A PRICE AND AVAILABILITY SURVEY OF ESSENTIAL MEDICINES IN HARARE PROVINCE, ZIMBABWE

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A thesis submitted to the College of Health Sciences, University of KwaZulu-Natal, Westville, in fulfilment of the requirements of the degree of Master of Pharmacy (Pharmacoeconomics)

Supervisor

Ms Varsha Bangalee

KwaZulu-Natal

2015

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This is the thesis in which the chapters are written as a set of discrete research publications, with an overall introduction and final summary.

This is to certify that the contents of this thesis are the original research work of Mr Amos Marume.

As the candidate's supervisor, I have approved this thesis for submission.

Supervisor Name: **Ms. Varsha Bangalee**

Signed: ………………………………   Date: ………………………………

ABSTRACT

Access to essential medicines is both a fundamental basic right and necessity for everyone, thus governments should make concerted efforts to ensure that all have access to safe, quality and comparative cost-effective medicines. Efforts aimed at identifying factors hindering full access are key in informing relevant policy makers. Thus in pursuant of making significant contributions to the above, a survey was carried-out in Harare metropolitan province of Zimbabwe to determine prices, price components, pricing policies, source and availability of essential medicines (their innovator and/or generic equivalents) in both private and public retail sectors. Comparisons with 36 other low to middle-income countries in the rest of Africa, Americas, Eastern Mediterranean, Europe, Southeast Asia and Western Pacific were also conducted. A standardized methodology developed by World Health Organization and Health Action International (WHO/HAI) was used to survey a selected basket of 40 medicines. The selection was based on the WHO/HAI core medicines list and the latest version of the essential drug list of Zimbabwe. The survey was conducted in 110 private pharmacies, of which 55 were from the central business district, 33 from the high density and 22 from the low density suburbs. In both private and public sectors, availability of the selected essential medicines (low priced generics) was quite high (>80%). Fewer innovator brands were found for the selected medicines. Median price ratios (MPR) of the lowest priced generics revealed that many people still might be having their accesses to essential medicines compromised by high prices, particularly in the private sector (4.52). The public sector showed significant progress towards procurement efficiency (MPR of 1.5). More than 70% of the surveyed medicines were from manufacturers outside Zimbabwe with more than 60% being produced by Indian generic manufacturers. Zimbabwe still needs to do more on pricing, particularly in the private sector as well as promoting local production among other efforts in its quest to ensure all its people have access to quality, safe and effective medicines.

DECLARATION 1 – PLAGIARISM

I, **Marume Amos**, declare that;

1. The research reported in this thesis, except where otherwise indicated, is my original work.

2. This thesis has not been submitted for any degree or examination at any other university.

3. This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

4. This thesis does not contain other persons' writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:

   a) Their words have been re-written, but the general information attributed to them has been referenced.

   b) Where their exact words have been used, then their writing has been placed in italics and inside quotation marks, and referenced.

5. This thesis does not contain text, graphics or tables copied from the Internet, unless specifically acknowledged, and the source being detailed in the thesis and in the references section.

A detail contribution to publications that form part and/or include research presented in this thesis is stated (include publications submitted, accepted, in *press* and published).

Signed

………………………….

DECLARATION 2 – LIST OF PUBLICATIONS

- Price and availability survey of basic pharmaceuticals and allied products in the Harare province, Zimbabwe; submitted to the African Journal of Primary Health Care & Family Medicine, Ref. No.: 1088.

ACTIVITIES AND RESEARCH OUTPUT

A. ACTIVITIES

o The researcher is the only academic representative of all pharmacy teaching institutions in Zimbabwe in the National Taskforce on Quality Assurance for medicines and related products, were issues to do with access to essential medicines like those for HIV/AIDS, tuberculosis, malaria, etc. are regularly tabled .

B. PUBLICATIONS

o Price and availability survey of basic pharmaceuticals and allied products in the Harare province, Zimbabwe; submitted to the African Journal of Primary Health Care & Family Medicine, Ref. No.: 1088.

C. CONFERENCES AND WORKSHOPS

o Attended and presented on the inaugural Pharmacist Council of Zimbabwe conference, Exploring new horizons: connecting the dots for a post 2015 vision, 26-29 March 2015, Elephant Hills Hotel, Victoria Falls, Zimbabwe.

o Attended and participated; International certificate course in ensuring product quality in procurement and supply chain of health commodities (UNDP, MoHCC, MCAZ and Empower), 27th – 31st October 2014, Harare, Zimbabwe.

o Attended workshop on understanding African pharmaceutical markets (UNDP, MoHCC, MCAZ and Empower), 31st October 2014, Harare, Zimbabwe. The workshop included issues to do with access to essential medicines.

o Regularly attends continuous professional development (CPD) programs for pharmacists, were issues affecting access to essential medicines are regularly tabled.

DEDICATION

To my beautiful wife and children.

ACKNOWLDEGEMENTS

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LIST OF ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral Therapy
AVERT	AIDS Education and Research Trust
CBD	Central Business District
EDLIZ	Essential Drug List of Zimbabwe
HAI	Health Action International
HD	High Density
HIV	Human Immunodeficiency Virus
IB	Innovator Brand
IRP	International Reference Price
LD	Low Density
LPG	Lowest Priced Generic
MPR	Median Price Ratio
OB	Originator Brand
TB	Tuberculosis
WHO	World Health Organization
ZNMP	Zimbabwe National Medicines Policy

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CHAPTER 1

1.1. Background to and rationale for this study

This chapter discusses the background and rationale for price and availability surveys of essential medicines particularly, in low and middle income countries like Zimbabwe. The World Bank (2013), notes that while in most parts of the world people are growing older than ever before and much progress done on prevention of child deaths sub-Saharan Africa still has significant challenges with communicable, maternal, nutritional, and newborn diseases. As noted sub-Saharan Africa has a worryingly high disease burden, with controllable infectious diseases contributing more than 69% of all deaths and a rapidly increasing non-communicable or chronic disease burden (contributing more 25% of deaths) (Kebede *et al*, 2010; Lawn and Kinney, 2009 and Young *et al*, 2010). Thus millions in the region are suffering serious complications and/or dying from manageable diseases like cholera, malaria, haemorrhagic fevers, HIV, diabetes, hypertension, etc. (Kebede *et al*, 2010; Lawn and Kinney, 2009 and Young *et al*, 2010). This epidemiological picture makes access to basic quality, safe and effective pharmaceutical care of paramount importance. Generally medicine availability and prices are significant determinants of access to basic pharmaceutical care. According to WHO/HAI (2008) at least 50% of people in poor third world countries in Africa and Asia have limited access to basic pharmaceutical care. WHO (2004) as cited by Cameron *et al* (2008) suggests that up to 90% of populations in third world countries like Zimbabwe use out-of-pocket cash payments for essential medicines making basic healthcare spending by households a significant expenditure. Given this observation, Zimbabwe's high unemployment level and economic challenges may significantly complicate access to basic medicines.

The economic situation has the ability to significantly affect availability of crucial medicines in both health sectors (i.e. public and private sectors) and affordability. The economic challenges and the high levels of out-of-pocket payments for healthcare has the ability to create even more vulnerable groups requiring protection leading to a potentially deadly vicious cycle. According to T'Hoen (2003) high prices of medicines are a significant barrier to essential medicines to many people. Higher prices are often associated with innovator/brand products as a result of intellectual property protection among other costs as compared to generic products (T'Hoen, 2003). Also fewer manufacturers are in brand medicine production as compared to those in generics hence any medicine available in a generic form is more likely to be way cheaper and more available. Thus generic medicines are more accessible to the general public,

so a pharmaceutical policy encouraging generic stocking and prescribing will enhance access to quality, safe and effective medicine. Comparing prices and policies/practices with international benchmarks allows the researcher to gather evidence, thus aiding policy makers to craft policy that will enhance medicine access and public health in general. Also the survey will assist policy makers in coming-up with various protection mechanisms that will ensure that all have access to basic healthcare. Assessing prices and various pricing policies in both public and private practices will also allow the nation to harmonize these policies for the betterment of all and further protection to the poor and other vulnerable groups. According to the Directorate of Pharmacy services in the Ministry of Health and Child Care (MoHCC), formerly Ministry of Health and Child Welfare (2011) Zimbabwe is not only faced with significant essential medicine shortages but also inadequate pharmaceutical professionals particularly in the public sector. Taking consideration of both sectors is based on the understanding that private sector often penetrates communities better as compared to the public sector hence better policies in private sector has immense potential in enhancing access to essential medicines. Thus this cross-sectional survey is not only going to assist in answering the researcher's research questions but also inform policy makers and other stakeholders determining access to medicines.

1.2. Aim

The main aim of this survey is to document and compare availability and prices of basic pharmaceuticals (innovator and their generic equivalents) in private and public health sectors in the Harare Province, Zimbabwe and compare the results with those in other countries.

1.3. Objectives:

To:

- Determine final retail prices charged to healthcare consumers on basic medicines (based on WHO/HAI and the Essential Medicine List of Zimbabwe) in both private and public pharmacies in Harare province, Zimbabwe relative to international prices.
- Compare levels of availability and prices of essential innovator products and their generic equivalents in both private and public health sectors.
- Determine the common sources of the selected essential medicines in both sectors.
- Determine the different price components and pricing policies in both private and public health sectors.

1.4. Novelty and significance of this study

In Zimbabwe, there is a dearth of information on prices or availability of essential medicines accessible for facilitation of policy formulation. With current trends in policy formulation utilizing evidence based methods/approaches, studies like this one need to be done often and on a national scale to assist in ensuring that formulators of the pharmaceutical policy have access to relevant evidence. Essential medicines have a central role in primary health care hence public health assurance. Various issues hinder access like prices and whether the medicines are available or not in the nearest retail outlet or primary health care centre. Surveys of this nature also inform policy makers on fairness and equality in pharmaceutical care thus promoting access to care for all as health is everyone's basic right.

1.5. Overview of this thesis

Chapter 2: Explores how sub-Saharan African countries, Zimbabwe in particular have a high disease burden hence demand for essential medicines. It also highlight issues to do with essential medicines and access to quality, safe and effective medicines.

Chapter 3: Describes surveys and their significance in social science research. Application of surveys in price and availability surveys.

Chapter 4: Contains the submitted manuscript which outlines the whole study. The article was submitted to the African Journal of Primary Health Care & Family Medicine, Ref. No.: 1088.

Chapter 5: Contains additional findings on availability and median price ratios of essential medicines surveyed. It also features comparisons of median price ratios across and within sectors.

