waste resources – often out-of-pocket payments by patients – and result in significant patient harm in terms of poor patient outcomes and adverse drug reactions. Furthermore, over-use of antimicrobials is leading to increased antimicrobial resistance and non-sterile injections to the transmission of hepatitis, HIV/AIDS and
other blood-borne diseases. Finally, irrational over-use of medicines can stimulate inappropriate patient demand, and lead to reduced access and attendance rates due to medicine stock-outs and loss of patient confidence in the health system.(4)

**Impact of Inappropriate Use of Drugs:**

The WHO argued that the impact of irrational use of drugs can be seen in many ways:

- Increased risk of unwanted effects such as adverse drug reactions and the emergence of antimicrobial resistance
- Waste of resources leading to reduced availability of other vital drugs and increased costs.
- Reduction in the quality of drug therapy leading to increased morbidity and mortality
- Psychosocial impacts, such as when patients come to believe that there is “a pill for every ill.” This may cause an apparent increased demand for drugs.(4)
1.2 Problem identification and Justification

Irrational use of medicines is an extremely serious global problem that is wasteful and harmful. Medically inappropriate, ineffective, and economically inefficient use of medicines is commonly observed in health care systems throughout the world, especially in developing countries. WHO estimates that worldwide more than 50% of all medicines are prescribed, dispensed, or sold inappropriately while 50% of patients fail to take them correctly. Moreover, about one-third of the world’s population lacks access to essential medicines. In developing and transitional countries, in primary care less than 40% of patients in the public sector and 30% of patients in the private sector are treated in accordance with standard treatment guidelines. Inappropriate use of medicines results in wastage of scarce resources and widespread health hazards. (2)

Overuse and misuse of antibiotics is a particularly serious global problem. Established and newly emerging infectious diseases are increasingly threatening the health of populations. If antibiotics become ineffective, these diseases will lead to increased morbidity, health-care use and eventually premature mortality. Furthermore, antibiotics are required for other treatments (taken for granted in developed countries), such as surgery and cancer chemotherapy, which would become unavailable with the disappearance of effective antibiotics. Unfortunately, while resistance to older antibiotics is increasing, the development of new generations of antibiotic medicines is stalling. Therefore, efficient use of existing antibiotics is needed to ensure the availability in the long term of effective treatment of bacterial infections. Efficient use includes both restrictive and appropriate use. However inappropriate and incorrect use of antibiotics occurs in both developing and developed countries. Doctors prescribe antibiotics to patients who do not need them, while patients do not adhere to their treatment causing the risk of antibiotic resistance. Two thirds of all antibiotics are sold without prescription, through unregulated private sectors. Even in those European
countries where over-the-counter delivery of antibiotics is not allowed, patients use antibiotics without prescription. Low adherence levels by patients are common, many patients taking antibiotics in under-dose or for shortened duration — three instead of 5 days.(2)

In Sudan it is observed that in most health facilities there are no written protocols or guidelines. In some facilities there are some guidelines but most provider do not adhere to them. The use of antibiotic is high and in most cases with no justification. Prescribing by generic names is poor. It is also observed that both patient and providers prefer injections over oral medication.

Assessing drug use by describing type, amount and reasons for irrational use of drugs is the first step in developing an effective intervention aimed at enhancing rational use of drugs. This research is the first attempt to describe prescribing pattern in wad Medani Gezira State using WHO prescribing indicators.

Research Questions:
This research addressed to main questions:

1. What are the drug prescribing patterns in Wad Medani Locality Gezira state Sudan?
2. Do these patterns conform with the WHO guidelines?
1.3 Objectives of the study:

1.3.1 General Objective:

To assess the drug prescribing patterns in public health centres in Wad Medani locality, Gezira state, Sudan according to WHO prescribing indicators.

1.3.2 Specific Objectives:

1. To calculate average number of drugs per encounter.
2. To measure the tendency to prescribe by generic name.
3. To measure the overall level of use of antibiotics.
4. To measure the overall level of use injections
5. To assess the degree to which practices conform to a national drug policy, as indicated by prescribing from the national essential drugs list.
CHAPTER TWO

LITERATURE REVIEW
2.1 Background Information:

2.1.1 Definition of rational use of medicines:

The Conference of Experts on the Rational Use of Drugs, convened by the World Health Organization in Nairobi in 1985, stated that:

“Rational use of drugs requires that patients receive medicines appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community.” (1)

2.1.2 Irrational use of medicines

Irrational or non-rational use is the use of medicines in a way that is not compliant with rational use as defined by above. Common examples of irrational drug use are:

- the use of too many medicines per patient (polypharmacy)
- inappropriate use of antimicrobials, often in inadequate dosage, for non-bacterial infections
- over-use of injections when oral formulations would be more appropriate
- failure to prescribe in accordance with clinical guidelines
- Inappropriate self-medication, often of prescription only medicines.
- non-adherence to dosing regimes (3)

2.1.3 Factors Underlying Irrational Use of Drugs

Many different factors affect the irrational use of drugs. In addition, different cultures view drugs in different ways, and this can affect the way drugs are used. The major forces can be categorized as those deriving from patients, prescribers, the workplace, the supply system including industry influences, regulation, drug information and misinformation, and combinations of these factors. (4)
- Patients level: drug misinformation, misleading beliefs and patient demands/expectations
- Prescribers: lack of education and training, inappropriate role models, lack of objective drug information, generalization of limited experience and misleading beliefs about drugs efficacy
- Workplace: heavy patient load, pressure to prescribe and lack of adequate lab capacity insufficient staffing
- Drug Supply System: unreliable suppliers, shortages and expired drugs supply
- Drug Regulation: nonessential drugs available, informal prescribers and lack of regulation enforcement
- Drug Industry: promotional activities and misleading claims

All of these factors are affected by changes in national and global practices. For example, the frequent use of injections is declining in many African countries because of the fear of HIV/AIDS. In some countries, however, the use of injectibles remains high due to false assumption of prescribers that injections will improve patient satisfaction and that the patients always expect them.
2.1.4 Impact of Inappropriate Use of Drugs:

The WHO argued that the impact of irrational use of drugs can be seen in many ways:

