

THE PRICES, AVAILABILITY AND AFFORDABILITY OF ESSENTIAL  
MEDICINES IN SUDAN

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A Thesis Submitted in Partial Fulfillment of the Requirements  
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การศึกษานี้มีวัตถุประสงค์เพื่อวิเคราะห์ราคา ความสามารถในการจัดหา และความสามารถในการเข้าถึงยาในบัญชียาหลัก (EM) ในประเทศซูดานในปี 2013 และวิเคราะห์ปัจจัยที่มีผลกระทบต่อราคา ยาเปรียบเทียบกับระหว่างเมืองหลวงกับรัฐอื่นๆ การศึกษานี้ใช้วิธีการศึกษาที่พัฒนาโดยองค์การอนามัยโลก (WHO) และองค์การสุขภาพระหว่างประเทศ (HAI) ในการวิเคราะห์ราคา ความสามารถในการจัดหา และความสามารถในการเข้าถึง ในขณะที่วิธีกำลังสองน้อยที่สุด (OLS) ถูกใช้เพื่อการวิเคราะห์วัดปัจจัยที่มีผลกระทบต่อราคา ยาเปรียบเทียบกับระหว่างเมืองหลวงกับรัฐอื่นๆการผันแปรราคา

ข้อมูลปฐมภูมิของยา 50 ชนิดจากบัญชียาหลักถูกเลือกมาจาก 99 ร้านขายยาใน 6 รัฐ โดย 35 , 36 และ28 ร้านมาจากภาครัฐ ภาคเอกชน และร้านที่จัดตั้งขึ้นตามกองทุนหมุนเวียน (RDF) ราคาถูกเปรียบเทียบกับราคาอ้างอิงระหว่างประเทศ (IRPs) เพื่อการหาอัตราส่วนราคา ค่าจ้างรายวันของค่าจ้างที่ต่ำที่สุดที่จ่ายให้แก่คนงานไร้ทักษะของรัฐบาลถูกนำมาใช้เพื่อประเมินถึงความสามารถของการเข้าถึงการได้รับยา

ราคาของแบรนด์ผู้ริเริ่ม (IB)ในสวนร้านขายยาเอกชนมีราคาสูงกว่าราคาอ้างอิงระหว่างประเทศ 4.24 เท่า ในขณะที่ราคาขายทั่วไปในภาคเอกชนสูงกว่าราคาอ้างอิงระหว่างประเทศ 2.9 เท่า ในร้านขายยาภาครัฐ ราคาของแบรนด์ผู้ริเริ่มและราคาขายทั่วไปสูงกว่าราคาอ้างอิงระหว่างประเทศ 2.67 และ 2.98 เท่า ในขณะที่ สำหรับ RDF ราคาของแบรนด์ผู้ริเริ่มและราคาขายทั่วไปสูงกว่าราคาอ้างอิงระหว่างประเทศ 1.88, 2.7 เท่า ตามลำดับ ในร้านขายยา RDF ราคาสูงกว่าราคา ที่จัดซื้อโดยภาครัฐ 41.9% ในขณะที่ราคาในร้านขายยาภาครัฐ และภาคเอกชนสูงกว่าราคาซื้อโดยภาครัฐ 62.4% และ 53.5% นอกจากนี้ยังพบว่าราคาขายในร้านขายยา ภาครัฐสูงกว่าราคาขายในร้านขายยาภาคเอกชนและร้านขายยา RDF

ความสามารถในการจัดหาได้ของยาในบัญชียาหลักในสวนของภาครัฐเท่ากับ 68.1% สำหรับยาทั่วไป และ 3.7% สำหรับ IB ในขณะที่ความสามารถในการจัดหายาภาคเอกชนเท่ากับ 83.9% และ 14.4% ตามลำดับ ความสามารถในการจัดหาทั่วไปของร้านขายยา RDF เท่ากับ 4.3% สำหรับ IB และ 53.4% สำหรับยาทั่วไป นอกจากนี้การศึกษาพบว่ายาหลักส่วนใหญ่ยังไม่สามารถเข้าถึงได้เนื่องจากต้นทุนในการรักษาสูงกว่าค่าแรงขั้นต่ำของภาครัฐ 1 วัน ผลของสมการถดถอยพบว่าราคาขายในรัฐห่างไกลและร้านยาภาคเอกชนมีราคาที่สูงกว่าราคาขายในเมืองหลวงระหว่าง 9% - 277%

สาขาวิชา เศรษฐศาสตร์สาธารณสุขและการจัดการบริการสุขภาพ

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MOHAMMED YUSUF AHMED MUSA: THE PRICES, AVAILABILITY AND  
AFFORDABILITY OF ESSENTIAL MEDICINES IN SUDAN. ADVISOR: ASSOC.  
PROF. SOTHITORN MALLIKAMAS, Ph.D., CO-ADVISOR: ASSOC. PROF.  
SAUWAKON RATANAWIJITRASIN, Ph.D., 102 pp.

This study aims to analyze the prices, availability and affordability of selected essential medicines (EM) in Sudan in 2013. It also analyzes factors affecting medicines prices variation between the Capital and other states. The methodology developed by World Health Organization (WHO) and Health Action International (HAI) is used to assess medicine prices, availability and affordability, while Ordinary Least Square (OLS) is used to estimate factors affecting price variation.

Primary data of 50 essential medicines were collected from 99 medicine outlets in six geographical states, of which 35, 36 and 28 pharmacies were public, private and Revolving Drug Fund (RDF) respectively. Medicine prices were compared with international reference prices (IRPs) to obtain a median price ratio. The daily wage of lowest paid unskilled government worker was used to gauge the affordability of medicines.

Innovator brand (IB) prices in private pharmacies were 4.24 times higher than the International Reference Prices (IRPs), while generics were 2.9 times higher. In the public pharmacies, IB and generic medicine prices were 2.67 and 2.98 times higher than IRPs, while in RDF, IB and generic medicine prices were 1.88 and 2.7 times higher than their IRPs respectively. The prices of RDF pharmacies was 41.9% higher than government procurement prices, while in the public and private pharmacies the prices were higher by 62.4% and 53.5% respectively. Prices in the public sector were found to be higher than the private and RDF sectors.

The availability of essential medicines in the public sector was 68.1% for the generics and 3.7% for IBs. While in the private, the availability was 83.9% and 14.4% respectively. The availability in RDF sector was 4.3% for IB and 53.4% for the generic. In addition, most of essential medicines were less affordable since the treatment cost was greater than one day wage of lowest paid government workers. Regression results show that drug prices were higher in remote states and also in private pharmacies when compared to the prices in the capital.

Field of Study: Health Economics and Health Care Management Student's Signature.....  
Academic Year: 2012..... Advisor's Signature.....  
Co-advisor's Signature.....

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**LIST OF ABBREVIATIONS**

|       |   |
|-------|---|
| C&F   | Cost and Freight                                      |
| CMS   | Central Medical Supplies                              |
| EML   | Essential Medicines List                              |
| EPI   | Expanded Program of Immunization                      |
| FTC   | Federal Trade Commission                              |
| HAI   | Health Action International                           |
| INN   | International Non-propriety Name                      |
| IRP   | International Reference Price                         |
| LPG   | Lowest Price Generic                                  |
| LMICs | Low and Middle Income Countries                       |
| MPR   | Median Price Ratios                                   |
| MRA   | Medicines Regulatory Authority                        |
| MSH   | Management Science for Health                         |
| NCD   | Non-communicable Disease                              |
| NEML  | National Essential Medicines List                     |
| NHIF  | National Health Insurance                             |
| NMP   | National Medicines Policy                             |
| NMPB  | National Medicines and Poisons Board                  |
| OB    | Originator Brand                                      |
| PPP   | Purchase Power Parity                                 |
| RDF   | Revolving Drug Fund                                   |
| RP    | Retail Price  |
| SDG   | Sudanese Pound  |
| TRIPS | Trade Related Aspects of Intellectual Property Rights |
| LPUGW | Lowest Payed Unskilled Government Worker              |
| WTO   | World Trade Organization                              |
| WP    | Whole Price   |

# CHAPTER I

## INTRODUCTION

### 1.1. Overview

Medicines account for 20%–60% of health spending in low income and developing countries and up to 90% of populations in these countries purchase their medicines out of their pocket (Cameron, Ewen, Ross, Ball, & Laing, 2009). These facts reflect the importance of essential medicines as part of the whole health system in these country settings.

High medicines prices, low affordability and poor availability are key obstacle to access to treatment in many low and middle-income countries. Certainly, in those countries where the majority of the population still buys its medicines through out-of-pocket payments, the high cost of medicines (relative to the household budget) means that an illness in the family exposes that family to the risk of catastrophic expenditure. Too often the choice is made to go without.

Although the prices of medicines have an impact on the affordability of drugs and ultimately on access to essential medicines, little is known about the prices paid by consumers for medicines in low-and-middle income countries. In May 2003, WHO in collaboration with Health Action International (HAI) published a manual, “Medicines Prices a New Approach to Measurement”. The manual describes a standardized methodology for collecting price data, availability, and affordability of selected medicines (brand and generics) from outlets in public, private and ‘other’ sector in a state or country. The methodology allows for determining medicine prices in comparison to an international reference price (IRP). The affordability is measured in terms of the daily wages of the lowest paid unskilled government worker. In addition, the manual also presents some automated analyses that can be interpreted easily. Thus, convenient comparisons between data obtained from various surveys are possible, since the indicators are defined consistently across all studies.

Access to essential medicines is a part of fulfillment of the right to the highest attainable standard of health (in short: the right to health), so why millions of patients go around the globe without treatments they need? The answer to this question is clear the reason is the price and availability of medicines to those who need them are

crucial factors, the price for the poor is simply too high and product are often not available, this may be not new to the sick and poor people but it has been news for those responsibility to ensure the health of citizen.

## **1.2. Significance of the problem**

Medicines prices, availability and it is affordability now stand as one of the big issues and challenges facing healthcare finance, not only in Sudan but worldwide.

Medicines prices in Sudan kept increasing and pharmaceutical expenditure are escalating, Health insurance schemes, private and public are more vulnerable to such cost escalating when the premium remains constant.

Given the volatile exchange rate in Sudan people think that the prices of medicines keep up increasing and never come back again. Pushing scarce resources available for pharmaceuticals to be not enough to supply the essential medicines for possible target of populations in the public sector, even the private sector including agencies importing medicines fail to supply the needed pharmaceuticals and the volume of imported medicines gone down from € 285 million in 2010 to €119 million in 2011 and drop dramatically to €54 million till September 2012<sup>1</sup>, this fact shows significant problem in the supply side of the medicines in the whole country, that failure in the supply side is sharply reflected in the demand side, e.g. some public hospitals announces acute shortage in medicines supply e.g. The Atomic Hospital and National, while National Health Insurance Fund (NHIF) report on December 2012 shows acute shortage in medicines, about 194 items out of 537 were not found in the local pharmaceutical market (NHIF, 2012). Despite that shortage NHIF mentioned in report the cost of the medicines is escalating dramatically, it increased by 18% from the 2011 to the first half 2012, the same increment was noticed from the 1<sup>st</sup> half 2012 to the 3<sup>rd</sup> quarter 2012, while it increased by 36% from the 3<sup>rd</sup> to the 4<sup>th</sup> quarter 2012<sup>1</sup>. The figure below shows the medicines prices trend purchased by NHIF during 2<sup>nd</sup> quarter 2011 and 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> quarter 2012, explain clearly how the medicine prices purchased by NHIF through competitive bidding tender was increasing dramatically e.g. the price of Insulin Mixtard increases by 40%, Ceftriaxone 1g injection by 90%, Normal Saline 0.9% by 12.7%, Amoxicillin 875mg+ Clavulonic

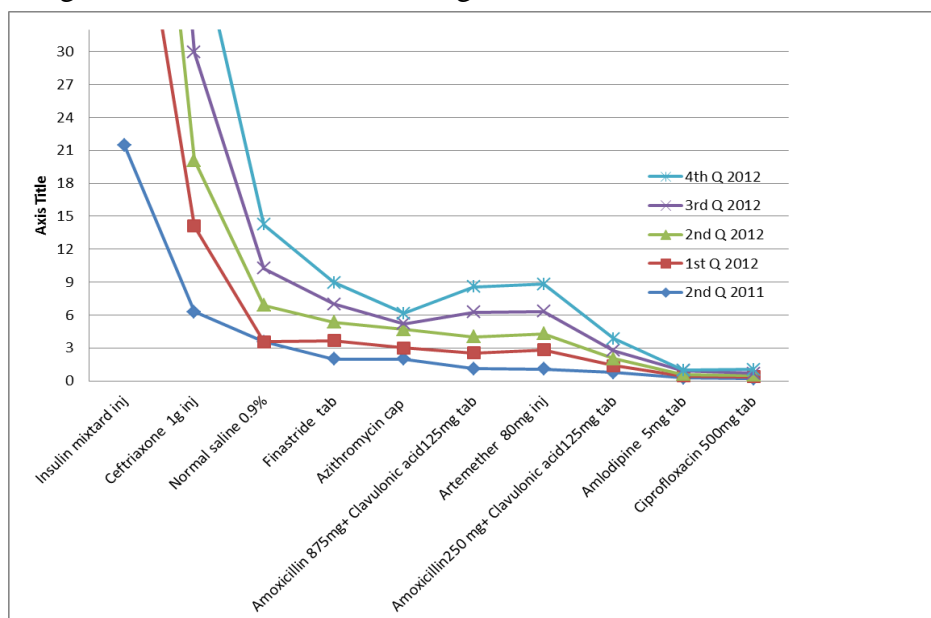
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<sup>1</sup> National Health Insurance Fund (2<sup>nd</sup> half 2012 tender report October 2012)



acid125mg tab by 108% and Artemether 80 mg/ml injection increases by 132% since 2011 to 4<sup>th</sup> quarter 2012.

Figure 1. 1 Prices trend of 10 high cost medicines in NHIF, Sudan



Source: NHIF tender reports 2011-2012

The high price of medicines is major concern for policy maker, insurance companies, public insurance, FMOH, SMOHs and patients as well, because high price can affect medicines affordability (ability of patient to buy their essential desired medicines) and availability, because scarce resources make insufficient quantities of essential medicines available which can be more less and less when it's prices increase. As equal access to medicines should be one of the health system objectives, really for that reason access to essential medicines is one of the MDGs should be achieved. Increasing medicines prices can affect the financing sustainability of healthcare system as whole. While low priced medicines which patients can afford can help improve population's health.

There are a great agree that competition are not usually present in pharmaceutical market at least to insure competitive efficient prices, hence there are consensus agreement that interventions either to promote competition or to regulate prices<sup>2</sup>. To give clue result to find optimum price regulation system is highly demanded now in Sudan.

<sup>2</sup> HAI, External Reference Pricing, 2011

If the outcomes of the regulation are difficult to predict, suppliers are forced to take decision with high uncertainty, like in Sudan when the government policies on exchange rate is not clear, many pharmaceutical companies keep their medicines and ban distributing medicines, the result was increasing medicines prices and reduce medicines availability.

The major implications of increasing medicines price in Sudan are:

1. National Health Insurance Fund (NHIF) mentioned in a conference joint all ministers of states social affairs, ZAKAT state trustees in August 2012 that the Medicines costs increased to more than (18%-50%) with less than one year (during the 4<sup>th</sup> quarter 2011 and the 3<sup>rd</sup> quarter 2012).looking fo answers and communicate the magnitude of the problem among stakeholders. The question that t is it that reasonable? Is that incremental costs are due to fluctuating and volatile exchange rate? Or some pharmaceutical companies just keep increasing the price?
2. In December and during country budgeting process NHIF call for support from national government and ask for increasing premium especially for poor families who are their premiums paid by Federal Ministry of Finance (tax-based) or by ZAKAT chamber (Muslims Contributions).because pharmaceutical cost is escalating (see table 1-1 below)

Table 1. 1 Medicines cost in relation to total expenditure in NHIF

| Period                                   | Pharmaceutical cost/month | %Ph. cost from the total Expenditure |
|--|---------------------------|--------------------------------------|
| 2011                                     | 7 Millions SDG            | 29%                                  |
| 1 <sup>st</sup> &2 <sup>nd</sup> quarter | 13 Millions SDG           | 43%                                  |
| 3rd quarter 2012                         | 18 Millions SDG           | 60%                                  |

Source: NHIF tender reports, 2011/2012

3. In August 2012 Central Medical Supplies (CMS) mentioned that 42 items of emergency medicines were out of their stock.

Paper published by WHO Controlling medicine prices in Sudan: the challenge of the recently established Medicines Regulatory Authority conclude that The current pricing system, in both public and private sectors, is of limited benefit in controlling escalating medicine prices in Sudan. There is gab to be address.

### 1.3. Research Questions

1. What is the status of availability of selected essential medicines in the public, private and RDF sector in Sudan?
2. Is medicine prices in Sudan vary among states, sectors and from other countries?
3. How affordable are medicines for treating common conditions for people on a low income?
4. What are the factors that affect patient's medicine price?

### 1.4. Research Objectives

#### 1.4.1. General objectives

To analyze the prices, availability and affordability of selected essential medicines in Sudan

#### 1.4.2. The Specific objectives are: to

1. Identify the status of availability of selected essential medicines in Sudan cross public, private and RDF sectors and to compare them.
2. Compare the prices of the selected essential medicines with the international reference price and cross Sudan states, private, public and RDF sectors.
3. Analyze affordability of selected standard treatment for common disease.
4. Analyze factors that affect patient's medicine price.

### 1.5. Scope of the Study

Study 50 selected essential medicines in private, public and Revolving Drug Fund (RDF) in six states in Sudan (Khartoum, Gazeera, River Nile, West Darfur, Sinnar and Red Sea) in February to March, 2013.

#### 1.5.1. Rationale of the scope

*The 6 states:* were selected in such way that it can represent the whole country of Sudan, while the 50 essential items were selected according to the following criteria:

*The fifty items:*

□ *Inclusion Criteria:* 14 items are from the global core items recommended by WHO for international comparison, 16 items are from the WHO/EMRO core list for comparison (Sudan in WHO /EMRO region) to facilitate country comparisons within the region and 20 items are selected to represent country health priorities. All selected Medicines are in the EML of Sudan in most important chronic and non-chronic disease.

□ *Exclusion Criteria:* items that have no reference price in MSH 2011

## 1.6. Hypothesis

1. There is no difference in medicine prices among states.

$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$ ; if the prices are the same in all states

$H_A: \mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5 \neq \mu_6$ ; if the prices are different in different states

## 1.7. Background

### 1.7.1. Demographic and socio economic indices

Sudan is one of the largest African countries with population of  $30,804 \times 10^3$ , the average house hold size is 5.7 and about 33.2% considered as urban, the dependency ratio is 84%. The economic activity rate is 37.4. However the unemployment rate for age greater than 10 and less than 25 is 40%, while proportion of elementary occupation is 30.5% and the proportions of employers is only 6.8%.(NSB, 2011).

The incidence of poverty in Sudan is 46.5, while severity of poverty is 7.8 and the average house hold consumption per person per month is 148 SDG, only 4% of population have saving or current accounts (FMoF, 2009)

### 1.7.2. Health indices

The life expectancy at birth was 59.8 year (2011) for both male and female. The infant mortality rate is 79/1,000, while children under five year age mortality rate was 111/1,000, the maternal mortality rate is 417(NSB, 2011). The leading causes of death are Malaria, pneumonia, Septicemia, Other Heart Diseases The 10 leading causes of mortality in hospitals in Sudan are: Malaria, pneumonia, Septicemia, Other

Heart Diseases, malignant neoplasm, disorders of the circulatory system, heart failure, acute renal failure, diabetes mellitus and malnutrition while the leading cause of admission are malaria, child birth, pneumonia, caesarean, obstetrics & gynecology, diarrhea & enteric gastritis, asthma, coetaneous abscess, diabetes and apportion.(FMoH, 2010).

The health infrastructure in Sudan is considered with very big gap that can affect access to health care table (1-2) shows the number of people per facility

Table 1. 2 The health facilities statistics in Sudan 2010

| <b>Facilities</b>                    | <b>Pop/facility</b> |
|--------------------------------------|---------------------|
| Hospitals                            | 1.0/100,000         |
| Hospital beds                        | 74/100,000          |
| Primary Health care Unit and centers | 15/100,000          |
| Licensed pharmacies                  | 5.9/100,000         |

Source: FMoH, 2011

### ***1.7.3. Pharmaceutical policy and regulation***

In Sudan a National Health Policy (NHP) exists from which the National Medicine Policy (NMP) documented. The NMP cover 10 basic issues concerning medicine policies, these includes Selection of essential medicines, Medicines pricing , Procurement, Distribution and regulation, Pharmacovigilance, Rational use of medicines, Human resource development, Research, Monitoring and evaluation and Traditional medicine (FMoH, 2010)

The pharmaceutical regulatory authority is semi-autonomous agency known as the National Medicines and Poisons Board (NMPB) that established in 2006. There also a legal provision for inspections of pharmaceutical companies and pharmacies, the NMPB has its own inspectors at the capital of Sudan and it depends on the pharmaceutical administration at the region level (FMoH, 2010)

To import medicine to Sudan the MDR ask for sample of the product for testing according to the legal provisions available. Also the legal provision restrict local manufacturer to be licensed and comply with Good Manufacture Practice (GMP) although GMP is not widely known and DRA not enforcing this issue as well

as the National Good Pharmacy Practice Guidelines which was published by the Medical Council but not enforces.

There is National Laboratory for testing the quality of medicines, the sample either collected by the DRA or those from the samples before entry at the port, in 2010 7536 samples were taken from the market and tested for their quality 816 items (10.8%) fail to meet the quality standard, the result of that test was not published to the public, instead the DRA ask to recall the items which fail to pass the quality test.

Free advertising of medicines is not allowed as stated in the legal provisions and the direct advertising of pharmaceuticals is abandoned, permission is needed from the NMPB before advertising<sup>3</sup>

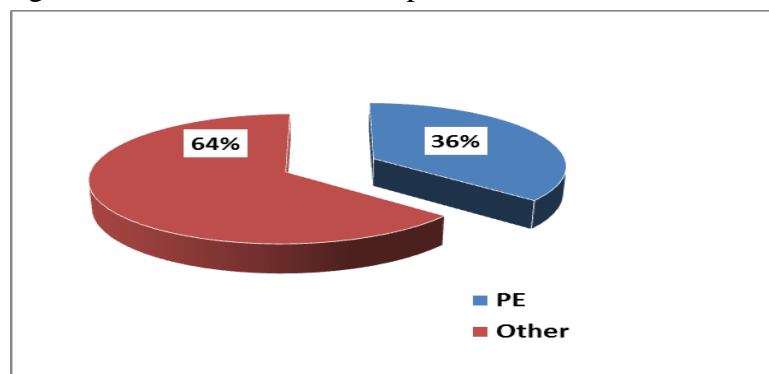
#### ***1.7.4. Medicines finance and supply***

The main sources of financing pharmaceuticals in Sudan are the health insurance (public, private and military), government tax-based subsidies like 1<sup>st</sup> 24hours emergency treatment, children under five and vaccination, other sources of finance like donors (malaria treatment) and charity organizations. However out of pocket represent more than 60% of pharmaceutical expending (PE) in Sudan. Pharmaceutical expenditure in Sudan represents 36% of total health expenditure (THE) (see figure 1-2 below)

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<sup>3</sup> Sudan Pharmaceutical Profile, FMOH, 2010

Figure 1. 2 Pharmaceutical Expenditure, Sudan 2010



Source: Sudan Pharmaceutical profile, 2010

### ***1.7.5. Patient's fees and co-payments***

At the point of healthcare delivery there fees patients has to pay especially when they ask for services not supported by the already known programs, same thing for medicine outlet. But for NHIF subscriber have to pay 25% of the whole prescription cost, while in private health insurance this copayment vary with in the benefit package from 0% to 25%, it reach to zero in military services. Also the rate of reimbursement varies in the different categories mentioned before.(FMoH, 2010)

### ***1.7.6. Medicines distribution channel in Sudan***

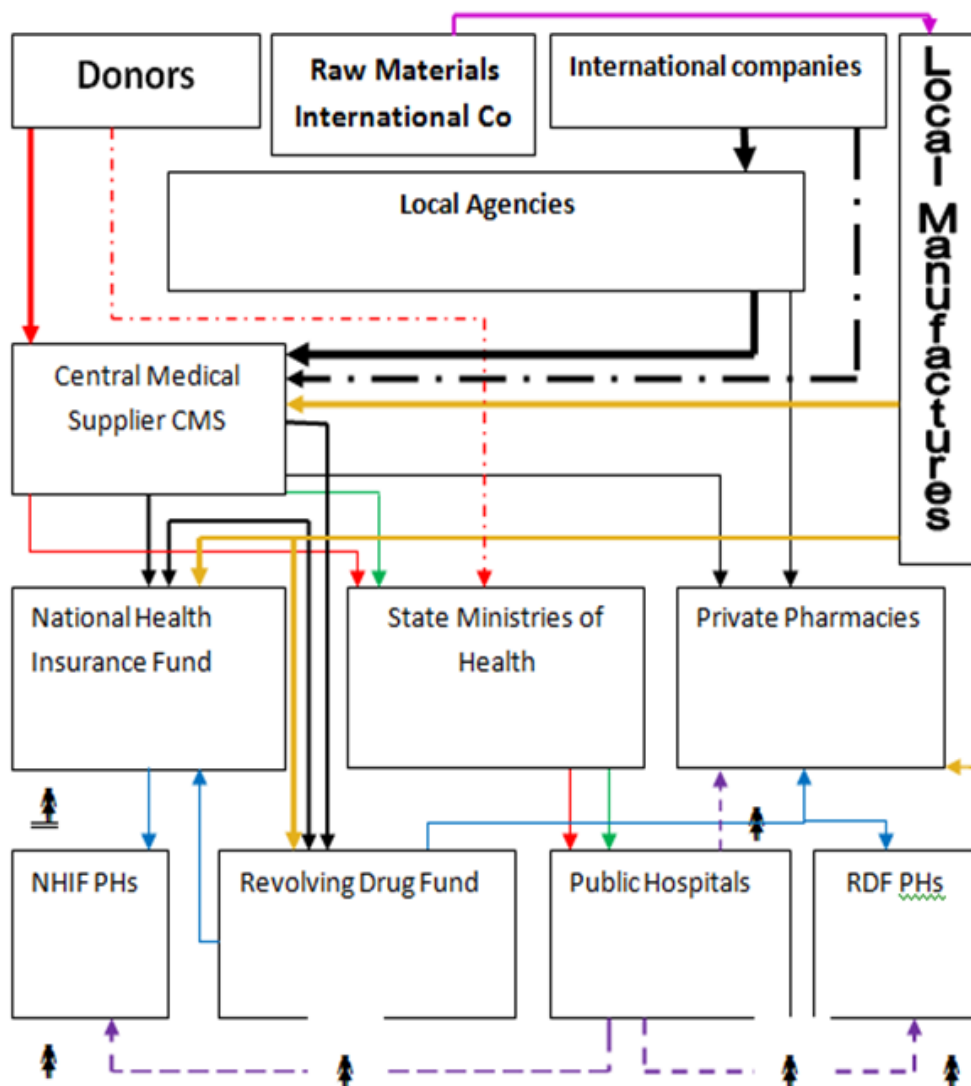
Medicines supply and distribution channels in Sudan is not so far integrated, especially in the public sector where the main procurement agents form the local markets are, NHIF, the Military Medical Services (MMS), Police Medical Services, Revolving Drug Fund and HI corporation Khartoum state. But CMS the main supplier for the public hospitals perform local and international tender biding to supply medicines.

Despite the big size of the public sector there still no unique supply. However the MMS and NHIF are the only public sectors that perform tender biding to supply their branches.in different states of the country. However the CMS is government main supplier that import from outside country it change it is objectives in 1990s and become one of the main competitor to the private sector and it expand their activities in all states by establishing RDF which contributes to sustain the medicines supply in remote areas (Mahgoub, 2009). Any regional RDF has it is own supply system and

medicines outlets where they provide retail services although they supply part of their medicines from CMS and local manufacturer and other local agencies.

NHIF has its own drug supply system and its own medicines outlets as well as MMS, figure (I-3) shows medicines distribution channels in Sudan, where there are scattered purchasing especially in the public sector

Figure 1.3 Medicines Distribution Channel in Sudan



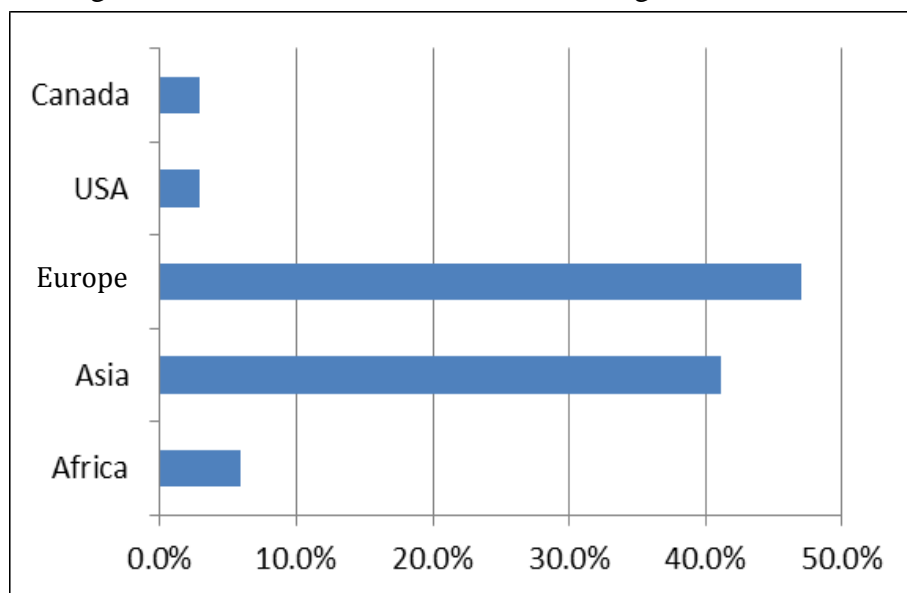
### 1.7.7. Sudan pharmaceutical industry

Sudan has 36 local pharmaceutical factories no one of them categorized as R & D factory, three of these factories are public, while the number of pharmaceutical agents are 112 agency, they import medicines from 36 different worldwide countries,



the diagram below in figure (I-4) represent the continental share for exporting medicines to Sudan, just in term of number of countries

Figure 1.4 Per cent of countries in each Region, 2012

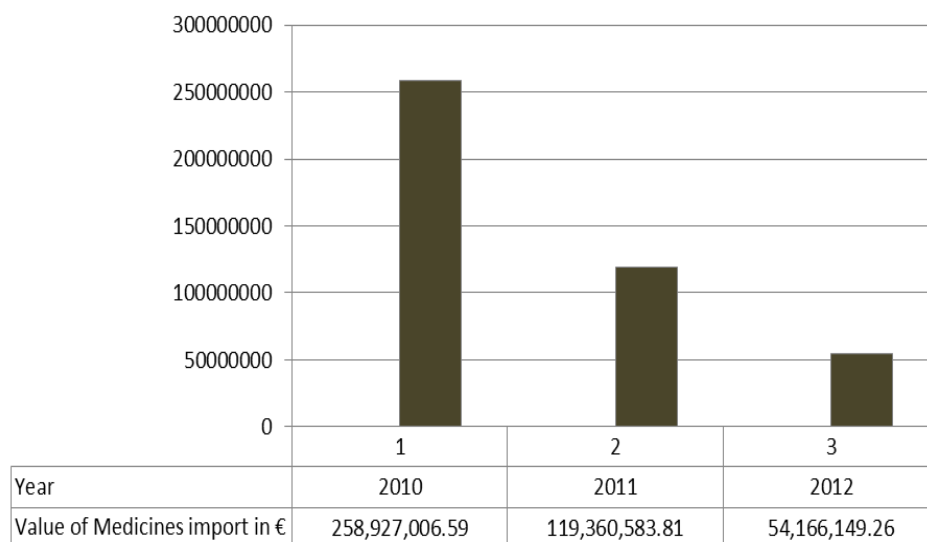


[Source: NMPB, Sudan, 2012]

Sudan national essential medicines list contain 542 and the registered medicines are 7,401 items as trade names not generics, from which is only 103 represent 21% as registration frequencies, the top registered item as frequencies were Metformin tablet and Multivitamins each registered 29 times.

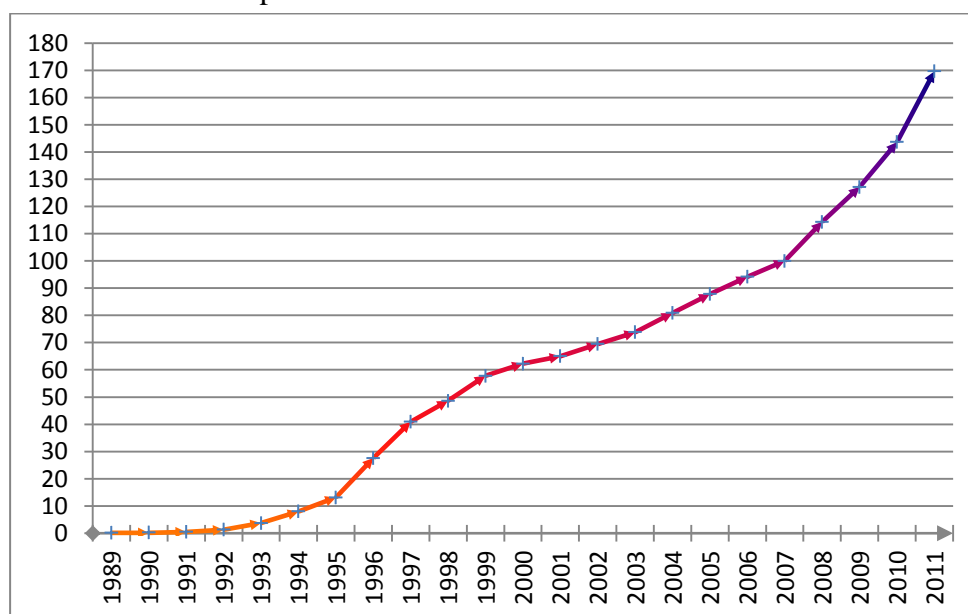
The annual value of medicines import on the last 3 years shown in the figure below (I-4) can reflect how is the medicines market in Sudan suffer much to import medicines, as local agencies and pharmaceutical companies complain that there is hard currency shortage and the gap is very clear when compare the value of medicines imports in 2010, 2011 and 2012, may be the effect of inflation (see figure I-5) the trend of the consumer price index in Sudan tells the pressure on the local currency due to inflation. The steady increasing in the CPI which medicines contribute to was reflected on medicines prices.