Chapter 6: Has general conclusions and recommendations based on the findings of this survey.

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CHAPTER 2

2.1. Disease burden in sub-Saharan Africa: Zimbabwe

Zimbabwe is a low-income country in the sub-Saharan region of Africa (The World Bank, 2016). Many low-income countries in sub-Saharan Africa have a very high disease burden with chronic diseases becoming more and more important each year (The World Bank, 2013; Cooper *et al*, 1998). According to de-Graft Aikins *et al* (2010) Africa which is the arguably the poorest continent virtually has a double burden of both infectious and chronic diseases. More than 69% of all deaths are as a result of infectious diseases and age-specific mortality due to chronic diseases is higher in sub-Saharan Africa than the rest of the world (de-Graft Aikins *et al*, 2010). Due to low or non-functioning health infrastructure (Cooper *et al*, 1998), maldistribution of healthcare resources (Agere, 1990) and shortage of key healthcare personnel the statistics are expected to get worse as the population in the continent continues to grow. Actually de-Graft Aikins *et al* (2010) in their article predicted a marked increase in deaths due to cardiovascular disease, cancer, respiratory disease and diabetes. The region has the highest mortality rate for children under 5 years. Zimbabwe is part of a few countries which have actually seen an increase in this rate (UNESCO, 2008).

According to WHO (2014) communicable, maternal, perinatal and nutritional conditions contributed 62% of all deaths followed by cancers at 10% and cardiovascular diseases (9%) in Zimbabwe. With a prevalence of HIV/AIDS just under 15% (Zimbabwe Country Report, 2015), it will be expected that HIV/AIDS is underlying in many of the disease noted by WHO (2014). Actually currently HIV/AIDS is the number one contributor to Zimbabwe's age-standardized death rate followed by stroke, respiratory diseases, coronary heart diseases, tuberculosis, malaria, diarrhoeal diseases then diabetes mellitus among other top 50 killers (MoHCC, 2015). Despite many efforts to combat HIV/AIDS since the first case was discovered in Zimbabwe in 1985, it is still a major contributor to the healthcare burden (Garbus and Khumalo-Sakutukwa, 2003). HIV/AIDS has led to many deaths across all age groups and genders. At one point it was predicted that Zimbabwe would have the world's lowest life expectancy (Garbus and Khumalo-Sakutukwa, 2003 and UNESCO, 2008). Generally HIV/AIDS is a serious problem in sub-Saharan Africa, AVERT (2015) estimates that in 2013 the region had "24.7 million people living with HIV, accounting for 71% of the global total."

The high disease burden in Zimbabwe and the whole of sub-Saharan Africa means that many significant efforts required to address this public health issue. This is true given most of the

said deaths are preventable through improved availability and access to basic health services and child nutrition programmes (UNESCO, 2008). From this analysis Zimbabwe has great need for quality, safe and effective essential medicines. Thus access to medicines like antiretrovirals becomes key in prevention and management (AVERT, 2015).

2.2. Essential medicine concept

The World Health Organization, (2015) defines essential medicines as;

> "those that satisfy the priority health care needs of the population" and "are selected with due regard to disease prevalence, evidence on efficacy and safety, and comparative cost-effectiveness."

Thus they should be;

> "available within the context of functioning health systems at all times in adequate amounts, in the appropriate dosage forms, with assured quality, and at a price the individual and the community can afford" – World Health Organization, (2015).

Zimbabwean National Medicine Policy (ZNMP) similarly defines essential medicines as;

> "those medicines, which are of the greatest importance, are basic, indispensable and needed to satisfy the health needs of the majority of the population" – Directorate of Pharmacy Services, (2011).

The concept is noble and implementation should be flexible and adaptable to each specific country's context. The concept is based on the understanding that it is not possible to have a full spectrum of all medicines thus countries can have a limited range of carefully selected essential medicines that will lead to better health care, better medicine management and lower costs (Laing, 2012). Zimbabwe has also adopted the essential medicines concept, with regularly publication of the Essential Drug List of Zimbabwe (EDLIZ). The main objective of EDLIZ is to ensure that health care needs of all Zimbabweans are met through the provision and proper use of essential medicines (NMTPAC, 2011).

The selection of medicines that are included in EDLIZ is based on;

- Relevance to prevalent diseases
- Proven efficacy and safety
- Adequate scientific data in a variety of settings
- Adequate quality

- Favourable cost-benefit ratio

- Desirable pharmacokinetics

- Possibilities for local manufacture

- Available as single ingredient items (NMTPAC, 2011)

In the Zimbabwean context the NMTPAC (2011) highlights several advantages for utilizing the essential medicine concept namely;

- Improved medicines supply due to easier supply chain management among other reasons.

- More rational prescribing – more focussed training of all healthcare professionals, better experience and more information when dealing with fewer options among other reasons.

- Lower costs – fewer options leads to more competition thus greater opportunities of getting cheaper options.

- Improved patient use (NMTPAC, 2011).

As stated in its ZNMP, Zimbabwe through the utilization of the essential medicine concept has an overall objective of improving, within the available resources, the health of the majority of the population of Zimbabwe by treating, curing, reducing or preventing diseases and/or disorders of health through medicine procurement, promotion of local production of essential medicines, management and use (Directorate of Pharmacy Services, 2011).

Noting many benefits the essential medicine concept brought since its inception and description as "a peaceful revolution in international public health" in 1977 the concept has also faced some criticisms. Often criticism comes from issues to do with who actually judges the importance on a particular disease, the patient suffering or providers and intellectual property rights like patents (Laing *et al*, 2003).

From the analysis it is vital that people have access to the specially selected medicines for healthcare objectives to be met. Actually everyone by international law has the right to health. Many factors however may hinder access essential medicines which are key in ensuring health for all (Hogerzeil and Mirza, 2011). Factors which limit access to essential medicines include, availability and prices (i.e. affordability). United Nations Development Group (2003) defines access "as having medicines continuously available and affordable at public or private health facilities or medicine outlets that are within one hour's walk from the homes of the population."

2.3. Prices of essential medicines

High essential medicines prices decrease affordability and have a negative impact on low income countries such as Zimbabwe and many other sub-Saharan countries particularly those with less government control on medicine pricing (Murray, 2015). Medicines have the ability to significantly consume a big portion of the healthcare budget particularly in developing and/or transitional countries where they account for 20–60% of all healthcare spending (WHO, 2004 as cited by Cameron *et al*, 2008). Also many in these countries rely on out-of-pocket payments for their pharmaceutical among other healthcare needs. Actually the World Health Organization (2004) as cited by Cameron *et al*, (2008) states that up to 90% of the population in developing countries purchase medicines through out-of-pocket payments. Thus high prices have a significant negative impact on access to essential medicines as many may "choose" to forgo treatments or look for other alternatives which may be not be as effective or safe. As essential medicines are public goods and not luxury goods that should be reserved for the rich, their prices must not become major barriers to access and healthcare advancements.

2.4. Availability of essential medicines

Availability of essential medicines is also key in ensuring that people have access to one of the key components of primary healthcare (PHC). Healthcare consumers should be able to purchase and/or get essential medicines as and when they are required (UN, 2011). In many developing countries access to essential medicines is hindered because many people rely on public health dispensing facilities which often do not have enough (UN, 2011). As noted above, medicine availability is often a challenge in many low-income countries like Zimbabwe particularly in the public sector (Murray, 2015). The said low availability is often attributed to;

- Lack of systematic procurement, supply and distribution systems
- Under-budgeting
- Poor demand forecasting and management among other reasons (UN, 2011; Murray, 2015).

Generally prices are lower in the public sector but availability is often very low as compared to the private sector thus both prices and availability can be major issues in determining access to essential medicines. Apart from lack of enough essential medicines the pharmaceutical market is now flooded with "fake" or counterfeit medicines that are killing many (WHO, 2006). Counterfeiting is one of the oldest profession and has invaded many pharmaceutical markets

world-over. (Fenoff and Wilson, 2009). The World Health Organization, (2006), estimated that the counterfeit medicine industry is a multi-million dollar business. Africa is under threat from counterfeit medicines, thus further to availability and price issues many are having access to essential medicines hindered due to many counterfeit medicinal products in the African pharmaceutical markets (Fenoff and Wilson, 2009).

2.5. Summary

Zimbabwe just like many other developing countries in the sub-Saharan Africa region have a higher disease burden hence demand for essential medicines. Many factors determine access to essential medicines but price and availability are key. Often in low – income countries like Zimbabwe the public sector has low availability while the private sector tend to have high prices as a result of limited government control on medicine prices. Thus many may have limited access to quality, safe and effective medicines.

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CHAPTER 3

3.1. Surveys

Surveys are very simple and involve data collection from selected participants based on their response to questions, thus describing quantitatively certain characteristics of a given population (De Leeuw *et al*, 2008). The information is usually gathered from a representative sample of the population (Fraenkel and Wallen, 1993). Similarly Tanur, (1982) as cited by Pinsonneault and Kraemer, (1993) defines a survey as "gathering information about the characteristics, actions or opinions of a large group of people, referred to as a population." They are conducted for the purposes of making a detailed description, exploration and/or an explanation of certain population characters (Burton, 2007). As highlighted above it utilizes a representative sample which is derived from a population of elements with equal chances of being selected. Surveys are versatile, efficient and generalizable which makes them popular with many scientists particularly in social science. Surveys allows researchers to gather unique information, use unbiased samples and collect same information from different respondents (Owens, 2002). As the goal of carrying-out a survey is to make generalizations, the sample should be a true representative of the population. Bartlett *et al* (2001) highlighted a table to use is coming-up with a representative sample in social science research (see table 3.1 below).

Table 3.1. Determining minimum returned sample size for a given population size for continuous and categorical data (Bartlett *et al*, 2001)

| Population size | Sample size | | | | | |
| | Continuous data (margin of error=.03) | | | Categorical data (margin of error=.05) | | |
	alpha=.10 t=1.65	alpha=.05 t=1.96	alpha=.01 t=2.58	p=.50 t=1.65	p=.50 t=1.96	p=.50 t=2.58
100	46	55	68	74	80	87
200	59	75	102	116	132	154
300	65	85	123	143	169	207
400	69	92	137	162	196	250
500	72	96	147	176	218	286
600	73	100	155	187	235	316
700	75	102	161	196	249	341
800	76	104	166	203	260	363
900	76	105	170	209	270	382
1,000	77	106	173	213	278	399
1,500	79	110	183	230	306	461
2,000	83	112	189	239	323	499
4,000	83	119	198	254	351	570
6,000	83	119	209	259	362	598
8,000	83	119	209	262	367	613
10,000	83	119	209	264	370	623

NOTE: The margins of error used in the table were 0.03 for continuous data and .05 for categorical data. Researchers may use this table if the margin of error shown is appropriate for their study; however, the appropriate sample size must be calculated if these error rates are not appropriate. Table developed by Bartlett, Kotrlik, & Higgins (Bartlett *et al*, 2001).