- Increased risk of unwanted effects such as adverse drug reactions and the emergence of antimicrobial resistance
- Waste of resources leading to reduced availability of other vital drugs and increased costs.
- Reduction in the quality of drug therapy leading to increased morbidity and mortality
- Psychosocial impacts, such as when patients come to believe that there is “a pill for every ill.” This may cause an apparent increased demand for drugs.(4)

2.1.5 Assessing the problem of irrational use:

There are several well-established methods to measure the type and degree of irrational use. In 1969, the European Drug Utilization Research Group was established to develop methods for drug utilization research. The Anatomical Therapeutic Chemical Classification (ATC) system and the defined daily dose (DDD) established by this group have been important in the development of drug utilization research. ATC\DDD methodology can be used to compare drug consumption among institutions, regions and countries. The system was originally developed in Scandinavia and then administered through WHO’s European Regional Office. In 1996, WHO accepted the system as its official international standard and established the WHO International Working Group for Drug Statistics Methodology in order to strengthen the system and promote its use, particularly in developing countries.(5). Aggregate medicine (drug) consumption data can be used to identify expensive medicines of lowerefficacy or to compare actual consumption versus expected consumption (from morbidity data) (6)
The WHO Drug use indicators can be used to identify general prescribing and quality of care problems at outpatient setting. They defined a limited number of objective measures that can describe the drug use situation in a country, region or individual health facility. Such measures, will allow health planners, managers and researchers to make basic comparisons between situations in different areas or at different times. These indicators measure performance in three general areas; Prescribing practices, patient care, facility-specific factors.(3). This research addresses only prescribing indicators.

**WHO\INRUD Prescribing indicators:**

1) Average number of drugs per encounter  
2) Percentage of drugs prescribed by generic name  
3) Percentage of encounters with an antibiotic prescribed  
4) Percentage of encounters with an injection prescribed  
5) Percentage of drugs prescribed from essential drugs list or formulary

**The optimal levels for INRUD\WHO drug use indicators**

- Average number of drugs prescribed per encounter (whether the patient actually received the drugs or not). Optimal level: $\leq 3$.
- Percentage of drugs prescribed by generic name. Optimal level: 100%.
- Percentage of patient encounters with an antibiotic prescribed. Optimal level: $\leq 30\%$.
- Percentage of patient encounters with an injection prescribed. Optimal level: $\leq 10\%$.
- Percentage of drugs prescribed from the national EDL or the facility’s formulary. Optimal level: 100%.(7)(8)
2.1.6 The concept of essential medicines:

In 1977 the WHO defined essential medicines as those which: “satisfy the needs of the majority of the population and therefore should be available at all times, in adequate amounts, in appropriate dosage forms and at a price the individual and community can afford”(9)

In 1977, the Expert Committee on the Use of Essential Medicines included established criteria for determining if a medicine fit the definition of an essential medicines and the first model of essential medicines list (EML) was published.(9)

The concept was mentioned in one of the ten points of the Alma Ata Declaration 1978 as one component of primary health care(10)

The "WHO Model List of Essential Medicines" has been updated every two years since 1977. The current version, the 18th, was published in 2013. The fourth edition of "WHO Model List of Essential Medicines for Children” was also published in 2013.(9)

Since the beginning of the 1980s the essential drugs concept has become one of the cornerstones of international and national health policy influencing decision making in not only developing but also industrialized countries. The selection and rational use of medicines are accepted as key principles of health service quality and management in both the public and private sectors. WHO has vigorously promoted the essential drugs concept and the rational use of drugs – at first through the Action Programme on Essential Drugs, which became a powerful advocate for the new policies. National drug policies were promoted by WHO and others as a guide to action and a key framework within which to coordinate the various policy components needed to guarantee access to and rational use of medicines.

Essential medicines are one of the vital tools needed to improve and maintain health. However, for too many people throughout the world medicines are still unaffordable, unavailable, unsafe and improperly used. An estimated
one-third of the world’s population lack regular access to essential drugs, with this figure rising to over 50% in the poorest parts of Africa and Asia.(9)

**2.1.7 Sudan National Essential drug List:**

In 1981 the Ministry of Health formulated a national drug policy (NDP) based on the concept of essential medicines. The first component of the NDP to be implemented was the selection of a national list of essential drugs (NLED). Although the first NLED was selected in 1981 and first published in 1982 yet it was not officially adopted.

In 1985 a national workshop was convened in Khartoum in which the 1982 NLED was revised and updated and levels of use allocated, but again it was not officially adopted. In 1987 the NLED was revised by the Standing Committee for Drug Products Registration. The revised NLED was adopted by Ministerial Order No. 7 dated 15 October 1987, printed in English and widely distributed. In November 1993 a national workshop was convened in Khartoum and revised 1987 NLED. The updated NLED was eventually adopted by Ministerial Order No. 4 dated 15 April 1995 printed in English (original) and Arabic and widely distributed.

In November 2001 a national workshop was convened in Khartoum and revised 1995 NLED. The updated list although not officially adopted, yet it was widely accepted and used. Eventually the NLED was updated by the Standing Committee for Drug Products Registration in May 2004 and its title was changed to the National List of Essential Medicines, using the word "medicine" instead of "drug" as adopted by the World Health Organization (WHO). It is planned to be adopted by the Federal Ministry of Health, printed and widely distributed during the current year 2006. (11)
2.1.8 International Nonproprietary Names:

International Nonproprietary Names (INN) identifies pharmaceutical substance or active pharmaceutical ingredient by a unique name that is globally and is public property. Nonproprietary name is also known as generic name. The INN system was established in 1950 by the World Health Assembly resolution WHA3.11 and began operating in 1953 when first list of INN was published. The aim of the INN system has been to provide health professionals with unique and universally available names to identify each pharmaceutical substance the existence of an standard international nomenclature for drug in form of INN is important for the clear identification, safe prescription and dispensing of medicines, and for communication and exchange of information among health professionals worldwide. Another important feature of the INN system is that the names of pharmacologically-related substances demonstrate their relationship by using a common "stem". By the use of common stems the medical practitioner, the pharmacist, or anyone dealing with pharmaceutical products can recognize that the substance belongs to a group of substances having similar pharmacological activity. (12)
2.2: Similar Studies:

