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UTILIZATION PATTERNS AND POTENTIAL COST SAVINGS OF GENERIC CARDIOVASCULAR MEDICATIONS AT PRIVATE COMMUNITY PHARMACIES IN THE JOHANNESBURG AREA: AN ANALYSIS OF MEDICAL CLAIMS RETROSPECTIVELY

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Research Report submitted for partial fulfillment of the requirements for the degree Master of Science in Medicine MSc (Med) in Pharmaceutical Affairs, Department of Pharmacy and Pharmacology, Faculty of Health Sciences, University of Witwatersrand.

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Abstract

Cardiovascular disease is a leading cause of death worldwide (Kishore et al., 2011), therefore how to prevent and treat this condition is of great importance to health care professionals and patients. Patients struggle to afford these medications which can ultimately influence their health outcome. Treatment of cardiovascular disease conditions may require several drugs and this causes an increase in health cost to the patient (Burapadaja Siriporn et al., 2007).The promotion of the use of generic medication and generic substitution is seen as one of the approaches to improve access to cardiovascular medications (Kishore et al., 2011; Kesselheim et al., 2008).

Generic medications play an important role in reducing health care costs and in increasing access to healthcare. A large number of branded or innovator drugs and molecules are no longer protected by their patents or will be reaching patent expiration soon. Therefore there is an increased interest in research on generic drug competition and its effect on the market. Once generics enter the market, they have many effects on areas such as market share, prices and quantities sold (Gonzalez et al., 2008).

The objective of this study was to determine the usage patterns of generic cardiovascular medications and possible cost savings that can be achieved by maximum generic substitution in the private community pharmacy health care environment in the Johannesburg area. Ten oral solid drug pairs experiencing generic substitution were investigated at four private community pharmacies that provided pharmaceutical products and services.

The study was a quantitative, retrospective study of medical claims. Data on computerized drug claims were provided by a South African pharmaceutical service provider. Data was extracted and analysed of patients who receive one or more cardiovascular drugs for the period of June 2009 to May 2011.

The results of this study showed that the cardiovascular (CVS) medications under study accounted for 21 817 of the total number of 282 109 items dispensed at all pharmacies for the study period which equals to 7.7%. Of the total of 21 817, the innovator CVS drugs accounted for a volume of 6 527 (29.9%) and the generics 15 290 (70.1%) of all the study CVS items dispensed. There was a decline in terms of percentage of innovator products (9.7%) and a corresponding increase in generic products by the same percentage from beginning to end of the study period in terms of items dispensed.

The total cost of the study CVS innovator and generic drugs was R3 249k. This accounted for 7.4% of the total cost of all items dispensed for all the study pharmacies which was R43 672k. Of the total of R3 249k, a cost of R1 240k (38.2%) accounted for the innovator items and R2 009k (61.8%) accounted for the generic items.

The average cost per CVS item for the entire study period was R149. The innovator average cost per item dispensed was R190 (±R93.28) and for generic R131 (±R59.55). There was a 9.9% decrease in percentage of innovator total cost and a corresponding 9.9% increase in percentage of generic cost from the beginning until end of the study period. The following was also revealed: the average cost per item decreased by R18 (from R156 during P1 to R138 for P6). The average cost per innovator item dispensed decreased by R10 (from R191 during P1 to R181 for P6) and the average cost per generic item decreased by R14 (from R138 during P1 to R124 for P6). The cost prevalence index (CPI) for innovator items was fairly expensive compared to generic medicine because the value of CPI was larger than 1.

Potential cost savings of R576k would have been achieved if the least expensive generic was substituted during each period for the entire study period. If the most expensive generic was substituted, the potential cost savings would have been R448k. (Note: k =1000).

Recommendations in this field of study for future research were also done.

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Declaration

I, Mr. Sagel Govender declare that this research report is my own work. This research report is being submitted for the degree of Master of Science in Medicine, MSc (Med) in Pharmaceutical Affairs, at the University of Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination at this or any other university.

_____

Sagel Govender

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CHAPTER 1: LITERATURE REVIEW

INTRODUCTION

The use of generic medication has become progressively more common in clinical practice internationally. Healthcare organizations around the world are constantly making efforts to find methods of reducing healthcare costs to patients. Examples of strategies are the regulations relating to the pricing of medication, improvement in health technology assessments that establish the cost-effectiveness of therapies, and importantly, promoting the use of more affordable generic medications instead of their branded or original counterparts (Crawford et al., 2006).

A large number of branded or innovator drugs and molecules are no longer protected by their patents or will be reaching patent expiration soon therefore, there is an increase interest in research on generic drug competition and its effect on the market. Previous studies had researched areas of market share, quantity sold and prices after generic entry. The majority of studies show a considerable decrease in market share of original branded drugs after patent expiry. Prices of the original branded drugs increase or remain mainly unchanged (Gonzalez et al., 2008).

1.1 Cardiovascular disease

Cardiovascular diseases are known to be a group of disorders of the heart and blood vessels and include. Examples of conditions that comprise CVD are strokes, heart failure heart attacks, diseases of the heart muscle and heart disease caused by high blood pressure (Steyn, 2007).

When there is a blockage that prevents the flow of blood to the heart or brain it can result in acute events such as heart attacks and strokes. One of the most frequent reasons is due to the build-up of fatty deposits on the blood vessels

inner walls. Strokes can occur when there is bleeding from the blood vessel in the brain or by blood clots (WHO, 2012e).

Cardiovascular disease (CVD) is one of the leading causes of death around the world (Kishore et al., 2011). It is a chronic disease and, if not treated correctly, may lead to further complications and even death of the individual. Therefore, how to prevent and treat this condition is of great importance to health care professionals and patients. Cardiovascular drugs in the United States of America are amongst the top 20 most frequently prescribed medications. Treatment of cardiovascular disease conditions may require several drugs and this causes an increase in health cost to the patient (Burapadaja Siriporn et al., 2007).

Mortality is generally higher in low and middle-income countries (Mathers et al., 2004; Fuster et al., 2010). The public sector may struggle to attain CVD medications in these countries (Mendis et al., 2007; Cameron et al., 2009). However this may not be the case in the private sector as there is greater availability, but patients in this sector battle to afford these medications due to their high costs. Patients are treated chronically for these types of disease conditions that increase their cost burden for an extended period of time (World Health Organization, 2004). In a study done to compare clinical evidence of brand name and generic medication for treatment of cardiovascular disease conditions, it was found that the evidence did not support the view that branded drugs were superior to their generic counterparts, although several editorialists counseled against the substitutability of generic medication. The promotion of generic substitution is important in order to reduce health care costs to patients (Kesselheim et al., 2008).

According to the World Health Organization (WHO) facts and figures, CVD accounts for more than half of the deaths across the European region and “causes 46 times the number of deaths and 11 times the disease burden caused by AIDS, tuberculosis and malaria combined in Europe. 80% of premature heart disease and stroke is preventable” (WHO, 2012b: pg. 1).

In 2008 there was an estimated 17.3 million individuals that died from CVDs which represent 30% of worldwide deaths. It was estimated that 7.3 million of the deaths occurred because of coronary heart disease and 6.2 million because of stroke. In low- and middle-income countries, more than 80% of deaths are due to CVD. This happens almost equally between men and women. It is predicted that by the year 2030 there will be almost 23.6 million people who will die from CVDs. This will result mainly from heart disease and stroke (WHO, 2011).

In South Africa during the period of 1997 to 2004, 195 people per day had died due to a CVD. Stroke accounted for 60 deaths per day and 33 deaths per day occurred due to heart attacks. It was projected that between 2000 and 2030, premature deaths caused by CVD are likely to increase by 41% for people of working age (35- 64 years) (Steyn, 2007).

1.1.1 Contributing factors

The genetic make-up of an individual serves as a good indication of the likelihood of developing certain diseases, which includes cardiovascular diseases. Following good habits related to health, for example, eating a sensible healthy diet, regular exercise and not smoking can be learnt early in life and contributes to the health of an adult. An unhealthy diet and physical inactivity can lead to unwanted effects for an individual such as an increase in blood pressure, blood glucose and blood lipids. Being overweight and obese can also occur (WHO, 2012a).

Socioeconomic group: According to research, it has been shown that males between 20 and 64 years of age in semi- and unskilled manual occupations run three times higher risk of premature death from CVD compared to those in professional and managerial positions (WHO, 2012a).

Mental health: Stress that is harmful can be associated with CVD. Poor life expectancy can be predicted by the incidence of depression among those who suffer from cardiovascular diseases (WHO, 2012a).

Diet: Hypertension can be caused by a high ingestion of salt (WHO, 2012a). Salt should be restricted and potassium intake from vegetables and fruits should be increased (Milne & Pinkney-Atkinson, 2004). There is compelling evidence, according to the WHO Global Health Report 2010, which mentions that saturated fat and trans-fat increase the risk of coronary heart disease. Substituting with monosaturated and polysaturated fat reduces the risk (WHO, 2012a).