In addition to being compatible with qualitative, quantitative and mixed methods; surveys also allow for both probability and non-probability sampling approaches (Burton, 2007). They can

be cross-sectional i.e. data collected at one point in time (a snap-shot) or longitudinal i.e. trend, cohort and/or panel surveys (Owens, 2002). Burton (2007) identified characteristics of a good survey namely;

- Quantitative
- Self-monitoring
- Contemporary
- Replicable
- Systematic
- Impartial
- Representative
- Theory-based

3.2. Survey methods

"A story. In the beginning, there was Quantitative Research. A few years later, there was Qualitative Research. And then Mixed Methods was born, as a separate child of these parents. Let's all welcome Mixed Methods" – Creswell and Piano Clark (2007)

Given the weakness and strength of each method i.e. qualitative or quantitative, many scientists are now advocating for mixed methods in social science research (Jick, 1979). So in research it is best to view qualitative and quantitative methods as complimentary rather than rivals contributing to the supremacy of mixed methods approaches (Jick, 1979). Johnson and Onwuegbuzie, (2004) has defined mixed methods research as "the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study". They went further and highlighted the strengths and weaknesses of qualitative (table 3.2 below), quantitative (table 3.3 below) and mixed methods (table 3.4 below).

Table 3.2. Strengths and weaknesses of qualitative research

Strengths	Weaknesses
Data are based on the participants' own categories of meaning.	Knowledge produced may not generalize to other people or other settings (i.e., findings may be unique to the relatively few people included in the research study).
Useful for studying a limited number of cases in depth.	It is difficult to make quantitative predictions.
Useful for describing complex phenomena.	It is more difficult to test hypotheses and theories.
Provides individual case information.	It may have lower credibility with some administrators and commissioners of programs.
Can conduct cross-case comparisons and analysis.	It generally takes more time to collect the data when compared to quantitative research.
Provides understanding and description of people's personal experiences of phenomena (i.e., the "emic" or insider's viewpoint).	Data analysis is often time consuming.
Can describe, in rich detail, phenomena as they are situated and embedded in local contexts.	The results are more easily influenced by the researcher's personal biases and idiosyncrasies.
The researcher identifies contextual and setting factors as they relate to the phenomenon of interest.	
The researcher can study dynamic processes (i.e., documenting sequential patterns and change).	
The researcher can use the primarily qualitative method of "grounded theory" to generate inductively a tentative but explanatory theory about a phenomenon.	
Can determine how participants interpret "constructs" (e.g., self-esteem, IQ).	
Data are usually collected in naturalistic settings in qualitative research.	
Qualitative approaches are responsive to local situations, conditions, and stakeholders' needs.	
Qualitative researchers are responsive to changes that occur during the conduct of a study (especially during extended fieldwork) and may shift the focus of their studies as a result.	
Qualitative data in the words and categories of participants lend themselves to exploring how and why phenomena occur.	
One can use an important case to demonstrate vividly a phenomenon to the readers of a report.	
Determine idiographic causation (i.e., determination of causes of a particular event).	

Adapted from Johnson and Onwuegbuzie, (2004).

Table 3.3. Strengths and weaknesses of quantitative research

Strengths	Weaknesses
Testing and validating already constructed theories about how (and to a lesser degree, why) phenomena occur.	The researcher's categories that are used may not reflect local constituencies' understandings.
Testing hypotheses that are constructed before the data are collected. Can generalize research findings when the data are based on random samples of sufficient size.	The researcher's theories that are used may not reflect local constituencies' understandings.
Can generalize a research finding when it has been replicated on many different populations and subpopulations.	The researcher may miss out on phenomena occurring because of the focus on theory or hypothesis testing rather than on theory or hypothesis generation (called the confirmation bias).
Useful for obtaining data that allow quantitative predictions to be made.	Knowledge produced may be too abstract and general for direct application to specific local situations, contexts, and individuals.
The researcher may construct a situation that eliminates the confounding influence of many variables, allowing one to more credibly assess *cause-and-effect* relationships.	
Data collection using some quantitative methods is relatively quick (e.g., telephone interviews).	
Provides precise, quantitative, numerical data.	
Data analysis is relatively less time consuming (using statistical software).	
The research results are relatively independent of the researcher (e.g., effect size, statistical significance).	
It may have higher credibility with many people in power (e.g., administrators, politicians, people who fund programs).	
It is useful for studying large numbers of people.	

Adapted from Johnson and Onwuegbuzie, (2004).

Table 3.4. Strengths and weaknesses of mixed research

Strengths	Weaknesses
Words, pictures, and narrative can be used to add meaning to numbers.	Can be difficult for a single researcher to carry out both qualitative and quantitative research, especially if two or more approaches are expected to be used concurrently; it may require a research team.
Numbers can be used to add precision to words, pictures, and narrative.	Researcher has to learn about multiple methods and approaches and understand how to mix them appropriately.
Can provide quantitative and qualitative research strengths.	Methodological purists contend that one should always work within either a qualitative or a quantitative paradigm.
Researcher can generate and test a grounded theory.	More expensive.
Can answer a broader and more complete range of research questions because the researcher is not confined to a single method or approach.	More time consuming.
A researcher can use the strengths of an additional method to overcome the weaknesses in another method by using both in a research study.	Some of the details of mixed research remain to be worked out fully by research methodologists (e.g., problems of paradigm mixing, how to qualitatively analyse quantitative data, how to interpret conflicting results).
Can provide stronger evidence for a conclusion through convergence and corroboration of findings.	
Can add insights and understanding that might be missed when only a single method is used.	
Can be used to increase the generalizability of the results.	
Qualitative and quantitative research used together produce more complete knowledge necessary to inform theory and practice.	

Adapted from Johnson and Onwuegbuzie, (2004).

3.3. Price and availability surveys

Surveys collecting both qualitative and quantitative data on essential medicines using the standardised World Health Organisation and Health Action International (WHO/HAI) methodologies have been used in several price, affordability and availability studies in several regions of the world (Mhlanga and Suleman, 2014; Madden *et al*, 2010; Russo and McPake, 2010). In these and other similar studies data was analysed for both generic and originator brand products, within the public and private sector. Several policy options in facilitating access to essential medicines in all these regions were influenced by these studies (van Mourik *et al.* 2010).

3.4. Summary

In the quest to ensure all have access to quality, safe and effective pharmaceutical care (i.e. primary health care) policy makers are using evidence based approaches in policy formulation. Mixed methods price and availability surveys are greatly assisting in devising sound policy positions that improves public health in general, by providing scientific evidence.

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CHAPTER 4

Price and availability survey of basic pharmaceuticals and allied products in the Harare province, Zimbabwe

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Summary

Number words: 4953

Pages: 20

Tables: 6

Figures: 1

Supplementary material: Two accompanying documents i.e. ethical clearance from University of KwaZulu Natal and Pharmacist Council of Zimbabwe approval.

Abstract

Background: Access to essential medicines is both a fundamental basic right and necessity for everyone, thus concerted efforts should be made to ensure all have access to safe, quality and effective medicines.

Aim: To determine prices, source and availability of essential medicines (their innovator and/or generic equivalents) in both private and public retail sectors.

Setting: Private and public sector retail pharmacies in Harare metropolitan province, Zimbabwe.

Methods: Forty medicines were selected for the survey. A standardised methodology developed by World Health Organization and Health Action International (WHO/HAI) was used to survey the selected medicines. The survey was conducted in 110 private pharmacies and the two central hospital pharmacies in Harare. Prices were compared with international reference prices (IRPs).

Results: In both sectors, availability of the selected medicines (low priced generics) were quite high (>80%). Fewer innovator brands were found for the selected medicines. Median price ratios (MPR) of lowest priced generics (LPG) showed that many still might be having their accesses to essential medicines compromised by high prices particularly in the private sector (with median MPR of 4.52). The public sector showed significant progress towards procurement efficiency (median MPR of 1.5). More than 70% of the surveyed medicines were from manufacturers outside Zimbabwe with more than 60% from Indian generic manufacturers.

Conclusion: Zimbabwe still needs to do more on pricing particularly in the private sector, promoting local production among other efforts in its quest to ensure all its people have access to quality, safe and effective medicines.

Sondage sur le prix et la disponibilité des produits pharmaceutiques de base et connexes dans la province de Harare, Zimbabwe

Contexte: L'accès aux médicaments essentiels est à la fois un droit fondamental et une nécessité pour tout le monde, donc des efforts concertés devraient être fournis pour assurer que chacun ait accès à des médicaments de qualité, sans danger et efficaces.

Objectif: déterminer les prix, l'origine et la disponibilité des médicaments essentiels (les produits innovants et / ou génériques équivalents) auprès des ventes au détail dans les secteurs public et privé.

Cadre: les pharmacies de vente au détail dans les secteurs privés et publics à Harare province métropolitaine de Zimbabwe.

Méthodologie: Quarante médicaments ont été sélectionnés pour le sondage. Une méthodologie standardisée élaboré par l'Organisation mondiale de la Santé et Action Internationale pour la Santé (OMS/AIS) a été utilisé pour étudier les médicaments sélectionnés. Le sondage a été mené dans 110 pharmacies privées et les deux pharmacies des hôpitaux centraux à Harare. Les prix ont été comparés avec les prix de référence internationaux (IRP).

Résultats: Dans les deux secteurs, la disponibilité des médicaments sélectionnés (des génériques à bas prix) était très élevée (> 80%). Nous n'avons trouvé que très peu de marques innovatrices pour les médicaments sélectionnés. Les ratios des prix médians (MPR) pour les génériques les moins chers (LPG) ont montré que beaucoup aurait accès aux médicaments essentiels qui seraient compromis par les prix élevés en particulier dans le secteur privé (avec MPR médian de 4,52). Le secteur public a montré des progrès significatifs sur l'efficacité des achats (médiane de 1,5 MPR). Plus de 70% des médicaments étudiés étaient fournis par des fabricants en dehors de Zimbabwe avec plus de 60%, des fabricants de génériques indiens.