The WHO Analyzed results of 35 country studies from 1988 to 2002, which have been evaluated, using the WHO standard methodology the common range of drugs, prescribed per patient is two to three. However, in Ghana, the maximum number of drugs per prescription was 4.4 and in several countries (Indonesia, Niger, Nigeria, India and Pakistan) the prescriptions were for three or more drugs. Overall about 45% of the patients were prescribed antibiotics. However, in Indonesia (1990), Pakistan (1998) and West Bengal, India, (1999) rates in excess of 70% were observed. On average over 23% of consultations resulted in an injection. Countries with the highest percentage of injections (over 60%) included Indonesia (1988), Pakistan, Uzbekistan and Ghana. On average more than 60% of medications were prescribed by generic name for the 26 countries that reported on this. In Pakistan, India, Uzbekistan and Namibia less than 50% of medications were prescribed as generics only eight out of the 37 indicator studies report the percentage of drugs prescribed from an essential medicines list. On average, over 60% of the drugs were prescribed from an essential medicines list. At the bottom end of the scale, in Namibia (2001), only 12% of medicines prescribed were from the essential medicines list. (5)

The WHO\INRUD when compared prescribing indicators by health facility ownership; overall, results suggest better prescribing patterns in public health-care facilities than in private for-profit facilities. Generics and medicines prescribed from an EML/formulary were much higher in studies in both the public and private not-for-profit sectors than in the private for-profit sector. The percentage of patients with an antibiotic prescribed was equivalently high in all sectors, at nearly half of all patients; about 20% of patients received an injection in the public and private for-profit sectors, but this percentage was much higher in studies from the private not-for-profit sectors. The percentages of patients treated according to clinical guidelines
were low in both the public and private for-profit sectors, although somewhat higher in the public sector. Fewer medicines were prescribed on average in the public sector (2.4 per patient) than in either of the private sectors (3.0 per patient). (13)

Hazra, A and others carried out a drug use study in India. Of the 312 prescriptions analyzed, the average number of drugs per encounter was 3.2; only two patients were treated without drugs; 46.2% of drugs were prescribed by generic name. Use of antibiotics (72.8% of encounters) and irrational fixed dose combinations (45.6% of prescribed drugs) were frequent, but injection use (3.9% of prescriptions) was low. Essential drugs lists and formularies were not followed. Only 45.7% of prescribed drugs conformed to the World Health Organization model list of essential drugs. (14)

Hamadeh, GN and others conducted a drug use study in Lebanon. They described prescribing practices of family physicians at a university health center in Lebanon using WHO prescribing indicators. Prescribing occurred in 27.1% of encounters, with a mean of 1.6 medications per encounter; 17.5% of all prescriptions included an antibiotic. Generic drugs and essential drugs each accounted for 2.9% of all medications. (15)

Otoom, S and others evaluated prescribing pattern in Jordan using WHO prescribing indicators. The mean number of drugs prescribed was 2.3 overall, ranging from 1.9 to 3.0. The percentage of drugs prescribed by generic name was very low, as was the percentage of prescriptions involving injections. The percentages of prescriptions involving antibiotics and drugs from the essential drugs list averaged 60.9% and 93% respectively. They concluded that the prescribing and use of drugs in Jordan requires rationalization, particularly the over-prescribing of antibiotics and the under-prescribing of generic drugs. (16)

Bashahil, K.A studied prescribing patterns in Hadramout, Yemen using WHO standard indicators of rational drug use. A mean of 2.8 drugs were prescribed per prescription, with a low rate of prescribing drugs by generic name
The proportion of prescriptions for antibiotics was 66.2%, for injectable drugs 46.0%. The percentage of drugs prescribed from essential drugs list was high (81.2%). Mahalli, A.A conducted a drug use study in Eastern province, Saudi Arabia to measure the performance of primary health care centres. Mean values were: number of drugs per encounter 2.4 (optimal ≤ 3), drugs prescribed by generic name 61.2% (optimal 100%), encounters with antibiotic prescribed 32.2% (optimal ≤ 30%), encounters with injection prescribed 2% (optimal ≤ 10%) and drugs prescribed from the national essential drugs list or facility formulary 99.2% (optimal 100%). (8)

Akl and others studied drug use and prescribing pattern in Alexandria, Egypt. The study showed that prescribing indicators were within optimal or slightly below the optimal value except encounters with antibiotics prescribed that were higher than the optimal value. Average number of drugs prescribed was 2.5 per encounter, percentage of drugs prescribed by generic name was 95.4 %, percentage of encounters with an antibiotic prescribed was 39.2 %, encounters with an injection prescribed was 9.9 %, percentage of drugs prescribed from EDL/formulary was 95.4 %. (7)

In 1991, a WHO team visited Sudan to evaluate the Nile Province essential drug project, which was designed as pilot programme to achieve a more rational use of drug and to test new delivery mechanisms in the country. The aim of the mission was to determine the degree to which it had met its objectives especially in terms of availability and rational use of drugs and to propose continuation \ expansion of its activities. A comparison between the situation 1989 and 1991 regarding rational use of drugs and prescribing pattern in hospital, HC and DS/PHC was done. In hospitals antibiotic prescription changed from 54% to 77%, number of drugs per encounter from 1.6 to 1.9 drug, and prescribing by generic name from 47% to 80%. In HC/dispensaries, percentage of injection decreased from 61% to 40% and prescribing by generic name increased from 26% to 44%. At the DS/PHC level, antibiotics prescription increased from 39% to 54%, number of drugs
prescribed increased from 0.9 to 1.2 drug per encounter, and prescribing by
generic name increased from 17% to 70%. They concluded, “The use of
generic names has enormously increased at all levels and especially at
DS/PHC level. The number of drugs per encounter has increased slightly
which is logical in view of an improved supply of drugs. The number of
injection has decreased at the HC level and remained constant at the other
levels. It is worrying to see that the prescription of antibiotics, which was
already high at all, levels has further increased at the hospital and DS/PHC
level. At the use of generic names should be encouraged.”(17)