Figure 1.5 The value of medicines imports 2010, 2011, 2012



Source: National Medicines and Poisons Board, Sudan, 2012

Figure 1.6 The consumer price index for Sudan 1989-2011



Source:(NSB, 2012)

### 1.7.8. The price components of medicine in Sudan

In the public sector where exclusively represented by CMS, the C&F is determined by the tender committee where the NMPB has no regulation on that, although they are represented in that committee as committee member, the price

components mentioned in the table (I-4) below, shows the government fees and other expenses charged to medicines before it reach warehouse. In addition in figure I- 6 where the CMS mark-up in Sudan 20% for private and public facilities and 12% for the RDFs

Table 1. 3 The price components by CMS till 2012, Sudan

| <u>Price component</u> | <u>C &amp; F</u>  |                   |
|------------------------|-------------------|-------------------|
|                        | <u>% (By air)</u> | <u>% (By sea)</u> |
| <u>Fees (taxes)</u>    |                   |                   |
| • Customs tax          | 10.0              | 10.0              |
| • Wound tax            | 1.0               | 1.0               |
| • Port fees            | 1.2               | 2.5               |
| • Total                | 12.2              | 13.5              |
| <u>Other expenses</u>  |                   |                   |
| • Clearance expenses   | 7.0               | 7.0               |
| • Insurance            | 2.0               | 2.0               |
| • Others               | 1.0               | 1.0               |
| • Bank charge          | 2.0               | 2.0               |
| • Transportation       | -                 | 35                |
| • Total                | 12.0              | 15.5              |

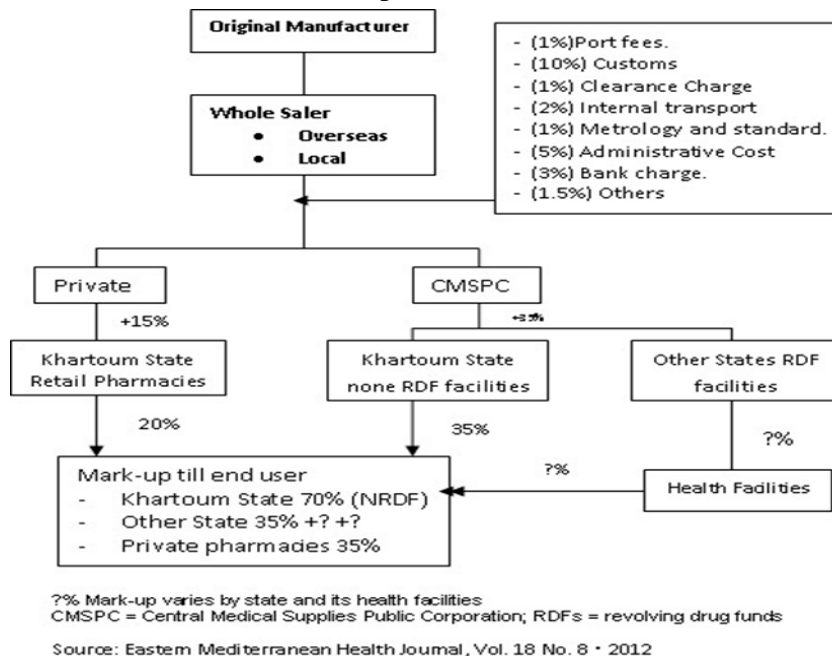
C&F = cost and freight.

Wound tax: tax source to support military

Source: G.K.M. Ali 1 and A.Y. Yahia 2, WHO

While in the private this can be vary and in different region there is different markup in the private and public sectors (see figure I-5)

Figure 1. 7 Medicines Price Mark-up in Sudan



The pricing system in the public sector based on a medicine's total C&F (i.e. wholesalers add a fixed percentage to the price they pay for the manufacturers from abroad), NMPB fixes maximum percentage mark-ups for all medicines for 2 stages of the distribution. Wholesaler's profit is 15% of the total costs to their central warehouses in Khartoum, and retailer's profit is 20% of the wholesaler's price, such system gives incentives to the whole seller and retailer to buy and sell high margin medicines for maximum profit that can affect medicines affordability and accessibility as well, this can give partial clue to the report mentioned that less than 50% of Sudanese has access to essential medicines. The government tax 1.5% to the retailer and 15% for profit. The C&F prices determined in NMPB where there is committee to evaluate and discuss with the importer the suggested prices and finally agreed before that the committee look to the brand price of the innovator for the same medicine.

### 1.7.9. The price mark-up in pharmaceutical

It is clear as shown in the figure (I-6) above the final price almost double or more than purchaser price. The government fees charged to the medicines is about

24.5% when it reaches to the port (port fee 1%, customs 10%, clearance charge 1%, internal transport 2%, metrology and standard 1%, administrative cost 5%, bank charge 3%, others 1.5%). While the mark-up charged by CMS to the retailer pharmacies is 35%, but only 15% is private companies charge as mark-up to the private and public retailer pharmacies. Khartoum state RDF charge 35% mark-up to the medicines that from CMS while 20% to medicines from the private companies, but other states RDF and private pharmacies charge higher mark-up, and that mark-up vary between the different states.

## **CHAPTER II LITERATURE REVIEW**

### **2.1. WHO\HAI standard methodology**

Despite of the facts that prices of medicines have an impact on the affordability of drugs and ultimately on access to essential medicines, little is known about the prices paid by patients for essential medicines in low and middle income countries.

In May 2003, WHO in collaboration with Health Action International (HAI) published a manual, “Medicines Prices a New Approach to Measurement”. The standard methodology describe precisely data collection on availability prices and affordability, from public, private or other sectors, for selected list of essential medicines, the survey on this methodology can be at states or country level, and allow assess prices and prices components of the medicine.(WHO/HAI, 2008b)

This methodology was validated for the possibility of bias due to limited target list and geographical sampling, no significance difference in overall availability and price of target list medicines by retail location (Madden et al., 2010). Madden concluded that WHO/HAI survey approach has suitable balance between modest research cost and optimal information for policy.

An study done on 2010 on the differences in the availability of medicines for chronic and acute conditions in the public and private sectors of developing countries used secondary data for fifty surveys conducted in forty developing countries using the WHO/HAI standard methodology the name of the countries and date of survey found in annex 2 tells that this standard methodology has done far to give clue comparisons between different countries. (A Cameron et al., 2011)

### **2.2. Medicine prices**

Dissemination of completed surveys of medicine prices and availability conducted according to the standardized WHO/HAI methodology, throughout WHO regions, during the period 2001–2008 is shown on the table II-1 below, In India the 1<sup>st</sup> survey done using the same standard methods was in Rajasthan state in (Kotwani, Ewen, & Laing, 2006) Kowari found that the local government medicine procurement

prices was efficient, for people who took their medicines from public the retail prices was relevant, although the availability was very low, people have to get their medicines from the private where half of the medicines surveyed is twice the international reference prices, and the price of medicines like Albendazole, Diclofenac and diazepam were very high.

Table 2. 1 Surveys completed using WHO/HAI methodology 2001-2008

| WHO region                   | Number of participating countries | Number of completed surveys |
|------------------------------|-----------------------------------|-----------------------------|
| Afro region                  | 11                                | 11                          |
| The Americas                 | 6                                 | 6                           |
| South- East Asia             | 4                                 | 10                          |
| Europe                       | 6                                 | 6                           |
| Eastern Mediterranean Region | 11                                | 14                          |
| Western Pacific Region       | 5                                 | 6                           |

Source: (Cameron A., Martin Auton, Dele Abegunde, 2011)

High medicine price affect all, countries, disease burden and all people, but the greatest price is paid by those who suffer from chronic non-communicable disease (NCD) those who are forced to pay out of their pockets. A global short survey done in May 2010 using standard WHO/HAI methodology for the price of 10ml vial human soluble insulin across 60 countries showed is very high in price when purchased from private medicines outlets, the prices vary between \$1.55 (Iran) to \$76.69 (Austria), the difference reached to 5000%, while the average international price of neutral human insulin was about \$20. In some counties like Congo the price of one 10ml vial was \$47.60, Indonesia \$ 44.68, Costa Rica \$51.21 and Palestine \$42.67 per a vial which is really unaffordable to many people in low and middle income countries. In Nigeria Insulin was unavailable in one of the state "Insulin is a strategic medicine which is shamefully unavailable, we have states where there is no insulin available" one of policy makers comment (HAI, 2010)

### ***2.2.1. The price components of medicine***

The price component vary among countries, among different sectors and even among the medicines which may be exempted from government fees (e.g. live saving essential medicines), while public sector may be exempted from certain taxes and tariff, but there are some prices components commonly found in medicine price in

different country settings eg. Manufacturer Sale Price, port and inspection fees, Insurance and Freight, pharmaceutical import fees, importer profit, value added tax, good and services tax and prescribing charge.

These components have their affect supply chain, which can be divided in to five stages that medicines go through as they moving from manufacture to the patient, although the components of each stage vary from one country to another. In stage one manufacture sale price in addition to insurance and freight, but for locally produced medicines this stage is only the 1<sup>st</sup> component will be considered.

The second stage known as landed price, this compose of all components arise during medicines procurement and delivery to procurement office (e.g. bank charge rate for foreign currency purchase, charge for inspection, port duties that includes ‘handling , docking, storage, insurance in port’, customer clearing, import tariff and importer’s profit. All centrally collected fees should be listed here.

Other charge including transportations to central storage, not domestic warehouse and distribution cost. While in the third stage "whole sale price" it based on landed price in addition to warehouse expenses or central storage administrative cost e.g. check quality, storage, transporting, and administrative costs. On stage four, the retail medicine outlets sale price is based on the whole sale price and includes the additional expenses e.g. storage, rent, salaries, and retailer profit. The last stage is stage five "Dispensed price" it includes stage 4 plus any dispensing charge and any sale taxes (WHO/HAI, 2008a)

Medicine mark-up in private pharmacy in Khartoum reached up to 94%, this includes government import fees, in other states the margin of profit is higher; mark-up exec that limit (G. Ali & Y. Yahia, 2012).

### ***2.2.2. Pricing policies***

Price regulation is considered as a vital element of government pharmaceutical policy; in developed country settings it can take different forms. Many approaches exist like free market pricing, international reference depend pricing, pricing compare to a substitute, price selling, profit margin controls (Espin, Rovira, & Labry, 2011).



In these settings, countries have well developed systems of health insurance including some level of coverage for drug expenditures. Furthermore, high-income countries have sufficient regulatory and enforcement capacity.

In the other hand pricing policies in low and middle-income countries are less developed. For example, few employ pricing policies such as external reference pricing (Espin et al., 2011). In these settings, there are very weak public regulatory authorities, and weak relationships with regulatory bodies, the police and judiciary; that leading to , ignorance of official prices from whole seller and dispenser (Seiter, 2010).

The outcomes of good price regulation in developed countries is more affordable medicine prices to patients (Gelders, Ewen, Noguchi, & Laing, 2005). Findings from a recent systematic comparative cross-section survey of selected medicines across low and middle-income countries conclude that there were wide variation in prices between brand medicines and generic one (WHO/HAI 2006).

Price regulation and enforcement assist to control big variation in medicines prices, moreover, that study revealed policies related to taxes tariff fees, affect access and affordability, can be improve by lowering tariffs, duties and taxes, in addition less expensive prices supplied by international organizations. (Cameron, Ewen, Ross, et al., 2009).

Furthermore, policy solutions should consider the local context as there can be wide differences within countries. For instance in Mozambique, local mark-ups are responsible for two-thirds of drug's final prices in private pharmacies; statutory and profit ceilings are applied unevenly; the local market responds effectively to the urban population's diverse needs through its low-cost and high-cost segments

The public authority's ability to negotiate with the pharmaceutical industry will affect the prices at which the authority procures medicines for its population. For example, some countries that procure well based on this survey are Jordan, Lebanon, Peru, Tunisia, and Uganda.

Apart from surveys using WHO/HAI methodology shows that LMICs faces difficulties to enforce in effectively enforcing statutory mark-up regulation (see Table 2-2) (Ball, 2011)

Table 2. 2 Enforcement of pharmaceutical mark-up regulations in LMIC

| Country    | Comment   |
|------------|---|
| Chad       | Official mark-ups in the public sector not respected  |
| Costa Rica | There is difficulties to control and monitor price margin and mark-up                       |
| Ghana      | Few public facilities followed government regulations , poor awareness of regulations       |
| India      | Small differences between official and actual retail prices                                 |
| Kosovo     | regulated mark-up of 15% of retail prices nor respected                                     |
| Mozambique | there is regulated mark-up policy, but not implemented                                      |
| Nepal      | Distributors were aware of regulated mark-ups but usually applied higher mark-ups           |
| Pakistan   | 3 of each 20 originator brand medicines had prices 17 – 50% higher than the regulated price |
| Russia     | Ineffective enforcement of wholesale and retail mark-ups noted                              |
| Yemen      | Actual prices found to deviate significantly from those predicted with official mark-ups    |

Source: HAI/ Medicine Prices and Availability, the regulation of mark-up in the pharmaceutical supply chain, 2010

At the same time the percentages cumulative mark-up differ in different low and middle income countries, (see table 2.2 below) (A Cameron, 2008).

In generic medicines pricing regulations in different countries where the policy vary within these countries e.g. in Belgium the generic medicines should be priced less than 30% and 40%, while in Denmark for reimbursement purposes, generic medicines need to be priced below the price level of originator one, but in Finland where free medicine pricing is stated, although a maximum wholesale price is fixed and serves as a basis for reimbursement, in country like India companies are free to set generic medicine prices, but essential medicines listed in NEML are price-controlled.

In United Kingdom pharmaceutical companies are free to set prices of generic medicines. However, the Department of Health cannot allow market failure if free price policy can lead to that (Simoens, 2007). But still new innovations in pharmaceutical market is necessary to develop the pharmaceutical sector, once a patented medicine enters the market, the manufacturer has some degree of monopoly power, the ability to set the product's price appreciably above the current production manufacturing expenses without perceive dramatic losses in sales.

Few product medicines not have alternative substitutes in the market. What matters most is that, the medicines are differentiated substantially from their substitutes; the producer can then make a trade-off between volume and price, differentiation happens as various chemicals targeted to specific disease have diverse therapeutic effects and contraindications.(Scherer, 2004)

Table 2. 3 Mark-up in Public &amp; Private in LMICs

| Country     | % mark-up in public sector | T% mark-up in private sector |
|-------------|----------------------------|------------------------------|
| China       | 24-35%                     | 11-33%                       |
| El Salvador |                            | 165-6894%                    |
| Ethiopia    | 79-83%                     | 76-148%                      |
| India       |                            | 29 -694%                     |
| Malaysia    | 19-46%                     | 65-149%                      |
| Mali        | 77-84%                     | 87-118%                      |
| Magnolia    | 32%                        | 68-98%                       |
| Morocco     |                            | 53-93%                       |
| Uganda      |                            | 30-66% 100-358%              |
| Pakistan    |                            | 28 – 35%                     |

Source: (Alexandra Cameron a, 2008)

Depend on the country pricing policy that country employ, cumulative percentage mark-up then will the final result of any underestimation on that particular policy and it is impact on affordability.

In 2003 Norwegian government implemented new price regulation on a selected medicines experiencing generic competition. The retail price cap, called “index price”, on a medicine was adjusted same to mean of three lowest producer prices on that medicines, in addition to a fixed wholesale and retail profit. This new policy aim to promote generics price competition and that policy helped to increase the market shares of generic drugs and succeeded in triggering price competition (Dalen, 2006)

But free market policy cannot control medicines price this evidence shown by (Z. U. D. Babar, Ibrahim, Singh, Bukahri, & Creese, 2007), study done in Malaysia where they show that the medicine cost and price is keep increasing in the country despite the free market competition, concluding that some extend of regulations is required in pharmaceutical market to be efficient.

### **2.2.3. Reference pricing**

According to Economic Co-operation and Development Organization (OECD) external reference price (ERP) benchmarking, defined as “the practice of comparing pharmaceutical prices across countries” and it is so far indicated that “there are various methods applied and different country baskets used”. This definition was adjusted by European-funded project Pharmaceutical Pricing and Reimbursement Information. The rationale behind reference price is aim to impose price cap, to bring purchaser and regulatory authorities to price bench-mark. But that definition is

adjusted to “The practice of using the price(s) of pharmaceutical product in one or several countries in order to derive a benchmark or reference or reference price for the purpose of setting or negotiating the price of the product in a given country”(Espin et al., 2011). However MSH reference price not always lower, (Russo, 2010) shows that the retail prices for generics were cheaper than the MSH reference price in public urban retail pharmacies in Mozambique.

Medicine prices are expressed in form of ratios relative to standard set of reference prices ease comparison between national and international prices, these international reference prices (IRP) are recent purchasing prices given by not-for-profit and for-profit agencies to develop more than one source product. And IRP is commonly of high significance when there is lots of supplier quoting for each medicine. That is why it is important to be sure that all surveyed medicines have IRP to make the comparison later on. There also other source of IRP like New Zealand Pharmaceutical Management Agency prices<sup>4</sup> and Australian Pharmaceutical Benefits Scheme prices<sup>5</sup> (WHO/HAI, 2008c)<sup>6</sup>

Drew backs in international comparisons when taking MPR in two or more different countries to compare the interpretation of the result can be rather difficult as the medicines market volumes in these countries may differ, some surveys may conducted in different years with countries subject to diverse inflation rate and having different retail buying power of the local exchange rate, adjustment the data for inflation and PPP is highly recommended (WHO/HAI, 2008c)

#### ***2.2.4. Lowest generic price and quality***

The lowest generic price is most likely preferable because it contribute to essential medicines availability and affordability, an study done in 2011 focusing on 8 items approved by WHO, 899 sample items were analyzed from 17 low and middle income countries, they found that 15% of these medicines failed to pass at least one test, these items which failed to pass their price were 13.6% - 18.7% lower than the good items (Bate, Jin, & Mathur, 2011). Meaning that lowest price generics not

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<sup>4</sup> <http://www.pharmac.govt.nz>

<sup>5</sup> <http://www.pbs.gov.au/html/healthpro/home>

<sup>6</sup> [http://www.who.int/medicines/areas/access/medicines\\_prices08/en/](http://www.who.int/medicines/areas/access/medicines_prices08/en/)

always the best answer to essential medicine affordability, quality factor should be considered when formulating pricing policies.

### **2.3. Medicines Availability**

Availability(physical availability) in general include the logistic process of making list, ordering, shipping, storing, distributing and delivering of health technology to the final user (Frost & Reich, 2008).

The availability is defined as, the percentage of medicine outlets in which the medicine was found on the day of data collection.(Cameron, Ewen, Auton, & Dele 2011). Availability then considered as especial component in having access to essential medicines, it is important for achieving the health-related MDGs and attending to the health needs of developing countries. However, essential medicines are available in only 42 % of facilities in the public sector compared to 64%in the private sector. In spite of poor availability, the scarce of national regulatory capacity to ensure and enforce quality remains a problem in many countries, and thus populations remain victims of poor quality medicines.

The availability of non-communicable diseases medicines is even lower than that of communicable diseases. This is also a growing concern in low-income countries, where the burden of these diseases is rapidly increasing.(UN, 2012)

Study of 30 essential medicines for communicable and non-communicable disease in 40 low and middle income countries shows that the generic medicines for non-communicable disease is less available than those generic of communicable disease in both public and private sector, in the public sector the availability was (36% versus 53.5%) while (54.7% versus 66.2%) in the private sector (A. Cameron, A. Ewen, et al., 2011) Medicines availability usually varies between public sector and private sector,

The availability of EM in the private sector is usually higher than public e.g survey conducted in Guatemala in 2010 revealed that the availability of selected EM in the public sector is only 25%, while it was 35% for the private (Anson, Ramay, de Esparza, & Bero, 2012).

Other studies shows that availability of acute and chronic disease medicines (generic) in 40 developing countries it was 36% for chronic and versus 53.5% of

acute disease medicines in the public, while in the private sector it was 54.7% for the chronic disease medicines versus 66.2% for the acute disease medicines (A, M, Ross-Degnan, Ball, & Laing, 2009).

In rural area in China suffer the same problem of availability and accessibility and patients will not reimburse when he buys the medicines from the private retail medicine outlets (Yang, Dib, Zhu, Qi, & Zhang, 2010).

To maintain stable medicine supply in the public sector in low and middle income countries it is rather difficult, e.g. in Nigeria where stock-out in the public sector is common problem (O'Connell et al., 2011).

There are some improvement in the availability of medicines using number of interventions in developing countries such as privatization of the distribution system, user fees system, revolving drug funds, disease-drug specific programs, organized supervisory visit programs, continuous training and educations, community based intervention, (Nunan & Duke, 2011). However evidence from Malaysia show the effect of privatization on prices but that not related so much to intervention of privatization rather to the pricing policy of the country (Z. D. Babar & Izham, 2009), Babar and Izham proof that privatization is not the correct answer to improve supply system.

In 2009 a survey conducted in five regions in India to assess the availability, prices and affordability of Beclometasone and Salbutamol inhalers, it found that the essential inhalation medicines for asthma were not available in the public sector where poor patients get their medicines, and the essential inhalation medicines for asthma were not affordable for the majority of the population (Kotwani, 2009).

Table 2. 4 Average Availability in 36 LMICs

| WHO region             | AFR       | AMR       | EMR       | EUR       | SEAR      | WPR       | All        |         |
|------------------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|---------|
| No of surveys          | n=8       | n=2       | n=11      | n=2       | n=8       | n=5       | n=36       |         |
| Basket of 15 medicines | 29.4      | 54.4      | 39.6      | 40.5      | 38.3      | 43.0      | 38.4       | Public  |
|                        | 20.3-41.2 | 52.7-56   | 9.7-60.4  | 32.1-57.9 | 16.3-57.9 | 22.2-79.2 | 9.7-79.2   |         |
|                        | 54.6      | 68.8      | 68.9      | 66.9      | 75.1      | 50.1      | 64.2       | Private |
|                        | 14.8-79   | 66.6-70.6 | 36.3-97.5 | 61.4-70.9 | 64.3-91.8 | 33.6-77.6 | 14.8 -97.5 |         |
| Ciprofloxacin 500mg    | 50.4      | 94.2      | 49.3      | 42.5      | 62.8      | 24.5      | 52         | Public  |
|                        | 4.2-82.1  | 92.3-96.2 | 0.0-100   | 0.0-85.0  | 0.0-100   | 0.0-75    | 0.0-100    |         |
|                        | 79.3      | 97.6      | 92.3      | 82.7      | 92.8      | 57.3      | 82.4       | Private |
|                        | 27.3-96   | 96.2-99   | 66.7-100  | 43.3-97.5 | 68.6-100  | 0.0-97.2  | 0.0-100    |         |

Source: (Cameron, Ewen, Ross-Degnan, Ball, & Laing, 2009)

Table 2.4 above summarize the availability of 15 basket of essential medicines taken from 36 LMICs survey conducted before using WHO/HAI standard methodology and give clue that the availability of basket of the this 15 medicines is usually low in the public when compared with the private sectors, although there is a variation in WHO regions according to economic status of the countries in each specific group.

## **2.4. Medicines Affordability**

### ***2.4.1. Measuring affordability***

Two approaches are generally used to estimate affordability. One relies on the ratio of expenditures to household resources, while the second approach focuses on the residual income after expenditure. In the first approach, the payment for a good is considered as catastrophic when it exceeds a certain proportion of a household's resources. For the second or "impoverishment" method considers the absolute available resources before and after payment for a commodity. If the household is initially above the poverty line but go below it after paying for the commodity, it can be said to have been "impoverished" by the payment. (LM Niëns et al., 2012)

The lowest paid unskilled government worker in the Democratic Republic of Congo has to work for 24 days to pay for one month's supply of two lowest priced generics for hypertension treatment (Captopril 25mg tablets) and diabetes (Metformin 500 mg tablets). The cost of originator brands even higher than generics, and buying the medicines from the public sector at a lower price is remote areas as the availability is only about 5%. This problem can be found in many other countries those same generic medicines are also unaffordable; about 6 days wages are needed each month to purchase the medicines in El Salvador, 4 days in Brazil (Rio Grande do Sul State), and about 3 days in Yemen and Mexico City (Bertoldi, Helfer, Camargo, Tavares, & Kanavos, 2012)

Till the end of 2007, more than 50 surveys had been conducted in LMICs, the results of these surveys revealed suitable clues shown for the first time, part of these facts are that in many LMICs medicines prices are high especially in the private sectors, while availability is low in the public sector and treatment is usually

unaffordable (WHO/HAI, 2008b) the table 2.5 below illustrate the availability and affordability of Salbutamol inhaler 0.1mg/dose in selected LMICs, gives evidence of very high price for salbutamol inhaler in the private sectors while it is less available in the public sector, so patients has to pay very high prices to get it. In Uganda for example patient has to pay 8 day's wage to get the treatment of originator Salbutamol inhaler while only 4.6 day's wage for lowest priced generic.

Table 2. 5 Availability, Affordability of Salbutamol inhaler in LMICs

|                     | Availability in Public sector |     | Affordability – private sector |          |
|---------------------|-------------------------------|-----|--------------------------------|----------|
|                     | Originator                    | LPG | Originator                     | LPG      |
| Uganda, April 2004  | 0%                            | 0%  | 5.6 days                       | 2.0days  |
| Ghana Oct 2004      | 4%                            | 11% | 8.0 days                       | 4.6 days |
| Mali, March 2004    | 0%                            | 0%  | 4.2 days                       | 2.7 days |
| Pakistan, July 2004 | 0%                            | 3%  | 1.4 days                       | 1.4 days |
| Indonesia Aug 2004  | 13%                           | 0%  | 4.1 days                       | -        |

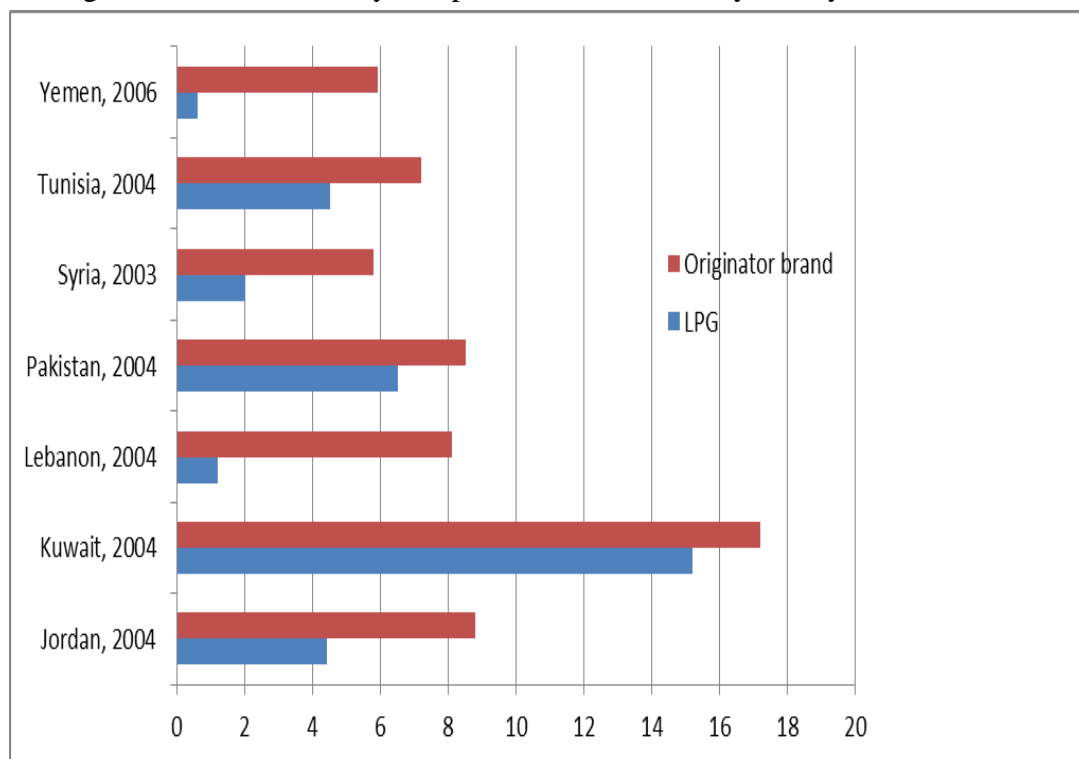
Source: (WHO/HAI, 2008b)

#### ***2.4.2. Comparisons of the affordability of treatment***

International comparisons of affordability can be made by transfer the data on the number of day's wages required to pay for course of treatment (affordability analysis) to a cross-country comparison chart (see figure 2.1 below) it shows peptic ulcer treatment with Ranitidine 150mg tablets purchased from retail pharmacy in Kuwait would cost 12 days of income for a person on the lowest government wage, while the same treatment course in other countries would be 6 -8 days' wages for the originator brand and 1-6 days' wages for the lowest-price generic, but in country context you find that in Kuwait for examples all citizens are covered by health insurance(WHO/HAI, 2008d). The figure II-1 shows the result of affordability in seven countries for patient to buy Ranitidine 150mg for one month



Figure 2. 1 Inter-country comparison of affordability 30 days Ranitidine



Source: WHO/HAI, 2008

Table 2.6 summarize the affordability of 36 countries in low and middle income derived from(Cameron, Ewen, Ross, et al., 2009) shows the day's wage needed to buy treatment of diabetes, adult RTI and asthma with the standard treatment course using day wage for lower wage unskilled government worker, explain the variations between WHO regions and how it vary between private and public sectors. Generally the treatment in the public sector is more affordable than private.

Table 2. 6 Mean number of day's wages of the LPUGW

|   |     | AFR         | AMR         | EMR          | ERO          | SEAR        | WPR         |
|---|-----|-------------|-------------|--------------|--------------|-------------|-------------|
| <b>Adult respiratory infection; amoxicillin 250 mg capsule/tablet, three per day for 7 days</b> |     |             |             |              |              |             |             |
| Private sector  | OB  | 2 · 9 (n=6) | 1 · 9 (n=1) | 1 · 6 (n=5)  | 1 · 4 (n=1)  | 1 · 2 (n=4) | 0 · 5 (n=2) |
| Private sector  | LPG | 0 · 5 (n=6) | 1 · 0 (n=2) | 0 · 6 (n=8)  | 2 · 9 (n=5)  | 0 · 6 (n=8) | 0 · 4 (n=4) |
| Public sector   | LPG | 0 · 5 (n=6) | 0 · 2 (n=1) | 0 · 3 (n=4)  | 7 · 9 (n=1)  | 0 · 4 (n=1) | 0 · 4 (n=3) |
| <b>Diabetes; Glibenclamide 5mg capsule/tablet, two per day for 30 days*</b>                     |     |             |             |              |              |             |             |
| Private sector  | OB  | 8 · 4 (n=7) | 4 · 5 (n=1) | 2 · 1 (n=8)  | 0 · 5 (n=1)  | 1 · 3 (n=8) | 1 · 6 (n=3) |
| Private sector  | LPG | 1 · 8 (n=7) | 1 · 5 (n=2) | 0 · 9 (n=12) | 1 · 8 (n=4)  | 0 · 4 (n=8) | 0 · 7 (n=4) |
| Public sector   | LPG | 1 · 1 (n=7) | 0 · 1 (n=1) | 0 · 5 (n=4)  | 2 · 5 (n=2)  | 0 · 6 (n=1) | 0 · 7 (n=1) |
| <b>Asthma; salbutamol 0·1 mg/dose inhaler, 200 doses</b>  |     |             |             |              |              |             |             |
| Private sector  | OB  | 4 · 4 (n=8) | 2 · 0 (n=3) | 1 · 6 (n=11) | 3 · 6 (n=4)  | 1 · 2 (n=9) | 1 · 4 (n=5) |
| Private sector  | LPG | 2 · 5 (n=6) | 1 · 0 (n=2) | 0 · 8 (n=10) | 5 · 0 (n=5)  | 0 · 6 (n=7) | 0 · 7 (n=6) |
| Public sector   | LPG | 1 · 6 (n=2) | 0 · 6 (n=1) | 0 · 7 (n=3)  | 15 · 0 (n=1) |             | 1 · 1 (n=2) |

Source: (A et al., 2009)

### **2.4.3. *Pay-for-delay***

Brand-name pharmaceutical companies can delay generic competition that lowers prices by agreeing to pay a generic competitor to keep its competing medicine off the market for a period of time, so called “pay-for-delay” , these types of agreements have grown up as part of patent litigation settlement agreements between originator and generic pharmaceutical companies.

These agreements are “win-win” for the companies: because the brand medicine price will stand high, and the brand named pharmaceutical companies and the generics will share the profit. The loser will be then; the consumers, they miss out on generic prices that can be as much as 80 percent lower than brand named prices, for example, brand name medicine that costs \$300 per month might cost as a generic product for the same medicine little as \$30 per month.(Commission, 2010)

### **2.4.4. *Generic Brand Paradox and Competition policy***

The promotion of generic substitutions among the policy makers and public as well as professionals, who should give more confidence to generics use, is more important now to save many resources for more access, and the need for inclusion generic promotion in national pharmaceutical policies (Cameron, Mantel-Teeuwisse, Leufkens, & Laing, 2012)

The prices differences between brand and generics medicines can be shown from market entry due to patent loss, that can be explained by market share medicines, the number and age of both brand and generic in specific market, the prices of the brand medicines could go up while for the generic go down, therefore, the price, the ratio between bran and generic, is negatively related to the number of generic medicines in the market (Kong, 2004).

Recent study shows that utilization of brand medicines go down in the two years before the generic entry and that will continue to the years following generic entry, despite decreases in prices given by generic substitute of a medicine. This reduction coincides with the market entry and increased utilization of branded medicine reformulations (Huckfeldt, 2011). However it has been argued that the impact of generic substitution has been significant; average price of substitutable drugs has decreased more than 10 %. However, price development has been very uneven, some of the prices have gone up and some were decreased more than 50 %.

The biggest factors affecting price development was the number of the competitors, basic position of the medicine and width of the price pipeline. (Aalto-Setala, 2008).

It has been discussed that trademarks for medicine names reduce search costs but at the same time increase product differentiation. In this special design, trademarks may not mean any benefit to consumers. In the other hand, the generic names of drugs or “International Nonproprietary Names” have unquestionable benefits in both economic theory and empirical studies. However advertising of brand medicines creates generic name recognition. The monopoly product producer will advertise less than the other competitors.(Feldman & Lobo, 2012)

## **2.5. Pharmaceutical Market Behavior is Sudan**

In 2006, medicines prices survey was done in Khartoum states to see the adherence of the whole seller and retailer to the price regulations stated by the NMPB, in that survey they calculate hypothetically the Whole sale Price (WP) and Retail Prices (RP), calculated by adding up government fees and profit % allowed by the regulations. They found that the WP and RP should be 1.5 and 1.8 from C&F price what is known as Marginal Price Ratio(MPR) which is equal to  $(WP/C\&F)$ ,  $(RP/C\&F)$ , unfortunately only 14 out of 105 importing companies comply, but for the RP more than 47% of selected medicines was lower, also on that report international comparison was done and The C&F price of more than one-fifth of the studied items was more than 10 times the International Reference Price (IRP); 17 out of 24 of these items were generics. The C&F prices of certain medicines were extraordinary high, up to 100 times the International Reference Price (IRP).(G. K. Ali & Y. Yahia, 2012)

## **2.6. Pharmaceutical Industry**

A key policy challenge for all countries is to balance industrial policy goals with health policy goals. There are a number of issues related to the pharmaceutical industry including intellectual property rights, pricing of medicines, competition in pharmaceutical markets, R&D particularly in areas of neglected disease that afflict developing countries and unethical practices of advertising and direct advertising to patients. This section focuses on the monopoly element of the pharmaceutical sector and implications for pricing policies that are relevant to the analysis in this thesis.