Conclusion: Zimbabwe doit encore faire plus au niveau prix en particulier dans le secteur privé ainsi que dans la promotion de la production locale, entre autres efforts dans sa quête pour assurer que tous ses habitants aient accès à des médicaments de qualité, sans danger et efficaces.

Introduction

The concept of essential medicines was introduced by the World Health Organization (WHO) in 1977[1]. Their selections is based on their public health relevance, efficacy, quality, safety and cost-effectiveness among other reasons. They may be viewed as "medicines that satisfy the priority health care needs of the population"[1]. Because they are of high value to any nation their availability and affordability is vital to ensure public health. Sub-Saharan Africa has a worryingly high disease burden, with controllable infectious diseases contributing more than 69% of all deaths and a rapidly increasing non-communicable or chronic disease burden (contributing more 25% of deaths) [2, 3, 4].

Zimbabwe had a growing population of more than 14 million people as at 2013[5]. This population is also under siege from various chronic and/or acute ailments and poverty (as more than 56% live by under a dollar a day)[6]. Thus Zimbabwe has so many poor people suffering from various diseases who need adequate, quality, safe and effective pharmaceutical care. Many diseases afflict Zimbabweans, young and old for example human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), tuberculosis (TB), cardiovascular diseases, diabetes, cancers, [5] and malaria, among other ailments. These issues further highlight the great need for essential medicines that the Zimbabwean population has. In Zimbabwe public healthcare financing and subsequent utilization are dependent on economic growth, thus as the economy grows, health is expected to improve[7]. The Government of National Unity brought some economic stability and slight improvements in many sectors including health, in Zimbabwe[8]. Those notable improvements are likely going to be eroded due to the lack of political fluency characterising the period post 2013 election. Thus price and availability surveys have a lot of potential to assist in the development of contingency measures that ensure populations have access to essential medicines by providing key evidence for pharmaceutical policy makers. Pricing and/or price surveys are critical in the quest to improve access to quality, safe and effective essential medicines[9], particularly in low- to medium income countries like Zimbabwe. Equitable access to quality, safe and effective essential medicines remains one of the most important determinants of the health of many i.e. public health[10], particularly in third world nations like Zimbabwe. There are levels that can be used to measure and report medicine availabilities namely; very low ($\leq 50\%$), low ($51 - 65\%$), fairly high ($66 - 80\%$) and high ($80\% <$)[10]. Cost of pharmaceuticals has been increasing significantly over the years even in developed countries leading to higher growth rates in expenditure on medicines even higher than the respective gross national product[11].

Surveys done in third world countries have shown very low accessibility to essential medicines. Chief among the reasons being the prices people pay as well as availability and poor supply chain management.[12] These findings further paints a bleak picture for third world countries. Surveys comparing the medicine prices against international reference prices (IRP) (i.e. affordability) and availability in various sectors based on the World Health Organization and Health Action International methodology have been done in many regions, resulting in important findings. Although several price and availability surveys have been done in many third world countries, Zimbabwe is among the fewer sub-Saharan countries with very little of such necessary data[13]. This study was therefore conducted to determine prices, price components, pricing policies, source and availability of essential medicines (their innovator and/or generic equivalents) in both private and public retail sectors. A comparison between the different sectors and with IRPs was also carried out.

Methods

Study design

A mixed methods cross-sectional descriptive survey design was used to collect the data for this study.

Setting and sampling

The study was conducted in Harare metropolitan province of Zimbabwe with a total human population of more than 2.1 million[14]. Harare is also the capital city of Zimbabwe. The total population for this study was made-up of all retail pharmacies (private and public) in Harare province, Zimbabwe. In the public sector data on prices and pricing policies is mostly centralized thus only retail pharmacies at the only two central government hospitals (Harare and Parirenyatwa hospitals) represented all public institutions in this survey. According to Medicines Control Authority of Zimbabwe there are about 465 privately owned retail pharmacies in and around Harare. Since the pharmacies are not evenly distributed throughout Harare, stratified sampling was applied. The sample was made-up of 50% (55 private retail pharmacies) from the Central Business District, 30% (33) High Density Suburbs and the remaining 20% (22) from Low Density Suburbs of Harare. Back up pharmacies were also identified to cater for those with less than 50% medicine availability and/or who would deny the researcher access to the information that was being sought for.

Selection of targeted medicines

As shown by table 1 below; 40 medicines were selected for the survey. The selection was based on the WHO/HAI global core medicines list[6] and the latest version of the Essential Drug List of Zimbabwe (EDLIZ). The WHO/HAI core list was established based on availability, importance, relevance in addressing overall global disease burden and representativeness. The supplementary medicines added were selected based on their relevance to local needs, level of use and availability.

Table 4.1: List of surveyed essential medicines

Generic name, dosage form and strength	Class and/or indication	Usually dispensed quantities

Amitriptyline 25mg tablets	Antidepressant	7, 14 or 30
Amlodipine 10mg tablets	Antihypertensive	30
Amoxicillin 250mg tablets/capsules	Antibacterial	42
Artemether/ Lumefantrine 20/120mg tablets	Antimalarial	24
Atenolol 50mg tablets	Antihypertensive	30
Atropine injectable	Antimuscarinic	1
Benzathine penicillin injectable	Antibacterial	1
Carbamazepine 200mg tablets	Antiepileptic	30
Ceftriaxone injectable	Antibacterial	1
Chlorpheniramine 5mg tablets	Antihistamine	21 or 30
Ciprofloxacin 500mg tablets	Antibacterial	10 or 14
Clindamycin 150mg capsules	Antibacterial	42
Codeine tablets	Opioid	15
Co-trimoxazole 480mg tablets	Antibacterial	60
Cotrimoxazole 240mg/5ml paed suspension	Antibacterial	100ml
Diclofenac 25mg tablets	Anti-inflammatory	21
Digoxin tablets	Cardiotonic glycoside	30
Doxycycline 100mg capsules	Antibacterial	14
Erythromycin 250mg tablets/capsules	Antibacterial	56
Fluconazole 200mg capsules/tablets	Antifungal	30
Glibenclamide 5mg tablets	Antidiabetic	30, 60 or 120
Halothane gas	Anaesthetic	1
Hydrochlorothiazide 25mg tablets	Antihypertensive	30
Ketamine injectable	Anaesthetic	1
Lignocaine injectable	Local anaesthetic	1
Miconazole oral gel	Antifungal	40ml
Nevirapine 10mg/ml pead suspension	Antiviral	100
Nifedipine 20mg SR tablets	Antihypertensive	30, 60 or 120
Omeprazole 20mg tablets/capsules	Anti-acid	30
Oxytocin injectable	Hormonal	1
Paracetamol 500mg tablets	Antipyretic	20
Paracetamol syrup	Antipyretic	100ml
Pethidine injectable	Opioid	1
Praziquantel 600mg tablets	Anti-schistosomiasis	2, 3, or 4
Prednisolone 5mg tablets	Steroidal anti-inflammatory	30, 60 or 120
Rifampicin/Isoniazid/Pyrazinamide/Ethambutol 150/75/400/275 tablets	Anti-tuberculosis	60 or 90
Salbutamol inhaler	Anti-asthmatic	1
Tenofovir/ Lamivudine/Effeviranz tablets	Antiviral(s)	30
Warfarin 5mg tablets	Anti-coagulant	30
Zidovudine/Lamivudine/Nevirapine 300/150/200mg tablets	Antiviral(s)	60

Data collection and recording

Data collection was done between June and August 2015. The researcher visited each pharmacy and collected the data on prices and availability using a standardized form[6]. The final

form used was adjusted accordingly, following a pilot study that was conducted prior to actual data collection. The retail price or price charged to the consumer was recorded for each of the selected medicines. Data on medicine availability, manufacturer and usually dispensed quantities were also collected. Data was collected on both the innovator brand (IB) and lowest priced generic (LPG) for all the selected medicines. Double entry technique was used in recording the data into a pre-programmed workbook. Data is based on particular dates each outlet was visited as this was a cross-sectional survey.

Statistical analysis

Statistical analysis was done using the Microsoft excel workbook and Stata statistical package with the help of a biostatistician. Median price ratios (MPR) of all the surveyed medicines, median MPRs, percentage availabilities and manufacturer's proportions we generated using the mentioned computer softwares. Median price ratio is the median price of each medicine divided by the international reference price (IRP). Zimbabwe is currently using United States dollar so there was no need currency conversions. The data of availability was based on the number of pharmacies that had the medicine on the day that particular pharmacy was surveyed.

Ethical considerations

The Humanities & Social Sciences Research Ethics Committee of the University of KwaZulu Natal (HSS/0346/015M) and the Pharmacist Council of Zimbabwe approved the research and study tools before data were collected. Consent from representatives of each targeted institution was sought for before data collection as well. Information was also treated with all necessary due regard to all the requirements and principles of confidentiality.

Results

All the targeted institutions were surveyed in this study.

Availability of essential medicines

Table 2 below compares availability of essential medicines in both private and public sectors in the Harare metropolitan province, Zimbabwe. The private sector is further divided into high density (HD), central business district (CBD) and low density (LD) suburbs. The availability of innovator brands was generally low across the sectors although it can be seen from table 2 that the low density had somewhat high availability of very few of the selected medicines. The public sector had most the medicines selected for the survey, particularly low priced generics. A few essential medicines were completely absent in the public sector namely; ciprofloxacin, amlodipine, omeprazole, chlorpheniramine, fluconazole, miconazole oral gel and praziquantel. Almost all of the medicines used in theatres were completely absent in the private sector. Availability of many other selected medicines (low priced generics) in the private sector was quite similar (i.e. mean availability in HD was 80%, CBD 77% and LD 85%). Availability of medicines in general in the public sector was also high with mean availability of 79%. Combining the two sectors, availability of the selected essential medicines (low priced generics) in the Harare metropolitan province, Zimbabwe was quite high (>80%).