Awad and others investigated prescribing and dispensing practices in two
teaching hospitals in Sudan. The study showed that number of drugs
prescribed, 1.9; percentage prescribed by generic name, 43.6 %; percentage of
patient encounters involving an antibiotic, 65.0%; percentage of patient
encounters with an injection prescribed, 10.5%. They concluded that Cost-
effective, multifaceted interventions are needed to improve current
prescribing and dispensing practices at the teaching hospitals in Khartoum
State, Sudan. (18)

Cheraghami, Am and Idries, AM evaluated the availability, affordability and
prescribing pattern of medicines in primary health care centers in six states of
Sudan. The average number of medicines per prescription was 2.3. On
average, the number of prescriptions containing at least one antibiotic was
66% and 27% of the prescriptions containing an injectable medicine.(19)

ELSalahi, Sara H and other evaluated the prescribing pattern in primary
health care centres (PHC) of Khartoum state. The study revealed that
the average number of drugs per encounter (Prescription) was two. The
percentage of drugs prescribed by generic name was 43.2 %. The percentage
of encounters with an antibiotic prescribed was 71.8 %. The percentage of
encounters with an injection prescribed was 13.7 %, and the percentage of
drugs prescribed from essential drugs list was 92.7 %. (20)
CHAPTER THREE
MATERIALS AND METHODS
3.1 Study Design:
A descriptive quantitative cross-sectional Study was carried out to assess prescribing patterns in a representative group of health centres.

3.2 Study area:
This study was carried out in Wad Medani locality, Gezira state, Sudan. Its area is 600 km². Total population is 415,213 according to the 5th Sudan population and housing census 2008, with a population density of 770. Number of public health centres is 49 health centre, most of these health centres are covered by health insurance either directly or indirectly.

3.3 Study subjects:
Prescription from public health centres in Wad Medani locality - Gezira State - Sudan.

- Inclusion criteria for health centres:
Health centres included in the study were public health centres in Wad Medani locality - Gezira State - Sudan.

- Exclusion criteria for health centres:
Private health centres (profit and nonprofit), health centres which are managed by medical assistant, health centres of universities

- Inclusion criteria of prescribing encounters:
Prescribing encounters of acute and chronic general medical conditions of all age groups.

- Exclusion criteria of prescribing encounters:
  - Prescriptions of patients planned for admission were not included in the study.
  - Prescribing encounters of specialist clinics like dermatology clinics, antenatal care, dental visits were also excluded from the study.
3.4 **Study period:**
Data collection took place over one month from 27 April 2015 to 24 May 2015

3.5 **Sample size:**

- Twenty Health centres and 30 prescribing encounter per facility making a total of 600 encounter as recommended by the WHO, the basis for this recommendation were:(3)

- Individual health providers tend to exhibit consistent practices over time, so that a sample drawn at one point in time will provide basically the same results as a sample that covers a longer period.

- Within facilities, differences between prescriber are best ignored in both sampling and data analysis.

- The goal of a drug use study should be to estimate percentage indicators that summarize values for the sample as a whole with a 95% confidence interval.

- Above a certain number of encounters, adding additional encounters to a sample within a facility adds very little new information.
3.6 Sampling methods:

In this study, sampling took place at two levels; health facility and patient encounter. Health centres were the primary unit of sampling.

3.6.1 Sampling of health centres:

Health centres were selected by systematic random sampling:

The names and locations of all health facilities that are to be included in the study were listed and numbered – 38 health centres. Annex (1)

Sampling interval was calculated by dividing the total number of facilities on the list by the number of facilities to be included in the sample:

\[
\frac{38}{20} = 1.9 \approx 2
\]

First health centre was selected: Sampling interval was rounded up to the highest full number [2]. A random number between one and this number was chosen by using a coin. The first selected health centre was number one.

Next facility in the sample, was identified by adding the sampling interval to the previous result, and rounding it up to find the facility number to be included and so on.

\[
1 + 2 = 3
\]

By doing so nineteen health centres were selected, the 20th health centre was selected randomly.

A record of the sampling frame was kept. (Annex 2)

3.6.2 Sampling of prescribing encounters:

The sample of prescribing encounters were collected prospectively from 30 consecutive patients attending the health centre during the period of the study. Data was collected retrospectively in health centres where records of prescription were available; (retained records in the pharmacy), thirty prescriptions were selected randomly over a period of 1 month
3.7 Preparation for field work

3.7.1 Ethical considerations:
Permission to conduct this study was obtained from department of family and community medicine – university of Gezira and from Wad Medani Health affairs. All health centres were notified by the purpose and methods of the research. In health centres where data was collected prospectively permission from patient to participate in the study was taken.

3.7.2 Scheduling of data collection visits:
- A list containing names and locations of all selected sites was prepared.
- The number of days required to collect data was estimated, based on the planned number of encounters for each health centre, the number of data collectors, and the travelling time required between sites.
- A schedule of visits was prepared with the dates of every site visit. (Annex 3).

3.7.3 Drug reference lists and data collection tools:
National essential drug List of and lists of generic and trade names were prepared and data collection tools were designed according to WHO guidelines (annex 4). Also an excel sheet was designed so that data could be entered and checked daily. (Annex 5)

3.7.4 Training of data collectors:
Two data collectors (assistant pharmacist) were trained using WHO model training programme for data collectors. This included background information, study objectives, data collection tools and inclusion and exclusion criteria for prescribing encounters(3)
3.7.5 Pilot study

The procedure of data collection was tested in two sites to allow field training of data collectors and to provide opportunity to identify unexpected problems.

3.8 Data collection in the field

- Data was collected prospectively from 30 consecutive patients encounter randomly somewhere in the middle of the clinic day just outside the treatment room, or in the pharmacy according to logistics of the selected facility (9 health centres). In health centres where there are retained records in the pharmacy were available, retrospective data was collected over a period of 1 month (11 health centres).

- Data collectors copied the drug names, leaving the indicators uncoded. Coding was done by a physician and two pharmacists later.