Overweight and obesity: CVD are more expected to develop in obese individuals. Low concentrations of HDL cholesterol and hypertension are some of the important risk factors for cardiovascular disease that are related to obesity (WHO, 2012a). Obesity and high levels of low- density lipoprotein (LDL) are also known to be secondary causes of dyslipidaemia which is an important risk factor in coronary heart disease (Bloem, 2009). An ideal weight (BMI<25) should be maintained and weight reduction should be considered for patients who are overweight (BMI>25) (Milne & Pinkney-Atkinson, 2004).

Inactivity: Ischaemic heart disease can be decreased by 30% if moderate physical activity is done for 150 minutes per week. It can also decrease the risk of hypertension and stroke (WHO, 2012a).

Tobacco: 10% of CVD worldwide are caused by smoking (WHO, 2012a). The use of tobacco products should be stopped. For patients with hypertension, nicotine replacements should be utilized while they are under medical supervision (Seedat and Rayner, 2012).

Alcohol: There is a direct relationship between alcohol consumption and the risk of cardiovascular disease. The greater the level of alcohol consumption, the greater the risk of cardiovascular disease (WHO, 2012a). Alcohol should be limited to an intake of 2 standard drinks per day for men and 1 standard drink for women and small men (Seedat and Rayner, 2012).

Diabetes: is also considered to be a major risk factor for cardiovascular disease (WHO, 2012a).

1.1.2 Prevention

Death and disability can be prevented and quality of life can be improved if a combination of risk factors for CVD can be concentrated at once, also employing medical screening for people at risk and thereafter supplying effective and affordable treatment to those individuals who are in need of it. In the United Kingdom it has been predicted that mortality from coronary heart disease (CHD) could have been halved if there were small changes in cardiovascular risk factors; “a 1% decrease in cholesterol in the population could lead to a 2- 4% CHD mortality reduction; a 1% reduction in smoking prevalence could lead to 2000 fewer CHD deaths per year; and a 1% reduction in population diastolic blood pressure could prevent around 1500 CHD deaths each year” (WHO, 2012b: pg.1).

An individual’s expenses can be reduced by adopting lifestyle changes. Nearly all of the changes are for free. Examples include a healthy diet, smoking cessation, increased physical activity and reduced alcohol intake. These lifestyle changes can decrease or delay the need to utilize medication which therefore can lead to a potential decrease in expenses in health for the individual patient and also for the third party payer (Greef, 2006).

1.1.3 Treatment

There are many options that are available to treat cardiovascular diseases:

- Medications that are effective and cheap are obtainable to treat almost every CVD.
- Specific risk predication charts are tools that can be utilised to identify individuals who are at risk.

- Combination drug therapy such as medication to decrease cholesterol, medication to decrease blood pressure and aspirin can aid in reducing the risk of recurrence or death of a heart attack or stroke.
- There are many operations that can be done to treat CVDs which include: coronary artery bypass, balloon angioplasty, valve repair and replacement, heart transplantation and artificial heart operations.
- Pacemakers, patches for closing holes in the heart and prosthetic valves are examples of medical devices that are needed to treat some CVDs (WHO, 2012b).

1.2 Brand name medications

Branded medications are originator or innovator products that have been discovered through research and development by an organization. They are then patented to ensure that the organization is the sole producer of the new drug. This strategy enables them to capitalize on any economic gain. Many countries have policies that promote innovation, as there is always a constant need to improve people's health and to provide better health care delivery. Government institutions aim to protect the intellectual property of innovator drug organizations as they form part of the response to the numerous challenges faced in the healthcare industry (King and Kanavos, 2002).

1.3 Branded medications that lose their patents

Original brand- name or innovator medications are generally sold at high prices and this can be seen as a cause in the increase in drugs costs (Kesselheim et al., 2006). Branded drugs are usually protected by their patents that allow pharmaceutical companies to set high prices and gain great profit margins in order to recover costs from research and development. Once the patents expire it opens up opportunities to other manufactures to produce these medications in the form of a less expensive generic (Crawford et al., 2006; Vogel, 2002; Camejo et al., 2011; Kesselheim et al., 2008). Therefore the promotion of substituting these branded drugs with a less expensive generic can be seen as a means of

controlling spending and also to reduce health care costs (Fischer and Avorn, 2004a). The requirements for registration of generic product may not be as stringent or complex compared to a branded product (Crawford et al., 2006; Vogel, 2002, Camejo et al., 2011).

1.4 Generic medication

Generic pharmaceutical manufacturing companies usually apply to the relevant regulatory authorities for approval to produce and market generic versions of the branded originator medications. This occurs once the originator's patent protection has expired. A non-propriety or branded generic can be seen as a method employed to market generic drugs (King and Kanavos, 2002). They are also sold at a reduced price when compared to the original branded medication. Production cost for companies that manufacture generics are reduced due to not having to spend a great deal on research and development of a new drug. Therefore they are able to price the generic medication at a discounted price compared to the originator product (Igbinovia, 2007).

Compared to branded medications, generics can be sold at forty to fifty percent of the branded medication's cost with an even lesser percentage in other cases, therefore there exists intense competition in the drug market (Lewin, 1987). Since 1990, expenditure on prescription drugs represents one of the highest components of health care costs in terms of growth. Between the years 1990 and 1999 the yearly average percent increase expenditure in prescription drugs averaged 12.2% (Kreling, Mott, Wiederholt, et al., 2001). By increasing the use of generic drugs this expenditure can be decreased due to the large difference in cost of generics when compared to branded medications. In the US when a generic drug was dispensed the average retail price of a prescription was $18.16 in the year 1999. When compared to a branded drug this amount was $60.66. If generic drugs were used instead of the branded counterparts there would have been a significant reduction in health care costs (Igbinovia, 2007).

1.5 Definition of a generic medicine in South Africa

In the Medicines and Related Substances Control Act, 101 of 1965, the definition of an interchangeable multi-source medicine is a medicine that should possess the same active substance or ingredient as the original or innovator product which should be available in the same concentration or strength, pharmaceutical dosage form and route of administration. It also must comply with similar standards needed for therapeutic equivalence (South African Department of Health, 2003).

1.6 Bioequivalence

Generic medications are pharmaceutically and therapeutically bioequivalent to their corresponding branded medication (South African Department of Health, 2003). Their active ingredient should be the same in terms of the requirements stated above but they may differ in other features such as their inactive ingredients, shape, colour and manufacturing process to name a few (Storm, 1987). According to the Medicines Control Council two pharmaceutical products are considered to be bioequivalent "if they are pharmaceutically equivalent or pharmaceutical alternatives and if their bioavailabilities in terms of peak (Cmax and Tmax) and total exposure (AUC) after administration of the same molar dose under the same conditions are similar to such a degree that their effects with respect to both efficacy and safety can be expected to be essentially the same" (Medicines Control Council, 2007: pg. 6). Bioequivalence is an area that is concerned with the release of the active ingredient from a pharmaceutical drug and its absorption into the blood stream later on (Medicines Control Council, 2007). Organizations that manufacture generic medication must prove that the generic medications are similar to the original branded medication (Go et al., 2011).

1.7 International studies

Prescription drugs represent a large proportion of the ever-growing costs for health care. Proportions or percentages range from 4% in the United States of America (USA) to almost 18% in France and Italy (Gonzalez et al., 2008). Policy makers realize the consequences of rising prescription drug costs. They are a burden to healthcare users as they battle to afford these payments (Fischer and Avorn, 2004b) which can ultimately lead them to default from their treatment plan and therefore adversely affecting their health outcomes (Shrank et al., 2006; Goldman et al., 2007). The use of generic products can be seen as a means to reduce healthcare costs. When generic drugs were introduced into Italy, it resulted in savings in excess of € 25million during 2002. Previous research illustrates the considerable benefits of generic substitution (Crawford et al., 2006). An example is a study done by Fischer and Avorn (2003) who investigated Medicaid prescription drug spending state-by-state in the USA. This study was done in the year 2000, and it was found that the States could have saved US$229 million with a larger use of generic medication. If best prices that were offered by each state were to be used nationally, it could have resulted in a total savings of US$450 million (Fischer and Avorn, 2003). In 2002 generic substitution was introduced in Sweden and the result was a 15% decrease in pharmaceutical prices on average (Kobayashi et al., 2011).

Patients and prescribers are likely to use these generics interchangeably with each other and the branded or original drug because of its cost savings. Prescribers and physicians determine the prescription medications that a patient will consume whether it is a branded or generic medication. This will generally affect the patients' drug therapy and its costs (Gonzalez et al., 2008). A national study was done to determine the use of cardiovascular medications by the elderly Medicare beneficiaries in USA. The study concluded that the elderly patients of generalists and to a larger degree, cardiologists, frequently use brand-name drugs when equivalents were available. Therefore there is a strong need to promote generic medication in order to reduce prescription drug costs (Federman et al., 2007).