Intellectual property rights are afforded to firms through the use of patents according to the World Trade Organization's legal framework found in the agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) (WTO 1994). This policy provides the legal framework for all countries that are part of the agreement to recognize patented pharmaceutical products. This has implications for pricing of medicines because the firm has a monopoly on the drug and in principle could set its price freely in a country's market. In developing countries, the implication is that high priced medicines would undermine access for patients. One proposed policy response is differential pricing (also referred to as Ramsey pricing or price discrimination). This policy means that pharmaceutical firms sell the same medicine to developing countries at different prices that reflect a country's price elasticity of demand (WTO and WHO 2001).

Medicine market should be controlled by the government, because free market of medicines because whatever reduction on the price without controlling markup may increase the profit for dispenser without benefit to the end user (Z. U. Babar, Izham, Singh, Bukahri, & Creese, 2007)

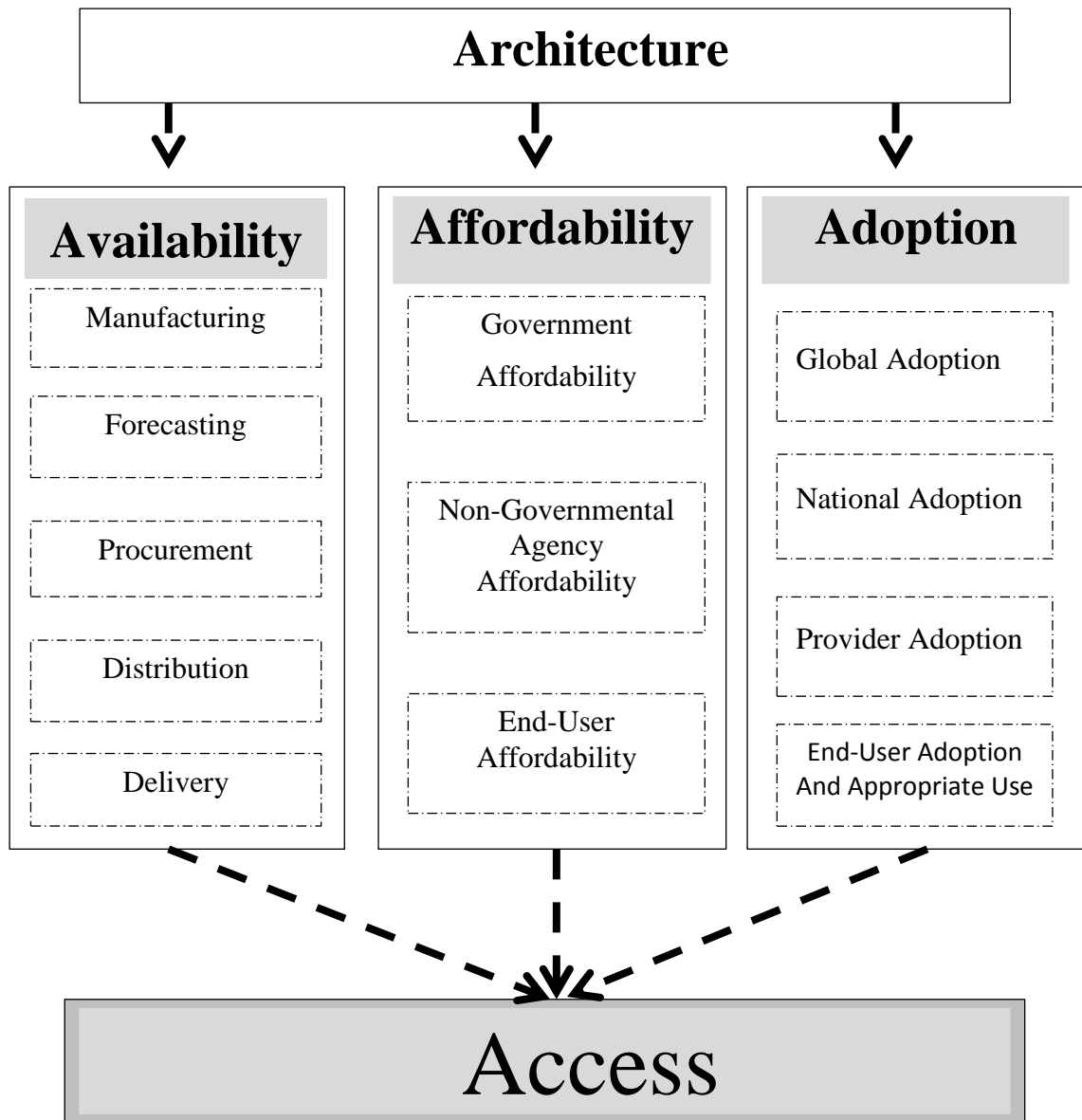
## **2.7. Access to health care**

Access is defined as "the concept representing the degree of fit between the client and the system" to specific dimensions including availability, affordability, accessibility, accommodation and acceptability (Penchansky & Thomas, 1981), meaning that access is not just use of the health care system. is argued by Penchansky as not true, the argument emphasize that access is no synonymous to available or accessible but actually it is difficult to differentiate between the three terms

### **2.7.1. *The access framework***

The access framework based on four aspects, the availability which emphasize the supply component of the access; affordability stand for the cost issues to the different stake holder in the game; and adoption which clarify the demand factors and acceptance. The frame work has organisation component which is (architecture) to all four basic components (see figure 2.2) (Frost & Reich, 2008). The architecture which is the organizational part required to organise the three main activities to achieve access

Figure 2. 2 Access framework



Source: (Frost & Reich, 2008)

The second component involved here as mentioned before is *Availability*; which includes many activities at different level to ensure reliable and sustain supply. The actors involved in the access activities includes international organisations like WHO, private sector organisation at the global level like multinational pharmaceutical companies, and private –public donor as well as bilateral aid agencies, while with in the country the actors include the private distributors of technologies; national public sectors such as the ministry of health or a national regulatory authority; public sector regional, district, and community agencies such as health care providers in public

clinics; community-based distributors of health technologies; and end-users including patients and consumers.(Frost & Reich, 2008)

Now it is clear that are two basic important part of access and the health goal "access" cannot be achieved unless the four components are integrated together, part of this study will look on some aspect of the availability specifically delivery and procurement as well as the end user affordability.

## **2.8. Factors affecting medicine prices**

### ***2.8.1. Research and development***

To develop new medicines cost a lot of money, because it is long research process it takes years to come up with new medicine, to develop new medicine in 1987 will cost US\$281 million, while it cost US\$ million in 2000 (DiMasi, Hansen, & Grabowski, 2003). May that the reason of high brand medicine price to compensate the cost of (Penchansky & Thomas, 1981)than what expected to recover the cost of production, the reason behind the development of patent guidelines in Canada to price new developed medicines should not go beyond the CPI(Sibbald, 2005)

### ***2.8.2. Generic competition***

Although economic theory required no to interfere with price regulation, majority of European countries regulate the price of the generic by different way e.g. maximum sales prices and the maximum reimbursement rate, price cap lead to the leveling off of generic prices(Puig Junoy, 2010), while intellectual property right may reduce generic medicines availability, while market competition and factors affecting demand size are most likely influence the generic suppliers, while the brand supplier set price to offset compulsory licensing and generic competition (Meiners, Sagaon-Teyssier, Hasenclever, & Moatti, 2011). However brand name medicines are lack of prices competition even when the patency is expired (Lexchin, 2004), although drug substitution has significant effect on medicines price (Aalto-Setala, 2008)

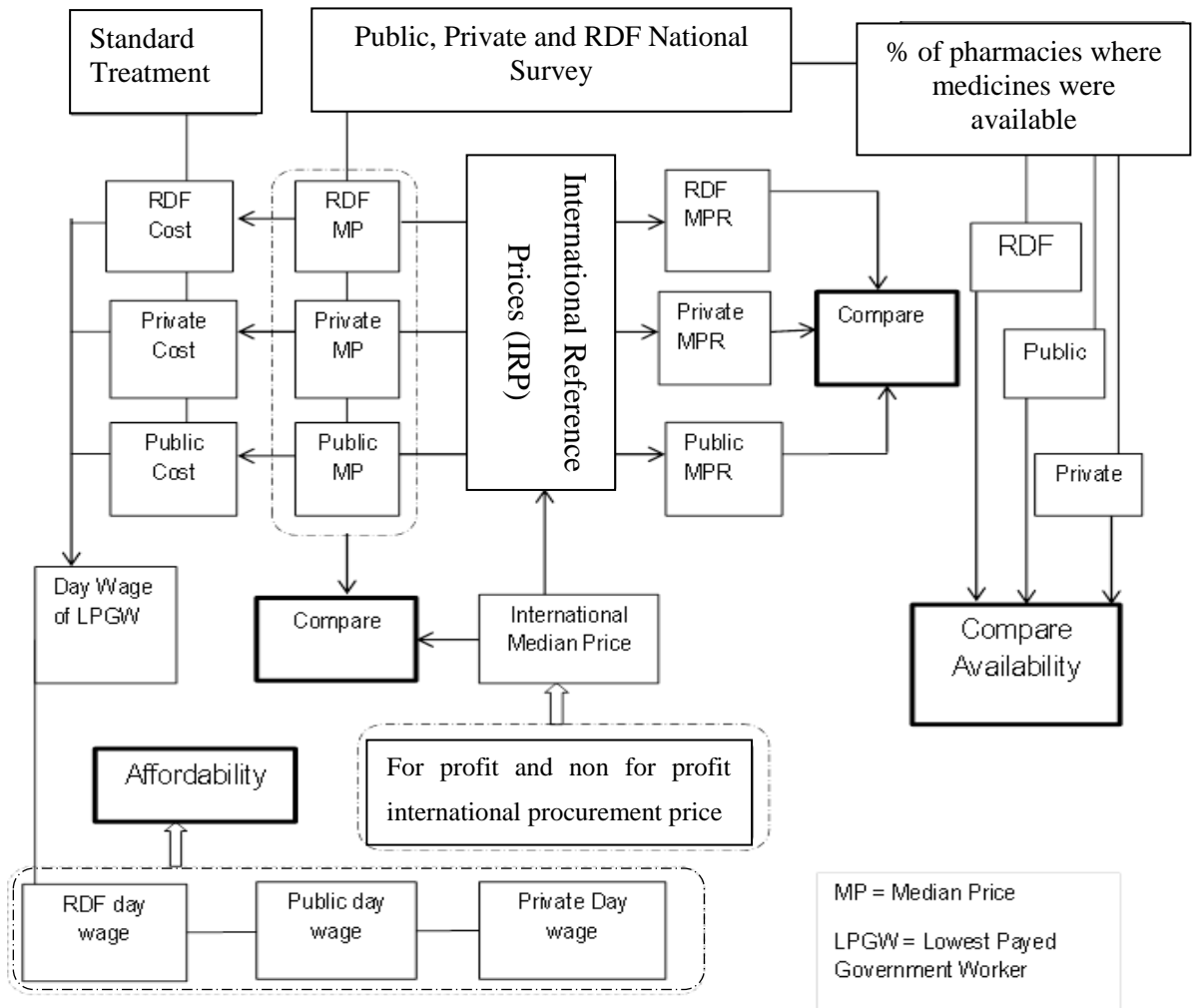
## CHAPTER III RESEARCH METHODOLOGY

This method adapted from WHO/HAI methodology developed to analyze prices, availability and affordability of essential medicines

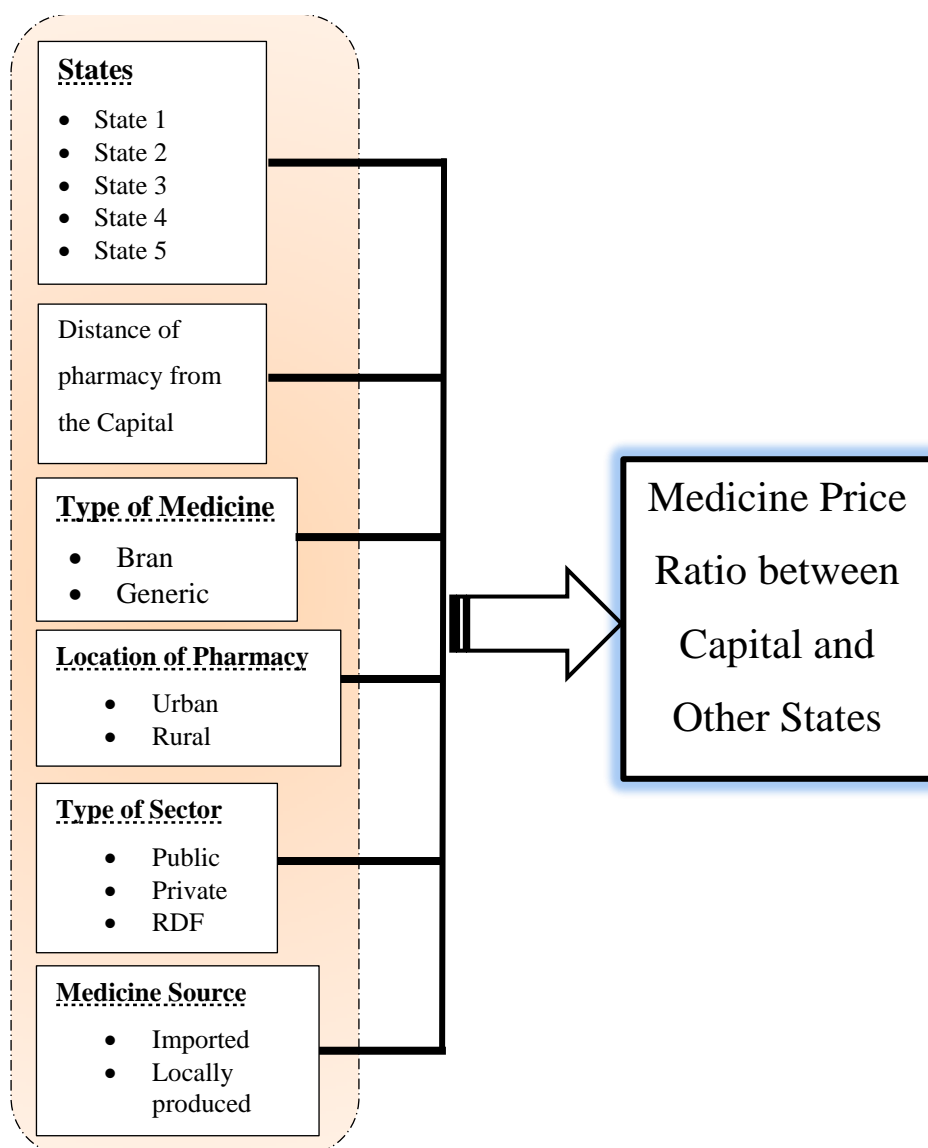
### 3.1. Study Design

This study is a descriptive cross sectional study aims to analyze the prices, availability, affordability of selected essential medicines in Sudan in 6 states, comparing public, private and RDF sectors with international reference prices, using primary and secondary data,

Figure 3. 1 Conceptual framework 1







### 3.2. Population and sampling

Study populations is essential medicines in Sudan, 50 essential medicines surveyed in six states, across private, public and RDF sectors in each 18 medicine outlets.

#### 3.2.1. Sampling method

Multi stage clustered sampling method

##### Stage 1: State selection

State selection: state of the capital selected purposively; because it is center of Sudan, higher population more than 7 million and base for all pharmaceutical companies, local manufacturer and National Medicines Regulatory Authorities. The

country then stratified in to 5 regions, North, South, East, West and conflict area, from each one state randomly selected. (Red Sea, River Nile, Sinnar, Gazeera and West Darfur) [See the map below]

Figure 3.3 Sudan Map



Sudan map

### Stage 2: Medicine outlets selection

In each selected state in stage 1,

Sectors were clustered to three sectors, the private, public and RDF sector. Then; Public medicine outlets selection: the pharmacy of outpatient care unit in regional public hospital purposively selected, because it represent the basic and standard public sector services, expected to have all essential medicines, the rest of the 5 medicine outlets were randomly selected from created list of public pharmacies within 3 hours traveling.

RDF and Private sector medicine outlets selection: for each selected public medicine outlet, 1 private and 1 RDF medicine outlets were randomly selected from predefined list of RDF and private medicine outlets created at beginning.

Table 3. 1 Number of pharmacies surveyed

| state       | Public   | Private  | RDF      |
|-------------|----------|----------|----------|
|             | Selected | Selected | Selected |
| Khartoum    | 6        | 6        | 6        |
| West Darfur | 6        | 5        | 4        |
| Sinnar      | 6        | 6        | 5        |
| Gazeera     | 6        | 6        | 5        |
| Red Sea     | 6        | 6        | 5        |
| River Nile  | 6        | 6        | 3        |
| Total       | 36       | 35       | 28       |

### Stage 3: Medicines selection

The 50 medicines surveyed:

- Global core list of 14 medicines specified by WHO, representative the global burden disease and common worldwide.
- Regional core list of 16, specified by WHO for EMRO region countries, they reflect and represent common disease treatment in the region.
- Supplementary list, 20 medicines selected according to Sudan health priority (See Appendix H ).

### 3.3. Data collection

6 pharmacist were trained, each in one state lead the survey with other two assistant pharmacist who were trained separately, a pilot survey conducted in two states and problems may face surveyors were defined.

### 3.4. Type of Data

Primary data from the country national survey and secondary data from IRP from MSH price indicators guidelines (see appendix B),

### 3.5. Data Collection

#### a- Primary data

### **3.5.1. Data collection tool**

The data collection tool designed and data were collected to the 50 selected essential medicines in

- Prices to patients (LPG and Brand) in private, public and RDF
- Government procurement prices
- The availability of selected medicines at survey time
- Manufacturers of the selected medicines
- Medicines pack size found.
- Location of the pharmacy, rural or urban
- Type of the medicine, (LPG or IB)
- Name of the medicine outlet

General information including; address, survey date, survey ID, surveyor's name, medicine outlet manager and comments

*(Data available in appendix B)*

### **3.5.2. Survey period**

The survey started on February 20, 2013 and finished on March 17, 2013

#### **b- Secondary data**

### **3.5.3. International Reference Prices (IRP)**

Median prices listed in the Management SMSH's International Drug Price Indicator Guide for 2011

### **3.5.4. Data for government procurement prices**

Data are collected centrally from secondary data from NHIF H.Q and Health Insurance Khartoum State (HIKS).

## **3.6. Data management**

### **3.6.1. Data quality**

Data entered to Excel file, three trained professional were hired for this job, it took them one week to finish it. From 103 listed form were selected to check the accuracy, then data were transformed to WHO/HAI work book, expert in HAI cross check all data and he picked some errors I fixed them all before analysis.

### 3.6.2. *Factors affecting patient's medicines price*

**The dependent variable:** the price ratio between the state of capital and other states to estimate prices variations between them, the capital where all pharmaceutical companies and drug authorities are located, high degree of competition and higher percentage of population, accordingly; medicines prices expected to be low

**Type of the sector:** whether it is private, public or RDF medicines outlets they are different in their objectives, e.g. the public sector's objective is not for profit as well as quasi-private (RDF) but the last has to provide the services and revolve the budget so few profit to cover overhead expenses, while private sector's objectives is completely for profit

**Source of medicines:** locally produced medicines is expected to be less price than those imported, although the pricing policy may affect that but still locally produced is expected to have less price than imported.

**Site of the medicine outlet:** we expect that medicines in urban area is less price than rural because the medicines warehouses and agents and the number of outlets in the urban can affect competition, also the cost transportation to the rural is higher than urban

**Distance of the selected state from the capital:** because all agents and local factories are concentrated in Capital, we expect that the near the state to the capital the less the prices of the medicine

**Type of the medicines:** brand medicines is expected to be higher in price than generic one due to cost of production which is very high at the beginning, mainly due to research and development

The expected signs of the coefficients are illustrated in table table (III-1) below

### 3.7. Operational definitions:

**Availability of medicine** is the percentage of medicines outlets where specific medicine is available at survey time.

**Affordability:** is the day wage of lowest paid unskilled government worker (LPGW) required to buy specific medicine, and that medicine price considered as affordable if it cost not more than one day wage.

**Median price ratio:** is the median retail price patient paid by patients or government procurement median price divided by median price of (IRP) from the MSH to see how far the medicine price is high or less depend on the ratio, e.g. if MPR is equal 2 that means the local price is high from international one by 2 fold.

### 3.8. Data analysis

I will use WHO/HAI standard workbook developed by WHO/HAI to analyze the data (Measuring medicine prices, availability, and affordability and price components) it is Excel Computerized Workbook can be downloaded from this website: <http://haiweb.org/medicineprices/manual/documents.html>, for the first part of analysis. While OLS to estimates coefficients of factors affecting medicine prices.

Unit price per tab/cap/ml/dose according to the specific medicine dosage form will be calculated considering the package size of the medicines.

#### 3.8.1. Availability

$$\text{Availability} = \frac{\text{All Medicine outlet where medicine available} \times 100}{\text{Total number of surveyed medicine outlets}}$$

Availability of individual medicine was calculated, then the availability in each individual sector was calculated, then different sectors were compared.

##### *d. Availability in the public sector*

$$= \frac{\text{Public Medicine outlet where medicine available}}{\text{whole public outlets surveyed}}$$

##### *e. Availability in the private sector*

$$= \frac{\text{Private Medicine outlet where medicine available}}{\text{whole private outlets surveyed}}$$

##### *f. And availability in RDF sector*

Then (d),(e) and (f) were compared

#### 3.8.2. Medicines prices

- **International comparison of the MPRs**

1. We picked up 2013 as base year for comparison, using MSH reference price 2011

2. MPR converted to Sudan specific prices

a. Multiply the appropriate MSH reference price to get the price in U.S. Dollar (USD)

b. Multiply (2a) times the relevance exchange rate used in the survey to obtain the local currency unit price.

3. Convert local currency to US dollars, this can be done by divide the local currency from (2b) by the official exchange rate for the U.S dollar in the time of the survey conducted (the period average exchange rate ).

4. Adjust for inflation/deflation: (because the different source of prices and difference in the times, e.g the survey in 2013, using MSH 2011 reference price, different prices from different countries for the comparison)

$$a1. \text{Deflation factor} = 1 - \frac{\text{SurveyYearUSCPI} - \text{BaseYearUSCPI}}{\text{BaseYearUSCPI}}$$

$$a2. \text{Inflation factor} = 1 + \frac{\text{SurveyYearUSCPI} - \text{BaseYearUSCPI}}{\text{BaseYearUSCPI}}$$

b. Multiply (4a1 or 4a2) times the price from (3) above

5. Recalculate MPR

Divide adjusted country prices from (3) or (4) above by the MSH reference price

### ***Inter-sectoral and regional variation in prices***

Compare between the MPR between the public private and RDF

- ***For the price comparison***

Calculate the MPR in each sector

$$a. \text{Median Price Ratio (MPR)} = \frac{\text{Median unit price from the Survey (public)}}{\text{Reference unit price from MSH}}$$

b. Median Price Ratio (MPR)

$$= \frac{\text{Median unit price from the Survey (Private)}}{\text{Reference unit price from MSH}}$$

Then compare [a] and [b] the individual medicines' price in the two sectors

- ***For government procurement prices***

*MPR for government procurement prices*

$$= \frac{\text{Government median procurement price}}{\text{International Reference Prices}}$$

### 3.8.3. Treatment affordability

Affordability of a disease treatments calculated based on lowest paid unskilled government worker.

- Calculate the minimum day's wage of unskilled government worker required to purchase disease's treatment using the National (MPR) as medicine price.
- We will calculate the affordability of treatment to the following disease in figure (III-1) where 10disease will be assessed for affordability

Table 3. 2 Standard Treatment affordability calculation

|    | Condition                | Medicine       | Strength   | Dosage Form | Treatment schedule                     |
|----|--------------------------|----------------|------------|-------------|--|
| 1  | Asthma                   | Salbutamol     | 0.1mg/dose | inhaler     | 1inhalor of 200 doses                  |
| 2  | Diabetes                 | Glibenclamide  | 5mg        | cap/tab     | 1cap/tab×2/day×30days = 60             |
| 3  | Hypertension             | Atenolol       | 50mg       | cap/tab     | 1cap/tab×30days = 30                   |
| 4  | Hypertension             | Captopril      | 25mg       | cap/tab     | 1cap/tab×2/day×30days = 60             |
| 5  | Hypercholesteromia       | Simvastatin    | 20mg       | cap/tab     | 1cap/tab×30days = 30                   |
| 6  | Depression               | Amitriptyline  | 25mg       | cap/tab     | 1cap/tab×3/day×30days = 90             |
| 7  | Adult RTI                | Ciprofloxacin  | 500mg      | cap/tab     | 1cap/tab×2/day for 7days = 14          |
| 8  | Pediatric RTI            | Co-trimoxazole | 8+40mg/ml  | suspension  | 5ml×2/days×7days = 70ml                |
| 9  | Adult RTI                | Amoxicillin    | 500mg      | cap/tab     | 1cap/tab×3/day ×7days = 21             |
| 10 | Adult RTI                | Ceftriaxone    | 1g/vial    | injection   | 1 injection                            |
| 11 | Anxiety                  | Diazepam       | 5mg        | cap/tab     | 1cap/tab×7day =7                       |
| 12 | Arthritis                | Diclofenac     | 50mg       | cap/tab     | 1cap/tab×2/day×30days = 60             |
| 13 | Pain/inflation pediatric | Paracetamol    | 24mg/ml    | suspension  | child1year: 120mg(=5ml)×3/day×3days=45 |
| 14 | Peptic ulcer             | Omeprazole     | 20mg       | cap/tab     | 1cap/tab×30days = 30                   |

Source: (WHO/HAI, 2008b)

### 3.8.4. Government procurement prices

Compare the generic government purchase price with IRP (MSH 2011), calculating the MPR

$$\text{Government Median Price Ratio} = \frac{\text{Government Median Procurement Price}}{\text{International Reference Price}}$$

### 3.8.5. Factors affecting patient's medicines prices

Use ordinary least square (OLS) for simple regression to analyze factors affecting patient's medicine price

The regression model:



$$\left(\frac{P_{State}}{P_{Capital}}\right)_i = \beta_0 \pm \beta_1 Sit_i \pm \beta_2 sector1_i + \beta_2 sector2_i \pm \beta_3 sour_i \pm \beta_4 typ_i \pm \beta_5 dist_i + \beta_6 state1_i + \beta_7 state2_i + \beta_8 state3_i + \beta_9 State4_i + \beta_{10} state5_i + \varepsilon_i$$

Where:

$\left(\frac{P_{State}}{P_{Capital}}\right)_i$  = the price ratio between medicines price in other states and medicine price in the capital of the *i*th medicine

$\beta_0$  : Constant term

$\beta_1 - \beta_{10}$  : the coefficients of the explanatory variables.

$sit_i$  : is dummy variable =1 if the site of the pharmacy is urban site, = 0 if rural site.

$sec1_i$  : is dummy variable =1 if the sector is private; otherwise = 0

$sec2_i$  : is dummy variable = 1 if the sector is RDF; otherwise = 0

$sour_i$  : is dummy variable = 1 if the medicine is imported, = 0 if locally produced

$typ_i$  : is dummy variable = 1 if the medicine is generic, = 0 if it is brand

$dist_i$  : Distance of the state from the capital in km

$state1$  : is dummy variable = 1 if the state is West Darfur; otherwise = 0

$State2$  : is dummy variable = 1 if the state is Gazeera; otherwise = 0

$State3$  : is dummy variable = 1 if the state is Sinnar; otherwise = 0

$State4$  : is dummy variable = 1 if the state is Red Sea; otherwise = 0

$State5$  : is dummy variable = 1 if the state is River Nile; otherwise = 0

$\varepsilon_i$  : is error term

Table 3. 3 Expected signs of the coefficients

| type of sector |         |        | source of med. |        | site of outlet |       | Distance | type of medicine |         |
|----------------|---------|--------|----------------|--------|----------------|-------|----------|------------------|---------|
| private        | Pubic   | RDF    | import         | local  | Urban          | Rural | +        | Brand            | Generic |
| +              | +       | +      | +              | +      | +              | +     |          | +                | +       |
| State 1        | State 2 | State3 | State4         | State5 |                |       |          |                  |         |
| +              | +       | +      | +              | +      |                |       |          |                  |         |

Sector type expected to have (+) sign, because moving from Khartoum out site to other state, medicine price will increase comparing Khartoum to other states and all other factors follow this expectation

**Factors affecting patient's medicines price**

Type of the sector: whether it is private, public or RDF medicines outlets they are different in their objectives, e.g. the public sector's objective is not for profit as well as quasi-private (RDF) but the last has to provide the services and revolve the budget so few profit to cover overhead expenses, while private sector's objectives is completely for profit

Source of medicines: locally produced medicines is expected to be less price than those imported, although the pricing policy may affect that but still locally produced is expected to have less price than imported.

Site of the medicine outlet: we expect that medicines in urban area is less price than rural because the medicines warehouses and agents and the number of outlets in the urban can affect competition, also the cost transportation to the rural is higher than urban

Distance of the selected state from the capital: because all agents and local factories are concentrated in Capital, we expect that the near the state to the capital the less the prices of the medicine

Type of the medicines: brand medicines is expected to be higher in price than generic one due to cost of production which is very high at the beginning, mainly due to research and development

## CHAPTER IV RESULTS AND DISCUSSIONS

This chapter presents the results of the study, which are divided into four parts. First part is the descriptive statistics of sample. Second part is prices, availability and affordability results. The third part is factors affecting medicine price results. The fourth part is the discussion of the whole result.

### 4.1. Descriptive statistics of sample

The sample consists of 50 item products (50 generics and its correspondent brands) with their strength and dosage form in smallest unit (tablet, capsule, ml) in 99 (35 public, 36 private and 28 RDF) pharmacies at six states (Table IV-1 below shows the count of surveyed pharmacies in each sector at different states)

The RDF medicine outlets were less than the other two sectors, because in River Nile state 3 RDF pharmacies were out of reach due to logistic obstacles, while in West Darfur; these were the RDF and public medicine outlets available within surveyed catchment area.