Table 4.2: Availability of essential medicines surveyed

Availability	Range	Public sector		Private sector					
		Lowest-price generics	Innovator brands	Lowest-price generics			Innovator brands		
				HD	CBD	LD	HD	CBD	LD
Absent	0%	Ciprofloxacin, amlodipine, omeprazole, chlorpheniramine, fluconazole, miconazole oral gel and praziquantel	The rest of the brands surveyed	Halothane and nevirapine susp.	Halothane, nevirapine susp., ketamine and RIPE	Halothane, ketamine and RIPE	The rest of the brands surveyed	The rest of the brands surveyed	The rest of the brands surveyed
Low	<50%	Diclofenac and doxycycline	None	Ketamine, codeine, RIPE and oxytocin	Lignocaine, atropine, oxytocin and pethidine	Lignocaine, nevirapine susp., atropine, oxytocin and pethidine	None	None	None
Fairly high	50-80%	RIPE	None	Lignocaine, tenolam-E, pethidine, atropine and zidolam-N	Benzathine, erythromycin, zidolam-N and codeine	zidolam-N	Salbutamol inhaler	None	None
High	>80%	Amitriptyline, amoxicillin, atenolol, nifedipine, carbamazepine, tenolam-E, paracetamol, hydrochlorothiazide, cotrimoxazole, halothane, lignocaine, ketamine, codeine, paracetamol syrup, atropine, AL, benzathine, ceftriaxone, clindamycin, cotrimoxazole susp., glibenclamide, erythromycin, salbutamol inhaler, oxytocin, zidolam-N, nevirapine susp. and prednisolone	Warfarin and digoxin	Amitriptyline, amoxicillin, atenolol, nifedipine, carbamazepine, diclofenac, ciprofloxacin, amlodipine, paracetamol, hydrochlorothiazide, cotrimoxazole, paracetamol syrup, omeprazole, chlorpheniramine, AL, benzathine, ceftriaxone, clindamycin, cotrimoxazole susp., glibenclamide, doxycycline, erythromycin, fluconazole, miconazole oral gel, praziquantel, salbutamol inhaler and prednisolone	Amitriptyline, tenolam-E, amoxicillin, atenolol, nifedipine, carbamazepine, diclofenac, ciprofloxacin, amlodipine, paracetamol, hydrochlorothiazide, cotrimoxazole, paracetamol syrup, omeprazole, chlorpheniramine, AL, ceftriaxone, clindamycin, cotrimoxazole susp., glibenclamide, doxycycline, fluconazole, miconazole oral gel, praziquantel, salbutamol inhaler and prednisolone	Amitriptyline, codeine, benzathine, tenolam-E, amoxicillin, atenolol, nifedipine, carbamazepine, diclofenac, ciprofloxacin, amlodipine, paracetamol, hydrochlorothiazide, cotrimoxazole, paracetamol syrup, omeprazole, chlorpheniramine, AL, ceftriaxone, clindamycin, cotrimoxazole susp., glibenclamide, doxycycline, erythromycin, fluconazole, miconazole oral gel, praziquantel, salbutamol inhaler and prednisolone	Warfarin and digoxin	Warfarin, salbutamol inhaler and digoxin	Warfarin, AL, amlodipine, salbutamol inhaler, carbamazepine and digoxin

Key: AL – Artemether/Lumefantrine 20/120mg tabs; RIPE – Rifampicin/Isoniazid/Pyrazinamide/Ethambutol 150/75/400/275 tabs; tenolam-E – Tenofovir/ Lamivudine/Effeviranz tabs and zidolam-N – Zidovudine/Lamivudine/Nevirapine 300/150/200mg tabs. HD – high density suburbs,

CBD – central business district and LD – low density suburbs.

Source of the surveyed essential medicines

Most medicines in both sectors private retail pharmacy (i.e. CBD, HD and LD) and the public sector are generic medicines manufactured by various Indian manufacturers (figure 1 below). More than 60% of all the surveyed medicines came from India, local manufacturers had under 30% and other international manufacturers had approximately10%.
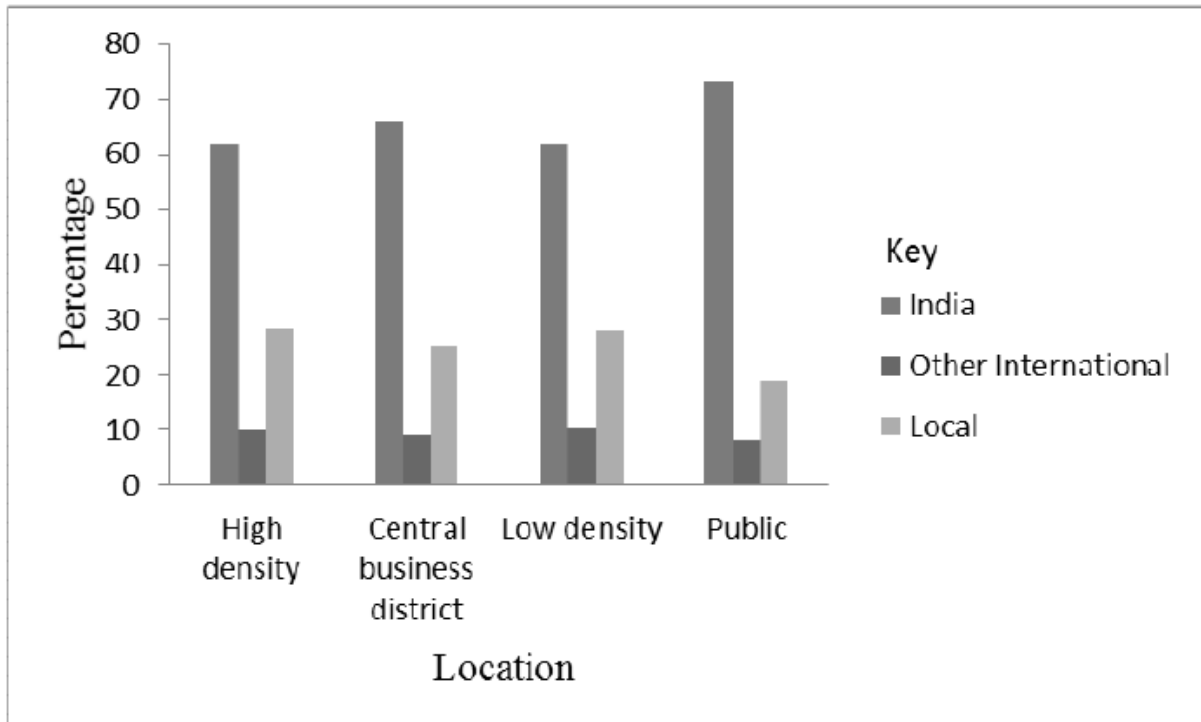
Figure 4.1: Sources of essential medicines surveyed

Prices of medicines

Generally prices in the private sector were higher than those in the public sector (see table 3 below). Based on table 3 below no significant differences were observed on medicine prices within the private retail pharmacy sector i.e. prices in the three subsectors i.e. central business district (CBD), high density (HD) and low density (LD). Median price ratio (MPR) of 1.5 found in the public sector is close to 1 implying more procurement efficiency.

Table 4.3: Median price ratio by sector

Sector	Median MPR of most sold generics
Private	4.52
(CBD)	(4.37)
(HD)	(5.15)
(LD)	(4.37)
N/B: CBD – Central business district, HD – high density & LD – low density suburbs.	
Public	1.5

MPR calculated based on supplier median price as given in the International Drug Price Indicator Guide 2014 edition (MSH, 2015) see also appendix 9.

Of the few innovator brands found in the private sector alone the median MPR was found to be 8.45 as shown in table 4 below.

Table 4.4: Median price ratio of Innovator brands (IB)

Sector	MPR of IB found
Private	8.45
Public	-

IB – innovator brands

MPR calculated based on supplier median price as given in the International Drug Price Indicator Guide 2014 edition (MSH, 2015) see also appendix 9.

Table 5 below presents MPR's of LPGs of medicines from different pharmacological classes by pharmacy sector. Prices of medicines in the private sector ranged from two (2) times to even more than 4 times that of the same medicine in the public sector. Some prices in the private retail sector were even 10 times high than the international reference prices (IRP).

Table 4.5: Median price ratios according to pharmacological classes

Pharmacological class or indication of medicine	Sector	
	Public	Private
Antidepressant(s)	2.50	6.25
Antibacterials	1.49	2.82
Antihypertensives	1.64	4.43
Anti-inflammatory and pain management	3.51	6.90
Anti-acid(s)	-	7.78
Antihistamine(s)	-	10.94
Anti-asthmatic(s)	3.66	4.76
Antidiabetic(s)	1.16	3.9

Independent t-tests

Based on the paired t-test carried out, pricing in the HD was significantly different from that of the CBD ($p < 0.05$), with those in the HD slightly higher for some medicines surveyed. Pricing in the LD was relatively the highest in most of the medicines surveyed. LD prices were significantly different from those of the CBD ($p = 0.0214$). Differences in prices between the private retail sector and the public was significant with those in the private way higher ($p = 0.0000$ which is significantly less than 0.05).

Comparing with other countries

Table 6 below compares MPR of innovator brands, whole surveyed basket of essential medicines and specific medicines. It compares the current situation in Harare, Zimbabwe with Zimbabwe in 2004[15] and 36 other low to middle-income countries in the rest of Africa (AFR); Americas (AMR); Eastern Mediterranean (EMR); Europe (EUR); Southeast Asia (SEAR) and Western Pacific (WPR) as reported in 2008[16]. From the table it can be seen that the current situation in Harare paints a better picture as compared to findings of studies done earlier in Zimbabwe and other countries. Innovator brands though marginally have seen decreases in prices. Lowest priced generics have also seen significantly improvements in-terms of availability and lower prices. The public sector have also seen tremendous improvements with an MPR of 1.5 now.