1.8 The South African health care environment

The South African health care environment is divided into two sectors: the private and public sectors. About 14% of the population is serviced by the private health sector (i.e. 6.7 million people), a sector that is accountable for over half of the South Africa's annual expenditure on health care. The country had spent approximately 8.7% (about R135 billion) of its GDPs on health care during the period of 2005- 2006. The private sector is also served by medical aid organizations and 56% of this amount went through this industry. Health care expenditure in the private sector is known to be increasing every year in South Africa, and medicines have been identified as the major contributor to this expenditure. Medicines are responsible for 18.3% of the total amount spent by the medical aid schemes. During the period between 2004 and 2006, the three main categories of drugs that were responsible for contributing the greatest to medication expenditure were antidepressants, antihypertensives and hypolipidaemic agents (Van der Westhuizen et al., 2010).

The Council for Medical Schemes (CMS) aims to increase transparency of scheme's pricing decisions, to improve the quality of provider negotiations, investigate and to investigate medical schemes contribution and cost increases. They intend to control any inappropriate costs that could be past onto the beneficiaries. During 2011, CMS expressed concern stating that most of the reviewed cost assumptions that were analysed were considerably over the recommended range of 4.3% and 5.3%. Also the median of the contribution increases was 2.1% greater than the maximum recommendation which indicated the existence of market imperfections in the fortitude of provider and non- health costs (CMS, 2011).

In South Africa a pharmacist who dispenses medication, must offer the patient the option of substituting this medication with a generic drug, if one is available. Only in certain instances a generic drug may not be offered, for example, if the prescriber has mentioned that the medication should not be substituted or if the

price or cost of the generic drug is greater in relation to that of its original or innovator drug (South African Department of Health., 2003).

1.9 Previous studies done in South Africa

A study done by Boyce and Bartlett in 1990 illustrated the effects of generic prescribing and generic substitution in terms of cost savings in South Africa. The results showed that savings in the region of 9.9% to 59.7% can be achieved depending on which medication is prescribed. Another study done in 1996 mentioned that if generic prescribing and substitution were practiced to its greatest capacity, it would result in a possible 10% further reduction in drug costs. These savings were illustrated again in 2006 where a potential saving of 9.3% was calculated of the actual antidepressant cost, if there was total substitution of all original or innovator drugs at the average price (Van der Westhuizen et al., 2010).

A study was done to determine the potential savings with generic substitution for innovator drug items which were listed in the chronic disease algorithms (as per the Council for Medical Schemes). The results of the study illustrated that there was a 49.9% (interquartile range 32.0 to 78.5%) median cost differential between an innovator and generic item (from the 80 medicines with equivalent generics for 22 conditions) (Gray and Nicolosi, 2009).

1.10 Conclusion

The purpose of this study was to investigate the dispensing patterns and cost of selected cardiovascular medication items at chosen private community pharmacies in the Johannesburg region. As mentioned previously, innovator medications are by and large dispensed at high prices (Kesselheim et al., 2006). Generic substitution of medication will play a key role in terms of increasing access to and affordability of healthcare in South Africa and around the world (Kishore et al., 2011; Kesselheim et al., 2008).

When generics enter the marketplace, there are many effects on areas such as market share, prices and quantities sold (Gonzalez et al., 2008). By researching data on these aspects one can establish the role of generics in providing cost-effective healthcare. In the U.S.A cardiovascular medications as a group make up the greatest part of outpatient prescription drug spending (Kesselheim et al., 2008).

The Mediscor Medicines Review for 2006 mentioned that the usage of generic medications in South Africa increased with 18.4 per cent from 2004 to 2006 (Bester M and Hammann E, 2007). In the 2011 report generic utilization continued to rise. The recorded rate in 2011 was 52.4% in comparison to 50.0% in 2010 and 48.8% for 2009 (Mediscor PBM, 2012). Generic medications are approved by regulatory authorities as legitimate and effective substitutes for innovator medicine items. Therefore one should observe maximum generic substitution for innovator items when a generic is available. In other words the dispensing of innovator items should decrease considerably to as close to zero percentage as possible. One should then observe the full impact of generic substitution in terms of cost savings, improving affordability of medicines and increasing their access. To the researcher's knowledge there have been no other similar studies done previously in this area.

CHAPTER 2

ASPECTS OF MANAGED HEALTH CARE, DRUG UTILIZATION REVIEW, PHARMACOECONOMICS AND RELATED ASPECTS

2.1 MANAGED CARE

According to Kane et al (1996), managed care can be defined as efforts used to rationalize, coordinate and channel the usage of services to reach the preferred service, access, and outcomes with costs being controlled. The concept of managed care was initiated in South Africa as a method of controlling health care costs in the year 1995. In the South African environment, The Council of Medical Schemes (2003) defines managed care as a term relating to various organizational health care strategies that seek to control cost, improve access and guarantying better quality of care that is offered to patients who are covered by medical schemes (Van Der Westhuizen, 2007).

Managed health care centers around measures that are used to reduce costs. Measures such as demanding discounts and proceeds are used to transfer risks from the medical aid to the health service provider. The provider therefore becomes forced to decrease costs (Luiz and Wessels, 2004). Using measures such as utilization reviews that are used for screening wasteful practices by health care providers and patients also controls costs. Cost- effective management of medical diseases and conditions endorsed by formularies and practice guidelines are also seen as measures to reduce costs. Discounts on supplies and services are discussed and access to expensive services is controlled (Kinghorn, 1996).

2.2 DRUG UTILIZATION REVIEW

Health care delivery systems are successful when there is a rational and cost-effective use of medicines. Drug utilization review and drug utilization evaluation are used to explain programmes that are intended to identify and/ or correct

inappropriate drug-use patterns (Barnard, 2001). They can also be used as a tool to contain medicine cost (Kinghorn, 1996).

2.2.1 Purpose of Drug Utilisation

The aim of a drug utilisation review is to determine if current prescribing patterns, dispensing and drug usage are consistent with standards and criteria. From these standards it can be identified whether the drug therapy is safe, effective, cost-effective and appropriate. It should also support optimal patient outcomes. By reviewing the patient's medical records, feedback can then be provided of how the consumption and drug use rates can be reduced. Drug costs can be reduced from here (Guo et al., 1995). According to Kralewski et al., (1994), there are two key reasons for the need of drug utilization review. First, there exists strong evidence that point out that current standards of prescribing and medication consumption are less than optimum. The second reason revolves around current spending and price increases of drugs (Kralewski, 1994).

The goal of drug utilization research is to find out whether drug usage in populations is rational or not (WHO, 2003a). The rational use of a drug for a patient involves the prescription of a well-documented drug at an optional dose, at an inexpensive price with the correct information (WHO, 2003b).

2.3 PHARMACOECONOMICS

Health economics is known to be the science of assessing costs and benefits. Its goal is to identify the most efficient therapy in order for maximum benefit to be achieved from a specified amount of resources and money (Walley, 2006). Health care expenditures are increasing considerably therefore it is important to take note of the economic aspects of medical interventions (Ellis et al., 2002; Marchetti et al., 1998). The economic and the clinical medicine fields of study are moving towards the general goal of cost- effectiveness in medical practice (McCombs, 1998). National health budgets all over the world have been

exhausted by the increasing costs of health care. This usually leads to limitation of services (Walley, 1999).

The cost of acquisition of the medication that is balanced against both cost savings from its use and added health benefits generated can be used to assess the true cost to a health system of utilising a specific drug (WHO, 2003a). The value of cost- effectiveness studies is increasing. Expenses on health interventions and guidelines for making treatment and resource allocation decisions needs to be validated (Ellis et al., 2002; Marchetti et al., 1998).

Pharmacoeconomics utilizes tools to identify, measure and compare the costs and consequences of medical interventions, which also include medicine therapy (Struwig, 2005). Economic evaluations of health care alternatives are becoming progressively more common as health care organisations and providers aim for the optimal use of the limited resources in health care (Struwig, 2005; Valodia, 2007).

Medication costs account for a significant part of the total cost of health care: in general 10-15% in developed countries, and up to 30-40% in a few developing countries (WHO, 2003b). Medication costs generally need to be understood in the context of the overall (net) costs to the health system. They cost money to buy, however the drug usage may also save costs elsewhere (WHO, 2003b).

Pharmacoeconomics puts into practice and applies the basic concepts of economics to health care. It is most frequently used to aid in the decision making process in order to evaluate the supply and demand for health care services and to offer a structure to understand decisions and the related consequences (Walley et al., 2004). Pharmacoeconomics also aids in balancing costs and outcomes and assists in establishing the most efficient use of health care services and products (Bungay and Sanchez, 2003).

Comparing the costs and outcomes of different treatments appears to be the vital objective of a pharmacoeconomic evaluation. This can be achieved by creating a

single index or cost-outcome ratio. A noteworthy choice of options suggesting the best value for money can be attained by an appropriately assembled pharmacoeconomic evaluation (Bloem, 2009).

2.3.1 Application of pharmacoeconomics

Pharmacoeconomic studies can be used in a variety of circumstances where decision making is required in the South African health care environment. Examples of these are the following:

- Formulary decisions
- Pricing decisions
- Clinical guidelines for prescribing decisions
- Selection of drugs
- Post-marketing surveillance
- Procurement
- Rational use of drugs
- Drug pricing (Bruckner et al., 2000).

Pharmacoeconomic studies can serve as evidence in managed care in order to control prescription drug costs. Quality must not be compromised (Ledwaba, 2004).