- After the data have been collected from each health facility, the data collected was checked to ensure that it was complete and of good quality (by the doctor supervising the data collection). The accuracy of the coding was validated for a percentage of the forms completed by each data coder. The results was entered onto a computerized version of the consolidation form. This was done every day, in case a record or form for a health centre gets lost, this way the missing information could be more easily traced closer to the time that it was lost.
3.9 Data analysis:

Data was entered on the prescribing indicator form. Then data was entered into a computer worksheet. The calculation was done as recommended by the WHO. (3)

3.9.1 Average number of drugs per encounter (C)

The number of encounters for which data were collected was counted, even if no drugs were given (A). Then we added up the total number of drugs prescribed during these encounters (B), this was divided by the number of encounters (A)

Formula: Average number of drugs  \( C = \frac{B}{A} \)

3.9.2 Percentage of drugs prescribed by generic name (E)

We divided the total number of generic drugs prescribed (D) the total number of drugs prescribed (B) multiplied this multiplied by 100 to make a percentage (E).

Formula: % Prescribed as generic  \( E = \frac{D}{B} \times 100\% \)

3.9.3 Percentage of encounters with an antibiotic prescribed (G)

We divided the total number of patients who received one or more antibiotics (F) by the total number of encounters (A) this was multiplied by 100 to make a percentage.

Formula: % Antibiotics  \( G = \frac{F}{A} \times 100\% \)

3.9.4 Percentage of encounters with an injection prescribed (I)

We divided the total number of patients who received one or more injections (H) by the total number of encounters (A) and multiplied this by 100 to make a percentage.
3.9.5 **Percentage of drugs prescribed from essential drugs list or formulary (K)**

We divided the total number of EDL drugs prescribed (J) by the total number of drugs prescribed (B) and multiplied this number by 100 to make a percentage (K).

Formula: % Drugs from essential drugs list \[ K = \frac{J}{B} \times 100\% \]

3.7.6 **The optimal levels for INRUD\WHO drug use indicators**

- Average number of drugs prescribed per encounter (whether the patient actually received the drugs or not). Optimal level: \( \leq 3 \).
- Percentage of drugs prescribed by generic name. Optimal level: 100%.
- Percentage of patient encounters with an antibiotic prescribed. Optimal level: \( \leq 30\% \).
- Percentage of patient encounters with an injection prescribed. Optimal level: \( \leq 10\% \).
- Percentage of drugs prescribed from the national EDL or the facility’s formulary. Optimal level: 100%.\(^7\)(\(^8\))

3.10 **Graphic displays of results**

After data have been entered into the spreadsheet, bar charts and pie charts were generated showing different levels of each indicator and how the health facilities in both sectors vary.
CHAPTER

FOUR RESULTS AND DISCUSSION
4.1 Results:

The results of this drug prescribing study in Wad Medani locality Gezira State Sudan were as follows:

![Graph showing drug prescribing patterns and indicators](image)

*Figure 1: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (1)*
Figure 2: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (2)

Figure 3: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (3)
Figure 4: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (4)

Figure 5: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (5)
Figure 6: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (6)

Figure 7: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (7)
Figure 8: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan Drug Prescribing Indicators at Facility No. (8)

Figure 9: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan Drug Prescribing Indicators at Facility No. (9)
Figure 10: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan Drug Prescribing Indicators at Facility No. (10)

Figure 11: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan Drug Prescribing Indicators at Facility No. (11)
**Figure 12:** Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (12)

**Figure 13:** Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (13)
Figure 14: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (14)

![Graph showing drug prescribing patterns](image)

Figure 15: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (15)

![Graph showing drug prescribing patterns](image)
Figure 16: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (16)

Figure 17: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (17)
**Figure 18:** Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (18)

**Figure 19:** Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (19)
Figure 20: Drug Prescribing Patterns at health centres in Wad Medani locality, Gezira state, Sudan. Drug Prescribing Indicators at Facility No. (20)

Figure 21: Average results of all health centres in Wad Medani locality, Gezira state, Sudan.
Figure 22: Percentage of drugs prescribed from National EDL in health centres in Wad Medani locality, Gezira state, Sudan

Figure 23: Percentage of drugs prescribed by generic name in health centres in Wad Medani locality, Gezira state, Sudan

Figure 24: Percentage of encounters with an antibiotic prescribed in health centres in Wad Medani locality, Gezira state, Sudan
Figure 25: Percentage of encounters with an injection prescribed in health centres in Wad Medani locality, Gezira state, Sudan

Figure 26: Average number of drugs per encounter in health centres in Wad Medani locality, Gezira state, Sudan
4.2 Discussion:

This was a descriptive cross-sectional study to assess drug-prescribing patterns in health centres in Wad Medani Locality, Gezira State, Sudan. The percentage of drugs prescribed from National EDL, which reflect the degree to which practices conform to a national drug policy, varied between health centres in Wad Medani from 56.16% to 88.89%. The average was 68.85%. This result was lower than optimal level (100%). This may reflect poor knowledge of health provider about the importance of essential drugs. the result was lower than that reported by the WHO systematic review, Bashahil, K.A in Hadramout, Yemen, ELSalahi, Sara H and others in Khartoum state, Otoom, S and others in Jordan, Akl and others in Alexandria, Egypt and Mahalli, A.A in Eastern province, Saudi Arabia which were 71.7% 81.2 %, 92.7, 93%, 99%, and 99.2% respectively. (5)(21)(20)(16)(7)(8) This result was higher than that reported by Hamadeh, GN and others in Lebanon which was 2.9% (15)

Prescribing by generic name (INN) is important for the clear identification, safe prescription and dispensing of medicines, and for communication and exchange of information among health professionals. Tendency to prescribe by generic name varied widely between health centres in Wad Medani from 19% to 63.93%, the average was 43.08%. This result was lower than optimal level (100%). The result was very similar to that reported by ELSalahi, Sara H and others in primary health care centres of Khartoum state which was 43.2(20). It was better than that reported in Hadramout, Yemen by Bashahil, K.A 39.2% (21) it was also better than that reported by Hamadeh, GN and others in Lebanon 2.9% (15). The result was lower than that reported in other studies; the WHO systematic review, Eastern province Saudi Arabia study conducted by Mahalli, A.A The WHO team report in Nile province, Akl and others in Alexandria, Egypt which were which were 60.3%, 61.2%, 70% and 95.4% respectively (5)(8)(17)(7).
Overuse of antibiotics is a particularly serious global problem. Percentage of encounters with an antibiotic prescribed varied considerably between health centres in Wad Medani from 24% to 90%. The average was 54.79%. Which was lower than the optimum level (≤30%) this result was very similar to that of the WHO team in the Nile province which was 54%. (17) This result was higher than that of the study conducted by Mahalli, A.A in Saudi Arabia, Akl and others study in Alexandria, Egypt and the WHO systematic review which were 32.2%, 39.2% and 44.8% respectively (8)(7)(5) This result was lower than that reported in Jordan by Otoom, S and others, in Hadramout, Yemen by Bashahil, K.A and in Khartoum by ELSalahi, Sara H and others which were 60.9%, 66.2% and 71.8% respectively. (16)(21)(20)