Table 4.6: Comparison of MPR by OB and LPG

	Sector	Originator brands	Across basket of essential medicines	Amoxicillin 250mg capsule/tablet	Ciprofloxacin 500mg tablet/capsule	Glibenclamide 5mg tablet/capsule	Salbutamol 200-dose inhaler 0.1mg/dose
Harare province (Zimbabwe) in 2015	Private	8.45	4.52	3.88	2.56	3.90	4.76
	Public	-	1.5	1.73	1.53	1.16	3.66
Zimbabwe in 2004	Private	9.82	3.35	-	-	-	-
	Public	-	2.57	-	-	-	-
AFR as reported in 2008	Private	62.92	21.23	7.69	22.04	33.87	7.19
	Public	-	6.79	5.96	21.07	17.65	3.58
AMR as reported in 2008	Private	52.66	25.21	29.63	53.10	67.56	5.58
	Public	-	3.18	4.55	2.06	3.18	1.82
EMR as reported in 2008	Private	24.54	13.75	14.11	50.47	25.06	3.28
	Public	-	6.88	5.67	13.79	17.97	3.02
EUR as reported in 2008	Private	24.96	8.69	13.78	22.12	12.98	4.05
	Public	-	8.19	10.49	6.79	10.54	3.73
SEAR as reported in 2008	Private	21.28	9.61	22.12	19.22	19.06	4.56
	Public	-	6.84	7.46	19.31	17.65	-
WPR as reported in 2008	Private	34.21	11.25	11.08	32.94	34.59	4.32
	Public	-	11.95	9.32	81.71	56.97	4.64

N/B: AFR – Africa; AMR – Americas; EMR – Eastern Mediterranean; EUR – Europe; SEAR – Southeast Asia and WPR – Western Pacific. Sample size (n) ranged from 1 to 20. The mean price ratio are based on final patient prices. (Cameron *et al*, 2008 and Gavaza *et al*, 2009)

Discussion

Based on informants from the retail pharmacist association (RPA) of Zimbabwe and policy documents (like the Zimbabwe National Medicines Policy (ZNMP)) Zimbabwe has a free market policy when it comes to medicines pricing and availability particularly in the private sector. There are various policy positions and recommendations from various stakeholders which are not being enforced. The retail pharmacist association of Zimbabwe has a policy position that for antiretrovirals, anticancer and insulins the mark-up charged by retail pharmacies should not exceed 25%. For other medicines they recommend a mark-up that does not exceed 50%. Retail pharmacies are also "allowed" to charge a professional fee of one United States dollar ($1) on all medicines pharmacists handle. Compounding fee is set at $5, for very complex compounding; pharmacies are "allowed" to charge extra $5 for every hour spent preparing the medicine. For all dangerous drugs or narcotics pharmacists are expected to charge an extra dollar as well. Stakeholders also agreed with the findings of this survey in terms of level of availability of essential medicines which was found to be above 80% and extent to which cheaper Indian produced medicines are flooding our markets (i.e. more than 60%). It is government policy that antiretrovirals, cotrimoxazole or other medicines used for prophylaxis of opportunistic infections in HIV/AIDS, antimalarial and anti-tuberculosis medicines be availed to the public free of charge in the public sector.

Availability of medicines in both sectors surveyed was found to be high (>80%), which shows considerable improvements based on surveys done earlier[15] and those done in countries of similar settings[16]. Essential medicine availability is one of the key components of the Zimbabwe National Medicines Policy (ZNMP). ZNMP is an integral part of the National Health Policy[17]. On availability of essential medicines ZNMP's aim is;

> "To ensure the highest possible availability of essential medicines throughout the nation, including 100% availability of vital medicines at all times at the primary healthcare level."[17]

Based on the findings of this research Zimbabwe may be viewed as had significantly made most of the difficult strides towards achieving the above mentioned objective given the observed high availability even in the public sector. Noting the virtual absence of innovator or originator brands in the public sector it can be concluded that Zimbabwe has also made concerted efforts to meet its other objective on generic medicines stated below.

"To provide safe and effective medicines of acceptable quality at a reasonable price to the public through the procurement of generic pharmaceutical products and the promotion of their use." [17]

However Zimbabwe appears to still have much work to do on promoting local production given more than 70% of all the medicines surveyed we produced by foreign companies outside Zimbabwe. Also cheaper generics produced in India (more than 60% of the surveyed medicines were from India) though good in terms keeping prices relatively lower might be hindering local production. Both the public and private sectors are overly relying on Indian produced lowest priced generics. This is despite ZNMP having another objective of promoting local production;

"To promote cost effective production of medicines within Zimbabwe in accordance with the standards of current Good Manufacturing Practices (cGMP)." [17]

The MPR of 1.5 in the public sector points to significant strides that have been made so far towards public procurement efficiency. The survey though highlighting progress and improvements particularly in the public sector, confirms that prices of medicines were still very high particularly in the private sector which serve many given its proximity to people. Some medicines in the private sector were priced more than 10 times the IRP, highlighting the need for clear policy frameworks that will guide pricing of essential medicines in the private sector as well. The amenability of the private sector means it will be closer to the people and serves many as compared to the public sector. This fact means that despite good developments in the public sector, high prices in the private sector significantly compromises affordability hence access to essential medicines by many people. This is because the public sector in Harare province cannot possibly serve more than 2.1 million people[14]. Thus high prices in the private sector if unaddressed will hinder access to quality, safe and effective medicines of many people in Harare and Zimbabwe at large as more than 56% live by under a dollar a day[6].

Strengths and limitations of the study

The study used already established and accepted tools and benchmarks (i.e. WHO/HAI methodology on price surveys and international reference prices). The availability and price survey had other similar studies done in other countries or regions of similar settings to benchmark with. The use of standardized methods and having other similar studies to benchmark with made comparison also easier. Given currently Zimbabwe is using United States dollar there were no complex exchange rate calculations needed.

The study was a cross-sectional survey implying the data collected were snapshots which makes it difficult to give a clearer picture of the nation and unable to pick trends. Given the IPRs are based on procurement or tender prices offered by both not-for-profit and for-profit suppliers the ratios might be compromised particularly for the private sector which usually gets all its supplies from for-profit suppliers. Also the study focussed on 40 medicines, not even alternatives thus the selected medicines might have introduced bias. As they are commonly used they might be highly available and with lower prices due to both sectors responding to demand and competition. Also because the cross-sectional survey could pick things like demand per amount available the availability level might be an over estimate.

Recommendations

More comprehensive WHO/HAI based surveys should be done annually. More frequency of these surveys; including many sectors and regions of the country will give a better picture on what the people of Zimbabwe are accessing and paying for their essential medicine needs (i.e. affordability).

The findings of the study shows that Zimbabwe has made some effort towards implementing some provisions of its national medicine policy (ZNMP), but more efforts are needed in promoting local production and clear pricing policies or laws that affect even the private sector. There is also need to further pursue efficiency in procurement and generic medicine usage.

Conclusions

High prices particularly in the private sector calls for more efforts to be done to ensure many people have access to essential medicines. Actions that could be taken include price ceiling/controls, single exit prices, abolishing professional or dispensing fees and many more. For access and affordability to be linked with more economic development there is need to promote local production while keeping prices of essential medicines low. More efforts still needs to be done to fully implement and realized all the benefits of ZNMP and sustaining the positives noted.

Conflict of interest

This serves as a clear declaration made by the authors that there are no financial or personal relationship(s) that may have inappropriately influenced the research and writing of this paper.

Author contributions

Both VB and AM contributed to the conceptualisation and designing of this study. AM collected the data and VB validated it. All authors provided edits to the draft manuscript and approved the final version.

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CHAPTER 5

Additional results

This chapter outlines other results and interpretations derived from the findings of this study.

5.1. Sources of medicines

Availability of medicines was generally high in both sectors being 80% or better. Most medicines found were low priced generics that are mostly produced by Indian manufacturers (see figure 5.1 below).
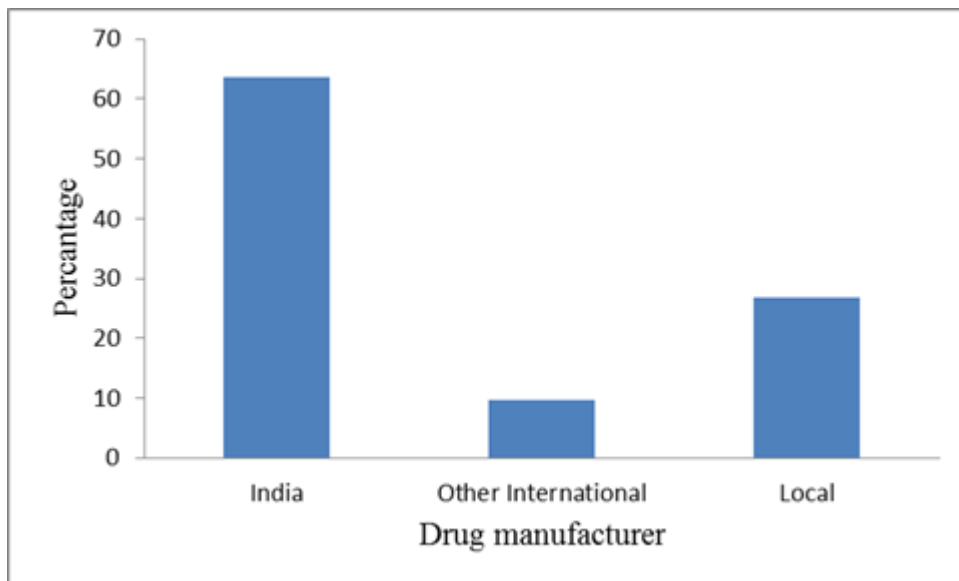
Figure 5.1: Origins of medicines found in pharmacies of both sectors (combined percentages)

5.2. Median price ratios

A comparison of prices within the private sector, revealed that though they were very similar it can be seen in figure 5.2. below that pharmacies in the central business district (CBD) were generally lower followed by those from the high density (HD) pharmacies. Low density (LD) pharmacies generally had high prices as compared to others within the private sector. This can be attributed to relative distribution of pharmacies with the CBD having more of the private pharmacies in Harare province, followed by HD then the LD. Also since many people stay in HD the relatively high prices as compared to the CBD are possibly a result of pharmacies responding to high demand and less competition.
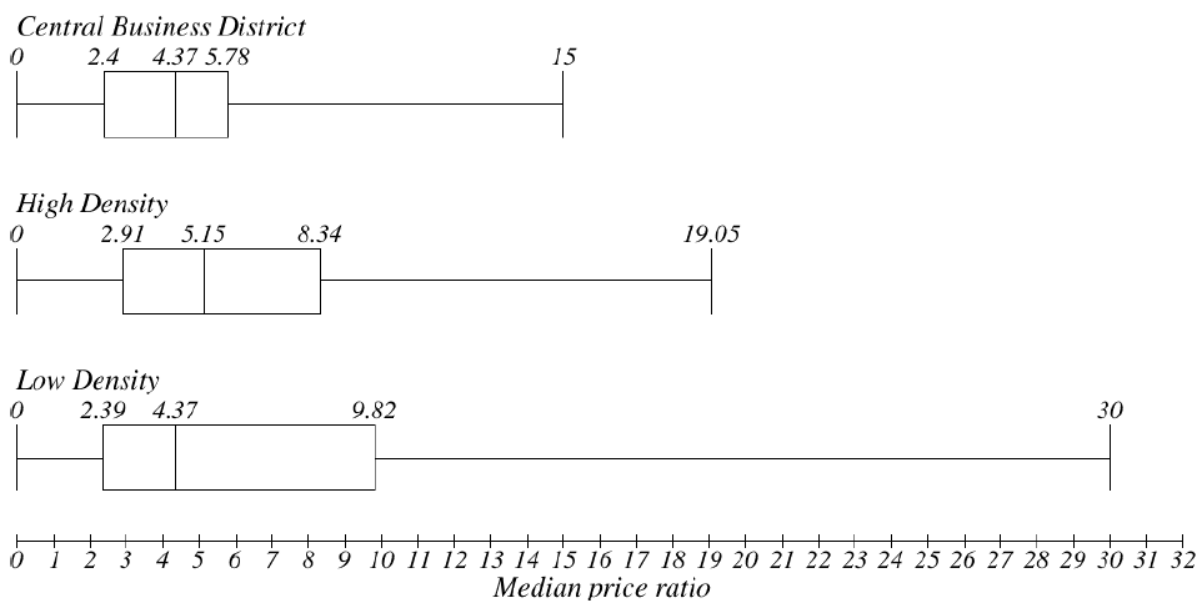
Figure 5.2: Box and whisker plot of median price ratios within the private sector