2.3.2 Benefits of pharmacoeconomics

Pharmacoeconomics can aid in balancing cost with patient outcome (quality of care), which usually results in maintaining or improving quality care at potential cost savings. It can be utilized to assess the value of the products and services pharmacists offer. Pharmacoeconomics can provide the data necessary to formulate better decisions in medicine usage which can be utilised to choose between alternative treatments. Pharmacists can also balance cost with quality and patient outcome with pharmacoeconomic data (Modiba, 2005).

2.4 GENERIC SUBSTITUTION

The objective of generic substitution is to decrease medicine cost whilst achieving the equivalent medical effect (Engstrom et al., 2012). A pharmacist may have the liberty to dispense any generic version of the medication instead of the brand name written on the prescription by the doctor, without consulting the doctor (The Association of the British Pharmaceutical Industry, 2012). According to the Medicines and Related Substances Control Act (101/1965), as amended in 1997, a pharmacist must inform the patient of the benefits of generic substitution and dispense generic medication unless prohibited by the patient to do so (South African Medicines and Related Substances Control Act, 1997). The National Drug Policy of South Africa encourages the use of generic medicines that aid in reducing drug costs and expenditure (South African Department of Health, 1996). Its aim is also to promote the availability of safe and effective medications at the lowest possible cost (South African Medicines and Related Substances Control Act , 1997).

According to the medicine legislation, the following applies:

- The patient has the right to refuse or prohibit the use of such generic substitution (Mestern, 2003).
- If the prescriber has written on the prescription the words “no substitution” next to the item prescribed, then the item prescribed should not be substituted.
- If the retail price of the generic medication is higher that that of the prescribed medicine then generic substitution may not take place.
- If the medication has been declared non- substitutable by the council, then the prescribed item should be dispensed (South African PSSA pharmacy law compendium ; MAE30, 2003).

In South Africa it was discovered that only 23.5 per cent of medicines prescribed had generic equivalents. This was a study that had been done to assess the potential savings from generic prescribing and generic substitution and from the

23.5 per cent of medicines that had generic equivalents only 21 per cent were prescribed as generic medicines. It was concluded that generic prescribing and substitution would have the potential to reduce the cost of medication by nearly 10 per cent if practised to the maximum capacity (Karim et al., 1996). Training and education provided to medical practitioners can greatly encourage generic substitution (Karim et al., 1996).

Stating once more, the Mediscor Medicines Review for 2006 mentioned that the usage of generic medications in South Africa increased with 18.4 per cent from 2004 to 2006, with 45.4 per cent of innovator items substituted in 2006. This is compared to the 54 per cent in the USA (Bester and Hammann, 2007). Generic substitution is yet to achieve its full potential (Van der Westhuizen, 2007).

2.5 MEDICINE PRICING IN SOUTH AFRICA

The South African government's goal is to guarantee that patients receive affordable medicines at best value (Van der Westhuizen, 2007). The country's regulations also aim to reduce the price of medicines (Rothman, 2007). In the year 2004, the South African government established the single exit price (SEP) system for medicines. This has stopped discounts and additional levies on medicines (Board of Healthcare Funders of Southern Africa, 2006; South African Medicines and Related Substances Control Act, 2005). One of the motivations for the need of a single exit price system for medicines is to guarantee, "South Africans have access to affordable, good quality medicine" (Free Market Foundation, 2006). The regulations also only provided for an additional dispensing fee to the single exit price (Board of Healthcare Funders of Southern Africa, 2006; South African Medicines and Related Substances Control Act, 2005). SEP was defined as the price set by the manufacturer or importer of a medicine or scheduled substance combined with the logistics fee and VAT (valued added tax) and is the price of the lowest unit of the medicine or schedule substance within a pack multiplied by the number of units per pack (South African Medicines and Related Substances Control Act, 2004). The new dispensing fee's goal is to prevent the inappropriate use of high- cost items. This

leads to greater accessibility of health care to more South Africans (Board of Healthcare Funders of Southern Africa, 2006; South African Medicines and Related Substances Control Act, 2005).

The Department of Health was instructed to reconsider the dispensing fee. This was due to the legal challenges facing these regulations and the dispensing fee (Board of Healthcare Funders of Southern Africa, 2006; South African Medicines and Related Substances Control Act, 2005).

CHAPTER 3

RESEARCH METHODOLOGY

Cardiovascular disease has a major impact on illness and healthcare. Healthcare costs are constantly increasing therefore it is important that generic substitution takes place in order to make medications much more affordable and accessible to the public.

This was a study of generic substitution at selected community pharmacies to investigate the rate of generic substitution and possible cost savings to both the consumer and to the pharmaceutical benefit management (PBM) company that can be achieved by maximum generic substitution of cardiovascular medications in the private health sector of South Africa for the period of June 2009 to May 2011.

This chapter will discuss the research objectives, research design, data source and study population. Data analysis, variables and measures, statistics used in the data analysis will also be discussed.

3.1 Objectives

The objectives of the study were:

1. To determine the extent of usage of generic cardiovascular medications in the private community pharmacy health care environment in the Johannesburg area of South Africa during the period of June 2009 to May 2011. This was done at selected pharmacies.
2. To determine the possible cost savings that can be achieved by dispensing generic medications and /or practicing generic substitution in the private community pharmacy health care environment in the Johannesburg area of South Africa during the period of June 2009 to May 2011. This was done at selected pharmacies.

The classes of cardiovascular medications to be investigated were: angiotensin-converting enzyme (ACE) inhibitors, cholesterol and triglyceride modifiers (HMG CoA reductase inhibitors), beta-blocking agents, diuretics, calcium channel blockers, angiotensin receptor blockers and platelet aggregation inhibitors (see Table 1 in methodology for more details). A quantitative, retrospective drug utilization review was conducted. The study drugs where specifically chosen to get an overall perspective on a number of drugs that had been generalized within the reporting period and for which there was claims data.

3.2 Study Design and Methodology

3.2.1 Type of study

This was a quantitative, retrospective study of cardiovascular drug usage for the period between June 2009 and May 2011. The data were acquired through a South African Pharmaceutical Benefit Management (PBM) company medicines claims database.

3.2.2 Study population and sampling

This study was conducted in a chain of private community pharmacies that provide pharmaceutical products and services. Four Pick n' Pay pharmacies were used for the study. The Boksburg, Woodmead, Soweto and Norwood Pick n' Pay pharmacies were used as the study pharmacies representing the east (Boksburg), north (Woodmead), south (Soweto) and central (Norwood) geographical areas of Johannesburg. All patients who utilized the study Pick n' Pay's pharmacies for cardiovascular medication during the study period were regarded as the target population.

3.2.3 Participants

The researcher collected data with the assistance of pharmacy staff members and Computer Kit Systems (CKS), which is a pharmaceutical service provider.

3.2.4 Measurements

The Monthly Index of Medical Specialties, also commonly referred to as the MIMS, was the reference text used to determine the list of cardiovascular (CVS) medications (Snyman, 2011). The medications were assigned to seven classes. Generic medications were available for all of the branded or innovator drugs chosen for the study where the patents have expired. The frequency of the dispensing and the total cost of the medicine treatment were assessed and analysed for innovator and generic dispensing and generic substitution of cardiovascular medications by pharmacists.

Table 1: The 10 oral solid drug pairs experiencing generic substitution between June 2009 and May 2011.

Branded drug	**Generic drug**	**Examples of generic drugs**	**Pharmacological Class**
Coversyl	perindopril	Cipla-Perindopril, Prexum	ACE inhibitors
Lipitor	atorvastatin	Aspavor, Atolip, Lipogen	HMG CoA reductase inhibitors
Prava	pravastatin	Aspen Pravastatin, Colite	HMG CoA reductase inhibitors
Concor	bisoprolol	Adco- Bisocor, Bilocor	Beta-blocking agents
Lasix	furosemide	Puresis, Sandoz Furosemide	Diuretics
Adalat XL	nifedipine	Adco-Vascard SR, Fedaloc SR	Calcium channel blockers
Norvasc	amlodipine	Amloc,Austel-Amlodipine, Ciplavasc	Calcium channel blockers
Cozaar	losartan	Cipla- Losartan, Zartan	Angiotensin receptor blockers
Aprovel	irbesartan	Irbewin	Angiotensin receptor blockers
Plavix	clopidogrel	Clopidogrel-Winthrop, Clopivas	Platelet aggregation inhibitors

The percentage rates or frequency of generic substitution were investigated. Dispensing patterns by pharmacists and costs for both innovator and generic drugs were examined. Analysis included determining the dispensing patterns and cost of all items dispensed on the database: total number of prescriptions, total number of items dispensed, average number of items per prescription, total cost of items dispensed, average cost per item and average cost per prescription.

Dispensing or usage patterns and cost of the CVS innovator drugs were compared to the generic drugs. Analysis for both innovator and generic drugs included percentage rates or frequency, total cost and average cost per item. This was also done in periods to investigate the impact of generic substitution over a certain period of time. Each individual pharmacy was also analysed and compared to the others.

Potential cost savings that could have been achieved if the innovator drugs were to be substituted by a generic (either the most expensive or least expensive generic drug) were also examined. These measurements and calculations were adapted from previous research (Van der Westhuizen, 2007).