The percentage of prescribing encounter with an injection prescribed varied from zero to 28%. The average was 10.78%, which was near optimal level (≤10%) This result was higher than that reported by Mahalli, A.A in Saudi Arabia and Akl and others study in Alexandria, Egypt which were 2% and 9.9% and respectively. (8)(7) This result was lower than that reported by ELSalahi, Sara H and others in Khartoum, the WHO systematic review and Bashahil, K.A in Yemen, which were 13.7%, 22.8% and 46% respectively. (20)(5)(21)

The average number of drugs per encounter varied from 1.95 to 3.43. The average result was 2.5, which was within optimal level (≤3). This result was similar to that reported by Akl and others study in Alexandria, Egypt. (7) It was higher than that reported by Mahalli, A.A in Saudi Arabia, the WHO systematic review, Otoom, S and others in Jordan, ELSalahi, Sara H and others in Khartoum and the WHO team report in the Nile province which were 2.4, 2.39, 2.3, and 1.2 respectively. (8)(5)(16)(20)(17) The result was lower than that reported by Bashahil, K.A in Hadramout, Yemen which was 2.8. (21)
CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATIONS
CONCLUSIONS:

The study revealed that percentage of drugs prescribed from National EDL was 68.9% which was low (optimal = 100%). Prescribing by generic names was poor, 43.1% (optimal = 100%). Antibiotic were over prescribed, where 54.8% of prescription included antibiotics (optimal ≤ 30%), percentage of encounters with an injection prescribed was a little bit higher than optimal, 10.8% (optimal ≤ 10%) and the average number of drugs prescribed per encounter was 2.5, within optimal level. Copy of essential drug list was not found in any health centre.

RECOMMENDATIONS:

- Evidence-based treatment guidelines are needed to help prescribers make decisions about appropriate treatments for specific clinical conditions.
- Clear criteria and strict lows to control antibiotic prescription
- To encourage doctors to prescribe by generic name for clear identification, safe prescription and dispensing of medicines, and for communication and exchange of information among health professionals.
- The national essential drug list need to be copied and distributed to all health facilities
- Supervision and audit for prescribing practice are essential to ensure good quality of care.
- Continued in-service education to health personnel to enhance good prescribing habits
References

2. WHO. The world medicines situation 2011. 2011..
21. Bashrahil KA. Indicators of rational drug use and health services in Hadramout, Yemen. EMHJ. 2010; 16(2).
38. Central Bureau of Statistics. 5th Sudan Population and Housing census- 2008 priority results; 2009.
### Appendices:

#### Annex (1)

**List of Health Centres - Wad Medani Locality – Gezira State – Sudan***

<table>
<thead>
<tr>
<th>NO</th>
<th>Health Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>El Debagha Health Centre</td>
</tr>
<tr>
<td>2</td>
<td>El Hekma Health Centre</td>
</tr>
<tr>
<td>3</td>
<td>El Telphezion Health Centre</td>
</tr>
<tr>
<td>4</td>
<td>Banat Health Centre</td>
</tr>
<tr>
<td>5</td>
<td>El Bohoth Health Centre</td>
</tr>
<tr>
<td>6</td>
<td>El Mazad Health Centre</td>
</tr>
<tr>
<td>7</td>
<td>Shakereen Health Centre</td>
</tr>
<tr>
<td>8</td>
<td>El Noreen Health Centre</td>
</tr>
<tr>
<td>9</td>
<td>Awoda Health Centre</td>
</tr>
<tr>
<td>10</td>
<td>Arkawit - Sharg Health Centre</td>
</tr>
<tr>
<td>11</td>
<td>Arkawit - Kuwaiti Health Centre</td>
</tr>
<tr>
<td>12</td>
<td>Abosnoon Health Centre</td>
</tr>
<tr>
<td>13</td>
<td>Habib Alla Health Centre</td>
</tr>
<tr>
<td>14</td>
<td>Dardig Health Centre</td>
</tr>
<tr>
<td>15</td>
<td>Gaziratalphil Health Centre</td>
</tr>
<tr>
<td>16</td>
<td>El Maki Health Centre</td>
</tr>
<tr>
<td>17</td>
<td>El Daraga Health Centre</td>
</tr>
<tr>
<td>18</td>
<td>El Shaheed El Zebair Health Centre</td>
</tr>
<tr>
<td>19</td>
<td>El Rai Health Centre</td>
</tr>
<tr>
<td>20</td>
<td>El Gadhaea Health Centre</td>
</tr>
<tr>
<td>21</td>
<td>El Shaheed Mostafa El Taib Health Centre</td>
</tr>
<tr>
<td>22</td>
<td>Marengan El Ommal Health Centre</td>
</tr>
<tr>
<td>23</td>
<td>Marengan Helat Hassan Health Centre</td>
</tr>
<tr>
<td></td>
<td>Health Centre</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>24</td>
<td>Um Sunot Health Centre</td>
</tr>
<tr>
<td>25</td>
<td>El Keraiba Health Centre</td>
</tr>
<tr>
<td>26</td>
<td>Atra Health Centre</td>
</tr>
<tr>
<td>27</td>
<td>El Thora Mobi Health Centre</td>
</tr>
<tr>
<td>28</td>
<td>Fadasi El Halimab Health Centre</td>
</tr>
<tr>
<td>29</td>
<td>Fadasi El Amrab Health Centre</td>
</tr>
<tr>
<td>30</td>
<td>Wad El Magdoub Health Centre</td>
</tr>
<tr>
<td>31</td>
<td>Hantoub Health Centre</td>
</tr>
<tr>
<td>32</td>
<td>El Ghanomab Health Centre</td>
</tr>
<tr>
<td>33</td>
<td>El Engaz Health Centre</td>
</tr>
<tr>
<td>34</td>
<td>El Tekelat Health Centre</td>
</tr>
<tr>
<td>35</td>
<td>Abo Haraz – Sharg Health Centre</td>
</tr>
<tr>
<td>36</td>
<td>Abo Haraz - Gharb Health Centre</td>
</tr>
<tr>
<td>37</td>
<td>El Erebab Health Centre</td>
</tr>
<tr>
<td>38</td>
<td>El Danagla Health Centre</td>
</tr>
</tbody>
</table>
*As listed by Health affairs Wad Medani Locality – Gezira State – Sudan
Annex (2)