The private sector had prices that were generally more than three (3) times more than those in the public sector (see figure 5.3. below). With fewer public sector pharmacies in Harare province, many people may still be having their access to quality, safe and effective medicines hindered by higher prices despite high availability. Private pharmacies have high penetration into people communities as compared to public sector outlets, thus higher prices noted in the sector have significant impact on access to essential medicines.
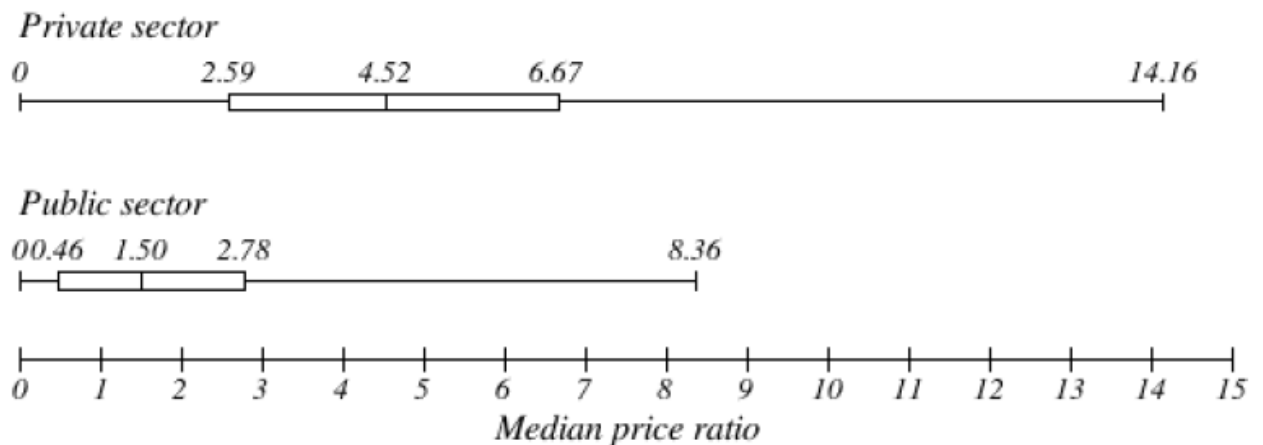
Figure 5.3: Box and whisker plot comparing median price ratios (MPR) of private and public sectors

Median MPR of 1.5 in the public sector underscores significant improvements in the public sector procurement, in-terms of its efficiency.

5.3. Conclusion

Generic medicines from India might be significantly limiting local production as they seem to be the most abundant in the Harare pharmaceutical market. But these products might also have significantly contributed to low prices and procurement efficiency particularly in the public sector.

CHAPTER 6

Conclusions and future recommendations

This chapter outlines the general conclusion of the study as well as recommendations for future research based on its findings.

6.1. General Conclusion

High prices particularly in the private sector calls for more efforts to be done to ensure many people have access to essential medicines. For access and affordability to be linked with more economic development there is need to promote local production while keeping prices of essential medicines low. More efforts still needs to be done to fully implement and realized all the benefits of ZNMP and sustaining the positives noted.

6.2. Recommendations and future studies

More comprehensive WHO/HAI based surveys should be done annually. More frequency of these surveys; including many sectors and regions of the country provide a better picture on what the people of Zimbabwe are accessing and paying for their essential medicine needs (i.e. affordability).

The findings of the study shows that Zimbabwe has made some effort towards implementing some provisions of its national medicine policy (ZNMP) particularly during its government of national unity (GNU) era, but more efforts are needed in promoting local production and clear pricing policies that affect even the private sector. There is also need to further pursue efficiency in procurement and generic medicine usage.

APPENDICES

Appendix 1: Proof of submission of article

Title Operations Coordinator <submissions@phcfm.org> Nov 11 (11 days

Dear Amos Marume

Ref. No.: 1088
Title: Price and availability survey of basic pharmaceuticals and allied products in the Harare province, Zimbabwe
Journal: **African Journal of Primary Health Care & Family Medicine**

We confirm and thank you for submitting your manuscript. Please use the manuscript reference number given above in all future correspondence.

With the online journal management system that we are using, you will be able to track progress of the manuscript through the editorial process by logging into the journal's website:

Manuscript URL: http://www.phcfm.org/index.php/phcfm/author/submission/1
Username: sinyoro

Your new submission will undergo a preliminary review by the editor to assess whether the article is within the focus of the journal.

Thank you for considering this journal to publish your work. If you have any questions, please do not hesitate to contact me.

Kind regards
Title Operations Coordinator
African Journal of Primary Health Care & Family Medicine

African Journal of Primary Health Care & Family Medicine
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Appendix 2: Ethical clearance

UNIVERSITY OF KWAZULU-NATAL

INYUVESI YAKWAZULU-NATALI

15 June 2015

Mr Amos Marume 213524974
School of Health Sciences-Pharmacology
Westville Campus

Dear Mr Marume

Protocol reference number: HSS/0346/015M
Project title: A price and avaiablity survey of basic pharmaceuticals and allied prodeucts in the Harare Province, Zimbabwe

Full Approval – Expedited Application

In response to your application received on 17 April 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of **3** years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

....
Dr Shamila Naidoo
On behalf of Dr Shenuka Singh (Chair)
Humanities & Social Sciences Research Ethics Committee

/pm

Cc Supervisor: Ms Varsha Bangalee
Cc Academic Leader Research: Prof j van Heerden
Cc School Administrator: ms P Nene

Appendix 3: Permission granted by the Pharmacists Council of Zimbabwe

Pharmacists Council of Zimbabwe
No. 17 Divine Road, Milton Park, Harare, P.O. Box CY 2138, Causeway, Harare, Zimbabwe
Tel: 04-740074, 741302, 740157
Email: pharmcouncil@gmail.com
Website: www.pharmcouncil.co.zw

All correspondence to be addressed to the Registrar

TO WHOM IT MAY CONCERN

RE - PERMISSION TO COLLECT DATA FOR ACADEMIC PURPOSES FOR MR AMOS MARUME FOR MPharm PHARMACOECONOMICS AT THE UNIVERSITY OF KWAZULU NATAL, SOUTH AFRICA

The Pharmacists Council of Zimbabwe has no objection for Mr Amos Marume to collect data in Harare Province in fulfilment of his research project on " A price and availability survey of basic pharmaceuticals and allied products in Harare Province, Zimbabwe" for the MPharm Pharmacoeconomics at the University of KwaZulu, South Africa.

Kindly allow him to collect the relevant data for his research project only (academic purposes only)

A KARONGA (Mr)
REGISTRAR

PHARMACISTS COUNCIL OF ZIMBABWE
17 Divine Road, Milton Park, Harare

0 4 MAY 2015

P.O. BOX CY2138, CAUSEWAY
TEL: 740074, 741302. FAX 740157

Appendix 4: Example of approvals from individual pharmacy outlets

Head Office: Suite C1A, Tafara Building, EastEnd Medical Centre, 60 G. Silundika, Harare, Zimbabwe
Email: guardianpzim@gmail.com

07 May 2015

To whom it may concern

RE: PERMISSION TO COLLECT DATA FOR ACADEMIC PURPOSES IN ANY OF OUR BRANCHES

This is to inform you that the management of Guardian Pharmacies have considered and approved your request to be allowed to collect data on prices and/or availability of various medicines. Also please note that the approval is only valid if the data is used for academic purposes. Please maintain all necessary ethical and confidential protocols and practices at all times.

For more information please contact the undersigned.

Sincerely

Tinashe Tevera
Chief Pharmacist

Milton Park Branch: 58 Palmer Rd	Katanga Branch: K2115 Katanga	Phone:	+263-4-792076
Milton Park	Vimbayi Surgery		+263-8644071778
Harare, Zimbabwe	Norton, Zimbabwe		+263-779716861

Appendix 5: Request for consent letter

To whom it may concern

RE: REQUEST AND CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

Researcher: Amos Marume (0772 687 090)

Dear Respondent,

I, **Amos Marume** am an MPharm. student with the Univesity of KwaZulu Natal (UKZN). You are invited to participate in a research project entitled:

A PRICE AND AVAILABILITY SURVEY OF BASIC PHARMACEUTICALS AND ALLIED PRODUCTS IN THE HARARE PROVINCE, ZIMBABWE.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this research project.

The questionnaire should only take 15-20 minutes to complete. In this questionnaire, you are asked to indicate what is true for you, so there are no "right" or "wrong" answers to any question. Work as rapidly as you can. If you wish to make a comment please write it directly on the booklet itself. I hope you will take the time to complete the questionnaire.

If you have any questions or concerns about participating in this study, please contact me on the numbers listed above.