The study also investigated the dispensing patterns and cost of innovator clone molecules. Potential cost savings were also calculated for these molecules.

3.3 Data collection and Analysis

In order to achieve the study objectives, data for the three consecutive years (i.e. from June 2009 and May 2011) were obtained from a South African pharmaceutical service provider Computer Kit Systems (CKS). Services provided by them include a data capturing service which includes the dispensing data of all items dispensed at pharmacies, both medical aid and non- medical aid data. Pick n' Pay utilizes the provider to manage the benefits of medical aid schemes and insurance organizations in South Africa. They are used for the processing of real-time medical scheme transactions at pharmacies and other

service providers. The service provider specializes in the provision of hardware, software, and support services to retail community pharmacies.

Information related to prescription records, price and medical scheme updates can also be supplied. Updates on the latest price changes are also provided. Each of the study pharmacies downloads these updates on a daily basis. Therefore the date and the new price of a medication can be identified and the necessary adjustments to the data analysis were done. Dispensing fees were included in the analysis. Data relating to prescription records of patients who collect at least one or more prescription cardiovascular medication that were processed as a computerized medical claim or dispensed to the patient (either medical aid or non-medical aid) were extracted and analysed on a monthly basis during the study period. These included patients who had repeat prescriptions and also items that were bought for cash.

The study also made use of ICD- 10 (International Statistical Classification of Diseases and Related Health Problems, 10th Revision) codes and proxy ICD- 10 for the classes of cardiovascular drugs under the study. This was to ensure that the study medications are used for cardiovascular conditions.

Medication cost- is the cost or value of a medication that is dispensed through the PBM database and includes the single exit price of the medication plus the dispensing fee.

Medication price- is the single exit price inclusive of VAT (value added tax) in line with pricing legislation (Government Notice, Gazette No 26304 of 30 April 2004) and excludes any professional fees that may be applicable.

Nappi (National Approved Product Pricing Index) code: The Nappi code is a unique nine digit number employed with electronic transactions in mind. This code is uniquely incorporated for each product name, pack size, strength, manufacturer plus exclusions (Snyman, 2011). Individual items are identified by making use of NAPPI codes.

3.4 Statistical analysis

Data were analysed using the STATA 11 and Microsoft Excel version 2010 programs. The programs were used to calculate basic descriptive statistics relating to, for example, frequencies and the average (arithmetic mean). Cost prevalence index and potential cost savings were also calculated.

3.4.1 Arithmetic mean (AM)

The AM was utilised in the data analysis to determine the average cost and the average number of items per prescription.

$$x = \sum_{n} x$$ .....Equation 1

Where:

x = the values of the variable

∑= the sum of

n = the number of observations (Van der Westhuizen E, 2007).

3.4.2 Standard deviation (SD)

The standard deviation equation was utilised in the data analysis in order to determine the SD of the average cost.

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$ .....Equation 2

Where:

s = standard deviation

x = value in the data set

$\bar{x}$ = arithmetic mean

n = the number of observations (Van der Westhuizen E, 2007).

3.4.3 Cost-prevalence index

According to Serfontein (1989) the cost-prevalence index can be utilised as an indication to illustrate the relationship between the total number of medicine items prescribed and the total medicine cost. Index numbers are generally utilized to investigate medication usage patterns. The cost -prevalence index (CPI) was calculated as follows (Van der Westhuizen, 2007):

$$\text{Cost- prevalence index} = \frac{\text{Cost (\%)}}{\text{Prevalence (\%)}} \quad \text{Equation 3}$$

Where:

- If the cost index < 1 then the drug items are relatively inexpensive.
- If the cost index = 1 then there is an equilibrium between the cost and prevalence of the product.
- If the cost index > 1 then the drug item is relatively expensive (Van der Westhuizen, 2007).

The CPI was utilised in the data analysis in order to determine how expensive the product was in relation to the number of drug items prescribed.

3.4.4 Potential cost savings

The calculations for potential cost savings that were done for the study were for innovator cardiovascular medicines that were available on the database that had an equivalent generic/s available (Bloem, 2009). In this study, potential cost savings can be observed as the medicine cost that could be saved if drug items are substituted with other drug items that contain the same active pharmaceutical ingredient and strength. These items can be referred to as “innovator” and “generic” items (Van der Westhuizen, 2007).

The equation below was adapted from previous research (Van der Westhuizen, 2007):

Cost Saving of Innovator Item for Py =
Total cost (Innovator tablets) –
[Cost per tablet (Generic item) X Total number of innovator tablets]

…….Equation 4

Where:

Innovator item: Is the name of an innovator item, e.g. Lipitor 10mg, Coversyl 4mg.

Py: Specific period of analysis. P1, P2, P3, P4, P5, P6.

3.5 MEASURING INSTRUMENTS

Measuring instruments such as frequency, cost were utilised in the analysis of the dispensing patterns of the study cardiovascular drugs.

3.5.1 Frequency

Frequency can be described as “the number of cases observed in a particular category, therefore a frequency distribution shows the manner in which the scores on a variable are distributed, i.e. how the frequencies of the various measurement categories vary” (Ledwaba, 2004: pg. 51). The frequency for a data value can also be described as the number of times the value occurs in the data set (Jaisingh, 2000). In this study, frequency, dispensing patterns and prevalence were used as synonyms to indicate the number of medicine items/ prescriptions claimed for a specific time period.

In this study the frequency of medicines was determined for the following categories:

- The frequency of all medicine items claimed through the database for the study period.
- The frequency of the study cardiovascular drugs for the study period.
- The frequency of innovator and generic items in general with specific reference to the study cardiovascular drugs.
- The frequency of innovator clone molecules and other generic items in general with specific reference to the study cardiovascular drugs.

3.5.2 Cost

Cost can be defined as the general worth of the total resources that are expended (input) while producing services or commodities (output) (Wilson, 1999).

For this study, the cost was analysed according to the following categories:

- The cost of all medicine items claimed through the database for the study period.
- The cost of the study cardiovascular drugs for the study period.

- The cost of innovator and generic items dispensed with specific reference to the study cardiovascular drugs.
- The cost of innovator clone molecule and other generic items dispensed with specific reference to the study cardiovascular drugs.

Cost of a medication included the medicine price (SEP) plus the dispensing fee and was used to calculate the total and average cost of treatment.

3.5.3 Reliability and validity of the data

The data were obtained directly from the medicine claims database. There was no type of manipulation whatsoever of the data that was undertaken by the researcher. The research was done from the point of view that all of the data obtained from the medicine claims database were reliable, correct, accurate and valid.

3.6 Ethics

Patient confidentially was maintained at all times during the study as well as during the collection of data. Pick n' Pay retailers had given permission for the data to be used for this study. The ethics committee of the University of Witwatersrand approved the study. The ethical permission was granted by the university for the study "Utilization patterns and potential cost savings of generic cardiovascular medications at private community pharmacies in the Johannesburg area: An analysis of medical claims retrospectively" and the ethical committee awarded the study the following permission number: M111102 (Appendix G). There also exists a possible conflict of interest with Pick n' Pay.

CHAPTER 4

RESULTS AND DISCUSSION

In this chapter the results from the retrospective study that was done on data from a medicine claims processing company will be discussed. Data were analysed based on dispensing patterns and cost of the study cardiovascular drugs for the study period.

4.1 Annotations concerning data analysis/ reporting of results

The study period for data analysis was from June 2009 to May 2011. Data in each year were divided into periods of four months as indicated in the table below. This was done to simplify the analysis process.

Table 2: The study periods for the years of analysis.

Period (P)	Month and year
P1	June 2009- September 2009
P2	October 2009- January 2010
P3	February 2010- May 2010
P4	June 2010- September 2010
P5	October 2010- January 2011
P6	February 2011- May 2011

- The drug items mentioned for this study are the items that were dispensed through the Pick n' Pay database.
- The frequency or dispensing patterns refers to the number of times that a trade name product was dispensed.
- Cardiovascular items: will refer only to the study CVS items that were chosen for the research.

4.2 Definitions and abbreviations:

Active ingredient: Defined as any constituent of a drug item intended to bring a pharmacological action or any other direct effect in the diagnosis, alleviation, cure, treatment or prevention of a disease, or to have an effect on the structure or any function of the body of humans or animals. Active ingredients consist of those constituents of the drug product that may go through a chemical change during the manufacturing of the drug items and are present in the drug item in a modified form intended to provide the specified activity or effect (Food and Drug Administration, 2012).

Medicine: According to the Medicine and Related Substances Control Act (101/1965), a medicine is defined as a substance or mixture of substances to be suitable for the use in the:

- Diagnosis, treatment, mitigation, modification or prevention of a disease, or abnormal physical or mental state, or the symptoms thereof in man, or
- Restoring, correcting, or modifying any somatic, physic, or organic function in man, and includes veterinary medicine (South Africa, 1997).

Innovator items: Innovator or original medicine items are pharmaceutical products that are protected by a patent for their chemical formulation or manufacturing process. They go through a comprehensive testing process before approval and are usually sold under a brand name (Van der Westhuizen, 2007).