Table 4. 1 Pharmacy Surveyed at different Sectors

| State        | Public    | Private   | RDF       | Total     |
|--------------|-----------|-----------|-----------|-----------|
| Khartoum     | 6         | 6         | 6         | 18        |
| West Darfur  | 5         | 6         | 4         | 15        |
| River Nile   | 6         | 6         | 3         | 15        |
| Sinnar       | 6         | 6         | 5         | 17        |
| Gazeera      | 6         | 6         | 5         | 17        |
| Port Sudan   | 6         | 6         | 5         | 17        |
| <b>Total</b> | <b>35</b> | <b>36</b> | <b>28</b> | <b>99</b> |

3593 prices observations were collected from above mentioned pharmacies at the six states during February 17 to March 10, 2013, data of medicines origin (imported or locally produced), the types of medicines (brand or generic) and the pharmacy site (rural or urban) were collected besides. Table 4.2 shows the distribution of medicines among different states and sectors according to medicines origin (locally produced or imported) and (generic or brand). The reason the brand column is zero at locally produced medicines as they were all imported, no brand is produced in the

country. In the same table the study reveal that the locally produced items represents 57.9% from the whole items surveyed, while the imported generics was 33.7% and only 8.4% for the brand

Table 4. 2 Distribution of Medicines type and Origin

| State        | Sector  | Medicine Origin  |       |             |            |
|--------------|---------|------------------|-------|-------------|------------|
|              |         | locally Produced |       | imported    |            |
|              |         | Type of Medicine |       |             |            |
|              |         | Generic          | Brand | Generic     | Brand      |
| Khartoum     | Public  | 92               | 0     | 77          | 11         |
|              | Private | 156              | 0     | 108         | 77         |
|              | RDF     | 102              | 0     | 49          | 4          |
| West Darfur  | Public  | 113              | 0     | 36          | 5          |
|              | Private | 147              | 0     | 75          | 6          |
|              | RDF     | 63               | 0     | 24          | 3          |
| Gazeera      | Public  | 106              | 0     | 65          | 8          |
|              | Private | 125              | 0     | 112         | 42         |
|              | RDF     | 81               | 0     | 49          | 8          |
| Sinnar       | Public  | 127              | 0     | 38          | 5          |
|              | Private | 158              | 0     | 95          | 30         |
|              | RDF     | 64               | 0     | 36          | 7          |
| Port Sudan   | Public  | 151              | 0     | 74          | 12         |
|              | Private | 152              | 0     | 112         | 39         |
|              | RDF     | 100              | 0     | 65          | 3          |
| River Nile   | Public  | 142              | 0     | 66          | 7          |
|              | Private | 153              | 0     | 106         | 28         |
|              | RDF     | 48               | 0     | 24          |            |
| <b>Total</b> |         | 2080(57.9%)      |       | 1211(33.7%) | 302 (8.4%) |

Table 4. 3 Distribution of Generic and Brand medicine in the Public Sector

|              |                | Generic | Brand | Total  |
|--------------|----------------|---------|-------|--------|
|              |                |         |       |        |
| Khartoum     | Count          | 169     | 11    | 180    |
|              | % within State | 93.9%   | 6.1%  | 100.0% |
| West Darfur  | Count          | 149     | 5     | 154    |
|              | % within State | 96.8%   | 3.2%  | 100.0% |
| Gazeera      | Count          | 171     | 8     | 179    |
|              | % within State | 95.5%   | 4.5%  | 100.0% |
| Sinnar       | Count          | 165     | 5     | 170    |
|              | % within State | 97.1%   | 2.9%  | 100.0% |
| Red Sea      | Count          | 225     | 12    | 237    |
|              | % within State | 94.9%   | 5.1%  | 100.0% |
| River Nile   | Count          | 208     | 7     | 215    |
|              | % within State | 96.7%   | 3.3%  | 100.0% |
| <b>Total</b> | Count          | 1087    | 48    | 1135   |
|              | % within State | 95.8%   | 4.2%  | 100.0% |

Khartoum has the higher percentage of brand availability (6.1%), then Red Sea (5.1%), then Gazeera (4.5%), while the availability of the brand in River Nile was 3.3%, then West Darfur and Sinnar showed the lowest level of brands (3.2% and 2.9%) respectively. But generally the availability of brand in Sudan is very low (see table 4.2)

Table 4. 4 Count and Percentage of Generic and Brand in the Private Sector

|              |                | Generic | Brand | Total  |
|--------------|----------------|---------|-------|--------|
| Khartoum     | Count          | 264     | 77    | 341    |
|              | % within State | 77.4%   | 22.6% | 100.0% |
| West Darfur  | Count          | 222     | 6     | 228    |
|              | % within State | 97.4%   | 2.6%  | 100.0% |
| Gazeera      | Count          | 237     | 42    | 279    |
|              | % within State | 84.9%   | 15.1% | 100.0% |
| Sinnar       | Count          | 253     | 30    | 283    |
|              | % within State | 89.4%   | 10.6% | 100.0% |
| Red Sea      | Count          | 264     | 39    | 303    |
|              | % within State | 87.1%   | 12.9% | 100.0% |
| River Nile   | Count          | 259     | 28    | 287    |
|              | % within State | 90.2%   | 9.8%  | 100.0% |
| <b>Total</b> | Count          | 1499    | 222   | 1721   |
|              | % within State | 87.1%   | 12.9% | 100.0% |

In the private sector Khartoum has higher frequencies of generics 264 and higher frequencies of IB 77 compare to other states, however Res Sea has the same generic frequencies 264 but less IB 39 than Khartoum, West Darfur has the lesser frequencies of generics and IB (6) (See table 4.4)

Table 4. 5 Count and Percentage of Generic and Brand in the RDF Sector

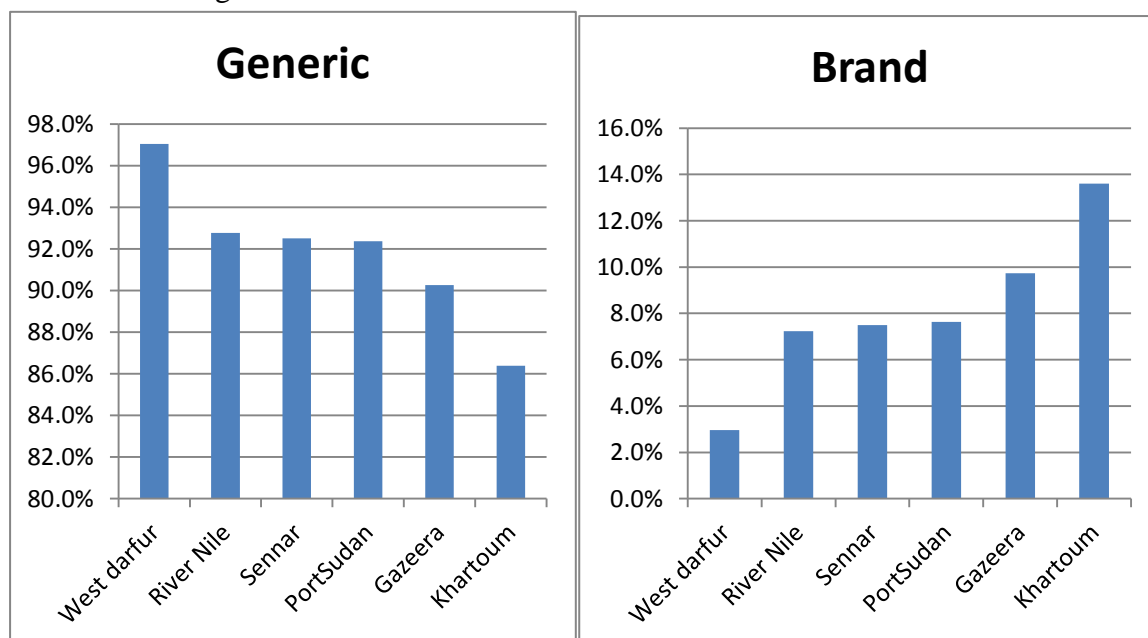
|             |                | Generic | Brand | Total  |
|-------------|----------------|---------|-------|--------|
| Khartoum    | Count          | 151     | 4     | 155    |
|             | % within State | 97.4%   | 2.6%  | 100.0% |
| West Darfur | Count          | 87      | 3     | 90     |
|             | % within State | 96.7%   | 3.3%  | 100.0% |
| Gazeera     | Count          | 130     | 8     | 138    |
|             | % within State | 94.2%   | 5.8%  | 100.0% |
| Sinnar      | Count          | 100     | 7     | 107    |
|             | % within State | 93.5%   | 6.5%  | 100.0% |
| Red Sea     | Count          | 165     | 3     | 168    |
|             | % within State | 98.2%   | 1.8%  | 100.0% |
| River Nile  | Count          | 72      | 7     | 79     |
|             | % within State | 91.1%   | 8.9%  | 100.0% |

In RDF sector Red Sea State has the higher frequencies of generics (165) then Khartoum state (151), while the higher level of frequencies in IB was in Sinnar and River Nile states (7), while the later has the lowest generic frequencies 72. But West Darfur and Red Sea has the lowest frequencies of IB (3) (see table IV- 5)

Table 4. 6 Count and Percentage of Generic and Brand in All three Sectors

|             |                | <b>Generic</b> | <b>Brand</b> | <b>Total</b> |
|-------------|----------------|----------------|--------------|--------------|
| Khartoum    | Count          | 584            | 92           | 676          |
|             | % within State | 86.4%          | 13.6%        | 100.0%       |
| West Darfur | Count          | 458            | 14           | 472          |
|             | % within State | 97.0%          | 3.0%         | 100.0%       |
| Gazeera     | Count          | 538            | 58           | 596          |
|             | % within State | 90.3%          | 9.7%         | 100.0%       |
| Sinnar      | Count          | 518            | 42           | 560          |
|             | % within State | 92.5%          | 7.5%         | 100.0%       |
| Red Sea     | Count          | 654            | 54           | 708          |
|             | % within State | 92.4%          | 7.6%         | 100.0%       |
| River Nile  | Count          | 539            | 42           | 581          |
|             | % within State | 92.8%          | 7.2%         | 100.0%       |
| Total       | Count          | 3291           | 302          | 3593         |
|             | % within State | 91.6%          | 8.4%         | 100.0%       |

Figure 4. 1 Brand Generic Distribution in different States



In figure IV- 1 above, West Darfur state showed higher percentage of generic (97%) when compared to brands, while Khartoum states shows 86% of the items

surveyed were generic and 14% for IBs, States like Red Sea, Sinnar and River Nile have the same level of generics (> 92%)

Tables 4.3, 4.4, 4.5, 4.6 summarizes the percentage of brand and generic among different states through the three sectors to reflect what is shown in figure 4.1 above.

Table 4. 7 Summary of Generic/Brand found according to Sectors

| Type of Medicine | State       | Sector |         |      | Total |
|------------------|-------------|--------|---------|------|-------|
|                  |             | public | private | RDF  |       |
| Generic          | Khartoum    | 169    | 264     | 151  | 584   |
|                  | West Darfur | 149    | 222     | 87   | 458   |
|                  | Gazeera     | 171    | 237     | 130  | 538   |
|                  | Sinnar      | 165    | 253     | 100  | 518   |
|                  | Red Sea     | 225    | 264     | 165  | 654   |
|                  | River Nile  | 208    | 259     | 72   | 539   |
|                  | Total       |        | 1087    | 1499 | 705   |
| Brand            | Khartoum    | 11     | 77      | 4    | 92    |
|                  | West Darfur | 5      | 6       | 3    | 14    |
|                  | Gazeera     | 8      | 42      | 8    | 58    |
|                  | Sinnar      | 5      | 30      | 7    | 42    |
|                  | Red Sea     | 12     | 39      | 3    | 54    |
|                  | River Nile  | 7      | 28      | 7    | 42    |
|                  | Total       |        | 48      | 222  | 32    |
| <b>Total</b>     | Khartoum    | 180    | 341     | 155  | 676   |
|                  | West Darfur | 154    | 228     | 90   | 472   |
|                  | Gazeera     | 179    | 279     | 138  | 596   |
|                  | Sinnar      | 170    | 283     | 107  | 560   |
|                  | Red Sea     | 237    | 303     | 168  | 708   |
|                  | River Nile  | 215    | 287     | 79   | 581   |
|                  | Total       |        | 1135    | 1721 | 737   |

In table 4.7 and figure 4.2 and figure 4.3 explain items frequencies, the frequencies of the generics in the private sector was 1499, 1087 the public sector and 705 for the RDF sector. The frequencies of the IBs as revealed by this study 222, 48 and 32 respectively.

Figure 4. 2 Distribution of Brands in States According to Sectors

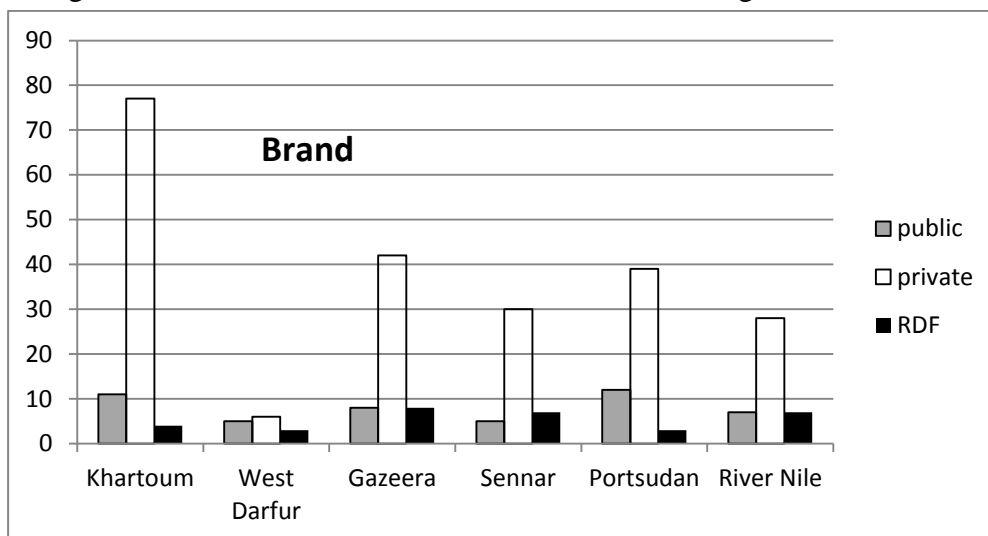
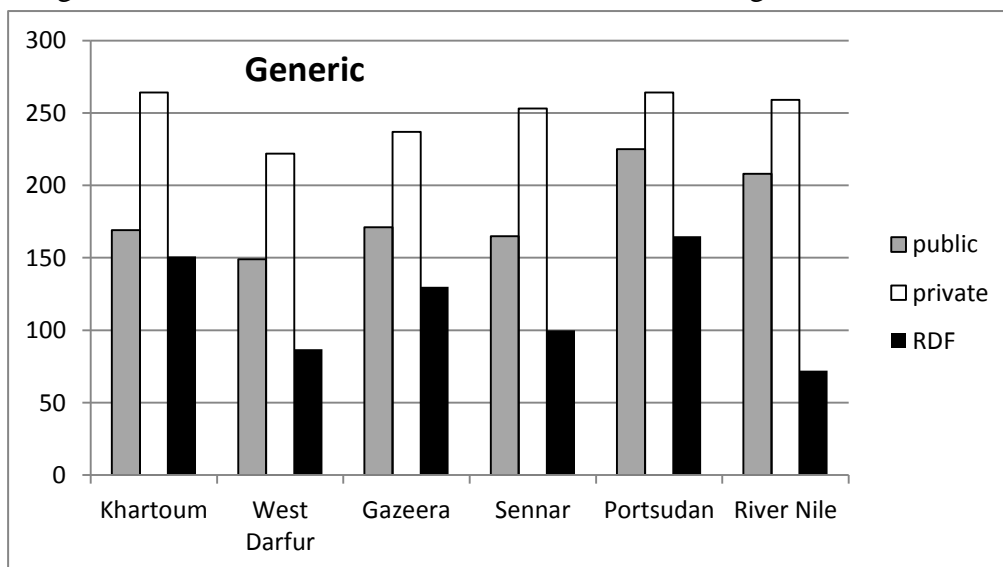


Figure 4. 3 Distribution of Generics in States According to Sectors



Private sector as shown in figure 4.2 and 4.3 has the high frequencies of generic and brand than the public sector.

cost at the level not to exceed their management capacity which depend mainly on the central tender supply system that supply the state NHIF pharmacies each three month (4<sup>th</sup> times a year), this in January, April, July and October, and the survey conducted during last ten days of February and 1<sup>st</sup> 10 days of March where the supply usually be at the lowest level.



There higher number of the generic found in the public sector was in Port Sudan (225generic). While the lowest was West Darfur (149generic) which is the most far state from the capital, followed by Khartoum State (169 generic) and this mainly because the public medicine outlets at Khartoum state taken in this study managed by the hospitals, while other public facilities at other states managed by NHIF. But the private sector has higher frequencies of generics for the same reason mentioned before, Khartoum and Port Sudan recorded the highest number of generics in the sector (265) , economically the two states considered as the best in the country where the economic and commercial activities is very high. The RDF sector which recorded the lowest frequencies of generic, we observed that Port Sudan was the best (165) and River Nile (72) was the least.

## 4.2. Medicine prices

### 4.2.1. *The Median Price Ratios (MPRs)*

Table 4. 8 Median MPR for Medicines with Minimum No. of Prices in all sectors

|                     | <b>GPP</b> | <b>Public</b> | <b>Private</b> | <b>RDF</b> |
|---------------------|------------|---------------|----------------|------------|
| <b>Brand</b>        |            | 2.67          | 4.24           | 1.88       |
| <b>Lowest Price</b> | 1.84       | 2.98          | 2.90           | 2.70       |

The results in table IV-1 show that the government procurement prices (GPP) for generics is 1.84 times the international reference prices, while the brand named medicines were sold in public sector 2.67 times it is international reference prices, 4.24 in the private sector and 1.88 in the RDF sector, at the same time the lowest price generics was sold in 2.98 times it is international reference price, 2.9 in the private sector and 2.7 in the RDF sector.

### 4.2.2. *Government procurement prices*

Table 4. 9 Median of MPR of GPP of all medicines

| Product type                               | Median MPR | 25 <sup>th</sup> percentile | 75 <sup>th</sup> percentile |
|--|------------|-----------------------------|-----------------------------|
| Lowest price generic<br>(n = 49 medicines) | 1.84       | 1.16                        | 3.24                        |

Of the 50 medicines included in this national survey, 49 generics were found the public sector as procurement prices, the public sector surveyed is exclusively procuring generic medicines, regarding the MPR, the public sector procuring generic at 1.84 times their international reference prices, so the government procuring at fair efficiency, the interquartile range revealed moderate variation across individual medicines.

Generic medicines being purchased at prices less than IRP include Hyoscine - N-Butylbromide (0.88), Norethiesterone 5mg tablet (0.82), Oral rehydration Salt (0.81), Lisinopril 5mg tablet (0.79), Salbutamol syrup (0.65), Atorvastatin 20mg (0.63), Gliclazide 80mg tablet (0.56), Amlodipine 5mg tablet (0.56), Insulin soluble (0.43) and Artemether 80mg injection (0.36). On the other hand, medicines for which the public sector is paying several times the international (IRP) include Diclofenac 50mg (23.16), Ferrous Sulphate + folic acid (12.2) and Fluoxetine 20mg tab (8.06)

[See Appendix L contains procurement prices for individual medicines]

#### **4.2.3. Public sector retail prices**

Table 4. 10 The Median of MPR in public sector retail prices

| Product type                            | Median MPR | 25 <sup>th</sup> percentile | 75 <sup>th</sup> percentile |
|---|------------|-----------------------------|-----------------------------|
| Originator brand (n = 3 medicines)      | 2.67       | 1.68                        | 3.24                        |
| Lowest price generic (n = 49 medicines) | 2.98       | 1.66                        | 4.69                        |

The results shown in table IV-2 above explain that the originator brand products are generally sold at 2.67 times their international reference price. Half of the originator brand medicines were priced at 1.68 (25<sup>th</sup> percentile) to 3.24 (75<sup>th</sup> percentile) times their international reference price; there is therefore moderate variation in MPRs across individual originator brand medicines in the public sector.

Lowest price generic medicines are almost sold at 2.98 times their international reference price. Half of the lowest priced generic medicines were priced at 1.66 (25<sup>th</sup> percentile) to 4.69 (75<sup>th</sup> percentile) times their IRP; therefore, there is moderate variation in MPRs across individual lowest price generics in the public sector.

Table 4. 11 The Median of MPR in RDF sector retail prices

| Product type                            | Median MPR | 25 <sup>th</sup> percentile | 75 <sup>th</sup> percentile |
|---|------------|-----------------------------|-----------------------------|
| Originator brand (n = 6 medicines)      | 1.88       | 1.09                        | 3.89                        |
| Lowest price generic (n = 46 medicines) | 2.70       | 1.88                        | 4.24                        |

The results shown in table IV-3 above in the RDF sector, the originator brand drugs are almost retailed at 1.88 times their international reference price. 50% of the brand drugs were priced at 1.09 (25<sup>th</sup> percentile) to 3.89 (75<sup>th</sup> percentile) times their international reference price; hence moderate variation in MPRs across individual IB medicines in the public sector.

Lowest price generic medicines are sold at 2.70 times their international reference price and 50% of generic medicines were retailed at 1.88 (25<sup>th</sup> percentile) to 4.24 (75<sup>th</sup> percentile) times their international reference price; hence there is moderate variation in MPRs across individual generic drugs in the RDF sector.

Brand products priced several folds more than IRPs include Carbimazole 5mg tablet (MPR = 3.81) and Salbutamol inhaler (MPR = 2.67). The 25<sup>th</sup> and 75<sup>th</sup> percentiles for individual medicines show that, for originator brands, there are no significance variations between public sector pharmacies. Generic products were retailed at prices several times more the IRPs include Diclofenac 50mg tablet (MPR = 29.3), Ferrous sulphate + folic acid (MPR = 21.22), Ceftriaxone 1g injection (MPR = 12.96). The 25<sup>th</sup> and 75<sup>th</sup> percentiles for individual medicines show that, for generic medicines, prices vary significantly between public sector pharmacies.

[See Appendix N contains the median price ratios for individual medicines found in the public sector]

#### ***4.2.4. Comparison of retail and procurement prices in the public sector***

Table 4. 12 MPR for medicines found in procurement and retail public sector

| Product type                                   | Median MPR Public Procurement | Median MPR Public Patient Prices | % difference patient prices to procurement |
|--|-------------------------------|----------------------------------|--|
| <b>Lowest price generic (n = 49 medicines)</b> | 1.75                          | 2.84                             | 62.4%                                      |

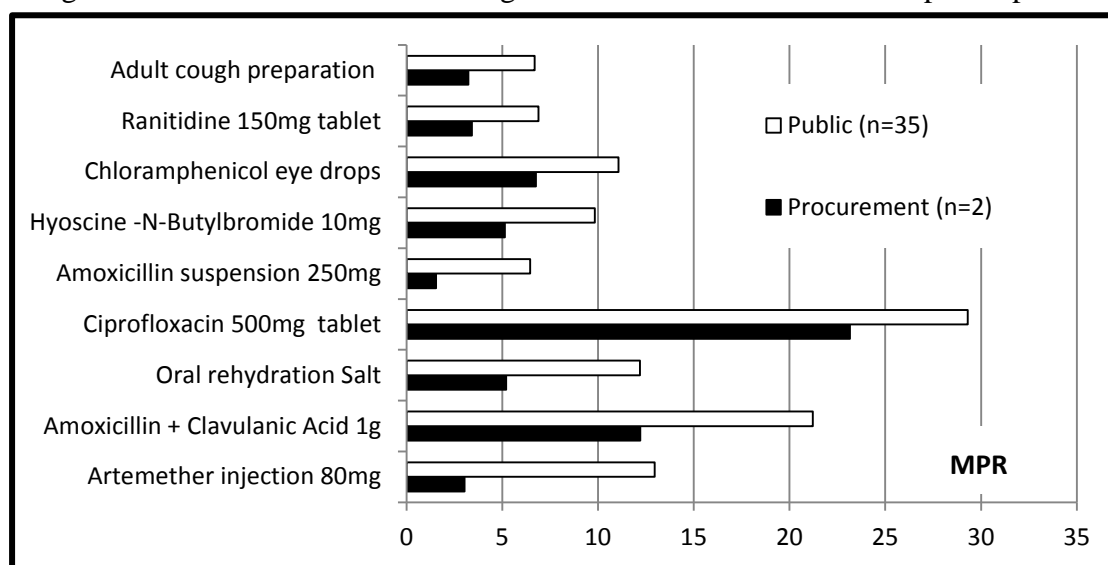
Table IV-4, to allow comparison between procurement prices and retail prices in public sector only medicines found in both public procurement and public sector pharmacies were included in the analysis. Results show that final retail prices in the public sector are 62.4% more than procurement prices for lowest price generics

Table 4. 13 MPR for medicines found in procurement and retail public sector

| Product type                               | Median MPR<br>Public Procurement | Median MPR<br>Public Patient Prices | % difference patient<br>prices to procurement |
|--|----------------------------------|-------------------------------------|---|
| Lowest price generic<br>(n = 49 medicines) | 1.84                             | 2.61                                | 41.9%   |

Results show that final patient prices in the RDF sector are 41.9% higher than procurement prices for generic. Form results shown in two tables above, The RDF sector has lower mark-up when compared to other public sector, the difference in mark-up reached up to 20%.

Figure 4. 4 Differences in selected generics between GPP and retail public prices



The figure above show the differences between government procurement prices and the retail prices in public sectors outlets, only Artemether injection 80mg, Amoxicillin suspension 250mg/5ml and Oral rehydration salts have difference more than 50%.

#### 4.2.5. Private sector retail prices

The originator brand drugs are almost retailed at price 4.24 times their international reference price. 50% of IB products were priced at 3.32 (25<sup>th</sup> percentile) to 8.18 (75<sup>th</sup> percentile) times their correspondent IRPs; hence there are substantial differences in MPRs across individual IB products in the private sector.

Lowest price generic medicines are generally sold at 2.9 times their international reference price. Half of the lowest priced generic medicines were priced at 2.01 (25<sup>th</sup> percentile) to 5.18 (75<sup>th</sup> percentile) times their international reference price; there is therefore substantial variation in MPRs across individual generic medicines in the public sector. [see table IV-5 below and Appendix O contains the median price ratios for individual medicines found in the private sector ]

Table 4. 14 The median of MPRs in private sector for all medicines

| Product type                               | Median MPR | 25 <sup>th</sup> percentile | 75 <sup>th</sup> percentile |
|--|------------|-----------------------------|-----------------------------|
| Originator brand<br>(n = 14 medicines)     | 4.24       | 3.32                        | 8.18                        |
| Lowest price generic<br>(n = 50 medicines) | 2.90       | 2.01                        | 5.18                        |

Brand named products were retailed at prices several times more than IRPs include, Atenolol 50mg tablet (MPR = 31.52), Paracetamol 500mg tablet (MPR = 13.08), Carbimazole 5mg tablet (MPR = 12.02). The 25<sup>th</sup> and 75<sup>th</sup> percentiles for individual products proof that, for brands, prices vary obviously between private sector pharmacies. LPG medicines retailed at prices number of times more than international reference prices include Diclofenac 50mg tablet (MPR = 27.13), Ferrous sulphate + folic acid capsule (MPR = 19.45), Artesunate 100mg tablet (MPR = 9.83). The 25<sup>th</sup> and 75<sup>th</sup> percentiles for individual medicines tell that, there is no significant variation between private sector pharmacies.

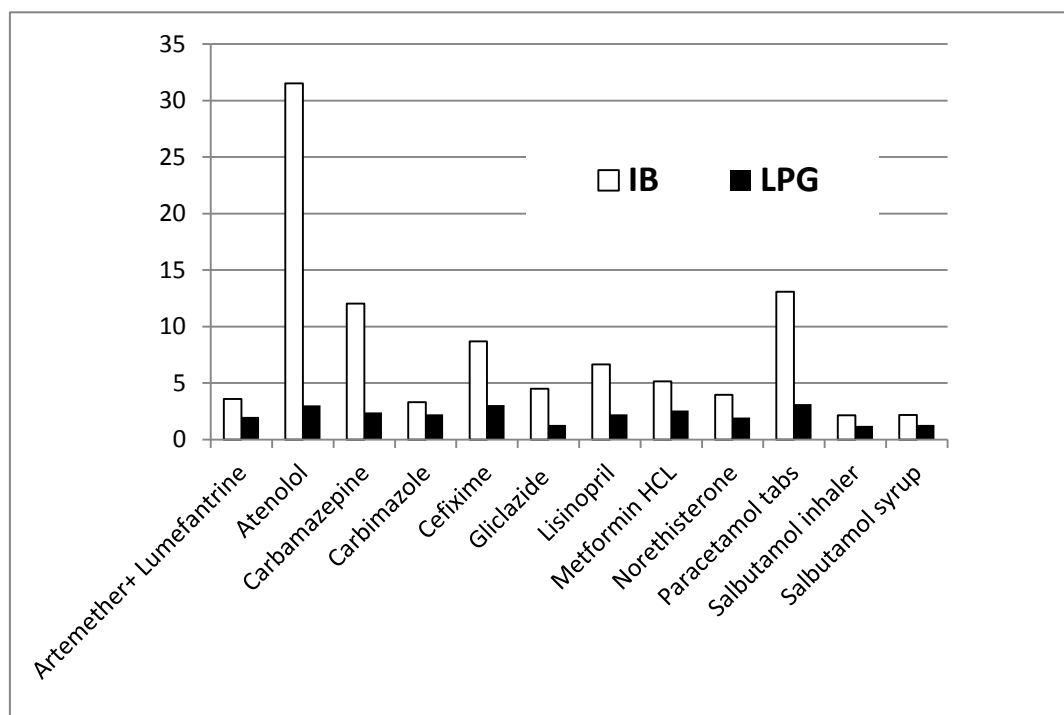
Table 4. 15 Comparison of MPRs of IB and LPG in private sector

| Type (n = 14 medicines) | Median MPR | 25 %ile | 75 %ile |
|-------------------------|------------|---------|---------|
| Originator brand        | 4.24       | 3.32    | 1.44    |
| Lowest price generic    | 2.10       | 8.18    | 2.53    |

In table IV-6 above, only those medicines, for which both OB and LPG equivalent product were found, were included in the analysis to allow for the comparison of MPs between the two medicines types. Findings show that in the

private sector, OB cost 100% more, than their LPG equivalent. There for, people are paying more when prescribed to OB than LPG.

Figure 4. 5 MPR for selected OB and LPG in private sector



The results the figure above show that the MPRs of selected OB and their equivalent LPG, the MPR of OB is generally high than those for lowest price generics, the highest difference were found in Atenolol 50mg tablet and Paracetamol 500mg tablet, the MPR within individual OB vary substantially.

#### 4.2.6. Comparison of retail prices in public, RDF and private sectors

Table 4. 16 Comparison of MPRs between public and private sectors

| Product type                               | Median MPR<br>Public sector patient<br>prices | Median MPR<br>Private sector patient<br>prices | % difference private to<br>public |
|--|---|--|-----------------------------------|
| Originator brand<br>(n = 3 medicines)      | 2.67  | 2.14   | -20.0%                            |
| Lowest price generic<br>(n = 49 medicines) | 2.98  | 2.82   | -5.3%                             |

In table IV-7 above, the analysis was restricted to medicines available in both sectors, to compare prices between them. Results show that final retail prices in the

private sector are 20.0% and 5.3% lower than in the public sector for OBs and generic equivalents, respectively.

Table 4. 17 Median MPRs for medicines found in both private and RDF sectors

| Product type                               | Median MPR<br>RDF sector patient prices | Median MPR<br>Private sector patient prices | % difference private<br>to RDF |
|--|---|---|--------------------------------|
| Originator brand<br>(n = 6 medicines)      | 1.88                                    | 2.88  | 34.5%                          |
| Lowest price generic<br>(n = 46 medicines) | 2.70                                    | 3.00  | 9.9%                           |

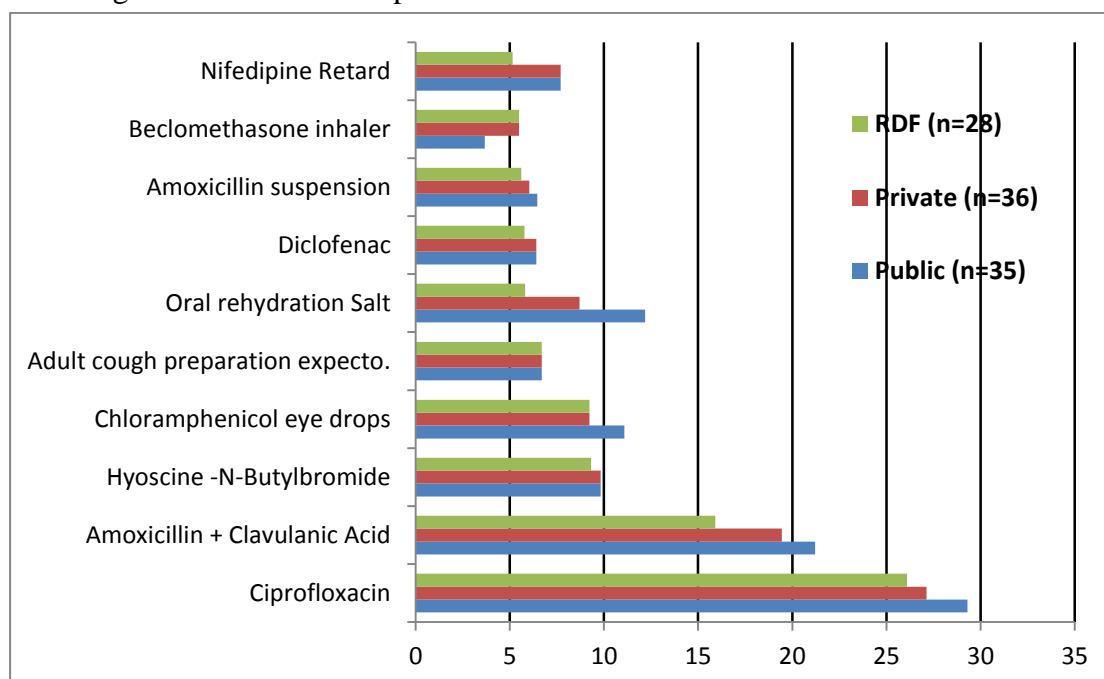
In the above table, comparison analysis for only the medicines those available private and RDF sectors was. Findings revealed that final patient prices in the private sector are 34.5% and 9.9% more than in the RDF sector for OBs and LPGs equivalents, respectively. However the availability of drugs in the RDF sector is low, patients are paying substantially higher retail prices to purchase medicines from the private sector and other public sector pharmacies (NHIF).

In the table below, only OBs and LPGs found in both sectors were included in the analysis to allow for the comparison of prices between the two types of public sectors (NHIF and RDF) to know the variation within the same sector but different context and objectives. Results show that final patient prices in the public sector are 47.2% and 11.3% higher than in the RDF sector for OBs and LPGs equivalents, respectively.

Table 4. 18 Median MPRs for medicines found in both public and RDF sectors

| Product type                               | Median MPR<br>RDF sector patient<br>prices | Median MPR<br>Public sector patient<br>prices | % difference<br>public to RDF |
|--|--|---|-------------------------------|
| Originator brand<br>(n = 6 medicines)      | 0.89                                       | 1.68  | 47.2%                         |
| Lowest price generic<br>(n = 46 medicines) | 2.70                                       | 3.05  | 11.3%                         |

Figure 4. 6 MPRs comparisons for a selected medicines across all sectors



#### 4.2.7. Regional analysis

##### *Comparison of prices and availability across the six regions surveyed*

As shown in table IV-8 below, the median MPR for LPGs in the private sector differed clearly across all surveyed six states (ANOVA test prove that there is significant different in prices between the six states surveyed, see table 4.7). Drugs retail prices were lowest in Khartoum State and highest in Wes Darfur State. Median MPRs for OBs vary from 2.82 in River Nile to 7.8 in Gazeera State. Median MPRs for LPGs ranged between 2.61 in Khartoum State to 3.71 in West Darfur.

Table 4. 19 ANOVA test, prices variations among states

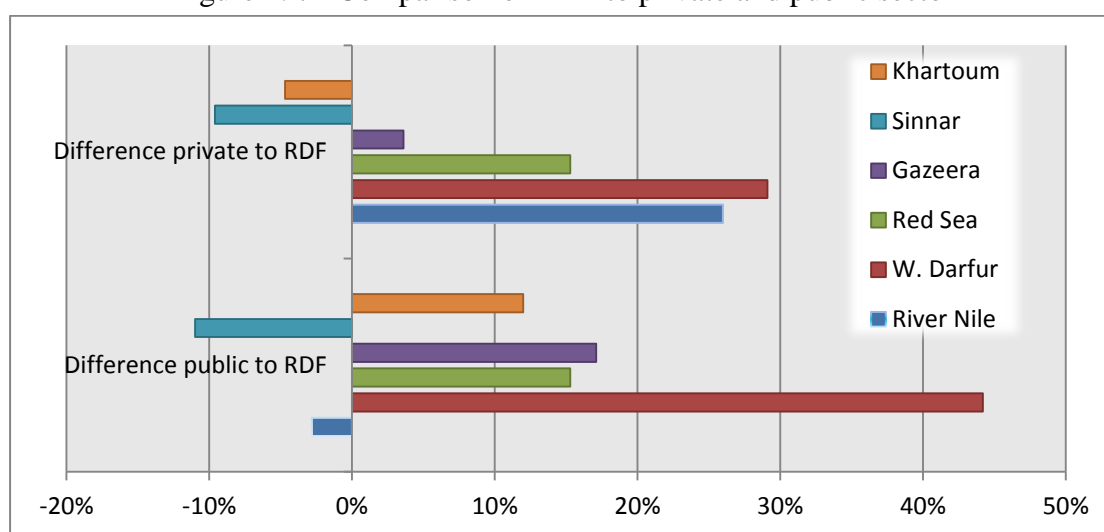
|                | Sum of Squares | df   | Mean Square | F     | Sig. |
|----------------|----------------|------|-------------|-------|------|
| Between Groups | 1700.541       | 387  | 4.394       | 1.548 | .000 |
| Within Groups  | 9097.009       | 3205 | 2.838       |       |      |
| Total          | 10797.550      | 3592 |             |       |      |



Table 4. 20 Median MPRs per survey area, private sector

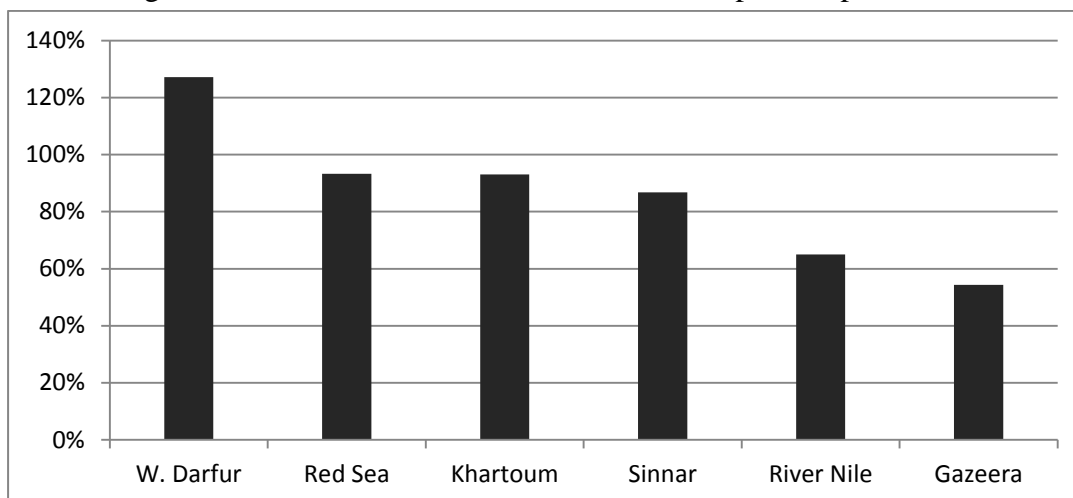
|                                  | River Nile | W. Darfur | Red Sea   | Gazeera   | Sinnar    | Khartoum  |
|----------------------------------|------------|-----------|-----------|-----------|-----------|-----------|
| Median MPR                       | (2 meds)   | (0 meds)  | (6 meds)  | (4 meds)  | (2 meds)  | (9 meds)  |
| Originator brand                 | 2.82       | --        | 4.9       | 7.8       | 7.02      | 3.47      |
| Median MPR                       | (44 meds)  | (36 meds) | (45 meds) | (41 meds) | (46 meds) | (45 meds) |
| Lowest price generic             | 3.06       | 3.71      | 3.01      | 2.84      | 2.86      | 2.61      |
| Difference public to RDF         | - 2.8 %    | 44.2%     | 15.3%     | 17.1%     | - 11%     | 12%       |
| Difference private to RDF        | 26.0%      | 29.1 %    | 15.3      | 03.6%     | - 9.6%    | - 4.7%    |
| Difference public to procurement | 65.0%      | 127.2%    | 93.3%     | 54.3%     | 86.8%     | 93.1%     |

Figure 4. 7 Comparison of RDF to private and public sector



The above figure show the results that common case in all states that RDF sector has lowest MP when compared to private and public sector, except in River Nile where public sector has lower prices than RDF, while in Sinnar RDF has higher prices than private and public sector. However the difference in the public sector is slightly higher. In Khartoum state, the private sector prices were set at level lower than RDF prices.