Sincerely

Researcher: Amos Marume (0772 687 090)

Appendix 6: Consent form for signing

CONSENT

I_____ (full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

_____   _____

Signature of Participant   Date

Appendix 7: Assessment of price and availability form

Number	A Generic name, dosage form and strength	B Medicine type	C Brand or product name	D Manufacturer	E Availability "yes" or "no"	F Pack size recommended	G Pack size found	H Price of pack found	I Unit Price (2 d.p.)	J Any other comments
1	Amitriptyline 25mg tabs	Brand								
		Generic								
2	Amoxicillin 250/500mg tabs/caps	Brand								
		Generic								
3	Atenolol 50mg tabs	Brand								
		Generic								
4	Nifedipine 20mg SR tabs	Brand								
		Generic								
5	Carbamazepine 200mg tabs	Brand								
		Generic								
6	Diclofenac 50mg tabs	Brand								
		Generic								
7	Ciprofloxacin 500mg tabs	Brand								
		Generic								
8	Tenofovir/ Lamivudine/ Effeviranz tabs	Brand								
		Generic								
9	Amlodipine 10mg tabs	Brand								
		Generic								
10	Paracetamol 500mg tabs	Brand								
		Generic								
11	Hydrochlorothiazide 25mg tabs	Brand								
		Generic								

12	Co-trimoxazole 480mg tabs	Brand									
		Generic									
13	Halothane gas	Brand									
		Generic									
14	Lignocaine inj	Brand									
		Generic									
15	Ketamine inj	Brand									
		Generic									
16	Codeine tabs	Brand									
		Generic									
17	Pethidine inj	Brand									
		Generic									
18	Paracetamol syrup	Brand									
		Generic									
19	Omeprazole 20mg tabs/caps	Brand									
		Generic									
20	Chlorpheniramine 5mg tabs	Brand									
		Generic									
21	Atropine inj	Brand									
		Generic									
22	Artemether/ Lumefantrine 20/120mg tabs	Brand									
		Generic									
23	Benzathine penicillin inj	Brand									
		Generic									
24	Ceftriaxone inj	Brand									
		Generic									
25	Clindamycin 150mg caps	Brand									
		Generic									

26	Cotrimoxazole 240mg/5ml paed Susp.	Brand								
		Generic								
27	Glibenclamide 5mg tabs	Brand								
		Generic								
28	Doxcycline 100mg caps	Brand								
		Generic								
29	Erythromycin 250mg tabs/cap	Brand								
		Generic								
30	Fluconazole 200mg cap/tabs	Brand								
		Generic								
31	Rifampicin/Isoniazid/Pyrazinamide/Ethambutol 150/75/400/275 tabs	Brand								
		Generic								
32	Miconazole oral gel	Brand								
		Generic								
33	Praziquantel 600mg tabs	Brand								
		Generic								
34	Warfarin 5mg tabs	Brand								
		Generic								
35	Digoxin tabs	Brand								
		Generic								
36	Salbutamol inhaler	Brand								
		Generic								
37	Oxytocin inj	Brand								
		Generic								
38	Zidovudine/Lamivudine/Nevirapine 300/150/200mg tabs	Brand								
		Generic								

39	Nevirapine 10mg/ml pead susp	Brand								
		Generic								
40	Prednisolone 5mg tabs	Brand								
		Generic								

Appendix 8: Median price ratios used

Generic name, dosage form and strength	CBD/IRP	HD/IRP	LD/IRP	Private/IRPS	public/IRPS
Amitriptyline 25mg tabs	7.569444444	6.25	9.097222222	6.25	2.5
Amoxicillin 250mg tabs/caps	3.880434783	3.831521739	4.211956522	3.880434783	1.72826087
Atenolol 50mg tabs	4.368932039	5.339805825	4.368932039	4.854368932	1.45631068
Nifedipine 20mg SR tabs	3.68	4	4	4	1.824
Carbamazepine 200mg tabs	5.154639175	5.154639175	5.154639175	5.154639175	2.783505155
Diclofenac 25mg tabs	9.160714286	8.928571429	9.821428571	8.928571429	8.357142857
Ciprofloxacin 500mg tabs	3.023255814	4.651162791	2.325581395	2.558139535	1.534883721
Tenofovir/ Lamivudine/Effeviranz tabs	2.527871403	2.678247342	0.259268862	2.592688618	0.000855587
Amlodipine 10mg tabs	2.588235294	3.032679739	2.614379085	2.614379085	1.239215686
Paracetamol 500mg tabs	7.777777778	11.11111111	4.444444444	8.888888889	3.997777778
Hydrochlorothiazide 25mg tabs	5.23255814	7.837209302	4.651162791	5.813953488	3.209302326
Co-trimoxazole 480mg tabs	3.040322581	2.822580645	2.862903226	2.822580645	1.858064516
Halothane gas	0	0	0	0	2.496
Lignocaine inj	5.28	6	6	6	3.12
Ketamine inj	0	14.5175064	0	4.269854825	0.819812126
Codeine tabs	3.230337079	4.213483146	3.019662921	3.230337079	1.685393258
Pethidine inj	3.50922797	3.899142189	3.639199376	3.899142189	0.834416428
Paracetamol syrup	5.555555556	5.555555556	3.240740741	5.555555556	1.111111111
Omeprazole 20mg tabs/caps	6.333333333	9.611111111	55.55555556	7.777777778	7.777777778
Chlorpheniramine 5mg tabs	15	7.5	30	10.9375	0
Atropine inj	5.783972125	5.574912892	6.968641115	6.968641115	5.43554007
Artemether/ Lumefantrine 20/120mg tabs	2.23135643	2.448620082	11.74398121	2.448620082	0.00244862
Benzathine penicillin inj	1.138519924	1.138519924	1.138519924	1.138519924	0.45540797
Ceftriaxone inj	0.401606426	0.401606426	0.240963855	0.401606426	0.096385542
Clindamycin 150mg caps	2.160864346	2.400960384	0.360144058	2.256902761	1.43577431
Cotrimoxazole 240mg/5ml paed susp.	5.882352941	5.392156863	3.921568627	5.882352941	2.352941176
Glibenclamide 5mg tabs	3.75	4.852941176	13.08823529	3.897058824	1.164705882
Doxcycline 100mg caps	6.262411348	9.078014184	7.517730496	7.553191489	0
Erythromycin 250mg tabs/cap	2.864450128	3.20971867	10.23017903	3.069053708	1.409207161
Fluconazole 200mg cap/tabs	4.45184136	6.104815864	5.66572238	5.66572238	0.226628895
Miconazole oral gel	1.26135217	1.26135217	2.018163471	1.26135217	0.63370333
Praziquantel 600mg tabs	5.546288574	8.34028357	1.392827356	6.672226856	0.393661384
Warfarin 5mg tabs	2.006128703	2.91113381	3.064351379	2.247191011	1.469867211
Digoxin tabs	10.74380165	9.917355372	40	10.33057851	4.363636364
Salbutamol inhaler	4.761904762	19.04761905	32.57142857	4.761904762	3.657142857
Oxytocin inj	6.857142857	10.28571429	10	10	2.228571429
Zidovudine/Lamivudine/Nevirapine 300/150/200mg	2.403373155	2.810962755	2.389318342	2.45959241	0.001173577
Nevirapine 10mg/ml pead susp	0	13.36633663	14.85148515	14.15841584	0.00990099
Prednisolone 5mg tabs	2.64957265	3.846153846	2.564102564	2.820512821	3.020512821

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Appendix 9: Prices and references used in calculations (International Drug Price Indicator Guide, 2014)

Generic name, dosage form and strength	private	public	cbd	hd	ld	IRPS
Amitriptyline 25mg tabs	0.045	0.018	0.0545	0.045	0.0655	0.0072
Amoxicillin 250mg tabs/caps	0.0714	0.0318	0.0714	0.0705	0.0775	0.0184
Atenolol 50mg tabs	0.05	0.015	0.045	0.055	0.045	0.0103
Nifedipine 20mg SR tabs	0.1	0.0456	0.092	0.1	0.1	0.025
Carbamazepine 200mg tabs	0.1	0.054	0.1	0.1	0.1	0.0194
Diclofenac 25mg tabs	0.05	0.0468	0.0513	0.05	0.055	0.0056
Ciprofloxacin 500mg tabs	0.11	0.066	0.13	0.2	0.1	0.043
Tenofovir/ Lamivudine/Effeviranz tabs	1	0.00033	0.975	1.033	0.1	0.3857
Amlodipine 10mg tabs	0.2	0.0948	0.198	0.232	0.2	0.0765
Paracetamol 500mg tabs	0.04	0.01799	0.035	0.05	0.02	0.0045
Hydrochlorothiazide 25mg tabs	0.025	0.0138	0.0225	0.0337	0.02	0.0043
Co-trimoxazole 480mg tabs	0.035	0.02304	0.0377	0.035	0.0355	0.0124
Halothane gas		0.312				0.125
Lignocaine inj	0.15	0.078	0.132	0.15	0.15	0.025
Ketamine inj	0.5	0.096		1.7		0.1171
Codeine tabs	0.23	0.12	0.23	0.3	0.215	0.0712
Pethidine inj	1.5	0.321	1.35	1.5	1.4	0.3847
Paracetamol syrup	0.03	0.006	0.03	0.03	0.0175	0.0054
Omeprazole 20mg tabs/caps	0.14	0.14	0.114	0.173	1	0.018
Chlorpheniramine 5mg tabs	0.0175		0.12	0.024	0.438	0.0016
Atropine inj	1	0.78	0.83	0.8	1	0.1435
Artemether/ Lumefantrine 20/120mg tabs	0.417	0.000417	0.38	0.417	2	0.1703
Benzathine penicillin inj	0.3	0.12	0.3	0.3	0.3	0.2635
Ceftriaxone inj	0.3	0.072	0.3	0.3	0.18	0.747
Clindamycin 150mg caps	0.188	0.1196	0.18	0.2	0.03	0.0833
Cotrimoxazole 240mg/5ml paed susp.	0.03	0.012	0.03	0.0275	0.02	0.0051
Glibenclamide 5mg tabs	0.0265	0.00792	0.0255	0.033	0.089	0.0068
Doxcycline 100mg caps	0.1065		0.0883	0.128	0.106	0.0141
Erythromycin 250mg tabs/cap	0.12	0.0551	0.112	0.1255	0.4	0.0391
Fluconazole 200mg cap/tabs	0.4	0.016	0.3143	0.431	0.4	0.0706
Rifampicin/Isoniazid/Pyrazinamide/Ethambutol 150/75/400/275		0.000015				0.0614
Miconazole oral gel	0.125	0.0628	0.125	0.125	0.2	0.0991
Praziquantel 600mg tabs	0.8	0.0472	0.665	1	0.167	0.1199
Warfarin 5mg tabs	0.22	0.1439	0.1964	0.285	0.3	0.0979
Digoxin tabs	0.125	0.0528	0.13	0.12	1.75	0.0121
Salbutamol inhaler	0.05	0.0384	0.05	0.2	0.342	0.0105
Oxytocin inj	1.75	0.39	1.2	1.8	1.75	0.175
Zidovudine/Lamivudine/Nevirapine 300/150/200mg ta	0.35	0.000167	0.342	0.4	0.34	0.1423
Nevirapine 10mg/ml pead susp	0.143	0.0001		0.135	0.15	0.0101
Prednisolone 5mg tabs	0.033	0.03534	0.031	0.045	0.03	0.0117