Generic drug: A generic drug has the same active ingredient as an original innovator medicine and can be manufactured once the innovator medicine is no longer patent protected. Generic medications must also comply with the relevant safety and quality requirements (The Association of the British Pharmaceutical Industry, 1999).

CVS: Cardiovascular system

±: Standard deviation (SD).

4.3 THE GENERAL MEDICINE DISPENSING PATTERNS AND COSTS OF THE STUDY POPULATION

The following tables illustrate the general dispensing patterns of all medicine items for the study populations at each pharmacy. The number of prescriptions, items dispensed and total cost of items dispensed at each pharmacy, were compared to each other. Also the average number of items per prescription, average cost per item and average cost per prescription were compared through the database. This was done to establish the general dispensing patterns and cost for the pharmacies.

Certain totals were also rounded off using the metric prefix ‘k’ which equals 1000 in instances where the total cost figure is too large. Other figures were rounded off to two, one or no decimal place. This was done to simplify the interpretation of the results. The original totals/ tables can be viewed in the Appendix E. Average costs of items and prescriptions, percentages, cost prevalence indexes were originally calculated from this appendix to attain the most accurate results.

Table 3: The total dispensing patterns and cost of all prescriptions and items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies.

Pharmacy	Total cost of items dispensed	Total number of prescriptions	Average cost per prescription (± SD)	Total number of items dispensed	Average number of items per prescription (± SD)	Average cost per item (± SD)
Boksburg	R9 617k	34 301	R280±425	71 388	2.08 ±1.22	R135±272
Norwood	R28 781k	92 597	R311±475	166 709	1.80 ±1.09	R173±335
Soweto	R2 014k	11 945	R169±264	21 280	1.78±1.09	R95±193
Woodmead	R3 260k	12 678	R257±395	22 732	1.79±1.08	R143±291
Total	R43 672k	151 521	R288±390	282 109	1.86±1.12	R155±272

Note: k= 1000

Table 3 illustrates the dispensing patterns and cost of all prescriptions and items dispensed at all the study Pick n' Pay Pharmacies for the study period. The total number of prescriptions for the study period was 151 521 and the total number of items dispensed was 282 109. The average number of items per prescription for all pharmacies was 1.86.

There was an increase in both the number of prescriptions and number of items dispensed on a month and year basis. This could have been due to an increase in the number of cash patients and patients with medical aids plus dependents at the pharmacies or an increase in the number of medical schemes that claimed through the PBM service. Pick n' Pay had also increased its marketing activities with its pharmacy division. This may have also created an awareness of the existence of these pharmacies and may have attracted more patients to visit them.

Total cost of all items dispensed for the study period was R43 672k. The average cost per item was R155 (±272) and the average cost per prescription was R288 (± 390) for the study period.

There was an increase in both the average cost per item (by 6%) and the average cost per prescription (by 11%) for the study period in terms of a month and year basis. This may be due to the yearly price increases of medicine items and also due to a constant increase in the number of items per prescription.

Norwood had most number of items dispensed for the study period which was 166 709 (59%) and Soweto the least with 21 280 (8%).

In terms of **the average number of items per prescription** for each pharmacy, Boksburg averaged the most at 2.08 (±1.22) and least was Soweto at 1.78 (±1.09).

For the **total cost of items dispensed** at each pharmacy, Norwood cost the most at R28 781k (66%) and least was Soweto at R2 014k (5%).

Norwood had the highest **average cost per item** R 173 (±335) and least was Soweto at R95 (±193).

The **average cost per prescription** was the highest at Norwood, R311 (±475). Soweto had the least, R169 (±264).

Demographic factors, competitors, years of existence of a pharmacy, amount and type of doctors in the area, financial background of an area are factors that may have contributed to differences between these pharmacies.

4.4 GENERAL DISPENSING PATTERNS OF THE STUDY CARDIOVASCULAR DRUGS

In this section CVS items will refer only to the CVS drugs that were chosen for the study. Their dispensing patterns and cost will be analyzed. Innovator and generic dispensing patterns and their cost will also be compared. The average cost per item, average cost per innovator item dispensed and the average cost per generic item will also be compared.

4.4.1 THE DISPENSING PATTERNS AND COST OF INNOVATOR MEDICINE ITEMS COMPARED TO GENERIC MEDICINE ITEMS AT ALL OF THE STUDY PHARMACIES

The generic CVS items were frequently more prevalent than their innovator CVS items for the entire study period (table 4, page 52).

In the Mediscor medicines review 2011. Innovator items with expired patents accounted for 19.2% volume distribution by product type and generic equivalents accounted for 52.4%. The balance of the distribution consisted of innovator items with a valid patent at 28.4%. The average cost for an original item with the patent being expired was R135 whilst the average generic item cost R89 (Mediscor PBM, 2012).

In this study, cardiovascular (CVS) drugs accounted for 21 817 of the total number of 282 109 items dispensed at all pharmacies for the study period which equals to 7.7%. Of the total of 21 817, the innovator CVS drugs accounted for a volume of 6 527 (29.9%) and the generics 15 290 (70.1%) of all the CVS items dispensed. From P1 to P6 it can be seen that there was a decline in terms of percentage of innovator products (9.7%) and a corresponding increase in generic products by the same percentage. This is also illustrated in figure 1, page 53.

The total cost of all items dispensed for all the study pharmacies, was R43 672k. The total cost of the study CVS innovator and generic drugs was R3 249k. This

accounted for 7.4% of the total cost of all items dispensed for all the study pharmacies. Of the total of R3 249k, a cost of R1 240k (38.2%) accounted for the innovator items and R2 009k (61.8%) accounted for the generic items.

The average cost per CVS item for the entire study period was R149. The innovator average cost per item dispensed was R190 (±R93.28) and for generic R131 (±R59.55). There was also a 9.9% decrease in percentage of innovator cost and a corresponding 9.9% increase in percentage of generic cost from P1 to P6. From P1 to P6 the following had been revealed: The average cost per item decreased by R18 (from R156 during P1 to R138 for P6). The average cost per innovator item dispensed decreased by R10 (from R191 during P1 to R181 for P6) and the average cost per generic item decreased by R14 (from R138 during P1 to R124 for P6). These changes can also be seen in figures 2 and 3, page 54 and 55. These decreases may be due to the fact that more and also cheaper generic medications are entering the market. Innovator companies may have also decreased their prices in order to remain competitive in the market.

There are also few other factors to consider: medical schemes refusing to cover fully for certain innovator products because of the cost and thus vouching for the respective cheaper generic, patients being offered and advised to try the cheaper generic with it's potential cost saving, due to prices increases patients cannot afford the expensive innovator product and thus opt for the generic drug, more and more doctors are advised to prescribe a generic equivalent of a medicine item because of its equivalent effect and cost saving. Doctors are also gaining more confidence with generic products and are therefore prescribing accordingly. This effect can also be seen to a certain extent at each of the pharmacies. These are factors that fall outside the scope of this study as they are uncontrollable from the viewpoint of this study.

In table 4 the cost- prevalence index (CPI) for the CVS medications was calculated for each period and this indicated that the CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than1.

Table 4: The total dispensing patterns and cost of CVS innovator and generic items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies.

Period	Total number of Innovator items dispensed	Total Cost of innovator items dispensed	Average cost per Innovator item dispensed (± SD)	Total number of Generic items dispensed	Total Cost of generic items dispensed	Average cost per Generic item dispensed (± SD)	CPII	CPIG
P1	1 165	R223k	R191±86.15	2 214	R305k	R138±58.59	1.2	0.9
P2	1 134	R214k	R189±86.82	2 397	R336k	R140±61.71	1.2	0.9
P3	1 095	R213k	R194±113.29	2 485	R332k	R133±63.21	1.3	0.9
P4	1 150	R224k	R195±95.32	2 606	R342k	R131±59.02	1.3	0.9
P5	1 047	R196k	R187±88.15	2 749	R341k	R124±55.48	1.3	0.9
P6	936	R169k	R181±85.50	2 839	R353k	R124±57.89	1.3	0.9
Total	6 527	R1 240k	R190 ±93.28	15 290	R2 009k	R131±59.55	1.3	0.9

CPII= Cost prevalence index for innovator item

CPIG= Cost prevalence index for generic item

Cost prevalence index (CPI) illustrates the relationship between the total number of medicine items prescribed and the total medicine cost.