Health centres Sampling Frame

<table>
<thead>
<tr>
<th>NO</th>
<th>Health centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>El Debagha Health Centre</td>
</tr>
<tr>
<td>2</td>
<td>El Hekma Health Centre</td>
</tr>
<tr>
<td>3</td>
<td>El Telphezion Health Centre</td>
</tr>
<tr>
<td>4</td>
<td>Banat Health Centre</td>
</tr>
<tr>
<td>5</td>
<td>El Bohoth Health Centre</td>
</tr>
<tr>
<td>6</td>
<td>El Mazad Health Centre</td>
</tr>
<tr>
<td>7</td>
<td>Shakereen Health Centre</td>
</tr>
<tr>
<td>8</td>
<td>El Noreen Health Centre</td>
</tr>
<tr>
<td>9</td>
<td>Awoda Health Centre</td>
</tr>
<tr>
<td>10</td>
<td>Arkawit - Sharg Health Centre</td>
</tr>
<tr>
<td>11</td>
<td>Arkawit - Kuwaiti Health Centre</td>
</tr>
<tr>
<td>12</td>
<td>Abosnoon Health Centre</td>
</tr>
<tr>
<td>13</td>
<td>Habib Alla Health Centre</td>
</tr>
<tr>
<td>14</td>
<td>Dardig Health Centre</td>
</tr>
<tr>
<td>15</td>
<td>Gaziratalphil Health Centre</td>
</tr>
<tr>
<td>16</td>
<td>El Maki Health Centre</td>
</tr>
<tr>
<td>17</td>
<td>El Daraga Health Centre</td>
</tr>
<tr>
<td>18</td>
<td>El Shaheed El Zebair Health Centre</td>
</tr>
<tr>
<td>19</td>
<td>El Rai Health Centre</td>
</tr>
<tr>
<td>20</td>
<td>El Gadhaelia Health Centre</td>
</tr>
<tr>
<td>21</td>
<td>El Shaheed Mostafa El Taib Health Centre</td>
</tr>
<tr>
<td>22</td>
<td>Marengan El Ommal Health Centre</td>
</tr>
<tr>
<td>23</td>
<td>Marengan Helat Hassan Health Centre</td>
</tr>
<tr>
<td>24</td>
<td>Um Sunot Health Centre</td>
</tr>
<tr>
<td>25</td>
<td>El Keraiba Health Centre</td>
</tr>
<tr>
<td>26</td>
<td>Atra Health Centre</td>
</tr>
<tr>
<td></td>
<td>Name</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>27</td>
<td>El Thora Mobi Health Centre</td>
</tr>
<tr>
<td>28</td>
<td>Fadasi El Halimab Health Centre</td>
</tr>
<tr>
<td>29</td>
<td>Fadasi El Amrab Health Centre</td>
</tr>
<tr>
<td>30</td>
<td>Wad El Magdoub Health Centre</td>
</tr>
<tr>
<td>31</td>
<td>Hantoub Health Centre</td>
</tr>
<tr>
<td>32</td>
<td>El Ghanomab Health Centre</td>
</tr>
<tr>
<td>33</td>
<td>El Engaz Health Centre</td>
</tr>
<tr>
<td>34</td>
<td>El Tekelat Health Centre</td>
</tr>
<tr>
<td>35</td>
<td>Abo Haraz – Sharg Health Centre</td>
</tr>
<tr>
<td>36</td>
<td>Abo Haraz - Gharb Health Centre</td>
</tr>
<tr>
<td>37</td>
<td>El Erebab Health Centre</td>
</tr>
<tr>
<td>38</td>
<td>El Danagla Health Centre</td>
</tr>
</tbody>
</table>
Annex (3)

Schedule of visits to Selected Health Centres

<table>
<thead>
<tr>
<th>NO</th>
<th>Health centre</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>El Debagha Health Centre</td>
<td>Monday 27\4\2015</td>
</tr>
<tr>
<td>2</td>
<td>El Telphezion Health Centre</td>
<td>Tuesday 28\4\2015</td>
</tr>
<tr>
<td>3</td>
<td>El Bohoth Health Centre</td>
<td>Wednesday 29\4\2015</td>
</tr>
<tr>
<td>4</td>
<td>Shakereen Health Centre</td>
<td>Thursday 30\4\2015</td>
</tr>
<tr>
<td>5</td>
<td>Awoda Health Centre</td>
<td>Sunday 3\5\2015</td>
</tr>
<tr>
<td>6</td>
<td>Arkawit - Kuwaiti Health Centre</td>
<td>Monday 4\5\2015</td>
</tr>
<tr>
<td>7</td>
<td>Habib Alla Health Centre</td>
<td>Tuesday 5\5\2015</td>
</tr>
<tr>
<td>8</td>
<td>Gaziratalphil Health Centre</td>
<td>Wednesday 6\5\2015</td>
</tr>
<tr>
<td>9</td>
<td>El Daraga Health Centre</td>
<td>Thursday 7\5\2015</td>
</tr>
<tr>
<td>10</td>
<td>El Rai Health Centre</td>
<td>Sunday 10\5\2015</td>
</tr>
<tr>
<td>11</td>
<td>El Shaheed Mostafa El Taib Health Centre</td>
<td>Monday 11\5\2015</td>
</tr>
<tr>
<td>12</td>
<td>Marengan Helat Hassan Health Centre</td>
<td>Tuesday 12\5\2015</td>
</tr>
<tr>
<td>13</td>
<td>El Keraiba Health Centre</td>
<td>Wednesday 13\5\2015</td>
</tr>
<tr>
<td>14</td>
<td>El Thora Mobi Health Centre</td>
<td>Thursday 14\5\2015</td>
</tr>
<tr>
<td>15</td>
<td>Fadasi El Amrab Health Centre</td>
<td>Sunday 17\5\2015</td>
</tr>
<tr>
<td>16</td>
<td>Hantoub Health Centre</td>
<td>Monday 18\5\2015</td>
</tr>
<tr>
<td>17</td>
<td>El Engaz Health Centre</td>
<td>Tuesday 19\5\2015</td>
</tr>
<tr>
<td>18</td>
<td>Abo Haraz – Sharg Health Centre</td>
<td>Wednesday 20\5\2015</td>
</tr>
<tr>
<td>19</td>
<td>El Erebab Health Centre</td>
<td>Thursday 21\5\2015</td>
</tr>
<tr>
<td>20</td>
<td>El Shaheed El Zubair</td>
<td>Sunday 24\5\2015</td>
</tr>
</tbody>
</table>
## Annex (4)