Figure 4. 8 Difference between GPP and retail price in public sector



In the figure IV-1 above the highest difference between the government procurement prices and public sector price found in West Darfur (more than 120%), and the lowest difference was in Gazeera State (less than 60%)

### 4.3. The availability of surveyed medicines

Table 4. 21 Mean availability of medicines, public, RDF and private sectors

|              | Public Sector (n=35 outlets) |                           | Private Sector (n=36 outlets) | RDF Sector (n=28 outlets) |
|--------------|------------------------------|---------------------------|-------------------------------|---------------------------|
|              | All medicines (n=49)         | EML medicines only (n=45) | all medicines (n=50)          |                           |
| Brand        | 3.7% (Std 9.9%)              | 4%                        | 14.4%                         | 4.5%                      |
| Lowest Price | 68.1% (Std 25.7%)            | 68.2%                     | 83.9%                         | 55.4%                     |

Average availability of all survey medicines in the public sector was fair at 68.1% and 55% for RDF. When analysis is limited to survey medicines listed on the national EML, public sector availability stays constant at 68.2%.for public, while it slightly increase for RDF to 55.4%.In the public sector, generics were the highest available Also the in the RDF.

Average availability in the private sector was good at 83.9%, generics were the predominant product type available. In the private sector, medicine availability was higher than that of the two public sectors.

Appendix L contains the availability of individual medicines in both public and private sectors. In the public sector, medicines with particularly low availability include Salbutamol inhaler (14.3%), Salbutamol syrup (14.3%), Simvastatin (0.0%).

In the RDF sector, medicines with particularly low availability include Salbutamol inhaler (0.0%), Salbutamol syrup (0.0%), Simvastatin (0.0%). In the private sector, medicines with particularly low availability include Salbutamol inhaler (16.7%), Salbutamol syrup (16.7%), Simvastatin (0.0%)

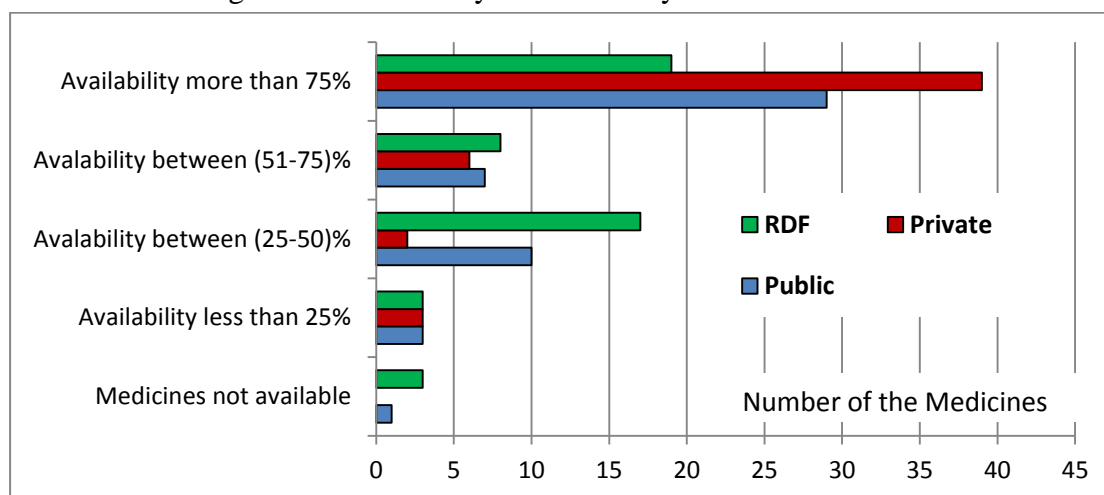
Table 4. 22 Summary of individual Drug availability in public sector

|   |   |   |
|---|---|---|
| Medicines not found in any outlets          | 1. Simvastatin 20mg tablet  |   |
| Medicines found in less than 25% of outlets | <ol style="list-style-type: none"> <li>1. Salbutamol syrup</li> <li>2. Glibenclamide 5mg tablet</li> <li>3. Salbutamol inhaler</li> </ol>   |   |
| Medicines found in 25 to 50% of outlets     | <ol style="list-style-type: none"> <li>1. Chloramphenicol eye drops</li> <li>2. Nifedipine Retard 20mgtablet</li> <li>3. Ciprofloxacin 500mg tablet</li> <li>4. Metronidazole 500mg tablet</li> <li>5. Ranitidine 150mg tablet</li> <li>6. Hyoscine -N-Butylbromide</li> <li>7. Omeprazole 20mg tablet</li> <li>8. Ibuprofen 400mg tablet</li> <li>9. Metronidazole 250mg tablet</li> <li>10. Oral rehydration Salt</li> </ol>  |   |
| Medicines found in 50 to 75% of outlets     | <ol style="list-style-type: none"> <li>1. Dexamethasone injection</li> <li>2. Lisinopril 10mg tablet</li> <li>3. Atorvastatin 20mg tablet</li> <li>4. Cefixime 400mg capsule</li> <li>5. Norethiesterone 5mg tablet</li> <li>6. Amoxicillin +ClavulanicAcid1g</li> <li>7. Paracetamol tabs 500mg</li> <li>8. Furosemide 40mg tablet</li> <li>9. Metformin HCL 500mg tablet</li> </ol>   |   |
| Medicines found in over 75% of outlets      | <ol style="list-style-type: none"> <li>1. Amitriptyline 25mg tablet</li> <li>2. Amoxicillin suspension</li> <li>3. Artemether injection</li> <li>4. Artesunate 50mg tablet</li> <li>5. Ceftriaxone injection 1g</li> <li>6. Adult cough preparation</li> <li>7. Beclomethasone inhaler</li> <li>8. Albendazole 200mg tablet</li> <li>9. Captopril 25mg tablet</li> <li>10. Carbamazepine 200mg tab</li> <li>11. Amoxicillin 500mg capsule</li> <li>12. Gliclazide 80mg tablet</li> <li>13 Paracetamol suspension</li> </ol> | <ol style="list-style-type: none"> <li>1. Diazepam 5mg tablet</li> <li>2. Insulin, Neutral Soluble</li> <li>3. Amlodipine 5mg tablet</li> <li>4. Amoxicillin + Clavulanic Acid</li> <li>5. Atenolol 50mg tablet</li> <li>6. Diclofenac 25mg tablet</li> <li>7. Ferrous Sulphate + Folic acid</li> <li>8. Fluoxetine 20mg tablet</li> <li>9. Carbimazole 5mg tab</li> <li>10. Artemether+ Lumefantrine</li> <li>11. Artesunate 100mg tablet</li> <li>12. Azithromycin suspension</li> <li>13. Co-trimoxazole suspension</li> <li>14. Diclofenac 50mg tablet</li> </ol> |

Table 4. 23 Summary of individual Drug availability in private sector

| Medicines not found in any outlets  | No medicine  |
|---|--|
| Medicines found in less than 25% of outlets   | <ol style="list-style-type: none"> <li>1. Salbutamol syrup</li> <li>2. Salbutamol inhaler</li> <li>3. Simvastatin 20mg tablet</li> </ol>   |
| Medicines found in 25 to 50% of outlets   | <ol style="list-style-type: none"> <li>1. Paracetamol tabs 500mg</li> <li>2. Ranitidine 150mg tablet</li> </ol>  |
| Medicines found in 50 to 75% of outlets   | <ol style="list-style-type: none"> <li>1. Metronidazole 500mg tablet</li> <li>2. Norethiesterone 5mg tablet</li> <li>3. Nifedipine Retard 20mg tablet</li> <li>4. Omeprazole 20mg tablet</li> <li>5. Oral rehydration Salt</li> <li>6. Paracetamol suspension</li> </ol>   |
| <b>Medicines found in over 75% of outlets</b> <ol style="list-style-type: none"> <li>1. Carbimazole 5mg tab</li> <li>2. Cefixime 400mg capsule</li> <li>3. Chloramphenicol eye drops</li> <li>4. Ciprofloxacin 500mg tablet</li> <li>5. Diazepam 5mg tablet</li> <li>6. Diclofenac 25mg tablet</li> <li>7. Ferrous Sulphate + Folic acid</li> <li>8. Fluoxetine 20mg tablet</li> <li>9. Co-trimoxazole suspension</li> <li>10. Diclofenac 50mg tablet</li> <li>11. Dexamethasone injection</li> <li>12. Furosemide 40mg tablet</li> <li>13. Glibenclamide 5mg tablet</li> <li>14. Gliclazide 80mg tablet</li> <li>15. Hyoscine -N-Butylbromide</li> <li>16. Ibuprofen 400mg tablet</li> <li>17. Insulin, Neutral Soluble</li> <li>18. Lisinopril 10mg tablet</li> <li>19. Metformin HCL 500mg tablet</li> <li>20. Metronidazole 250mg tablet</li> </ol> | <ol style="list-style-type: none"> <li>21. Amitriptyline 25mg tablet</li> <li>22. Amoxicillin suspension</li> <li>23. Adult cough preparation</li> <li>24. Albendazole 200mg tablet</li> <li>25. Amoxicillin 500mg capsule</li> <li>26. Amlodipine 5mg tablet</li> <li>27. Amoxicillin + Clavulanic Acid</li> <li>28. Amoxicillin + Clavulanic Acid 2</li> <li>29. Artemether injection</li> <li>30. Artesunate 50mg tablet</li> <li>31. Atenolol 50mg tablet</li> <li>32. Artemether+ Lumefantrine</li> <li>33. Artesunate 100mg tablet</li> <li>34. Azithromycin suspension</li> <li>35. Atorvastatin 20mg tablet</li> <li>36. Ceftriaxone injection 1g</li> <li>37. Beclomethasone inhaler</li> <li>38. Captopril 25mg tablet</li> <li>39. Carbamazepine 200mg tab</li> </ol> |

Figure 4. 9 Summary of availability in the three sectors



The figure above summarizes the availability of lowest price generics in the private, public and RDF sectors, it is clear that private sector has better availability, 38 items were found to have availability more than 75%, at the same time only 28 medicines were found to have that level of availability in the public sector and less than 20 medicines in RDF sector.

Figure 4. 10 The availability of selected medicines in all surveyed sectors

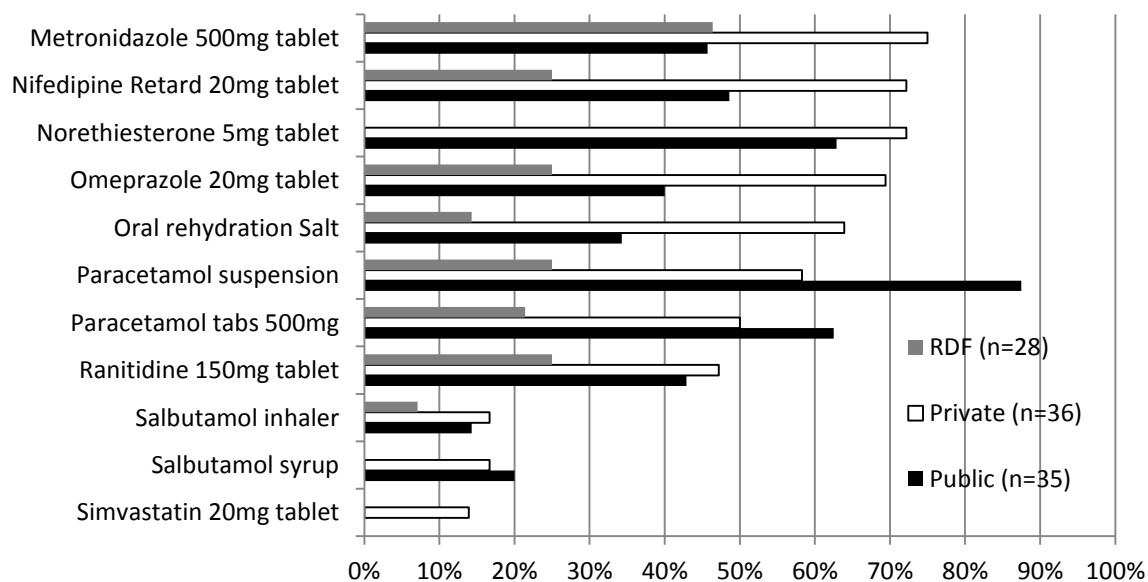
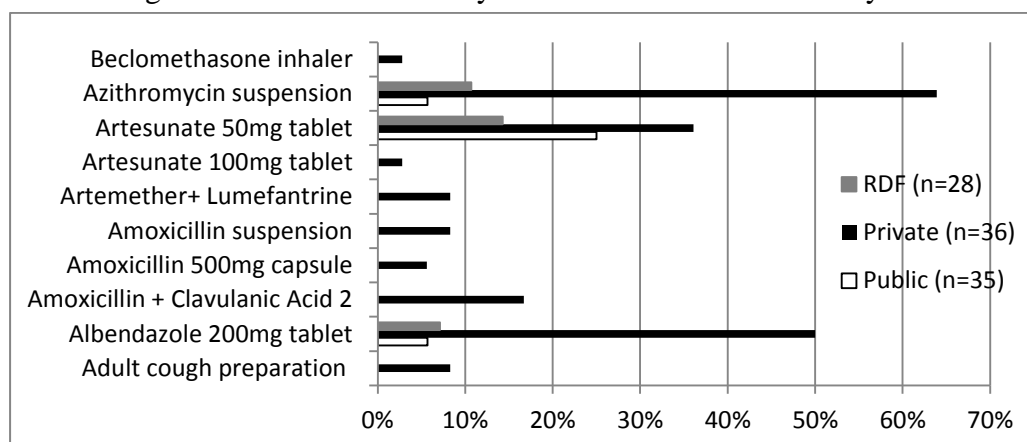


Figure 4. 11 The availability of selected brands in all surveyed sectors



#### 4.4. Affordability of standard treatment

The affordability of treatment for 14 common conditions was assessed in term of days' wage of lowest paid government unskilled worker, for chronic disease full treatment course for one month, while for acute conditions full treatment course for the condition was assessed. The days' wage in local currency equal about 12 SDG.

Table 4. 24 Days' wages of the LPGW to buy treatment in all sectors

| Disease condition and 'standard' treatment |                                      |  | Day's wages to pay for treatment |               |         |
|--|--------------------------------------|--|----------------------------------|---------------|---------|
| Condition                                  | medicines                            | course of treatment                              | LPG - public                     | LPG - private | LPG RDF |
| Asthma                                     | Salbutamol inhaler                   | 1 inhaler of 200 doses                           | 1.6                              | 1.4           | -       |
| Diabetes                                   | Glibenclamide 5 mg cap/tab           | 1 cap/tab x 2 x 30 days = 60                     | 0.5                              | 0.8           | 0.8     |
| Hypertension                               | Atenolol 50 mg cap/tab               | 1 cap/tab x 30 days = 30                         | 0.7                              | 0.5           | 0.5     |
| Hypertension                               | Captopril 25 mg cap/tab              | 1 cap/tab x 2 x 30 days = 60                     | 3.3                              | 3.3           | 2.0     |
| Hypercholesterolemia                       | Simvastatin 20 mg cap/tab            | 1 cap/tab x 30 days = 30                         | 2.1                              | 2.0           | 1.5     |
| Depression                                 | Amitriptyline 25 mg cap/tab          | 1 cap/tab x 3 for 30 days = 90                   | 2.3                              | 2.3           | 1.5     |
| Adult respiratory infection                | Ciprofloxacin 500 mg cap/tab         | 1 cap/tab x 2 for 7 days = 14                    | 1.2                              | 1.2           | 1.1     |
| Pediatric respiratory inf.                 | Co-trimoxazole 8+40 mg/ml suspension | 5ml twice a day for 7 days = 70 ml               | 0.4                              | 0.5           | 0.4     |
| Adult respiratory infection                | Amoxicillin 500mg cap/tab            | 1 cap/tab x 3 for 7 days = 21                    | 1.1                              | 1.1           | 1.0     |
| Adult respiratory infection.               | Ceftriaxone 1 g/vial injection       | 1 vial   | 13.9                             | 3.8           | 3.0     |
| Anxiety                                    | Diazepam 5mg cap/tab                 | 1 cap/tab x 7 days = 7                           | 0.1                              | 0.1           | 0.1     |
| Arthritis                                  | Diclofenac 50mg cap/tab              | 1 cap/tab x 2 x 30 days = 60                     | 5.3                              | 4.9           | 4.8     |
| Pain/inflammation                          | Paracetamol suspension               | child 1 year: 120mg (=5ml) x 3 for 3 days = 45ml | 0.3                              | 0.3           | 0.3     |
| Ulcer                                      | Omeprazole 20mg cap/tab              | 1 cap/tab x 30 days = 30                         | 2.7                              | 2.5           | 2.3     |

The affordability in the public sector as shown in the result in the table above can be considered as poor. However some medicines were found to have days' wage lower than 1, these were, Adult respiratory tract infection using Ceftriaxone injection 1g (13.9), Arthritis treated with Diclofenac 50mg tablet cost (5.3) Asthma, Salbutamol inhaler (1.6), Hypertension, captopril 25mg tablet (3.3) and Hypercholesterolemia , Simvastatin 20mg tablet (2.1).

In RDF other public sector the affordability of lowest price generics was better than the other two sectors, but the availability in RDF sector is always questionable. However some treatments are likely higher than one days' wage of lowest paid government worker.

Treatment that cost one day wage of LPGW in the private sector, examples of such medicines and condition were; Arthritis treated with 50mg Diclofenac 50mg tablet (4.9 day wage), Adult respiratory tract infection treated with Ceftriaxone 1g injection (3.8 days' wages), Ulcer treated with Omeprazole 20mg cap/tab (2.5 days' wages) and Hypercholesterolemia treated with Simvastatin 20mg tablet (2.1 days' wages). But still in private sectors there were conditions that can be treated with less than one day wage like, anxiety 0.1 days' wages) and pediatric respiratory tract infections (0.5 of days' wages).

Treating same condition with OB, patients has to pay more days' wage to get them in the private sector. For example, treating Asthma with Salbutamol inhaler costs 2.5 of days' wages (1.4 for generic), while treating Hypertension with Atenolol 50mg tablet costs 5.2 of days' wages (0.5 for the generic). And treating adult infection with Amoxicillin + Clavulonic acid 1g cost 9.2 days' wage (5.1 for the generic).

In case families where more than one patients has to be treated, then more days' wages should be forgone, e.g. hypertensive and asthmatic father on Captopril 25mg and Salbutamol inhaler and asthmatic child on Salbutamol inhaler as well, such family has to pay 6.5 days' wage to get their 30 days treatment from the public sector

Figure 4. 12 Affordability to treatment for common diseases

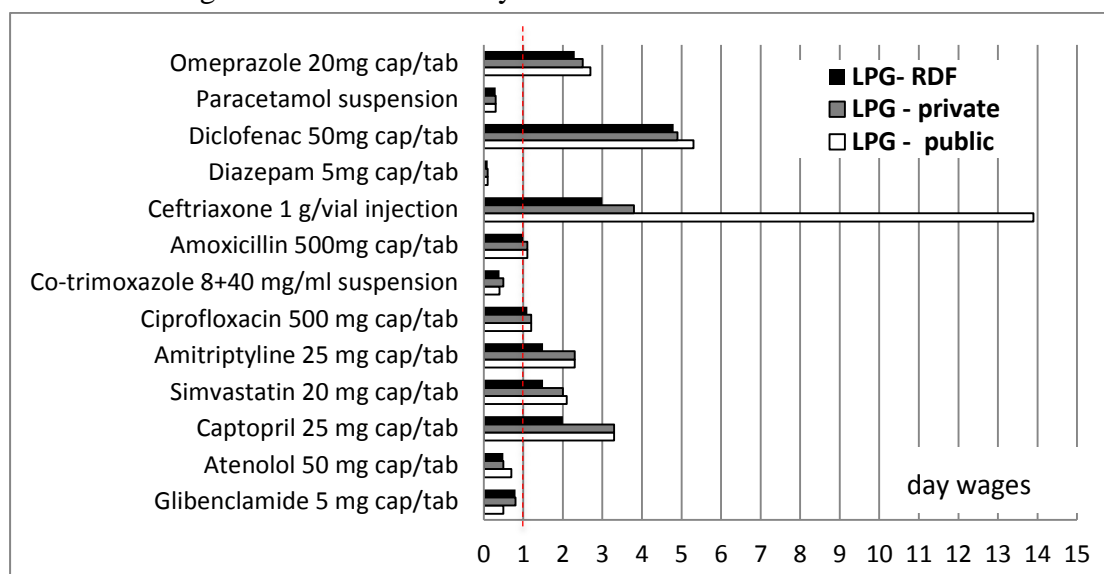


Table 4. 25 Day wages required for malaria treatment

| medicines                     | Days' wages required |                |            |
|-------------------------------|----------------------|----------------|------------|
|                               | public sector        | private sector | RDF sector |
| Artemether 80mg injection     | 2.8                  | 3              | 2.6        |
| Artemether + Lumefantrine tab | 1.1                  | 3.3            | -          |
| Artesunate Adult 100mg tab    | 1.3                  | 1.3            | 1.2        |
| Artesunate child 50mg tab     | 1.0                  | 0.8            | 0.8        |

In 2005 a report of systemic analysis (Ewen, Laing, Nouguchi, & Gelders, 2006) revealed that variety of MPR of Glibenclamide in 7 countries, when the MPRs from these countries compared to Sudan (result from this study) Sudan seemed a little bit higher even from neighboring country like Chad. (See figure 4.13).

This variations in MPRs between the three sectors is mainly due to fact that each sector has it is own objectives, public sector which mainly NHIF medicines outlets seems mark high prices by more than 5% in LPG over the private can align with NHIF objective which is to contain cost of services.

RDF charge prices lower by 10% to 11% when compare to the public and private sector is aligning with the RDF objective to ward accessibility. However the availability in this sector which will be discussed later is questionable.



Average availability in the private sector was good at 83.9%. for generics medicines. In the private sector, medicine availability was higher than that of the other two public sectors. [The availability of individual medicines in public, RDF and private sectors in appendix L]

In the public sector, medicines with particularly low availability include Salbutamol inhaler (14.3%), Salbutamol syrup (14.3%), Simvastatin (0.0%).

Artemether 80mg injection (LPG) used as second line for malaria treatment in adult require 2.8 days' wage in the public sector and 3 days' wage in the private and 2.5 in the RDF (see Table 4.25 ). Compare to surveys conducted in 2004 the affordability of Salbutamol inhaler in in the private sector Uganda was 5.6 days for the brand and 2 days for LPG, while in Ghana was 8 days (IB) and 4.6 days (LPG) and in Mali the affordability was 4.2 days for the IB and 2.7 for the LPG (WHO/HAI, 2008b)while in Sudan is less than two days' wage (1.6 days in the public sector, 1.4 days in the private sector) and only 3.1 days, 2.5 days for the IB in the public and private sectors respectively.

In WHO/EMRO where Sudan is part of found in 2009 the affordability of Glibenclamide 5mg tabs was 2.1 days (IB, private), 0.9(LPG, private) and 0.5 (LPG, public) (Cameron, Ewen, Ross, et al., 2009) compare to Sudan these figures a little bit lower in the region than Sudan.

A report review 2005 (Ewen et al., 2006) reviewing the prices availability and affordability of chronic medicines, comparing days' wage for Beclomethasone inhaler to the all countries appeared in figure IV- 11, LPG Beclomethasone inhaler in Sudan seems not so far different from those countries despite the economic variations between these countries. Although Lebanon, India (Chinnai) and Kenya seemed a little bit lower than 2 days' wage.

#### **4.5. Factors affecting medicine prices**

According to the model developed to analyze the effect of various factors mentioned in table 4.26 below, the dependent variable was the medicines' price ratio between the Capital and other states ( $P_s/P_c$ ), Gretle was used to estimate coefficients

|                                  | River Nile | W. Darfur | Red Sea   | Gazeera   | Sinnar    | Khartoum  |
|----------------------------------|------------|-----------|-----------|-----------|-----------|-----------|
| Median MPR                       | (2 meds)   | (0 meds)  | (6 meds)  | (4 meds)  | (2 meds)  | (9 meds)  |
| Originator brand                 | 2.82       | --        | 4.9       | 7.8       | 7.02      | 3.47      |
| Median MPR                       | (44 meds)  | (36 meds) | (45 meds) | (41 meds) | (46 meds) | (45 meds) |
| Lowest price generic             | 3.06       | 3.71      | 3.01      | 2.84      | 2.86      | 2.61      |
| Difference public to RDF         | - 2.8 %    | 44.2%     | 15.3%     | 17.1%     | - 11%     | 12%       |
| Difference private to RDF        | 26.0%      | 29.1 %    | 15.3      | 03.6%     | - 9.6%    | - 4.7%    |
| Difference public to procurement | 65.0%      | 127.2%    | 93.3%     | 54.3%     | 86.8%     | 93.1%     |

Table 4. 26 Regression Result

| <i>Variables</i> | <i>Coefficient</i> | <i>Std. Error</i>  | <i>t-ratio</i> | <i>p-value</i> |     |
|------------------|--------------------|--------------------|----------------|----------------|-----|
| Const            | 1.0117             | 0.1609             | 6.2868         | 0.00000        | *** |
| State1           | 2.7789             | 1.2682             | 2.1912         | 0.0285         | **  |
| State2           | 0.3128             | 0.1772             | 1.7651         | 0.0776         | *   |
| State3           | 0.5537             | 0.2731             | 2.0272         | 0.0427         | **  |
| State4           | 1.5481             | 0.7134             | 2.1699         | 0.0301         | **  |
| State5           | 0.0930             | 0.0270             | 3.4392         | 0.0006         | *** |
| Sector2          | 0.0443             | 0.0646             | 0.6853         | 0.4932         |     |
| Sector1          | 0.1138             | 0.0616             | 1.8475         | 0.0648         | *   |
| Distance         | 0.0023             | 0.0009             | 2.5354         | 0.0113         | **  |
| type             | -0.1647            | 0.1150             | -1.4319        | 0.1523         |     |
| Site             | 0.0685             | 0.0844             | 0.8116         | 0.4171         |     |
| sour             | 0.0681             | 0.0694             | 0.9821         | 0.3261         |     |
| R-squared        | 0.089838           | Adjusted R-squared | 0.087043       |                |     |

As shown in table 4.26 above the result of regression, all states have significant effect on the price ratio, state1 which is West Darfur the farthest state from the capital has the highest effect coefficient, meaning that; the highest variation of medicine prices. State4 (Red Sea) which is the second state after West Darfur in term of how far from the capital 675km far, so; moving from capital to state4 the price ratio increase by 1.55 times. While state3 (Sinnar) which is 310km far, it found the price ratio increase by 0.55 time. Then state2 (Gazeera 186km) the price ratio found to increase only by 0.31 time from the capital. But state5 (River Nile 310km) appeared to has the least effect between all states on price ratio which was only 0.09 times.

Sector1 was private show that moving from public to private cross capital and states will increase the price ratio by 11.4%, while sector2 which is insignificant due to the fact that RDF as sector with common objectives in all states where to contribute

to increase medicines accessibility and improve affordability, that is why no significance differences between the capital and other states in this sector.

Also the distance found to has significant coefficient and as moving from capital to the remote moving 1km from Khartoum will increase the price ratio by 0.23%.

## **4.6. Discussions**

### ***4.6.1. Medicine prices***

The retail price of medicines in the public sector for lowest price generics is 2.98 times their international reference prices, and higher than the private sector (2.9) and RDF (2.7), the public sector here mainly NHIF medicines outlets, NHIF purchase medicines at price 1.84 times international reference prices, and retailed to their clients at price higher than their procurement price by 62.4%. But NHIF clients are forced to get their medicine from NHIF medicine outlets paying co-payment of 25% of the total cost of the medicines. Increasing profit margin meaning that NHIF medicines cost will be less than 75%.

The way social health insurance in Sudan containing medicines cost to face very low premium from high risky people, it is also efficient way to collect indirect premium, especially from those who get free insurance card. Secrets behind the public sector (mainly NHIF facilities have higher prices than the private sector).

The RDF which is also public sector, but their mission objectives is to improve essential medicines access and affordability, the medicines priced at very low rate in RDF facilities, only 41.9% higher than the government procurement prices.

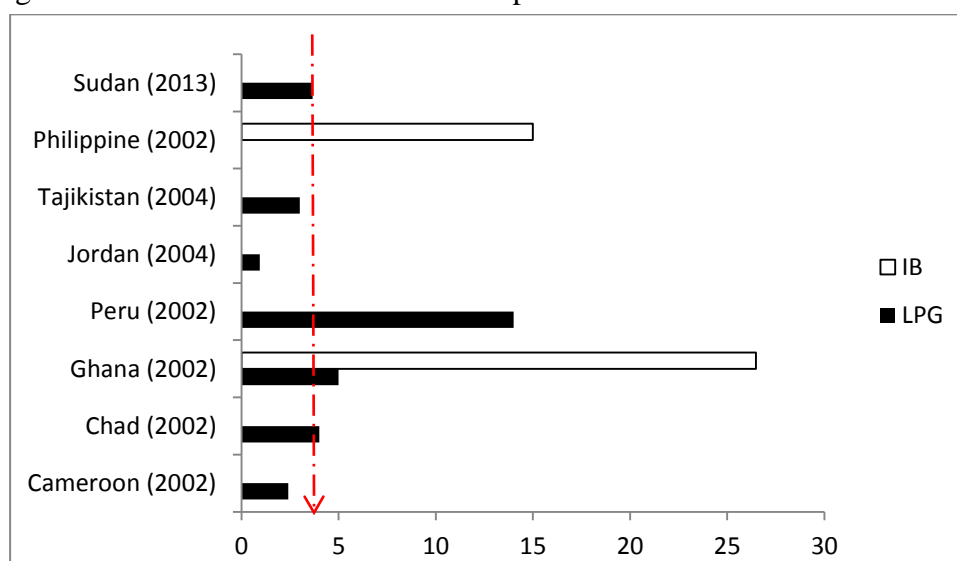
The significance variations in medicines price among states, is reasonable, because Sudan is very big country, no paved roads in many states, therefore, there is transportation cost, e.g. the private sector in West Darfur the farthest state, medicines were priced at 3.71 times their international reference prices compare to Khartoum state, the capital the medicines were retailed at price 2.61 times international reference price (the minimum median price ratio). Gazeera state which is the nearest state to the capital medicines were price at 2.84 times their international reference price.

In Table 4.13 below, the MPR of Glibenclamide 5mg tablet was compared among different countries, the comparison shows that Sudan and Chad almost the

same in MPR of Glibenclamide 5mg, while in Cameron, Jordan and Tajikistan, the MPR is lower than Sudan.

The far the state the highest price ratio will be observed, State like West Darfur, where no paved road, the cost of transportation is found to be high, there for the medicine's prices are high. But states like Gazeera and River Nile, the nearest state to Khartoum, and the transportation cost is low, there for medicines were sold in low prices compared to West Darfur and Red Sea.

Figure 4. 13 MPRs of Glibenclamide in public sector in selected countries



#### 4.6.2. Medicines availability

Despite of better prices offered by the RDF sector, but the availability in this sector is low (55.4%) compared to the private and RDF sectors 83.9% and 68.2% respectively. Given advantages of good prices by RDF unfortunately not accompanied by good availability, patients are forced to get some medicines in higher prices in other public and private sectors.