k= 1000

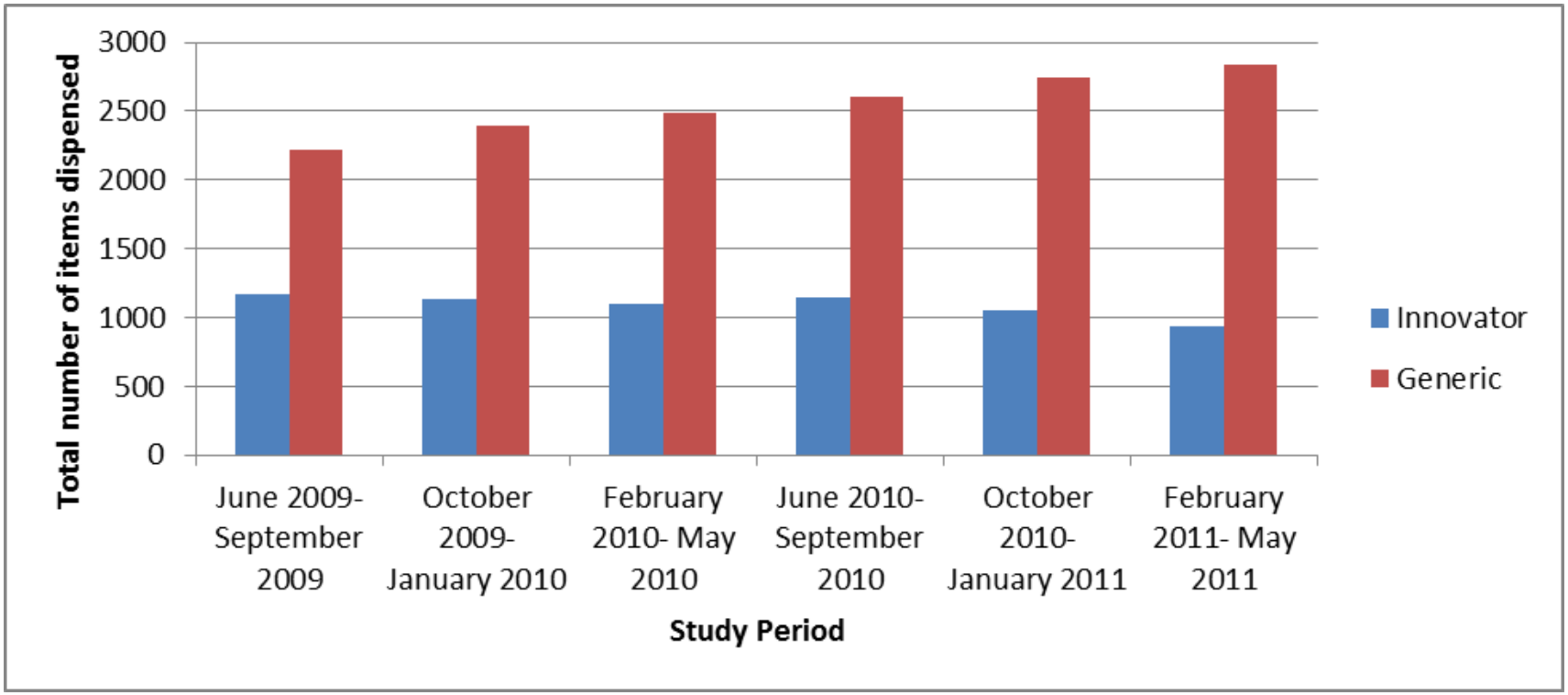

Figure 1: **The total dispensing patterns of CVS innovator and generic items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies.**

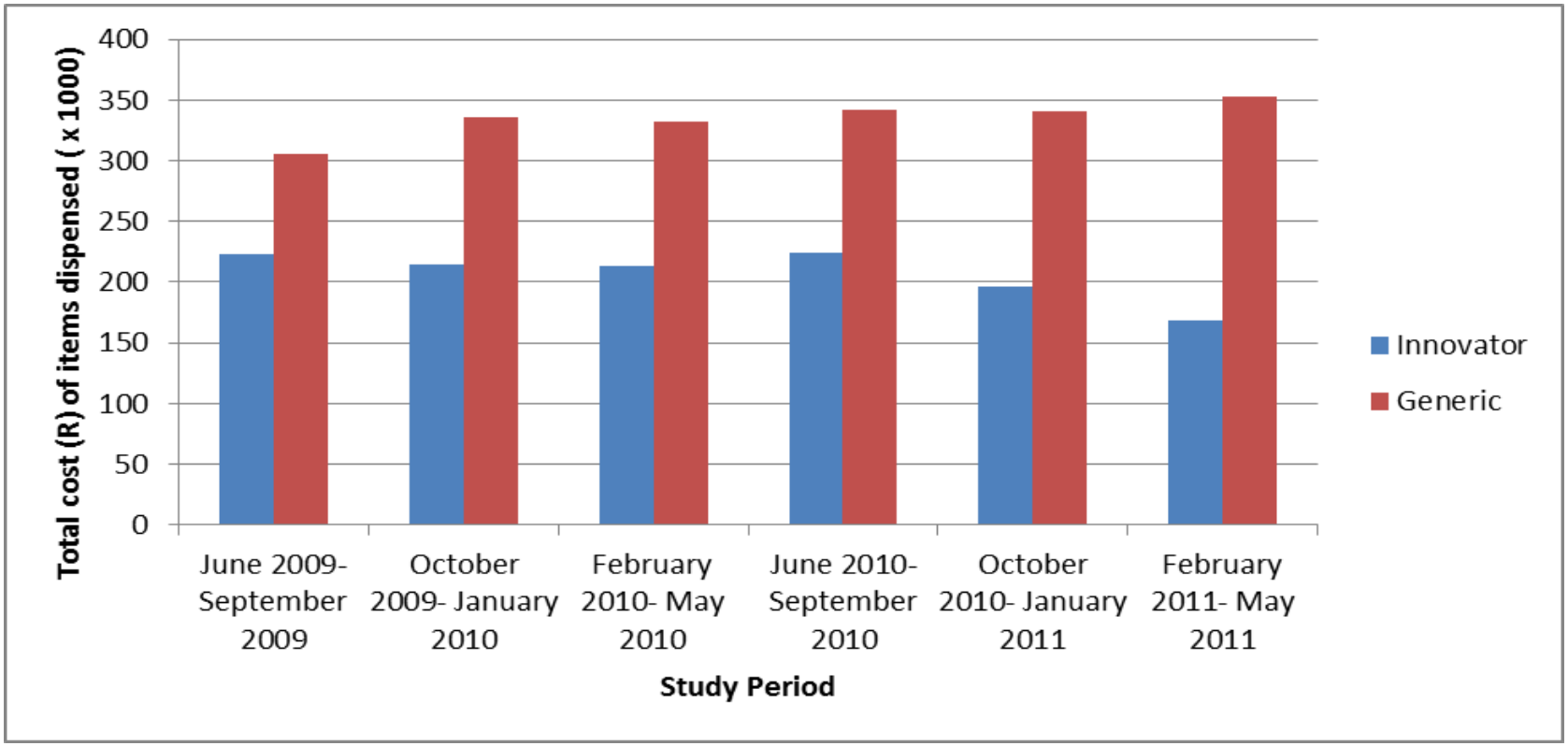

Figure 2: **The total cost of CVS innovator and generic items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies.**