### PRESCRIBING INDICATOR FORM

Location: ____________________ Investigator: ________________  
Date____________

<table>
<thead>
<tr>
<th>Seq. #</th>
<th>Type (R/P)</th>
<th>Date of Rx</th>
<th>Age (yrs)</th>
<th># Drugs</th>
<th># Generic</th>
<th>Antib. (0/1)</th>
<th>Injec. (0/1)</th>
<th># on EDL</th>
<th>Diagnosis (Optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total**  
**Average**  
**Percentage**  

<table>
<thead>
<tr>
<th></th>
<th>% of total drugs</th>
<th>% of total cases</th>
<th>% of total cases</th>
<th>% of total drugs</th>
</tr>
</thead>
</table>

* 0 = No 1 = Yes
Summary of all selected health centres and the average for prescribing indicators in health centres in Wad Medani locality, Gezira state, Sudan.

Excel sheet for data entry and analysis.
<table>
<thead>
<tr>
<th>Facility Number</th>
<th>Percentage of drugs prescribed from National EDL</th>
<th>Percentage of drugs prescribed by generic name</th>
<th>Percentage of encounters with an antibiotic prescribed</th>
<th>Percentage of encounters with an injection prescribed</th>
<th>Average number of drugs per encounter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56.94</td>
<td>50.00</td>
<td>50.00</td>
<td>6.67</td>
<td>2.40</td>
</tr>
<tr>
<td>2</td>
<td>59.42</td>
<td>42.03</td>
<td>71.43</td>
<td>10.71</td>
<td>2.46</td>
</tr>
<tr>
<td>3</td>
<td>78.26</td>
<td>46.38</td>
<td>33.33</td>
<td>13.33</td>
<td>2.30</td>
</tr>
<tr>
<td>4</td>
<td>56.16</td>
<td>43.84</td>
<td>66.67</td>
<td>13.33</td>
<td>2.43</td>
</tr>
<tr>
<td>5</td>
<td>73.77</td>
<td>63.93</td>
<td>70.00</td>
<td>3.33</td>
<td>2.03</td>
</tr>
<tr>
<td>6</td>
<td>69.35</td>
<td>27.42</td>
<td>70.00</td>
<td>6.67</td>
<td>2.07</td>
</tr>
<tr>
<td>7</td>
<td>77.03</td>
<td>54.05</td>
<td>46.67</td>
<td>3.33</td>
<td>2.47</td>
</tr>
<tr>
<td>8</td>
<td>64.29</td>
<td>19.05</td>
<td>50.00</td>
<td>15.00</td>
<td>2.10</td>
</tr>
<tr>
<td>9</td>
<td>56.41</td>
<td>35.90</td>
<td>36.67</td>
<td>13.33</td>
<td>2.60</td>
</tr>
<tr>
<td>10</td>
<td>72.88</td>
<td>44.07</td>
<td>24.00</td>
<td>12.00</td>
<td>2.36</td>
</tr>
<tr>
<td>11</td>
<td>60.53</td>
<td>34.21</td>
<td>66.67</td>
<td>16.67</td>
<td>2.53</td>
</tr>
<tr>
<td>12</td>
<td>66.29</td>
<td>42.70</td>
<td>53.33</td>
<td>6.67</td>
<td>2.97</td>
</tr>
<tr>
<td>13</td>
<td>61.17</td>
<td>43.69</td>
<td>90.00</td>
<td>26.67</td>
<td>3.43</td>
</tr>
<tr>
<td>14</td>
<td>80.00</td>
<td>44.21</td>
<td>41.38</td>
<td>27.59</td>
<td>3.28</td>
</tr>
<tr>
<td>15</td>
<td>88.89</td>
<td>30.86</td>
<td>66.67</td>
<td>10.00</td>
<td>2.70</td>
</tr>
<tr>
<td>16</td>
<td>67.07</td>
<td>59.76</td>
<td>73.33</td>
<td>3.33</td>
<td>2.73</td>
</tr>
<tr>
<td>17</td>
<td>81.08</td>
<td>35.14</td>
<td>36.84</td>
<td>0.00</td>
<td>1.95</td>
</tr>
<tr>
<td>18</td>
<td>71.83</td>
<td>60.56</td>
<td>65.52</td>
<td>10.34</td>
<td>2.45</td>
</tr>
<tr>
<td>19</td>
<td>73.13</td>
<td>46.27</td>
<td>43.33</td>
<td>10.00</td>
<td>2.23</td>
</tr>
<tr>
<td>20</td>
<td>62.50</td>
<td>37.50</td>
<td>40.00</td>
<td>6.67</td>
<td>2.67</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>68.9</strong></td>
<td><strong>43.1</strong></td>
<td><strong>54.8</strong></td>
<td><strong>10.8</strong></td>
<td><strong>2.5</strong></td>
</tr>
</tbody>
</table>