Although the 1<sup>st</sup> line antimalarial agents now found to be free, but still the availability of the free treatment is under question, the availability of for-retail anti-malarias is very high, e.g. the availability of the 2<sup>nd</sup> line anti-malarias Artemether injection 80mg found in the public, private and RDF sectors was 100%, 97% and 82% respectively, Artemether + Lumefantrine tablets 77.1%, 97.2% and 82.1% respectively, while the availability of the 1<sup>st</sup> line Artesunate 100mg adult and

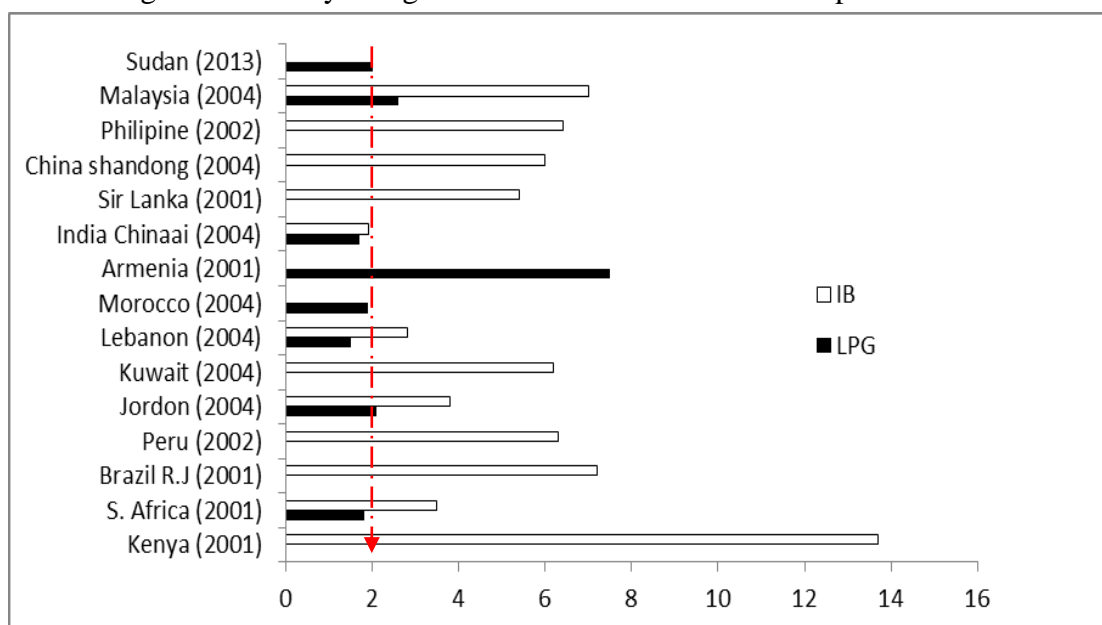
Artesunate 50mg children were 77.1%, 97.2%, 78.6% for the former and 100%, 97%, 75% for the later respectively in the three sectors.

#### 4.6.3. Treatment affordability

Generally treatment of common disease in Sudan were not affordable, In case families where more than one patients has to be treated, then more days' wages should be forgone, e.g. hypertensive and asthmatic father on Captopril 25mg and Salbutamol inhaler and asthmatic child on Salbutamol inhaler as well, such family has to pay 6.5 days' wage to get their 30 days treatment from the public sector, which is extremely hard to such family. Malaria which is common disease in Sudan, in many cases two or more of family member will infected by disease, 2.6 days' wages required to purchase Artesunate 100mg tablet for two patients.

In Table 4.14 below, the affordability to treat asthma with Beclomethasone Inhaler in different countries when compared to Sudan, the days' wages needed in Sudan is almost similar to many countries like, India (Chennai), Morocco, Jordan and South Africa for the lowest price generic.

Figure 4. 14 Days' wage for Beclomethasone inhaler in private sector



#### ***4.6.4. Limitations of this study***

The prices surveyed in this study are the retail price at the pharmacies, no analysis to the real cost behind which high medicines price in Sudan hide, neither the prices component.

The availability mentioned here, is at the time of survey, but assessment of the whole supply system in public and private sector is of significant importance, to gather factors influence medicines supply.

## **CHAPTER V CONCLUSIONS AND POLICY IMPLICATIONS**

### **5.1. Conclusions**

This study aims to analyze the prices, availability and affordability of 50 essential medicines in six states in Sudan crosses three sectors public, private and Revolving Drug Fund (RDF), and assess factors affecting medicine price ratio between capital and other states. 99 medicine outlets were surveyed to get data regarding prices, availability, medicines source and type (IB, LPG).

The price of lowest price generic medicines paid by patient in Sudan is high in public sector, where the pharmacies are controlled by NHIF, medicines were price 2.98 times international reference prices, while the retail price of the OB was 2.67 times their IRPs. Private sector is low when compared to the public sector on the retail prices, on average, 20% and 5% for OB and lowest price generic respectively.

In the private the sector LPG were priced at 2.9 times their international reference prices and the OBs were priced at 4.24 times their international reference prices. However the private sector retail prices on average, 34.5% and 9.9% more for the OBs and LPGs respectively when compared to RDF sector.

The retail prices of medicines in the significantly vary among states, in private sector, in West Darfur the patient paying 3.71 times international reference prices, while in Khartoum where minimum retail prices set at only 2.61 times their international reference prices.

In public sector 50% of LPG medicines were priced between 1.66 (25 percentile) and 4.69 (75 percentile) times their IRPs. While 50% of the OBs were lay between 1.68 to 3.24 times IRPs respectively. In the private sector 50% of LPPGs were lay between 2.01 and 5.81 times IRPs and 3.32 to 8.18 for the OB medicines times their IRPs respectively. Given these variations, many factors were found to affect these disparities.

Generally the availability of lowest price generic medicines given by this study is good in public sector (68.2%), fair in RDF sector (53.4%) and very good in the public sector (83.9%). However the availability of originator brand medicines was very low, the highest availability of OB medicines found in the public sector

(14.30%). Medicines with particular low availability in the public sector include Simvastatin 20 mg (0.0%), Salbutamol inhaler (14.30%) and Salbutamol syrup (14.30%).

Given fair availability in RDF where the medicines retailed at lower prices compared to the two other sectors, patients forced to buy their medicines in prices little bit higher from public and private sectors.

Affordability of medicines in Sudan is poor, given the common conditions assessed for affordability, only five conditions were found to cost less than 1 days' wage for lowest paid unskilled government workers 12 SDG (local currency) in the three sectors includes; Diabetes treated with Glibenclamide 5mg tablet, Hypertension treated with atenolol 50mg tablet, Respiratory tract infection in children treated with Co-trimoxazole suspension, Anxiety treated with Diazepam 5mg tablet and Pain/inflammation in children using Paracetamol syrup.

## **5.2. Policy implications and recommendations**

### ***5.2.1. Dissemination results of this study***

This study will be disseminated through different means to attain maximum benefits; it will contribute to increase HAI prices data base, where other countries can compare to it is results and findings

### ***5.2.2. Policy options***

#### ***Medicines prices:***

The prices disparities among states need to be regulated and controlled, meanwhile, medicines prices in Sudan need to be adjusted to the international reference prices to improve medicines affordability

#### **(1) Control medicines prices**

- Enforce price regulations at the states level, through State Miniseries of Health – pharmaceutical directorates.
- More studies should be conducted on overhead cost variation among states, to set-up clear markups and profit margin in all states.
- Assess the pricing policy in Sudan, and consider international reference pricing (benchmarking) as tool to adjust and control generic prices.



- Continuous monitoring of medicines prices to evaluate the effect of any interventions.
- (2) Improve government procurement and retail prices
  - Enforce public sector group purchasing of medicines, including all stakeholders.
  - The pricing policy in the public sector need to be evaluated, specifically, those for National Health Insurance Fund.

### ***Availability***

Regarding the low retail price found in Revolving Drug Fund medicine outlets, this sector need to be strengthened and reorganized to achieve their missions toward improve access

- Essential medicines should be on the top of priorities when supplying medicines in RDF and public sectors.
- Medicines regulatory authorities if necessary to encourage local pharmaceutical agencies, local manufacturers and medicines suppliers to ease have stores in at least each state capital.

### ***Affordability***

To improve affordability, many factors can be considered. However, in this study, only medicine prices were assessed, there for options and opportunities to improve affordability can be summarized in:

- Exempt essential medicines from government fees.
- Dissemination of medicine prices to public will increase prices transparency.
- Generic promotion, through public sectors including social health insurance scheme

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## **APPENDICES**

## APPENDIX A

### (1) The list of the originator brand surveyed

| Med. No. | Medicine Name<br>(Name must be unique) | Medicine Strength | Dosage Form        | Target Pack Size | Medicine list | "Originator" Product |                |
|----------|--|-------------------|--------------------|------------------|---------------|----------------------|----------------|
|          |  |                   |                    |                  |               | Name                 | Manufacturer   |
| 1        | Adult cough preparation expecto.       | 1bott/100ml       | syrup              | 100              | Supplementary |                      |                |
| 2        | Albendazole                            | 200 mg            | cap/tab (non-chew) | 2                | Regional      | Zental               | GSK            |
| 3        | Amitriptyline                          | 25mg              | cap/tab            | 100              | Global        | Tryptizol            | MSD            |
| 4        | Amlodipine                             | 5 mg              | cap/tab            | 30               | Supplementary | Norvasc              | Pfizer         |
| 5        | Amoxicillin                            | 500 mg            | cap/tab            | 16               | Global        | Amoxil               | GSK            |
| 6        | Amoxicillin + Clavulanic Acid          | 250 mg + 125 mg   | cap/tab            | 20               | Supplementary | Augmentin            | GSK            |
| 7        | Amoxicillin + Clavulanic Acid          | 875 mg + 125 mg   | cap/tab            | 14               | Supplementary | Augmentin            | GSK            |
| 8        | Amoxicillin suspension                 | 50 mg/ml          | millilitre         | 75               | Regional      | Amoxil               | GSK            |
| 9        | Artemether injection                   | 80mg/ml           | millilitre         | 8                | Supplementary |                      |                |
| 10       | Artemether+ Lumefantrine               | 20+120 mg         | cap/tab            | 24               | Supplementary | Coartem              | Novartis       |
| 11       | Artesunate                             | 100 mg            | cap/tab            | 1                | Supplementary |                      |                |
| 12       | Artesunate                             | 50 mg             | cap/tab            | 1                | Supplementary |                      |                |
| 13       | Atenolol                               | 50 mg             | cap/tab            | 30               | Global        | Tenormin             | AstraZeneca    |
| 14       | Atorvastatin                           | 20 mg             | cap/tab            | 30               | Regional      | Lipitor              | Pfizer         |
| 15       | Azithromycin suspension                | 40mg/ml           | millilitre         | 15               | Supplementary | Zithromax            | Pfizer         |
| 16       | Beclomethasone inhaler                 | 50 mcg/dose       | dose               | 200              | Regional      | Becotide             | GSK            |
| 17       | captopril                              | 0.50%             | cap/tab            | 60               | Global        | Capoten              | Squibb         |
| 18       | Carbamazepine                          | 200 mg            | cap/tab            | 100              | Regional      | Tegretol             | Novartis       |
| 19       | Carbimazole                            | 5 mg              | cap/tab            | 30               | Supplementary | Neo-Mercazole        | Amdipharm      |
| 20       | Cefixime                               | 400mg             | cap/tab            | 8                | Supplementary | Suprax               | Sanofi-Aventis |
| 21       | Ceftriaxone injection                  | 1 g/vial          | vial               | 1                | Global        | Rocephin             | Roche          |
| 22       | Chloramphenicol eye drops              | 0.005             | millilitre         | 5                | Regional      | Chloromycetin        | Parke Davis    |
| 23       | Ciprofloxacin                          | 500 mg            | cap/tab            | 10               | Global        | Ciproxin             | Bayer          |
| 24       | Co-trimoxazole suspension              | 8+40 mg/ml        | millilitre         | 75               | Global        | Bactrim              | Roche          |
| 25       | Dexamethasone injection                | 4mg /ml           | millilitre         | 1                | Regional      | Decadron             | MSD            |
| 26       | Diazepam                               | 5 mg              | cap/tab            | 100              | Global        | Valium               | Roche          |
| 27       | Diclofenac                             | 25 mg             | cap/tab            | 30               | Supplementary | Volterin             | Novartis       |
| 28       | Diclofenac                             | 50mg              | cap/tab            | 30               | Global        | Volterin             | Novartis       |
| 29       | Ferrous Sulphate + Folic acid          | 200 mg + 0.4 mg   | cap/tab            | 30               | Supplementary | Fefol                |                |
| 30       | Fluoxetine                             | 20 mg             | cap/tab            | 30               | Regional      | Prozac               | Eli Lilly      |
| 31       | Furosemide                             | 40 mg             | cap/tab            | 1000             | Regional      | Lasix                | Sanofi-Aventis |
| 32       | Glibenclamide                          | 5 mg              | cap/tab            | 100              | Global        | Daonil               | Sanofi-Aventis |
| 33       | Gliclazide                             | 80 mg             | cap/tab            | 100              | Regional      | Diamicon             | Servier        |
| 34       | Hyoscine -N-Butylbromide               | 10 mg             | cap/tab            | 100              | Supplementary | Buscopan             | Bayer          |
| 35       | Ibuprofen                              | 400 mg            | cap/tab            | 500              | Regional      | Brufen               | Knoll          |
| 36       | Insulin, Neutal Soluble                | 100 IU/ml         | millilitre         | 10               | Supplementary | Insulin Neutral      | Novo Nordisk   |
| 37       | Lisinopril                             | 10 mg             | cap/tab            | 30               | Regional      | Zestril              | AstraZeneca    |
| 38       | Metformin HCL                          | 500 mg            | cap/tab            | 50               | Regional      | Glucophage           | Roche          |
| 39       | Metronidazole                          | 200 mg            | cap/tab            | 500              | Supplementary | Flagyl               | Winthrop       |
| 40       | Metronidazole (2)                      | 400mg             | cap/tab            | 20               | Regional      | Flagyl               | Winthrop       |
| 41       | Nifedipine Retard                      | 20 mg             | cap/tab            | 30               | Regional      | Adalat Retard        | Bayer          |
| 42       | Norethiesterone                        | 5 mg              | cap/tab            | 30               | Supplementary | Primolut-N           | Bayer          |
| 43       | Omeprazole                             | 20 mg             | cap/tab            | 14               | Global        | Losec                | AstraZeneca    |
| 44       | Oral rehydration Salt                  | 1 PK/litter       | Sachet             | 1                | Supplementary | Non-proprietary      | WHO formula    |
| 45       | Paracetamol suspension                 | 24 mg/ml          | millilitre         | 60               | Global        | Panadol              | GSK            |
| 46       | Paracetamol tabs                       | 500 mg            | cap/tab            | 20               | Supplementary | Panadol              | GSK            |
| 47       | Ranitidine                             | 150 mg            | cap/tab            | 30               | Regional      | Zantac               | GSK            |
| 48       | Salbutamol inhaler                     | 100 mcg/dose      | dose               | 200              | Global        | Ventoline            | GSK            |
| 49       | Salbutamol syrup                       | 0.4mg/ml          | millilitre         | 75               | Supplementary | Ventoline            | GSK            |
| 50       | Simvastatin                            | 20mg              | cap/tab            | 30               | Global        | Zocar                | MSD            |





|   |                        |               |                |      |  |                |                     |
|---|------------------------|---------------|----------------|------|--|----------------|---------------------|
| Amoxicillin + Clavulanic Acid 250 mg + 125 mg cap/tab | Originator brand       | Augmentin     | GSK            | 20   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 20   |  | per cap/tab    |                     |
| Amoxicillin + Clavulanic Acid 875 mg + 125 mg cap/tab | Originator brand       | Augmentin     | GSK            | 14   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 14   |  | per cap/tab    |                     |
| Amoxicillin suspension 50 mg/ml millilitre            | Originator brand       | Amoxil        | GSK            | 75   |  | per millilitre |                     |
|   | Low est-priced generic |               |                | 75   |  | per millilitre |                     |
| Artemether injection 80mg/ml millilitre               | Originator brand       |               |                | 8    |  | per millilitre | no originator brand |
|   | Low est-priced generic |               |                | 8    |  | per millilitre |                     |
| Artemether+ Lumefantrine 20+120 mg cap/tab            | Originator brand       | Coartem       | Novartis       | 24   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 24   |  | per cap/tab    |                     |
| Artesunate 100 mg cap/tab                             | Originator brand       |               |                | 1    |  | per cap/tab    | no originator brand |
|   | Low est-priced generic |               |                | 1    |  | per cap/tab    |                     |
| Artesunate 50 mg cap/tab                              | Originator brand       |               |                | 1    |  | per cap/tab    | no originator brand |
|   | Low est-priced generic |               |                | 1    |  | per cap/tab    |                     |
| Atenolol 50 mg cap/tab                                | Originator brand       | Tenormin      | AstraZeneca    | 30   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 30   |  | per cap/tab    |                     |
| Atorvastatin 20 mg cap/tab                            | Originator brand       | Lipitor       | Pfizer         | 30   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 30   |  | per cap/tab    |                     |
| Azithromycin suspension 40mg/ml millilitre            | Originator brand       | Zithromax     | Pfizer         | 15   |  | per millilitre |                     |
|   | Low est-priced generic |               |                | 15   |  | per millilitre |                     |
| Beclomethasone inhaler 50 mcg/dose dose               | Originator brand       | Becotide      | GSK            | 200  |  | per dose       |                     |
|   | Low est-priced generic |               |                | 200  |  | per dose       |                     |
| captopril 25mg cap/tab                                | Originator brand       | Capoten       | Squibb         | 60   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 60   |  | per cap/tab    |                     |
| Carbamazepine 200 mg cap/tab                          | Originator brand       | Tegretol      | Novartis       | 100  |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 100  |  | per cap/tab    |                     |
| Carbimazole 5 mg cap/tab                              | Originator brand       | Neo-Mercazole | Amdipharm      | 30   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 30   |  | per cap/tab    |                     |
| Cefixime 400mg cap/tab                                | Originator brand       | Suprax        | Sanofi-Aventis | 8    |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 8    |  | per cap/tab    |                     |
| Ceftriaxone injection 1 g/vial vial                   | Originator brand       | Rocephin      | Roche          | 1    |  | per vial       |                     |
|   | Low est-priced generic |               |                | 1    |  | per vial       |                     |
| Chloramphenicol eye drops 0.005 millilitre            | Originator brand       | Chloromycetin | Parke Davis    | 5    |  | per millilitre |                     |
|   | Low est-priced generic |               |                | 5    |  | per millilitre |                     |
| Ciprofloxacin 500 mg cap/tab                          | Originator brand       | Ciproxin      | Bayer          | 10   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 10   |  | per cap/tab    |                     |
| Co-trimoxazole suspension 8+40 mg/ml millilitre       | Originator brand       | Bactrim       | Roche          | 75   |  | per millilitre |                     |
|   | Low est-priced generic |               |                | 75   |  | per millilitre |                     |
| Dexamethasone injection 4mg /ml millilitre            | Originator brand       | Decadron      | MSD            | 1    |  | per millilitre |                     |
|   | Low est-priced generic |               |                | 1    |  | per millilitre |                     |
| Diazepam 5 mg cap/tab                                 | Originator brand       | Valium        | Roche          | 100  |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 100  |  | per cap/tab    |                     |
| Diclofenac 25 mg cap/tab                              | Originator brand       | Volterin      | Novartis       | 30   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 30   |  | per cap/tab    |                     |
| Diclofenac 50mg cap/tab                               | Originator brand       | Volterin      | Novartis       | 30   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 30   |  | per cap/tab    |                     |
| Ferrous Sulphate + Folic acid 200 mg + 0.4 mg cap/tab | Originator brand       | Fefol         |                | 30   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 30   |  | per cap/tab    |                     |
| Fluoxetine 20 mg cap/tab                              | Originator brand       | Prozac        | Eli Lilly      | 30   |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 30   |  | per cap/tab    |                     |
| Furosemide 40 mg cap/tab                              | Originator brand       | Lasix         | Sanofi-Aventis | 1000 |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 1000 |  | per cap/tab    |                     |
| Glibenclamide 5 mg cap/tab                            | Originator brand       | Daonil        | Sanofi-Aventis | 100  |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 100  |  | per cap/tab    |                     |
| Gliclazide 80 mg cap/tab                              | Originator brand       | Diamcron      | Servier        | 100  |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 100  |  | per cap/tab    |                     |
| Hyoscine -N- Butylbromide 10 mg cap/tab               | Originator brand       | Buscopan      | Bayer          | 100  |  | per cap/tab    |                     |
|   | Low est-priced generic |               |                | 100  |  | per cap/tab    |                     |

|   |                        |                 |              |  |     |  |  |                |
|---|------------------------|-----------------|--------------|--|-----|--|--|----------------|
| Ibuprofen 400 mg cap/tab                      | Originator brand       | Brufen          | Knoll        |  | 500 |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 500 |  |  | per cap/tab    |
| Insulin, Neutral Soluble 100 IU/ml millilitre | Originator brand       | Insulin Neutral | Novo Nordisk |  | 10  |  |  | per millilitre |
|   | Low est-priced generic |                 |              |  | 10  |  |  | per millilitre |
| Lisinopril 10 mg cap/tab                      | Originator brand       | Zestril         | AstraZeneca  |  | 30  |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 30  |  |  | per cap/tab    |
| Metformin HCL 500 mg cap/tab                  | Originator brand       | Glucophage      | Roche        |  | 50  |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 50  |  |  | per cap/tab    |
| Metronidazole 200 mg cap/tab                  | Originator brand       | Flagyl          | Winthrop     |  | 500 |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 500 |  |  | per cap/tab    |
| Metronidazole (2) 400mg cap/tab               | Originator brand       | Flagyl          | Winthrop     |  | 20  |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 20  |  |  | per cap/tab    |
| Nifedipine Retard 20 mg cap/tab               | Originator brand       | Adalat Retard   | Bayer        |  | 30  |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 30  |  |  | per cap/tab    |
| Norethiesterone 5 mg cap/tab                  | Originator brand       | Primolut-N      | Bayer        |  | 30  |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 30  |  |  | per cap/tab    |
| Omeprazole 20 mg cap/tab                      | Originator brand       | Losec           | AstraZeneca  |  | 14  |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 14  |  |  | per cap/tab    |
| Oral rehydration Salt 1 PK/litter Sachet      | Originator brand       | Non-proprietary | WHO formula  |  | 1   |  |  | per Sachet     |
|   | Low est-priced generic |                 |              |  | 1   |  |  | per Sachet     |
| Paracetamol suspension 24 mg/ml millilitre    | Originator brand       | Panadol         | GSK          |  | 60  |  |  | per millilitre |
|   | Low est-priced generic |                 |              |  | 60  |  |  | per millilitre |
| Paracetamol tabs 500 mg cap/tab               | Originator brand       | Panadol         | GSK          |  | 20  |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 20  |  |  | per cap/tab    |
| Ranitidine 150 mg cap/tab                     | Originator brand       | Zantac          | GSK          |  | 30  |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 30  |  |  | per cap/tab    |
| Salbutamol inhaler 100 mcg/dose dose          | Originator brand       | Ventoline       | GSK          |  | 200 |  |  | per dose       |
|   | Low est-priced generic |                 |              |  | 200 |  |  | per dose       |
| Salbutamol syrup 0.4mg/ml millilitre          | Originator brand       | Ventoline       | GSK          |  | 75  |  |  | per millilitre |
|   | Low est-priced generic |                 |              |  | 75  |  |  | per millilitre |
| Simvastatin 20mg cap/tab                      | Originator brand       | Zocar           | MSD          |  | 30  |  |  | per cap/tab    |
|   | Low est-priced generic |                 |              |  | 30  |  |  | per cap/tab    |

## Appendix C (3-1) availability, Median price ratio and MP of Public Sector

| No. | Medicine Name                    | Medicine Type | Include in analysis? | 25%ile | 75%ile | Min   | Max   | % with med. | # of prices | % with drug | Median Price | Price Ratio (MPR) |
|-----|----------------------------------|---------------|----------------------|--------|--------|-------|-------|-------------|-------------|-------------|--------------|-------------------|
| 1   | Adult cough preparation expecto. | Brand         | 0                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 1   | Adult cough preparation expecto. | Lowest Price  | 1                    | 3.65   | 5.11   | 2.92  | 5.84  | 82.9%       | 29          | 82.9%       | 0.06         | 4.38              |
| 2   | Albendazole                      | Brand         | 1                    |        |        |       |       | 2.9%        | 1           | 2.9%        |              |                   |
| 2   | Albendazole                      | Lowest Price  | 1                    | 16.01  | 17.93  | 8.54  | 19.21 | 34.3%       | 12          | 34.3%       | 2.10         | 17.93             |
| 3   | Amitriptyline                    | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 3   | Amitriptyline                    | Lowest Price  | 1                    | 7.54   | 13.20  | 3.77  | 15.08 | 48.6%       | 17          | 48.6%       | 0.30         | 11.31             |
| 4   | Amlodipine                       | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 4   | Amlodipine                       | Lowest Price  | 1                    | 1.89   | 2.51   | 1.57  | 4.08  | 94.3%       | 33          | 94.3%       | 0.30         | 1.89              |
| 5   | Amoxicillin                      | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 5   | Amoxicillin                      | Lowest Price  | 1                    | 4.26   | 5.32   | 2.66  | 5.67  | 82.9%       | 29          | 82.9%       | 0.63         | 4.43              |
| 6   | Amoxicillin + Clavulanic Acid    | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 6   | Amoxicillin + Clavulanic Acid    | Lowest Price  | 1                    | 3.97   | 4.60   | 2.06  | 8.88  | 68.6%       | 24          | 68.6%       | 2.50         | 3.97              |
| 7   | Amoxicillin + Clavulanic Acid 2  | Brand         | 1                    |        |        |       |       | 2.9%        | 1           | 2.9%        |              |                   |
| 7   | Amoxicillin + Clavulanic Acid 2  | Lowest Price  | 1                    | 2.56   | 4.50   | 1.93  | 4.71  | 40.0%       | 14          | 40.0%       | 5.00         | 3.14              |
| 8   | Amoxicillin suspension           | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 8   | Amoxicillin suspension           | Lowest Price  | 1                    | 3.36   | 4.41   | 2.32  | 4.64  | 85.7%       | 30          | 85.7%       | 0.11         | 3.71              |
| 9   | Artemether injection             | Brand         | 0                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 9   | Artemether injection             | Lowest Price  | 1                    | 0.56   | 0.92   | 0.05  | 1.21  | 68.6%       | 24          | 68.6%       | 4.20         | 0.80              |
| 10  | Artemether+ Lumefantrine         | Brand         | 1                    |        |        |       |       | 5.7%        | 2           | 5.7%        |              |                   |
| 10  | Artemether+ Lumefantrine         | Lowest Price  | 1                    | 0.88   | 2.12   | 0.88  | 2.19  | 20.0%       | 7           | 20.0%       | 0.56         | 0.98              |
| 11  | Artesunate                       | Brand         | 0                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 11  | Artesunate                       | Lowest Price  | 1                    | 14.10  | 14.46  | 11.57 | 17.35 | 40.0%       | 14          | 40.0%       | 15.00        | 14.46             |
| 12  | Artesunate 2                     | Brand         | 0                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 12  | Artesunate 2                     | Lowest Price  | 1                    | 12.21  | 16.29  | 10.18 | 21.72 | 48.6%       | 17          | 48.6%       | 12.00        | 16.29             |
| 13  | Atenoldol                        | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 13  | Atenoldol                        | Lowest Price  | 1                    | 4.44   | 6.65   | 3.33  | 8.87  | 88.6%       | 31          | 88.6%       | 0.27         | 5.91              |
| 14  | Atorvastatin                     | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 14  | Atorvastatin                     | Lowest Price  | 1                    | 1.86   | 3.37   | 1.19  | 5.62  | 62.9%       | 22          | 62.9%       | 1.60         | 2.25              |
| 15  | Azithromycin suspension          | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 15  | Azithromycin suspension          | Lowest Price  | 1                    | 1.60   | 3.19   | 1.28  | 13.83 | 77.1%       | 27          | 77.1%       | 0.67         | 2.66              |
| 16  | Beclomethasone inhaler           | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 16  | Beclomethasone inhaler           | Lowest Price  | 1                    | 1.83   | 2.18   | 1.17  | 4.13  | 48.6%       | 17          | 48.6%       | 0.12         | 1.87              |
| 17  | Captopril                        | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 17  | Captopril                        | Lowest Price  | 1                    | 9.36   | 11.08  | 7.80  | 18.72 | 42.9%       | 15          | 42.9%       | 0.65         | 10.14             |
| 18  | Carbamazepine                    | Brand         | 1                    |        |        |       |       | 5.7%        | 2           | 5.7%        |              |                   |
| 18  | Carbamazepine                    | Lowest Price  | 1                    | 2.95   | 4.71   | 2.36  | 4.71  | 77.1%       | 27          | 77.1%       | 0.30         | 3.54              |
| 19  | Carbimazole                      | Brand         | 1                    | 4.86   | 6.54   | 2.80  | 6.54  | 37.1%       | 13          | 37.1%       | 0.60         | 5.61              |
| 19  | Carbimazole                      | Lowest Price  | 1                    | 2.34   | 3.27   | 2.24  | 3.74  | 14.3%       | 5           | 14.3%       | 0.27         | 2.52              |
| 20  | Cefixime                         | Brand         | 1                    |        |        |       |       | 5.7%        | 2           | 5.7%        |              |                   |
| 20  | Cefixime                         | Lowest Price  | 1                    | 4.22   | 5.37   | 3.58  | 7.80  | 80.0%       | 28          | 80.0%       | 6.33         | 4.86              |
| 21  | Ceftriaxone injection            | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 21  | Ceftriaxone injection            | Lowest Price  | 1                    | 11.34  | 22.33  | 2.06  | 24.73 | 77.1%       | 27          | 77.1%       | 55.50        | 19.07             |
| 22  | Chloramphenicol eye drops        | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 22  | Chloramphenicol eye drops        | Lowest Price  | 1                    | 4.52   | 4.90   | 3.77  | 18.85 | 71.4%       | 25          | 71.4%       | 1.20         | 4.52              |
| 23  | Ciprofloxacin                    | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 23  | Ciprofloxacin                    | Lowest Price  | 1                    | 6.90   | 8.28   | 3.45  | 8.97  | 88.6%       | 31          | 88.6%       | 1.00         | 6.90              |
| 24  | Co-trimoxazole suspension        | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 24  | Co-trimoxazole suspension        | Lowest Price  | 1                    | 2.75   | 3.25   | 2.37  | 4.73  | 88.6%       | 31          | 88.6%       | 0.07         | 2.96              |
| 25  | Dexamethasone injection          | Brand         | 1                    |        |        |       |       | 0.0%        | 0           | 0.0%        |              |                   |
| 25  | Dexamethasone injection          | Lowest Price  | 1                    | 1.93   | 4.07   | 1.22  | 6.11  | 45.7%       | 16          | 45.7%       | 1.40         | 2.85              |

### Appendix D (3-2) availability, Median price ratio and MP of Public Sector

| No. | Medicine Name                 | Medicine Type | Include in analysis? | 25%ile | 75%ile | Min   | Max    | % with med. | # of prices | % with drug | Median Price | Price Ratio (MPR) |
|-----|-------------------------------|---------------|----------------------|--------|--------|-------|--------|-------------|-------------|-------------|--------------|-------------------|
| 26  | Diazepam                      | Lowest Price  | 1                    | 4.31   | 9.97   | 3.83  | 11.12  | 51.4%       | 18          | 51.4%       | 0.18         | 6.90              |
| 27  | Diclofenac                    | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 27  | Diclofenac                    | Lowest Price  | 1                    | 7.99   | 9.84   | 4.92  | 43.04  | 97.1%       | 34          | 97.1%       | 0.20         | 9.84              |
| 28  | Diclofenac 2                  | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 28  | Diclofenac 2                  | Lowest Price  | 1                    | 34.34  | 80.80  | 18.18 | 101.00 | 45.7%       | 16          | 45.7%       | 1.07         | 43.09             |
| 29  | Ferrous Sulphate + Folic acid | Brand         | 0                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 29  | Ferrous Sulphate + Folic acid | Lowest Price  | 1                    | 27.31  | 39.01  | 15.60 | 52.66  | 82.9%       | 29          | 82.9%       | 0.40         | 31.21             |
| 30  | Fluoxetine                    | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 30  | Fluoxetine                    | Lowest Price  | 1                    |        |        |       |        | 2.9%        | 0           | 2.9%        |              |                   |
| 31  | Furosemide                    | Brand         | 1                    |        |        |       |        | 2.9%        | 1           | 2.9%        |              |                   |
| 31  | Furosemide                    | Lowest Price  | 1                    | 7.07   | 9.43   | 4.71  | 14.14  | 82.9%       | 29          | 82.9%       | 0.20         | 9.43              |
| 32  | Glibenclamide                 | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 32  | Glibenclamide                 | Lowest Price  | 1                    | 5.39   | 8.08   | 5.39  | 10.77  | 97.1%       | 34          | 97.1%       | 0.10         | 5.39              |
| 33  | Gliclazide                    | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 33  | Gliclazide                    | Lowest Price  | 1                    | 1.63   | 3.07   | 0.72  | 3.43   | 40.0%       | 14          | 40.0%       | 0.60         | 2.17              |
| 34  | Hyoscine -N-Butylbromide      | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 34  | Hyoscine -N-Butylbromide      | Lowest Price  | 1                    | 1.77   | 2.84   | 0.79  | 3.15   | 77.1%       | 27          | 77.1%       | 0.25         | 1.97              |
| 35  | Ibuprofen                     | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 35  | Ibuprofen                     | Lowest Price  | 1                    | 5.49   | 8.79   | 4.39  | 8.79   | 71.4%       | 25          | 71.4%       | 0.30         | 6.59              |
| 36  | Insulin, Neutral Soluble      | Brand         | 1                    | 0.89   | 1.31   | 0.50  | 1.56   | 42.9%       | 15          | 42.9%       | 4.00         | 1.01              |
| 36  | Insulin, Neutral Soluble      | Lowest Price  | 1                    | 1.06   | 1.06   | 1.01  | 1.06   | 14.3%       | 5           | 14.3%       | 4.20         | 1.06              |
| 37  | Lisinopril                    | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 37  | Lisinopril                    | Lowest Price  | 1                    | 1.82   | 2.55   | 1.28  | 4.68   | 68.6%       | 24          | 68.6%       | 0.67         | 2.44              |
| 38  | Metformin HCL                 | Brand         | 1                    |        |        |       |        | 2.9%        | 1           | 2.9%        |              |                   |
| 38  | Metformin HCL                 | Lowest Price  | 1                    | 3.16   | 5.06   | 2.53  | 6.74   | 82.9%       | 29          | 82.9%       | 0.40         | 5.06              |
| 39  | Metronidazole                 | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 39  | Metronidazole                 | Lowest Price  | 1                    | 3.83   | 7.67   | 3.83  | 19.17  | 80.0%       | 28          | 80.0%       | 0.15         | 5.75              |
| 40  | Metronidazole (2)             | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 40  | Metronidazole (2)             | Lowest Price  | 1                    | 6.22   | 7.46   | 3.73  | 9.94   | 54.3%       | 19          | 54.3%       | 0.25         | 6.22              |
| 41  | Nifedipine Retard             | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 41  | Nifedipine Retard             | Lowest Price  | 1                    | 4.83   | 6.64   | 3.62  | 7.24   | 82.9%       | 29          | 82.9%       | 0.60         | 5.43              |
| 42  | Norethisterone                | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 42  | Norethisterone                | Lowest Price  | 1                    | 2.25   | 3.50   | 0.75  | 3.50   | 37.1%       | 13          | 37.1%       | 0.95         | 2.37              |
| 43  | Omeprazole                    | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 43  | Omeprazole                    | Lowest Price  | 1                    | 8.87   | 10.93  | 7.60  | 13.31  | 91.4%       | 32          | 91.4%       | 1.07         | 9.51              |
| 44  | Oral rehydration Salt         | Brand         | 0                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 44  | Oral rehydration Salt         | Lowest Price  | 1                    | 1.63   | 2.17   | 1.63  | 4.33   | 37.1%       | 13          | 37.1%       | 1.00         | 2.17              |
| 45  | Paracetamol suspension        | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 45  | Paracetamol suspension        | Lowest Price  | 1                    | 3.68   | 4.60   | 2.30  | 5.52   | 85.7%       | 30          | 85.7%       | 0.07         | 3.68              |
| 46  | Paracetamol tabs              | Brand         | 1                    |        |        |       |        | 5.7%        | 2           | 5.7%        |              |                   |
| 46  | Paracetamol tabs              | Lowest Price  | 1                    | 4.62   | 4.62   | 2.54  | 6.93   | 94.3%       | 33          | 94.3%       | 0.10         | 4.62              |
| 47  | Ranitidine                    | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 47  | Ranitidine                    | Lowest Price  | 1                    | 3.08   | 3.85   | 2.89  | 5.78   | 77.1%       | 27          | 77.1%       | 0.35         | 3.37              |
| 48  | Salbutamol inhaler            | Brand         | 1                    | 3.09   | 4.19   | 2.62  | 4.19   | 28.6%       | 10          | 28.6%       | 0.19         | 3.93              |
| 48  | Salbutamol inhaler            | Lowest Price  | 1                    | 1.91   | 2.09   | 1.26  | 2.62   | 62.9%       | 22          | 62.9%       | 0.10         | 1.99              |
| 49  | Salbutamol syrup              | Brand         | 1                    |        |        |       |        | 2.9%        | 1           | 2.9%        |              |                   |
| 49  | Salbutamol syrup              | Lowest Price  | 1                    | 1.51   | 2.07   | 1.13  | 2.26   | 77.1%       | 27          | 77.1%       | 0.06         | 1.70              |
| 50  | Simvastatin                   | Brand         | 1                    |        |        |       |        | 0.0%        | 0           | 0.0%        |              |                   |
| 50  | Simvastatin                   | Lowest Price  | 1                    | 3.19   | 3.65   | 2.28  | 11.54  | 31.4%       | 11          | 31.4%       | 0.84         | 3.19              |

**Appendix E (4-1) availability, Median price ratio and MP of Private Sector**

| No. | Medicine Name                    | Medicine Type | Include in analysis? | 25%ile | 75%ile | Min   | Max    | % with med. | # of prices | Median Price Ratio (MPR) | Median Price |
|-----|----------------------------------|---------------|----------------------|--------|--------|-------|--------|-------------|-------------|--------------------------|--------------|
| 1   | Adult cough preparation expecto. | Brand         | 0                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 1   | Adult cough preparation expecto. | Lowest Price  | 1                    | 3.65   | 5.11   | 2.74  | 5.84   | 100.0%      | 36          | 4.38                     | 0.06         |
| 2   | Albendazole                      | Brand         | 1                    |        |        |       |        | 5.6%        | 2           |                          |              |
| 2   | Albendazole                      | Lowest Price  | 1                    | 12.81  | 17.08  | 8.54  | 42.69  | 63.9%       | 23          | 12.81                    | 1.50         |
| 3   | Amitriptyline                    | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 3   | Amitriptyline                    | Lowest Price  | 1                    | 9.43   | 13.57  | 3.77  | 94.27  | 72.2%       | 25          | 11.31                    | 0.30         |
| 4   | Amlodipine                       | Brand         | 1                    |        |        |       |        | 5.6%        | 2           |                          |              |
| 4   | Amlodipine                       | Lowest Price  | 1                    | 1.89   | 3.14   | 1.26  | 8.38   | 100.0%      | 36          | 1.99                     | 0.32         |
| 5   | Amoxicillin                      | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 5   | Amoxicillin                      | Lowest Price  | 1                    | 4.26   | 4.43   | 3.55  | 7.09   | 97.2%       | 35          | 4.43                     | 0.63         |
| 6   | Amoxicillin + Clavulanic Acid    | Brand         | 1                    |        |        |       |        | 5.6%        | 2           |                          |              |
| 6   | Amoxicillin + Clavulanic Acid    | Lowest Price  | 1                    | 2.80   | 4.07   | 2.22  | 4.76   | 94.4%       | 34          | 3.25                     | 2.05         |
| 7   | Amoxicillin + Clavulanic Acid 2  | Brand         | 1                    | 4.94   | 5.25   | 4.71  | 5.61   | 16.7%       | 6           | 4.96                     | 7.89         |
| 7   | Amoxicillin + Clavulanic Acid 2  | Lowest Price  | 1                    | 2.47   | 2.96   | 0.67  | 3.37   | 100.0%      | 36          | 2.76                     | 4.39         |
| 8   | Amoxicillin suspension           | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 8   | Amoxicillin suspension           | Lowest Price  | 1                    | 3.71   | 4.18   | 2.32  | 4.64   | 91.7%       | 33          | 3.71                     | 0.11         |
| 9   | Artemether injection             | Brand         | 0                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 9   | Artemether injection             | Lowest Price  | 1                    | 0.76   | 0.88   | 0.48  | 1.00   | 97.2%       | 35          | 0.86                     | 4.50         |
| 10  | Artemether+ Lumefantrine         | Brand         | 1                    | 5.11   | 5.33   | 3.87  | 6.27   | 61.1%       | 22          | 5.25                     | 3.00         |
| 10  | Artemether+ Lumefantrine         | Lowest Price  | 1                    | 2.92   | 3.03   | 1.75  | 3.28   | 16.7%       | 6           | 2.92                     | 1.67         |
| 11  | Artesunate                       | Brand         | 0                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 11  | Artesunate                       | Lowest Price  | 1                    | 14.46  | 16.39  | 11.15 | 21.21  | 86.1%       | 31          | 14.46                    | 15.00        |
| 12  | Artesunate 2                     | Brand         | 0                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 12  | Artesunate 2                     | Lowest Price  | 1                    | 12.55  | 16.29  | 10.18 | 20.36  | 94.4%       | 34          | 13.57                    | 10.00        |
| 13  | Atenolol                         | Brand         | 1                    | 41.19  | 52.09  | 28.52 | 61.00  | 27.8%       | 10          | 46.34                    | 2.09         |
| 13  | Atenolol                         | Lowest Price  | 1                    | 4.44   | 5.55   | 3.33  | 266.17 | 94.4%       | 34          | 4.44                     | 0.20         |
| 14  | Atorvastatin                     | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 14  | Atorvastatin                     | Lowest Price  | 1                    | 1.43   | 2.51   | 1.26  | 4.01   | 86.1%       | 31          | 1.55                     | 1.10         |
| 15  | Azithromycin suspension          | Brand         | 1                    |        |        |       |        | 8.3%        | 3           |                          |              |
| 15  | Azithromycin suspension          | Lowest Price  | 1                    | 2.00   | 4.79   | 1.33  | 11.44  | 91.7%       | 33          | 3.99                     | 1.00         |
| 16  | Beclomethasone inhaler           | Brand         | 1                    |        |        |       |        | 8.3%        | 2           |                          |              |
| 16  | Beclomethasone inhaler           | Lowest Price  | 1                    | 1.79   | 2.11   | 1.40  | 3.90   | 58.3%       | 21          | 1.87                     | 0.12         |
| 17  | Captopril                        | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 17  | Captopril                        | Lowest Price  | 1                    | 8.58   | 12.48  | 4.68  | 17.16  | 47.2%       | 17          | 10.14                    | 0.65         |
| 18  | Carbamazepine                    | Brand         | 1                    | 16.26  | 18.85  | 11.78 | 21.21  | 63.9%       | 23          | 17.68                    | 1.50         |
| 18  | Carbamazepine                    | Lowest Price  | 1                    | 3.54   | 3.83   | 2.36  | 14.14  | 97.2%       | 35          | 3.54                     | 0.30         |
| 19  | Carbimazole                      | Brand         | 1                    | 4.67   | 9.86   | 3.83  | 22.75  | 19.4%       | 7           | 4.86                     | 0.52         |
| 19  | Carbimazole                      | Lowest Price  | 1                    | 2.80   | 3.74   | 1.87  | 5.61   | 88.9%       | 32          | 3.27                     | 0.35         |
| 20  | Cefixime                         | Brand         | 1                    | 12.65  | 14.70  | 8.82  | 15.19  | 36.1%       | 13          | 12.78                    | 16.67        |
| 20  | Cefixime                         | Lowest Price  | 1                    | 4.22   | 4.99   | 3.55  | 5.75   | 97.2%       | 35          | 4.47                     | 5.83         |
| 21  | Ceftriaxone injection            | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 21  | Ceftriaxone injection            | Lowest Price  | 1                    | 4.12   | 6.53   | 2.75  | 20.61  | 97.2%       | 35          | 5.15                     | 15.00        |
| 22  | Chloramphenicol eye drops        | Brand         | 0                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 22  | Chloramphenicol eye drops        | Lowest Price  | 1                    | 3.02   | 4.52   | 2.26  | 6.03   | 83.3%       | 30          | 4.15                     | 1.10         |
| 23  | Ciprofloxacin                    | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 23  | Ciprofloxacin                    | Lowest Price  | 1                    | 6.90   | 7.59   | 5.52  | 10.35  | 100.0%      | 36          | 6.90                     | 1.00         |
| 24  | Co-trimoxazole suspension        | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 24  | Co-trimoxazole suspension        | Lowest Price  | 1                    | 2.96   | 3.55   | 2.66  | 4.73   | 94.4%       | 34          | 3.55                     | 0.08         |
| 25  | Dexamethasone injection          | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 25  | Dexamethasone injection          | Lowest Price  | 1                    | 4.07   | 6.11   | 2.04  | 14.25  | 75.0%       | 27          | 4.07                     | 2.00         |

## Appendix F (4-2) availability, Median price ratio and MP of Private Sector

| No. | Medicine Name                 | Medicine Type | Include in analysis? | 25%ile | 75%ile | Min   | Max    | % with med. | # of prices | Median Price Ratio (MPR) | Median Price |
|-----|-------------------------------|---------------|----------------------|--------|--------|-------|--------|-------------|-------------|--------------------------|--------------|
| 26  | Diazepam                      | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 26  | Diazepam                      | Lowest Price  | 1                    | 3.83   | 7.67   | 3.83  | 11.50  | 80.6%       | 29          | 7.67                     | 0.20         |
| 27  | Diclofenac                    | Brand         | 1                    |        |        |       |        | 8.3%        | 3           |                          |              |
| 27  | Diclofenac                    | Lowest Price  | 1                    | 7.38   | 9.84   | 4.92  | 9.84   | 100.0%      | 36          | 9.84                     | 0.20         |
| 28  | Diclofenac 2                  | Brand         | 1                    |        |        |       |        | 8.3%        | 3           |                          |              |
| 28  | Diclofenac 2                  | Lowest Price  | 1                    | 32.32  | 40.40  | 20.20 | 101.00 | 94.4%       | 34          | 39.90                    | 0.99         |
| 29  | Ferrous Sulphate + Folic acid | Brand         | 0                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 29  | Ferrous Sulphate + Folic acid | Lowest Price  | 1                    | 23.40  | 36.08  | 15.60 | 41.61  | 100.0%      | 36          | 28.61                    | 0.37         |
| 30  | Fluoxetine                    | Brand         | 1                    |        |        |       |        | 2.8%        | 1           |                          |              |
| 30  | Fluoxetine                    | Lowest Price  | 1                    | 6.10   | 18.29  | 4.27  | 24.19  | 13.9%       | 5           | 12.81                    | 0.90         |
| 31  | Furosemide                    | Brand         | 1                    |        |        |       |        | 5.6%        | 2           |                          |              |
| 31  | Furosemide                    | Lowest Price  | 1                    | 7.07   | 9.43   | 4.71  | 14.14  | 91.7%       | 33          | 9.43                     | 0.20         |
| 32  | Glibenclamide                 | Brand         | 1                    |        |        |       |        | 2.8%        | 1           |                          |              |
| 32  | Glibenclamide                 | Lowest Price  | 1                    | 5.39   | 10.77  | 5.39  | 10.77  | 94.4%       | 34          | 8.08                     | 0.15         |
| 33  | Gliclazide                    | Brand         | 1                    | 6.63   | 7.23   | 5.06  | 11.02  | 13.9%       | 5           | 6.63                     | 1.83         |
| 33  | Gliclazide                    | Lowest Price  | 1                    | 1.26   | 2.17   | 0.72  | 3.98   | 69.4%       | 25          | 1.90                     | 0.53         |
| 34  | Hyoscine -N-Butylbromide      | Brand         | 1                    |        |        |       |        | 2.8%        | 1           |                          |              |
| 34  | Hyoscine -N-Butylbromide      | Lowest Price  | 1                    | 1.58   | 2.36   | 0.79  | 3.15   | 97.2%       | 35          | 2.36                     | 0.30         |
| 35  | Ibuprofen                     | Brand         | 1                    |        |        |       |        | 2.8%        | 1           |                          |              |
| 35  | Ibuprofen                     | Lowest Price  | 1                    | 6.59   | 8.79   | 4.39  | 11.44  | 91.7%       | 33          | 6.59                     | 0.30         |
| 36  | Insulin, Neutral Soluble      | Brand         | 1                    | 1.06   | 1.26   | 0.60  | 1.64   | 25.0%       | 9           | 1.13                     | 4.50         |
| 36  | Insulin, Neutral Soluble      | Lowest Price  | 1                    | 0.76   | 0.98   | 0.76  | 1.06   | 16.7%       | 6           | 0.82                     | 3.25         |
| 37  | Lisinopril                    | Brand         | 1                    | 8.16   | 13.92  | 5.73  | 14.44  | 33.3%       | 12          | 9.76                     | 2.68         |
| 37  | Lisinopril                    | Lowest Price  | 1                    | 2.14   | 4.18   | 1.30  | 9.11   | 94.4%       | 34          | 3.29                     | 0.90         |
| 38  | Metformin HCL                 | Brand         | 1                    | 7.58   | 8.85   | 3.79  | 10.11  | 25.0%       | 9           | 7.58                     | 0.60         |
| 38  | Metformin HCL                 | Lowest Price  | 1                    | 3.79   | 5.06   | 2.53  | 8.85   | 91.7%       | 33          | 3.79                     | 0.30         |
| 39  | Metronidazole                 | Brand         | 1                    |        |        |       |        | 5.6%        | 2           |                          |              |
| 39  | Metronidazole                 | Lowest Price  | 1                    | 3.83   | 7.67   | 1.92  | 7.67   | 94.4%       | 34          | 5.75                     | 0.15         |
| 40  | Metronidazole (2)             | Brand         | 1                    |        |        |       |        | 2.8%        | 1           |                          |              |
| 40  | Metronidazole (2)             | Lowest Price  | 1                    | 6.22   | 9.01   | 2.49  | 37.29  | 88.9%       | 32          | 7.46                     | 0.30         |
| 41  | Nifedipine Retard             | Brand         | 1                    |        |        |       |        | 2.8%        | 1           |                          |              |
| 41  | Nifedipine Retard             | Lowest Price  | 1                    | 5.43   | 7.24   | 3.02  | 9.95   | 91.7%       | 33          | 6.33                     | 0.70         |
| 42  | Norethisterone                | Brand         | 1                    | 3.96   | 5.92   | 3.92  | 6.00   | 36.1%       | 13          | 5.83                     | 2.33         |
| 42  | Norethisterone                | Lowest Price  | 1                    | 2.50   | 3.00   | 1.50  | 3.75   | 86.1%       | 31          | 2.87                     | 1.15         |
| 43  | Omeprazole                    | Brand         | 1                    |        |        |       |        | 8.3%        | 3           |                          |              |
| 43  | Omeprazole                    | Lowest Price  | 1                    | 7.60   | 9.51   | 6.34  | 15.84  | 100.0%      | 36          | 8.87                     | 1.00         |
| 44  | Oral rehydration Salt         | Brand         | 0                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 44  | Oral rehydration Salt         | Lowest Price  | 1                    | 2.17   | 3.25   | 1.63  | 6.50   | 80.6%       | 29          | 3.25                     | 1.50         |
| 45  | Paracetamol suspension        | Brand         | 1                    |        |        |       |        | 2.8%        | 1           |                          |              |
| 45  | Paracetamol suspension        | Lowest Price  | 1                    | 4.14   | 4.60   | 3.68  | 6.44   | 83.3%       | 30          | 4.60                     | 0.08         |
| 46  | Paracetamol tabs              | Brand         | 1                    | 19.24  | 24.82  | 17.31 | 30.78  | 50.0%       | 18          | 19.24                    | 0.42         |
| 46  | Paracetamol tabs              | Lowest Price  | 1                    | 4.62   | 4.62   | 3.46  | 9.23   | 100.0%      | 36          | 4.62                     | 0.10         |
| 47  | Ranitidine                    | Brand         | 1                    |        |        |       |        | 8.3%        | 3           |                          |              |
| 47  | Ranitidine                    | Lowest Price  | 1                    | 2.89   | 3.61   | 0.96  | 4.81   | 97.2%       | 35          | 2.89                     | 0.30         |
| 48  | Salbutamol inhaler            | Brand         | 1                    | 2.09   | 3.67   | 1.52  | 4.71   | 66.7%       | 24          | 3.14                     | 0.15         |
| 48  | Salbutamol inhaler            | Lowest Price  | 1                    | 1.78   | 1.86   | 1.47  | 2.62   | 72.2%       | 26          | 1.78                     | 0.09         |
| 49  | Salbutamol syrup              | Brand         | 1                    | 2.83   | 3.77   | 1.36  | 5.66   | 47.2%       | 17          | 3.21                     | 0.11         |
| 49  | Salbutamol syrup              | Lowest Price  | 1                    | 1.89   | 2.26   | 1.51  | 2.64   | 91.7%       | 33          | 1.89                     | 0.07         |
| 50  | Simvastatin                   | Brand         | 1                    |        |        |       |        | 0.0%        | 0           |                          |              |
| 50  | Simvastatin                   | Lowest Price  | 1                    | 2.66   | 3.52   | 1.65  | 13.58  | 50.0%       | 18          | 3.04                     | 0.80         |

## Appendix G (5-1) availability, Median price ratio and MP of RDF

| No. | Medicine Name                | Medicine Type | Include in analysis? | Median Price Ratio (MPR) | 25 <sup>th</sup> ile | 75 <sup>th</sup> ile | Min   | Max   | % with med. | # of prices | Median Price |
|-----|------------------------------|---------------|----------------------|--------------------------|----------------------|----------------------|-------|-------|-------------|-------------|--------------|
| 1   | Adult cough preparation exp  | Brand         | 0                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 1   | Adult cough preparation exp  | Lowest Pric   | 1                    | 3.65                     | 3.28                 | 4.38                 | 2.19  | 8.03  | 77.4%       | 24          | 0.05         |
| 2   | Albendazole                  | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 2   | Albendazole                  | Lowest Pric   | 1                    | 8.54                     | 8.54                 | 11.74                | 8.54  | 21.34 | 12.9%       | 4           | 1.00         |
| 3   | Amitriptyline                | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 3   | Amitriptyline                | Lowest Pric   | 1                    | 7.58                     | 7.54                 | 9.80                 | 3.77  | 10.18 | 22.6%       | 7           | 0.20         |
| 4   | Amlodipine                   | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 4   | Amlodipine                   | Lowest Pric   | 1                    | 1.89                     | 1.89                 | 2.20                 | 1.68  | 4.40  | 74.2%       | 23          | 0.30         |
| 5   | Amoxicillin                  | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 5   | Amoxicillin                  | Lowest Pric   | 1                    | 4.12                     | 3.55                 | 4.43                 | 3.19  | 5.32  | 64.5%       | 20          | 0.58         |
| 6   | Amoxicillin + Clavulanic Aci | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 6   | Amoxicillin + Clavulanic Aci | Lowest Pric   | 1                    | 3.69                     | 3.49                 | 3.97                 | 1.98  | 4.60  | 58.1%       | 18          | 2.33         |
| 7   | Amoxicillin + Clavulanic Aci | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 7   | Amoxicillin + Clavulanic Aci | Lowest Pric   | 1                    | 2.78                     | 2.66                 | 2.92                 | 1.83  | 4.04  | 74.2%       | 23          | 4.43         |
| 8   | Amoxicillin suspension       | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 8   | Amoxicillin suspension       | Lowest Pric   | 1                    | 3.19                     | 2.78                 | 3.65                 | 1.86  | 4.18  | 71.0%       | 22          | 0.09         |
| 9   | Artemether injection         | Brand         | 0                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 9   | Artemether injection         | Lowest Pric   | 1                    | 0.74                     | 0.67                 | 0.76                 | 0.48  | 0.86  | 58.1%       | 18          | 3.88         |
| 10  | Artemether+ Lumefantrine     | Brand         | 1                    | 3.94                     | 3.94                 | 4.93                 | 2.77  | 5.25  | 19.4%       | 6           | 2.25         |
| 10  | Artemether+ Lumefantrine     | Lowest Pric   | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 11  | Artesunate                   | Brand         | 0                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 11  | Artesunate                   | Lowest Pric   | 1                    | 13.69                    | 11.57                | 13.98                | 9.64  | 14.46 | 32.3%       | 10          | 14.20        |
| 12  | Artesunate 2                 | Brand         | 0                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 12  | Artesunate 2                 | Lowest Pric   | 1                    | 13.57                    | 12.21                | 14.93                | 8.41  | 16.29 | 35.5%       | 11          | 10.00        |
| 13  | Atenolol                     | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 13  | Atenolol                     | Lowest Pric   | 1                    | 4.44                     | 4.44                 | 4.44                 | 2.96  | 9.51  | 74.2%       | 23          | 0.20         |
| 14  | Atorvastatin                 | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 14  | Atorvastatin                 | Lowest Pric   | 1                    | 1.53                     | 1.50                 | 2.54                 | 1.26  | 2.60  | 32.3%       | 10          | 1.09         |
| 15  | Azithromycin suspension      | Brand         | 1                    |                          |                      |                      |       |       | 3.2%        | 1           |              |
| 15  | Azithromycin suspension      | Lowest Pric   | 1                    | 1.86                     | 1.33                 | 3.99                 | 1.06  | 6.65  | 74.2%       | 23          | 0.47         |
| 16  | Beclomethasone inhaler       | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 16  | Beclomethasone inhaler       | Lowest Pric   | 1                    | 1.83                     | 1.83                 | 1.95                 | 1.72  | 1.95  | 22.6%       | 7           | 0.12         |
| 17  | Captopril                    | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 17  | Captopril                    | Lowest Pric   | 1                    | 6.24                     | 5.23                 | 7.02                 | 4.68  | 10.14 | 22.6%       | 7           | 0.40         |
| 18  | Carbamazepine                | Brand         | 1                    |                          |                      |                      |       |       | 9.7%        | 3           |              |
| 18  | Carbamazepine                | Lowest Pric   | 1                    | 2.36                     | 2.36                 | 3.54                 | 1.77  | 5.89  | 51.6%       | 16          | 0.20         |
| 19  | Carbimazole                  | Brand         | 1                    |                          |                      |                      |       |       | 9.7%        | 3           |              |
| 19  | Carbimazole                  | Lowest Pric   | 1                    | 2.80                     | 2.80                 | 2.92                 | 2.52  | 4.67  | 29.0%       | 9           | 0.30         |
| 20  | Cefixime                     | Brand         | 1                    | 13.17                    | 13.02                | 13.17                | 12.59 | 13.17 | 12.9%       | 4           | 17.17        |
| 20  | Cefixime                     | Lowest Pric   | 1                    | 4.22                     | 3.96                 | 4.47                 | 3.83  | 7.92  | 67.7%       | 21          | 5.50         |
| 21  | Ceftriaxone injection        | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 21  | Ceftriaxone injection        | Lowest Pric   | 1                    | 4.12                     | 2.58                 | 8.50                 | 2.47  | 22.33 | 74.2%       | 23          | 12.00        |
| 22  | Chloramphenicol eye drops    | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 22  | Chloramphenicol eye drops    | Lowest Pric   | 1                    | 2.83                     | 2.26                 | 3.02                 | 1.89  | 4.52  | 38.7%       | 12          | 0.75         |
| 23  | Ciprofloxacin                | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 23  | Ciprofloxacin                | Lowest Pric   | 1                    | 6.21                     | 5.17                 | 6.90                 | 3.45  | 7.24  | 77.4%       | 24          | 0.90         |
| 24  | Co-trimoxazole suspension    | Brand         | 1                    |                          |                      |                      |       |       | 0.0%        | 0           |              |
| 24  | Co-trimoxazole suspension    | Lowest Pric   | 1                    | 2.75                     | 2.44                 | 2.96                 | 1.48  | 4.73  | 71.0%       | 22          | 0.06         |




### Appendix H (5-2) availability, Median price ratio and MP of RDF

| No. | Medicine Name                 | Medicine Type | Include in analysis? | Median Price Ratio (MPR) | 25%ile | 75%ile | Min   | Max   | % with med. | # of prices | Median Price |
|-----|-------------------------------|---------------|----------------------|--------------------------|--------|--------|-------|-------|-------------|-------------|--------------|
| 25  | Dexamethasone injection       | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 25  | Dexamethasone injection       | Lowest Price  | 1                    | 5.09                     | 2.04   | 5.09   | 1.02  | 7.13  | 41.9%       | 13          | 2.50         |
| 26  | Diazepam                      | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 26  | Diazepam                      | Lowest Price  | 1                    | 3.83                     | 3.83   | 3.83   | 3.83  | 7.67  | 45.2%       | 14          | 0.10         |
| 27  | Diclofenac                    | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 27  | Diclofenac                    | Lowest Price  | 1                    | 9.84                     | 7.38   | 9.84   | 4.92  | 14.76 | 83.9%       | 26          | 0.20         |
| 28  | Diclofenac 2                  | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 28  | Diclofenac 2                  | Lowest Price  | 1                    | 38.38                    | 32.32  | 39.29  | 20.20 | 40.40 | 32.3%       | 10          | 0.95         |
| 29  | Ferrous Sulphate + Folic acid | Brand         | 0                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 29  | Ferrous Sulphate + Folic acid | Lowest Price  | 1                    | 23.40                    | 22.10  | 24.70  | 17.16 | 39.01 | 74.2%       | 23          | 0.30         |
| 30  | Fluoxetine                    | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 30  | Fluoxetine                    | Lowest Price  | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 31  | Furosemide                    | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 31  | Furosemide                    | Lowest Price  | 1                    | 8.48                     | 7.07   | 9.43   | 4.71  | 9.43  | 71.0%       | 22          | 0.18         |
| 32  | Glibenclamide                 | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 32  | Glibenclamide                 | Lowest Price  | 1                    | 8.08                     | 5.39   | 10.77  | 5.39  | 10.77 | 77.4%       | 24          | 0.15         |
| 33  | Gliclazide                    | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 33  | Gliclazide                    | Lowest Price  | 1                    | 2.17                     | 1.89   | 2.17   | 1.36  | 4.39  | 22.6%       | 7           | 0.60         |
| 34  | Hyoscine -N-Butylbromide      | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 34  | Hyoscine -N-Butylbromide      | Lowest Price  | 1                    | 1.77                     | 1.58   | 2.36   | 0.79  | 2.76  | 71.0%       | 22          | 0.23         |
| 35  | Ibuprofen                     | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 35  | Ibuprofen                     | Lowest Price  | 1                    | 6.59                     | 5.49   | 6.59   | 2.20  | 8.79  | 74.2%       | 23          | 0.30         |
| 36  | Insulin, Neutral Soluble      | Brand         | 1                    | 1.01                     | 0.97   | 1.36   | 0.60  | 1.47  | 19.4%       | 6           | 4.00         |
| 36  | Insulin, Neutral Soluble      | Lowest Price  | 1                    |                          |        |        |       |       | 6.5%        | 2           |              |
| 37  | Lisinopril                    | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 37  | Lisinopril                    | Lowest Price  | 1                    | 3.64                     | 3.25   | 4.01   | 2.47  | 7.29  | 61.3%       | 19          | 1.00         |
| 38  | Metformin HCL                 | Brand         | 1                    | 6.32                     | 6.32   | 6.32   | 6.32  | 6.32  | 12.9%       | 4           | 0.50         |
| 38  | Metformin HCL                 | Lowest Price  | 1                    | 4.11                     | 3.16   | 6.32   | 2.53  | 6.32  | 38.7%       | 12          | 0.33         |
| 39  | Metronidazole                 | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 39  | Metronidazole                 | Lowest Price  | 1                    | 5.18                     | 3.83   | 5.75   | 3.83  | 26.84 | 71.0%       | 22          | 0.14         |
| 40  | Metronidazole (2)             | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 40  | Metronidazole (2)             | Lowest Price  | 1                    | 6.22                     | 5.28   | 7.46   | 4.97  | 11.60 | 45.2%       | 14          | 0.25         |
| 41  | Nifedipine Retard             | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 41  | Nifedipine Retard             | Lowest Price  | 1                    | 4.98                     | 4.52   | 6.33   | 1.81  | 6.33  | 35.5%       | 11          | 0.55         |
| 42  | Norethisterone                | Brand         | 1                    |                          |        |        |       |       | 9.7%        | 3           |              |
| 42  | Norethisterone                | Lowest Price  | 1                    | 2.94                     | 2.37   | 3.00   | 1.75  | 3.00  | 25.8%       | 8           | 1.18         |
| 43  | Omeprazole                    | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 43  | Omeprazole                    | Lowest Price  | 1                    | 8.24                     | 7.60   | 8.87   | 5.07  | 10.65 | 71.0%       | 22          | 0.93         |
| 44  | Oral rehydration Salt         | Brand         | 0                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 44  | Oral rehydration Salt         | Lowest Price  | 1                    | 2.17                     | 2.17   | 2.17   | 1.08  | 4.33  | 45.2%       | 14          | 1.00         |
| 45  | Paracetamol suspension        | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 45  | Paracetamol suspension        | Lowest Price  | 1                    | 3.68                     | 3.49   | 4.83   | 1.84  | 5.06  | 61.3%       | 19          | 0.07         |
| 46  | Paracetamol tabs              | Brand         | 1                    |                          |        |        |       |       | 6.5%        | 2           |              |
| 46  | Paracetamol tabs              | Lowest Price  | 1                    | 4.62                     | 3.92   | 4.62   | 2.31  | 4.62  | 83.9%       | 26          | 0.10         |
| 47  | Ranitidine                    | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 47  | Ranitidine                    | Lowest Price  | 1                    | 2.89                     | 2.65   | 3.37   | 1.44  | 3.85  | 74.2%       | 23          | 0.30         |
| 48  | Salbutamol inhaler            | Brand         | 1                    | 1.60                     | 1.52   | 2.04   | 1.47  | 2.83  | 58.1%       | 18          | 0.08         |
| 48  | Salbutamol inhaler            | Lowest Price  | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 49  | Salbutamol syrup              | Brand         | 1                    | 1.60                     | 1.60   | 1.70   | 1.60  | 1.70  | 16.1%       | 5           | 0.06         |
| 49  | Salbutamol syrup              | Lowest Price  | 1                    | 1.46                     | 1.27   | 1.89   | 0.75  | 2.26  | 51.6%       | 16          | 0.05         |
| 50  | Simvastatin                   | Brand         | 1                    |                          |        |        |       |       | 0.0%        | 0           |              |
| 50  | Simvastatin                   | Lowest Price  | 1                    | 2.22                     | 1.79   | 2.50   | 1.71  | 21.05 | 19.4%       | 6           | 0.58         |

## Appendix I (6) International reference prices in US\$

| Med. No. | Medicine Name<br>(Name must be unique) | Medicine Strength | Dosage Form  | Target Pack Size | Medicine list | National Essential Medicine List | MSH 2011 Unit Price (\$US) | Price of Target Pack (\$US) | Price of Target Pack (local currency) | Reference Unit Price (local currency) | Med.No |
|----------|--|-------------------|--------------|------------------|---------------|----------------------------------|----------------------------|-----------------------------|---------------------------------------|---------------------------------------|--------|
| 1        | Adult cough preparation expecto.       |                   | syrup        | 100              | Supplementary | yes                              | 0.0031                     | \$0.3100                    | 1.3702                                | 0.0137                                | 50     |
| 2        | Albendazole                            | 200 mg            | cap/tab (non | 2                | Regional      | yes                              | \$0.0265                   | \$0.0530                    | 0.2343                                | 0.1171                                | 1      |
| 3        | Amitriptyline                          | 25 mg             | cap/tab      | 100              | Global        | yes                              | \$0.0060                   | \$0.6000                    | 2.6520                                | 0.0265                                | 42     |
| 4        | Amlodipine                             | 5 mg              | cap/tab      | 30               | Supplementary | yes                              | \$0.0360                   | \$1.0800                    | 4.7736                                | 0.1591                                | 26     |
| 5        | Amoxicillin                            | 500 mg            | cap/tab      | 16               | Global        | yes                              | \$0.0319                   | \$0.5104                    | 2.2560                                | 0.1410                                | 3      |
| 6        | Amoxicillin + Clavulanic Acid          | 250+125 mg        | cap/tab      | 20               | Supplementary | yes                              | \$0.1426                   | \$2.8520                    | 12.6058                               | 0.6303                                | 36     |
| 7        | Amoxicillin + Clavulanic Acid 2        | 875+125 mg        | cap/tab      | 14               | Supplementary | yes                              | \$0.3600                   | \$5.0400                    | 22.2768                               | 1.5912                                | 24     |
| 8        | Amoxicillin suspension                 | 50 mg/ml          | millilitre   | 75               | Regional      | yes                              | \$0.0065                   | \$0.4875                    | 2.1548                                | 0.0287                                | 41     |
| 9        | Artemether injection                   | 80 mg/ml          | millilitre   | 8                | Supplementary | yes                              | \$1.1900                   | \$9.5200                    | 42.0784                               | 5.2598                                | 25     |
| 10       | Artemether+ Lumefantrine               | 20+120 mg         | cap/tab      | 24               | Supplementary | yes                              | \$0.1292                   | \$3.1008                    | 13.7055                               | 0.5711                                | 27     |
| 11       | Artesunate                             | 100 mg            | cap/tab      | 1                | Supplementary | yes                              | \$0.2347                   | \$0.2347                    | 1.0374                                | 1.0374                                | 29     |
| 12       | Artesunate 2                           | 50 mg             | cap/tab      | 1                | Supplementary | yes                              | \$0.1667                   | \$0.1667                    | 0.7368                                | 0.7368                                |        |
| 13       | Atenolol                               | 50 mg             | cap/tab      | 30               | Global        | yes                              | \$0.0102                   | \$0.3060                    | 1.3525                                | 0.0451                                | 4      |
| 14       | Atorvastatin                           | 20 mg             | cap/tab      | 30               | Regional      | yes                              | \$0.1610                   | \$4.8300                    | 21.3486                               | 0.7116                                | 33     |
| 15       | Azithromycin suspension                | 40 mg/ml          | millilitre   | 15               | Supplementary | yes                              | \$0.0567                   | \$0.8505                    | 3.7592                                | 0.2506                                | 47     |
| 16       | Beclomethasone inhaler                 | 50 mcg/dose       | dose         | 200              | Regional      | yes                              | \$0.0145                   | \$2.9000                    | 12.8180                               | 0.0641                                | 28     |
| 17       | Captopril                              | 25 mg             | cap/tab      | 60               | Global        | yes                              | \$0.0145                   | \$0.8700                    | 3.8454                                | 0.0641                                | 43     |
| 18       | Carbamazepine                          | 200 mg            | cap/tab      | 100              | Regional      | yes                              | \$0.0192                   | \$1.9200                    | 8.4864                                | 0.0849                                | 22     |
| 19       | Carbimazole                            | 5 mg              | cap/tab      | 30               | Supplementary | yes                              | \$0.0242                   | \$0.7260                    | 3.2089                                | 0.1070                                | 40     |
| 20       | Cefixime                               | 400 mg            | cap/tab      | 8                | Supplementary | yes                              | \$0.2950                   | \$2.3600                    | 10.4312                               | 1.3039                                | 48     |
| 21       | Ceftriaxone injection                  | 1 g/vial          | vial         | 1                | Global        | yes                              | \$0.6586                   | \$0.6586                    | 2.9110                                | 2.9110                                | 6      |
| 22       | Chloramphenicol eye drops              | 0.50%             | millilitre   | 5                | Regional      | yes                              | \$0.0600                   | \$0.3000                    | 1.3260                                | 0.2652                                | 5      |
| 23       | Ciprofloxacin                          | 500 mg            | cap/tab      | 10               | Global        | yes                              | \$0.0328                   | \$0.3280                    | 1.4498                                | 0.1450                                | 7      |
| 24       | Co-trimoxazole suspension              | 8+40 mg/ml        | millilitre   | 75               | Global        | no                               | \$0.0051                   | \$0.3825                    | 1.6907                                | 0.0225                                | 8      |
| 25       | Dexamethasone injection                | 4 mg/ml           | millilitre   | 1                | Regional      | yes                              | \$0.1111                   | \$0.1111                    | 0.4911                                | 0.4911                                | 16     |
| 26       | Diazepam                               | 5 mg              | cap/tab      | 100              | Global        | yes                              | \$0.0059                   | \$0.5900                    | 2.6078                                | 0.0261                                | 9      |
| 27       | Diclofenac                             | 25 mg             | cap/tab      | 30               | Supplementary | no                               | \$0.0046                   | \$0.1380                    | 0.6100                                | 0.0203                                | 10     |
| 28       | Diclofenac 2                           | 50mg              | cap/tab      | 30               | Global        | no                               | \$0.0056                   | \$0.1680                    | 0.7426                                | 0.0248                                | 45     |
| 29       | Ferrous Sulphate + Folic acid          | 200+0.4 mg        | cap/tab      | 30               | Supplementary | yes                              | \$0.0029                   | \$0.0870                    | 0.3845                                | 0.0128                                | 37     |
| 30       | Fluoxetine                             | 20 mg             | cap/tab      | 30               | Regional      | yes                              | \$0.0159                   | \$0.4770                    | 2.1083                                | 0.0703                                | 23     |
| 31       | Furosemide                             | 40 mg             | cap/tab      | 1000             | Regional      | yes                              | \$0.0048                   | \$4.8000                    | 21.2160                               | 0.0212                                | 30     |
| 32       | Glibenclamide                          | 5 mg              | cap/tab      | 100              | Global        | yes                              | \$0.0042                   | \$0.4200                    | 1.8564                                | 0.0186                                | 11     |
| 33       | Gliclazide                             | 80 mg             | cap/tab      | 100              | Regional      | no                               | \$0.0626                   | \$6.2600                    | 27.6692                               | 0.2767                                | 20     |
| 34       | Hyoscine -N-Butylbromide               | 10 mg             | cap/tab      | 100              | Supplementary | yes                              | \$0.0287                   | \$2.8700                    | 12.6854                               | 0.1269                                | 38     |
| 35       | Ibuprofen                              | 400 mg            | cap/tab      | 500              | Regional      | yes                              | \$0.0103                   | \$5.1500                    | 22.7630                               | 0.0455                                | 21     |
| 36       | Insulin, Neutral Soluble               | 100 IU/ml         | millilitre   | 10               | Supplementary | yes                              | \$0.8982                   | \$8.9820                    | 39.7004                               | 3.9700                                | 17     |
| 37       | Lisinopril                             | 10 mg             | cap/tab      | 30               | Regional      | yes                              | \$0.0621                   | \$1.8630                    | 8.2345                                | 0.2745                                | 19     |
| 38       | Metformin HCL                          | 500 mg            | cap/tab      | 50               | Regional      | yes                              | \$0.0179                   | \$0.8950                    | 3.9559                                | 0.0791                                | 18     |
| 39       | Metronidazole                          | 200 mg            | cap/tab      | 500              | Supplementary | yes                              | \$0.0059                   | \$2.9500                    | 13.0390                               | 0.0261                                | 31     |
| 40       | Metronidazole (2)                      | 400 mg            | cap/tab      | 20               | Regional      | yes                              | \$0.0091                   | \$0.1820                    | 0.8044                                | 0.0402                                | 46     |
| 41       | Nifedipine Retard                      | 20 mg             | cap/tab      | 30               | Regional      | yes                              | \$0.0250                   | \$0.7500                    | 3.3150                                | 0.1105                                | 15     |
| 42       | Norethisterone                         | 5 mg              | cap/tab      | 30               | Supplementary | yes                              | \$0.0905                   | \$2.7150                    | 12.0003                               | 0.4000                                | 39     |
| 43       | Omeprazole                             | 20 mg             | cap/tab      | 14               | Global        | yes                              | \$0.0255                   | \$0.3570                    | 1.5779                                | 0.1127                                | 12     |
| 44       | Oral rehydration Salt                  | 1 PK/l litre      | sachet       | 1                | Supplementary | yes                              | \$0.1044                   | \$0.1044                    | 0.4614                                | 0.4614                                | 49     |
| 45       | Paracetamol suspension                 | 24 mg/ml          | millilitre   | 60               | Global        | yes                              | \$0.0041                   | \$0.2460                    | 1.0873                                | 0.0181                                | 13     |
| 46       | Paracetamol tabs                       | 500 mg            | cap/tab      | 20               | Supplementary | yes                              | \$0.0049                   | \$0.0980                    | 0.4332                                | 0.0217                                | 35     |
| 47       | Ranitidine                             | 150 mg            | cap/tab      | 30               | Regional      | yes                              | \$0.0235                   | \$0.7050                    | 3.1161                                | 0.1039                                | 34     |
| 48       | Salbutamol inhaler                     | 100 mcg/dose      | dose         | 200              | Global        | yes                              | \$0.0108                   | \$2.1600                    | 9.5472                                | 0.0477                                | 14     |
| 49       | Salbutamol syrup                       | 0.4 mg/ml         | millilitre   | 75               | Supplementary | yes                              | \$0.0080                   | \$0.6000                    | 2.6520                                | 0.0354                                | 32     |
| 50       | Simvastatin                            | 20 mg             | cap/tab      | 30               | Global        | yes                              | \$0.0595                   | \$1.7850                    | 7.8897                                | 0.2630                                | 44     |

## Appendix K 7: Ethical Clearance

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|  <p>         الصندوق القومي للتأمين الصحي<br/>         National Health Insurance Fund<br/>         الإدارة العامة للتخطيط والبحوث والعمليات<br/>         إدارة البحوث والسياسات<br/>         جدة الخرطوم - السودان       </p> <p>         NO/NHIF/rd/TC/2012<br/>         Date 28/03/2013       </p> <h2 style="text-align: center;">Certification</h2> <p>         This is to certify that the National Health Insurance Fund<br/>         is accepting the<br/>         Request of Dr :Mohammed Yusuf Ahmed Musa from<br/>         Department of Health services, National Health Insurance<br/>         Fund to undertake the study entitled(The Prices, Availability       </p> | <p>and Affordability of Essential medicines in Sudan)to be carried in Sudan.</p> <p style="text-align: center;"><i>Murad I. Aziz</i></p> <p>         Dr Murad I Abdel Aziz<br/> <b>MBBS, MD, MPH, PhD, CCST, FPPH</b> </p> |
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### Appendix L medicines availability in the private, public and EDF sectors

|                                 |               | Medicines Availability in Outlets |                   |               |                  |                   |               |
|---------------------------------|---------------|-----------------------------------|-------------------|---------------|------------------|-------------------|---------------|
| Medicine Name                   | Medicine list | Brand                             |                   |               | Lowest Price     |                   |               |
|                                 |               | Public<br>(n=35)                  | Private<br>(n=36) | RDF<br>(n=28) | Public<br>(n=35) | Private<br>(n=36) | RDF<br>(n=28) |
| Adult cough preparation         | Supplementary | 0.0%                              | 8.3%              | 0.0%          | 97.1%            | 100.0%            | 92.9%         |
| Albendazole 200mg tablet        | Regional      | 5.7%                              | 50.0%             | 7.1%          | 94.3%            | 100.0%            | 92.9%         |
| Amitriptyline 25mg tablet       | Global        | 0.0%                              | 0.0%              | 0.0%          | 100.0%           | 100.0%            | 85.7%         |
| Amlodipine 5mg tablet           | Supplementary |                                   |                   |               | 82.9%            | 100.0%            | 85.7%         |
| Amoxicillin 500mg capsule       | Global        | 0.0%                              | 5.6%              | 0.0%          | 87.5%            | 100.0%            | 82.1%         |
| Amoxicillin + Clavulanic Acid   | Supplementary |                                   |                   |               | 82.9%            | 100.0%            | 82.1%         |
| Amoxicillin + Clavulanic Acid 2 | Supplementary | 0.0%                              | 16.7%             | 0.0%          | 62.5%            | 100.0%            | 82.1%         |
| Amoxicillin suspension          | Regional      | 0.0%                              | 8.3%              | 0.0%          | 100.0%           | 100.0%            | 78.6%         |
| Artemether injection            | Supplementary | 0.0%                              | 0.0%              | 0.0%          | 100.0%           | 97.2%             | 82.1%         |
| Artemether+ Lumefantrine        | Supplementary | 0.0%                              | 8.3%              | 0.0%          | 77.1%            | 97.2%             | 82.1%         |
| Artesunate 100mg tablet         | Supplementary | 0.0%                              | 2.8%              | 0.0%          | 77.1%            | 97.2%             | 78.6%         |
| Artesunate 50mg tablet          | Supplementary | 25.0%                             | 36.1%             | 14.3%         | 100.0%           | 97.2%             | 75.0%         |
| Atenolol 50mg tablet            | Global        | 0.0%                              | 0.0%              | 0.0%          | 82.9%            | 97.2%             | 71.4%         |
| Atorvastatin 20mg tablet        | Regional      |                                   |                   |               | 68.6%            | 97.2%             | 64.3%         |
| Azithromycin suspension         | Supplementary | 5.7%                              | 63.9%             | 10.7%         | 77.1%            | 97.2%             | 57.1%         |
| Beclomethasone inhaler          | Regional      | 0.0%                              | 2.8%              | 0.0%          | 97.1%            | 94.4%             | 85.7%         |
| Captopril 25mg tablet           | Global        | 0.0%                              | 27.8%             | 0.0%          | 88.6%            | 94.4%             | 82.1%         |
| Carbamazepine 200mg tab         | Regional      | 0.0%                              | 0.0%              | 0.0%          | 88.6%            | 94.4%             | 78.6%         |
| Carbimazole 5mg tab             | Supplementary | 0.0%                              | 5.6%              | 0.0%          | 80.0%            | 94.4%             | 78.6%         |
| Cefixime 400mg capsule          | Supplementary | 0.0%                              | 33.3%             | 0.0%          | 68.6%            | 94.4%             | 67.9%         |
| Ceftriaxone injection 1g        | Global        | 0.0%                              | 5.6%              | 0.0%          | 100.0%           | 94.4%             | 64.3%         |
| Chloramphenicol eye drops       | Regional      |                                   |                   |               | 48.6%            | 94.4%             | 39.3%         |
| Ciprofloxacin 500mg tablet      | Global        | 0.0%                              | 8.3%              | 0.0%          | 45.7%            | 94.4%             | 35.7%         |
| Co-trimoxazole suspension       | Global        | 0.0%                              | 8.3%              | 3.6%          | 77.1%            | 91.7%             | 82.1%         |
| Dexamethasone injection         | Regional      | 0.0%                              | 2.8%              | 0.0%          | 71.4%            | 91.7%             | 82.1%         |
| Diazepam 5mg tablet             | Global        | 0.0%                              | 0.0%              | 0.0%          | 85.7%            | 91.7%             | 78.6%         |
| Diclofenac 25mg tablet          | Supplementary | 2.9%                              | 5.6%              | 0.0%          | 82.9%            | 91.7%             | 78.6%         |
| Diclofenac 50mg tablet          | Global        | 2.9%                              | 47.2%             | 17.9%         | 77.1%            | 91.7%             | 57.1%         |
| Ferrous Sulphate + Folic acid   | Supplementary | 2.9%                              | 25.0%             | 14.3%         | 82.9%            | 91.7%             | 42.9%         |
| Fluoxetine 20mg tablet          | Regional      | 0.0%                              | 2.8%              | 0.0%          | 82.9%            | 91.7%             | 39.3%         |
| Furosemide 40mg tablet          | Regional      | 0.0%                              | 2.8%              | 0.0%          | 54.3%            | 88.9%             | 50.0%         |
| Glibenclamide 5mg tablet        | Global        | 37.1%                             | 19.4%             | 10.7%         | 14.3%            | 88.9%             | 32.1%         |
| Gliclazide 80mg tablet          | Regional      | 0.0%                              | 0.0%              | 0.0%          | 87.5%            | 86.1%             | 35.7%         |
| Hyoscine -N-Butylbromide        | Supplementary |                                   |                   |               | 40.0%            | 86.1%             | 35.7%         |
| Ibuprofen 400mg tablet          | Regional      | 0.0%                              | 36.1%             | 10.7%         | 37.1%            | 86.1%             | 28.6%         |
| Insulin, Neutral Soluble        | Supplementary | 0.0%                              | 2.8%              | 0.0%          | 85.7%            | 83.3%             | 67.9%         |
| Lisinopril 10mg tablet          | Regional      | 0.0%                              |                   | 0.0%          | 71.4%            | 83.3%             | 42.9%         |

|                               |               |       |       |       |       |       |       |
|-------------------------------|---------------|-------|-------|-------|-------|-------|-------|
| Metformin HCL 500mg tablet    | Regional      | 0.0%  | 0.0%  | 0.0%  | 51.4% | 80.6% | 50.0% |
| Metronidazole 250mg tablet    | Supplementary |       |       |       | 37.1% | 80.6% | 50.0% |
| Metronidazole 500mg tablet    | Regional      | 0.0%  | 0.0%  | 0.0%  | 45.7% | 75.0% | 46.4% |
| Nifedipine Retard 20mg tablet | Regional      | 0.0%  | 0.0%  | 0.0%  | 48.6% | 72.2% | 25.0% |
| Norethiesterone 5mg tablet    | Supplementary | 28.6% | 66.7% | 64.3% | 62.9% | 72.2% | 0.0%  |
| Omeprazole 20mg tablet        | Global        | 0.0%  | 13.9% | 0.0%  | 40.0% | 69.4% | 25.0% |
| Oral rehydration Salt         | Supplementary | 2.9%  | 5.6%  | 0.0%  | 34.3% | 63.9% | 14.3% |
| Paracetamol suspension        | Global        | 0.0%  | 8.3%  | 0.0%  | 87.5% | 58.3% | 25.0% |
| Paracetamol tabs 500mg        | Supplementary | 0.0%  | 0.0%  | 0.0%  | 62.5% | 50.0% | 21.4% |
| Ranitidine 150mg tablet       | Regional      | 0.0%  | 0.0%  | 0.0%  | 42.9% | 47.2% | 25.0% |
| Salbutamol inhaler            | Global        | 42.9% | 25.0% | 21.4% | 14.3% | 16.7% | 7.1%  |
| Salbutamol syrup              | Supplementary | 5.7%  | 61.1% | 21.4% | 20.0% | 16.7% | 0.0%  |
| Simvastatin 20mg tablet       | Global        | 0.0%  | 2.8%  | 0.0%  | 0.0%  | 13.9% | 0.0%  |

**Appendix M** Government procurement prices

| No. | Medicine Name                    | Medicine Type | Median Price Ratio (MPR) | 25%ile | 75%ile |
|-----|----------------------------------|---------------|--------------------------|--------|--------|
| 1   | Adult cough preparation expecto. | Lowest Price  | 2.34                     | 1.79   | 2.90   |
| 2   | Albendazole                      | Lowest Price  | 5.20                     | 4.78   | 5.62   |
| 3   | Amitriptyline                    | Lowest Price  | 5.53                     | 5.53   | 5.53   |
| 4   | Amlodipine                       | Lowest Price  | 0.56                     | 0.56   | 0.56   |
| 5   | Amoxicillin                      | Lowest Price  | 1.47                     | 1.47   | 1.47   |
| 6   | Amoxicillin + Clavulanic Acid    | Lowest Price  | 1.33                     | 1.25   | 1.41   |
| 7   | Amoxicillin + Clavulanic Acid 2  | Lowest Price  | 1.01                     | 1.00   | 1.02   |
| 8   | Amoxicillin suspension           | Lowest Price  | 1.29                     | 1.20   | 1.38   |
| 9   | Artemether injection             | Lowest Price  | 0.36                     | 0.34   | 0.37   |
| 10  | Artemether+ Lumefantrine         | Lowest Price  | 1.84                     | 1.53   | 2.15   |
| 11  | Artesunate                       | Lowest Price  | 5.14                     | 5.02   | 5.27   |
| 12  | Artesunate 2                     | Lowest Price  | 6.75                     | 6.67   | 6.84   |
| 13  | Atenolol                         | Lowest Price  | 6.14                     | 3.85   | 8.43   |
| 14  | Atorvastatin                     | Lowest Price  | 0.63                     | 0.61   | 0.65   |
| 15  | Azithromycin suspension          | Lowest Price  | 2.06                     | 2.06   | 2.06   |
| 16  | Beclomethasone inhaler           | Lowest Price  | 2.12                     | 1.59   | 2.65   |
| 17  | Captopril                        | Lowest Price  | 3.42                     | 3.06   | 3.78   |
| 18  | Carbamazepine                    | Lowest Price  | 1.84                     | 1.49   | 2.19   |
| 19  | Carbimazole                      | Lowest Price  | 4.85                     | 3.79   | 5.91   |
| 20  | Cefixime                         | Lowest Price  | 1.35                     | 1.32   | 1.39   |
| 21  | Ceftriaxone injection            | Lowest Price  | 3.04                     | 2.92   | 3.15   |
| 22  | Chloramphenicol eye drops        | Lowest Price  | 1.45                     | 1.24   | 1.66   |
| 23  | Ciprofloxacin                    | Lowest Price  | 1.98                     | 1.80   | 2.16   |
| 24  | Co-trimoxazole suspension        | Lowest Price  | 1.47                     | 1.23   | 1.70   |
| 25  | Dexamethasone injection          | Lowest Price  | 2.63                     | 2.63   | 2.63   |
| 26  | Diazepam                         | Lowest Price  | 3.31                     | 3.23   | 3.39   |
| 27  | Diclofenac                       | Lowest Price  | 3.24                     | 3.18   | 3.29   |
| 28  | Diclofenac 2                     | Lowest Price  | 23.16                    | 23.16  | 23.16  |

|    |                               |              |       |       |       |
|----|-------------------------------|--------------|-------|-------|-------|
| 29 | Ferrous Sulphate + Folic acid | Lowest Price | 12.20 | 10.34 | 14.06 |
| 30 | Fluoxetine                    | Lowest Price | 8.06  | 8.06  | 8.06  |
| 31 | Furosemide                    | Lowest Price | 3.61  | 3.41  | 3.81  |
| 32 | Glibenclamide                 | Lowest Price | 2.40  | 2.08  | 2.73  |
| 33 | Gliclazide                    | Lowest Price | 0.56  | 0.45  | 0.67  |
| 34 | Hyoscine -N-Butylbromide      | Lowest Price | 0.88  | 0.87  | 0.88  |
| 35 | Ibuprofen                     | Lowest Price | 2.33  | 2.33  | 2.33  |
| 36 | Insulin, Neutral Soluble      | Lowest Price | 0.43  | 0.39  | 0.47  |
| 37 | Lisinopril                    | Lowest Price | 0.79  | 0.75  | 0.82  |
| 38 | Metformin HCL                 | Lowest Price | 1.46  | 1.46  | 1.46  |
| 39 | Metronidazole                 | Lowest Price | 2.40  | 2.05  | 2.75  |
| 40 | Nifedipine Retard             | Lowest Price | 2.28  | 2.22  | 2.35  |
| 41 | Norethiesterone               | Lowest Price | 0.82  | 0.72  | 0.92  |
| 42 | Omeprazole                    | Lowest Price | 1.55  | 1.42  | 1.68  |
| 43 | Oral rehydration Salt         | Lowest Price | 0.81  | 0.77  | 0.85  |
| 44 | Paracetamol suspension        | Lowest Price | 1.46  | 1.31  | 1.60  |
| 45 | Paracetamol tabs              | Lowest Price | 1.66  | 1.58  | 1.73  |
| 46 | Ranitidine                    | Lowest Price | 1.24  | 1.18  | 1.31  |
| 47 | Salbutamol inhaler            | Lowest Price | 1.02  | 0.94  | 1.11  |
| 48 | Salbutamol syrup              | Lowest Price | 0.65  | 0.61  | 0.70  |
| 49 | Simvastatin                   | Lowest Price | 1.16  | 1.16  | 1.16  |

**Appendix N** Retail price in the Public sector outlets

| No. | Medicine Name                    | Medicine Type | Median Price Ratio (MPR) | 25%ile | 75%ile |
|-----|----------------------------------|---------------|--------------------------|--------|--------|
| 1   | Adult cough preparation expecto. | Lowest Price  | 2.98                     | 2.48   | 3.47   |
| 2   | Albendazole 200mg tablet         | Lowest Price  | 12.19                    | 10.89  | 12.19  |
| 3   | Amitriptyline 25mg tablet        | Lowest Price  | 7.69                     | 5.13   | 8.97   |
| 4   | Amlodipine 5mg tablet            | Lowest Price  | 1.28                     | 1.28   | 1.71   |
| 5   | Amoxicillin 500mg capsule        | Lowest Price  | 3.01                     | 2.89   | 3.62   |
| 6   | Amoxicillin + Clavulanic Acid    | Lowest Price  | 2.70                     | 2.70   | 3.13   |
| 7   | Amoxicillin + Clavulanic Acid 2  | Lowest Price  | 2.14                     | 1.74   | 3.06   |
| 8   | Amoxicillin suspension 250mg     | Lowest Price  | 2.52                     | 2.29   | 3.00   |
| 9   | Artemether injection 80mg        | Lowest Price  | 0.54                     | 0.38   | 0.62   |
| 10  | Artemether+ Lumefantrine         | Lowest Price  | 0.67                     | 0.60   | 1.44   |
| 11  | Artesunate 100mg tablet          | Lowest Price  | 9.83                     | 9.59   | 9.83   |
| 12  | Artesunate 50mg tablet           | Lowest Price  | 11.07                    | 8.31   | 11.07  |
| 13  | Atenolol 50mg tablet             | Lowest Price  | 4.02                     | 3.02   | 4.52   |
| 14  | Atorvastatin 20mg tablet         | Lowest Price  | 1.53                     | 1.27   | 2.29   |
| 15  | Azithromycin suspension          | Lowest Price  | 1.81                     | 1.09   | 2.17   |
| 16  | Beclomethasone inhaler           | Lowest Price  | 1.27                     | 1.25   | 1.49   |
| 17  | Captopril 25mg tablet            | Lowest Price  | 6.90                     | 6.37   | 7.53   |
| 18  | Carbamazepine 200mg              | Lowest Price  | 2.40                     | 2.00   | 3.21   |
| 19  | Carbimazole 5mg tablet           | Brand         | 3.81                     | 3.31   | 4.45   |
| 20  | Carbimazole 5mg tablet           | Lowest Price  | 1.72                     | 1.59   | 2.23   |
| 21  | Cefixime 400mg capsule           | Lowest Price  | 3.30                     | 2.87   | 3.65   |
| 22  | Ceftriaxone injection 1g         | Lowest Price  | 12.96                    | 7.71   | 15.18  |
| 23  | Chloramphenicol eye drops        | Lowest Price  | 3.08                     | 3.08   | 3.33   |
| 24  | Ciprofloxacin 500mg tablet       | Lowest Price  | 4.69                     | 4.69   | 5.63   |
| 25  | Co-trimoxazole suspension        | Lowest Price  | 2.01                     | 1.87   | 2.21   |
| 26  | Dexamethasone injection          | Lowest Price  | 1.94                     | 1.32   | 2.77   |
| 27  | Diazepam 5mg tablet              | Lowest Price  | 4.69                     | 2.93   | 6.78   |
| 28  | Diclofenac 25mg tablet           | Lowest Price  | 6.69                     | 5.43   | 6.69   |
| 29  | Diclofenac 50mg tablet           | Lowest Price  | 29.30                    | 23.35  | 54.95  |
| 30  | Ferrous Sulphate + Folic acid    | Lowest Price  | 21.22                    | 18.57  | 26.53  |
| 31  | Furosemide 40mg tablet           | Lowest Price  | 6.41                     | 4.81   | 6.41   |
| 32  | Glibenclamide 5mg tablet         | Lowest Price  | 3.66                     | 3.66   | 5.49   |
| 33  | Gliclazide 80mg tablet           | Lowest Price  | 1.47                     | 1.11   | 2.09   |
| 34  | Hyoscine -N-Butylbromide 10mg    | Lowest Price  | 1.34                     | 1.21   | 1.93   |
| 35  | Ibuprofen 400mg tablet           | Lowest Price  | 4.48                     | 3.73   | 5.97   |
| 36  | Insulin, Neutral Soluble         | Brand         | 0.69                     | 0.61   | 0.89   |
| 37  | Insulin, Neutral Soluble         | Lowest Price  | 0.72                     | 0.72   | 0.72   |
| 38  | Lisinopril 10mg tablet           | Lowest Price  | 1.66                     | 1.24   | 1.73   |
| 39  | Metformin HCL 500mg tablet       | Lowest Price  | 3.44                     | 2.15   | 3.44   |
| 40  | Metronidazole 250mg tablet       | Lowest Price  | 3.91                     | 2.61   | 5.22   |



|    |                               |              |      |      |      |
|----|-------------------------------|--------------|------|------|------|
| 41 | Metronidazole 500mg tablet    | Lowest Price | 4.23 | 4.23 | 5.07 |
| 42 | Nifedipine Retard 20mg tablet | Lowest Price | 3.69 | 3.28 | 4.51 |
| 43 | Norethiesterone 5mg tablet    | Lowest Price | 1.61 | 1.53 | 2.38 |
| 44 | Omeprazole 20mg tablet        | Lowest Price | 6.46 | 6.03 | 7.43 |
| 45 | Oral rehydration Salt powder  | Lowest Price | 1.47 | 1.11 | 1.47 |
| 46 | Paracetamol suspension        | Lowest Price | 2.50 | 2.50 | 3.13 |
| 47 | Paracetamol 500mg tabs        | Lowest Price | 3.14 | 3.14 | 3.14 |
| 48 | Ranitidine 150mg tablet       | Lowest Price | 2.29 | 2.09 | 2.62 |
| 49 | Salbutamol inhaler            | Brand        | 2.67 | 2.10 | 2.85 |
| 50 | Salbutamol inhaler            | Lowest Price | 1.35 | 1.30 | 1.42 |
| 51 | Salbutamol syrup              | Lowest Price | 1.15 | 1.03 | 1.41 |
| 52 | Simvastatin 20mg tablet       | Lowest Price | 2.17 | 2.17 | 2.48 |

**Appendix O** The Median price ratio for private sector outlets

| No. | Medicine Name                    | Medicine Type | Median Price Ratio (MPR) | 25%ile | 75%ile |
|-----|----------------------------------|---------------|--------------------------|--------|--------|
| 1   | Adult cough preparation expecto. | Lowest Price  | 2.98                     | 2.48   | 3.47   |
| 2   | Albendazole                      | Lowest Price  | 8.71                     | 8.71   | 11.61  |
| 3   | Amitriptyline                    | Lowest Price  | 7.69                     | 6.41   | 9.23   |
| 4   | Amlodipine                       | Lowest Price  | 1.35                     | 1.28   | 2.14   |
| 5   | Amoxicillin                      | Lowest Price  | 3.01                     | 2.89   | 3.01   |
| 6   | Amoxicillin + Clavulanic Acid    | Lowest Price  | 2.21                     | 1.90   | 2.76   |
| 7   | Amoxicillin + Clavulanic Acid 2  | Brand         | 3.37                     | 3.36   | 3.57   |
| 8   | Amoxicillin + Clavulanic Acid 2  | Lowest Price  | 1.88                     | 1.68   | 2.01   |
| 9   | Amoxicillin suspension           | Lowest Price  | 2.52                     | 2.52   | 2.84   |
| 10  | Artemether injection             | Lowest Price  | 0.58                     | 0.52   | 0.60   |
| 11  | Artemether+ Lumefantrine         | Brand         | 3.57                     | 3.47   | 3.62   |
| 12  | Artemether+ Lumefantrine         | Lowest Price  | 1.98                     | 1.98   | 2.06   |
| 13  | Artesunate                       | Lowest Price  | 9.83                     | 9.83   | 11.14  |
| 14  | Artesunate 2                     | Lowest Price  | 9.23                     | 8.54   | 11.07  |
| 15  | Atenolol                         | Brand         | 31.51                    | 28.01  | 35.42  |
| 16  | Atenolol                         | Lowest Price  | 3.02                     | 3.02   | 3.77   |
| 17  | Atorvastatin                     | Lowest Price  | 1.05                     | 0.97   | 1.70   |
| 18  | Azithromycin suspension          | Lowest Price  | 2.71                     | 1.36   | 3.26   |
| 19  | Beclomethasone inhaler           | Lowest Price  | 1.27                     | 1.22   | 1.43   |
| 20  | Captopril                        | Lowest Price  | 6.90                     | 5.84   | 8.49   |
| 21  | Carbamazepine                    | Brand         | 12.02                    | 11.06  | 12.82  |
| 22  | Carbamazepine                    | Lowest Price  | 2.40                     | 2.40   | 2.60   |
| 23  | Carbimazole                      | Brand         | 3.31                     | 3.18   | 6.71   |
| 24  | Carbimazole                      | Lowest Price  | 2.23                     | 1.91   | 2.54   |
| 25  | Cefixime                         | Brand         | 8.69                     | 8.60   | 10.00  |
| 26  | Cefixime                         | Lowest Price  | 3.04                     | 2.87   | 3.39   |
| 27  | Ceftriaxone injection            | Lowest Price  | 3.50                     | 2.80   | 4.44   |
| 28  | Chloramphenicol eye drops        | Lowest Price  | 2.82                     | 2.05   | 3.08   |
| 29  | Ciprofloxacin                    | Lowest Price  | 4.69                     | 4.69   | 5.16   |
| 30  | Co-trimoxazole suspension        | Lowest Price  | 2.41                     | 2.01   | 2.41   |
| 31  | Dexamethasone injection          | Lowest Price  | 2.77                     | 2.77   | 4.15   |
| 32  | Diazepam                         | Lowest Price  | 5.22                     | 2.61   | 5.22   |
| 33  | Diclofenac                       | Lowest Price  | 6.69                     | 5.02   | 6.69   |
| 34  | Diclofenac 2                     | Lowest Price  | 27.13                    | 21.98  | 27.47  |
| 35  | Ferrous Sulphate + Folic acid    | Lowest Price  | 19.45                    | 15.92  | 24.54  |
| 36  | Fluoxetine                       | Lowest Price  | 8.71                     | 4.15   | 12.44  |
| 37  | Furosemide                       | Lowest Price  | 6.41                     | 4.81   | 6.41   |
| 38  | Glibenclamide                    | Lowest Price  | 5.49                     | 3.66   | 7.33   |
| 39  | Gliclazide                       | Brand         | 4.51                     | 4.51   | 4.92   |
| 40  | Gliclazide                       | Lowest Price  | 1.29                     | 0.86   | 1.47   |

|    |                          |              |       |       |       |
|----|--------------------------|--------------|-------|-------|-------|
| 41 | Hyoscine -N-Butylbromide | Lowest Price | 1.61  | 1.07  | 1.61  |
| 42 | Ibuprofen                | Lowest Price | 4.48  | 4.48  | 5.97  |
| 43 | Insulin, Neutral Soluble | Brand        | 0.77  | 0.72  | 0.86  |
| 44 | Insulin, Neutral Soluble | Lowest Price | 0.56  | 0.51  | 0.66  |
| 45 | Lisinopril               | Brand        | 6.64  | 5.55  | 9.47  |
| 46 | Lisinopril               | Lowest Price | 2.24  | 1.46  | 2.84  |
| 47 | Metformin HCL            | Brand        | 5.16  | 5.16  | 6.02  |
| 48 | Metformin HCL            | Lowest Price | 2.58  | 2.58  | 3.44  |
| 49 | Metronidazole            | Lowest Price | 3.91  | 2.61  | 5.22  |
| 50 | Metronidazole (2)        | Lowest Price | 5.07  | 4.23  | 6.13  |
| 51 | Nifedipine Retard        | Lowest Price | 4.31  | 3.69  | 4.92  |
| 52 | Norethiesterone          | Brand        | 3.97  | 2.69  | 4.02  |
| 53 | Norethiesterone          | Lowest Price | 1.95  | 1.70  | 2.04  |
| 54 | Omeprazole               | Lowest Price | 6.03  | 5.17  | 6.46  |
| 55 | Oral rehydration Salt    | Lowest Price | 2.21  | 1.47  | 2.21  |
| 56 | Paracetamol suspension   | Lowest Price | 3.13  | 2.81  | 3.13  |
| 57 | Paracetamol tabs         | Brand        | 13.08 | 13.08 | 16.88 |
| 58 | Paracetamol tabs         | Lowest Price | 3.14  | 3.14  | 3.14  |
| 59 | Ranitidine               | Lowest Price | 1.96  | 1.96  | 2.45  |
| 60 | Salbutamol inhaler       | Brand        | 2.14  | 1.42  | 2.49  |
| 61 | Salbutamol inhaler       | Lowest Price | 1.21  | 1.21  | 1.26  |
| 62 | Salbutamol syrup         | Brand        | 2.18  | 1.92  | 2.56  |
| 63 | Salbutamol syrup         | Lowest Price | 1.28  | 1.28  | 1.54  |
| 64 | Simvastatin              | Lowest Price | 2.07  | 1.81  | 2.39  |

**BIOGRAPHY**

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