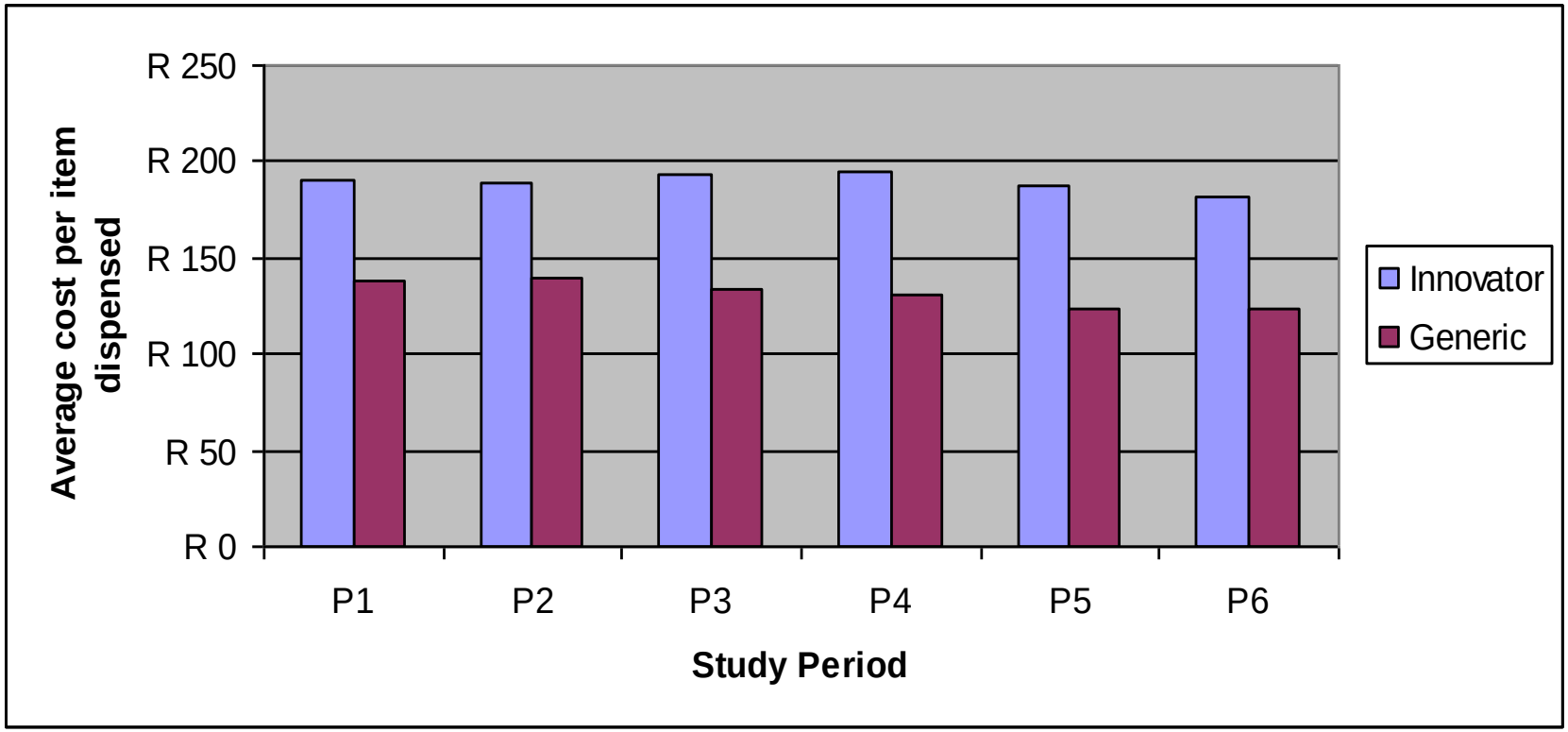

Figure 3: The average cost per innovator and generic CVS item dispensed for each study period at the Pick n' Pay pharmacies.

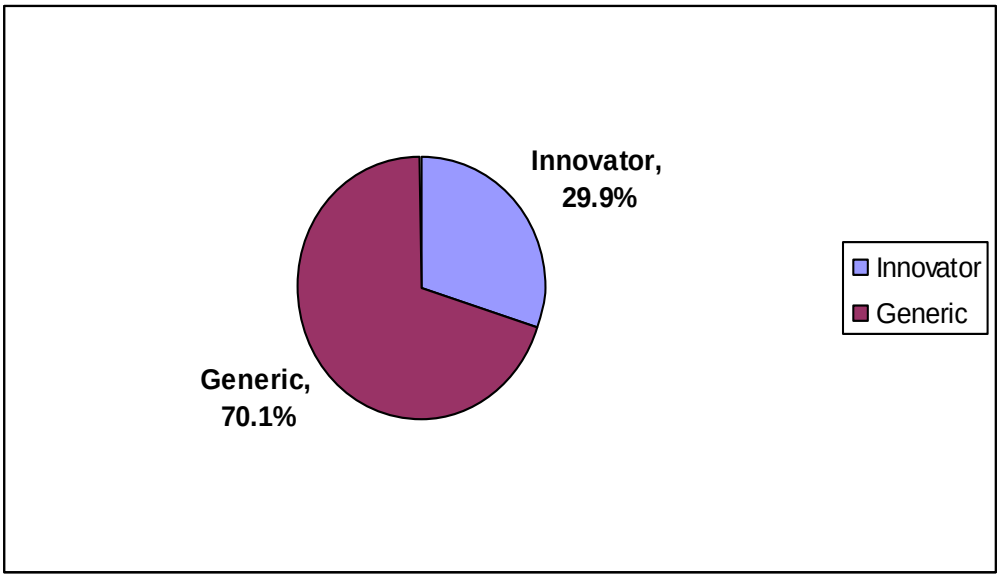

Figure 4: The total dispensing patterns of the CVS items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies (%).

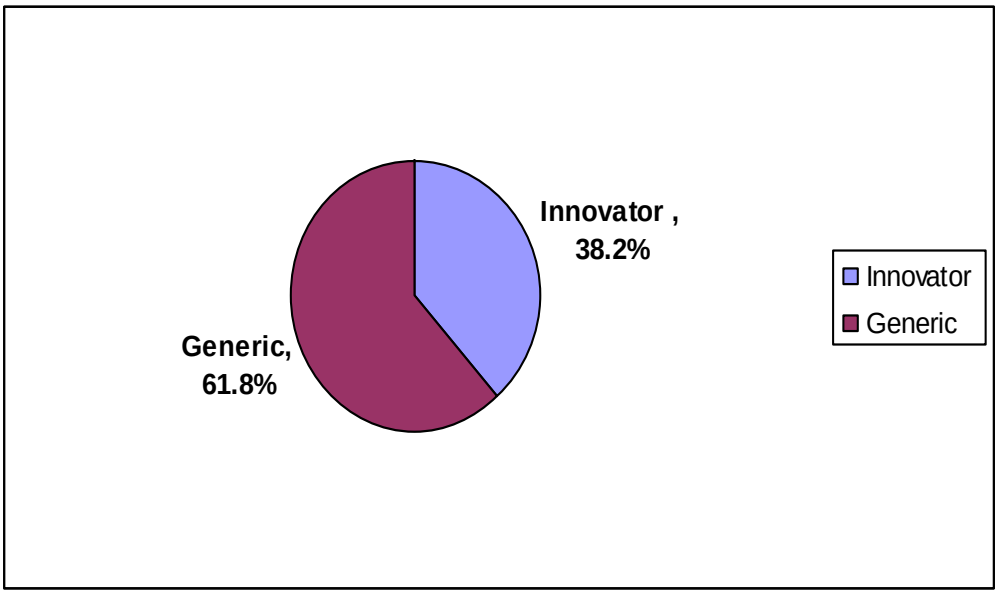

Figure 5: The total cost of the CVS items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies (%).

The percentage of innovator and generic dispensing patterns and cost is illustrated in figures 4 and 5. It can be seen that generics were dispensed more frequently and had a greater portion of the costs compared to innovator items.

4.4.2 THE DISPENSING PATTERNS AND COST OF INNOVATOR MEDICINE ITEMS COMPARED TO GENERIC MEDICINE ITEMS AT EACH OF THE STUDY PHARMACIES

In this section the innovator and generic medicine items dispensing patterns and costs were compared to each other at the different pharmacies. The average cost per item, average cost per innovator item dispensed and the average cost per generic item were also compared. The results are shown in table 5, page 60.

The amount of innovator items dispensed at Boksburg totaled 1 559 items which is 23.5% of the total of 6 620 of both innovator and generic CVS items dispensed. Generic items amounted to 5 061 which equaled to 76.5%. In relation to the total cost for these items which was R923k, innovator expenditure amounted to R298k (32.3%) of this total whilst generic expenditure amounted to R625k (67.7%). Although innovator items amounted to 23.5% of the dispensing, it contributed to 32.3% of the total cost of both innovator and generic items dispensed.

Norwood illustrated that from the total of 12 937 of CVS items dispensed, 4 425 items (34.2%) accounted for innovator items and 8 512 items (65.8%) accounted for generic items for the entire study period. While the cost of innovator items accounted for 41.8% (which equals R 838k) of the total cost of R2 002k for these items, generic expenditure amounted to 58.2% (which equals R1 165k). It can be noted that though innovator items amounted to 34.2% of the dispensing, it contributed to 41.8% of the total cost of both innovator and generic items dispensed.

For Soweto, it was shown that from the total of 1 116 of both innovator and generic CVS items dispensed, 268 of the items (24.0%) accounted for innovator items and 848 items (76.0%) accounted for generic items for the entire study period. The total cost for these items was R156k, innovator expenditure amounted to R48k (31.0%) whilst generic expenditure amounted to R108k (69.0%). It can be considered that although innovator items amounted to 24.0%

of the dispensing, it contributed to 31.0% of the total cost of both innovator and generic items dispensed.

Of the total of 1 144 of both innovator and generic CVS items dispensed, 275 of items dispensed (24.0%) accounted for innovator items and 869 items (76.0%) accounted for generics at Woodmead. Innovator expenditure amounted to R56k (33.4%) whilst generic expenditure amounted to R112k (66.6%). Innovator items amounted to 24.0% of the dispensing but contributed to 33.4% of the total cost of both innovator and generic items dispensed.

In terms of dispensing patterns from the above results, Norwood dispensed the most amount of innovator items (34.2%) from its total CVS items dispensed instead of the corresponding generic and least was Boksburg (23.5%).

The **average cost per item** at each of the pharmacies was also investigated. Norwood had the highest cost per item at R155 and the lowest was Boksburg at R139. The high amount of innovator items dispensed at Norwood probably had an influence of the pharmacy having the highest average cost per item compared to the other pharmacies.

The **average cost per innovator item** dispensed at the pharmacies was also calculated. Woodmead had the highest average cost per innovator item dispensed at R204 and last was Soweto at R180.

For the calculation of the **average cost per generic item** dispensed at the pharmacies, Boksburg had the lowest average cost per generic item, R123. Norwood had the highest at R137.

The cost- prevalence index (CPI) for the CVS medications was calculated for each pharmacy. At all the four pharmacies the CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

These calculations give an idea of the financial background of an area, dispensing patterns of the pharmacists and doctor prescribing habits.

Table 5: The total dispensing patterns and cost of the CVS items over the 24 months at each of the participating Pick n' Pay Pharmacies.

Pharmacy	Total number of innovator items dispensed	Total cost of innovator items dispensed	Average cost per innovator item dispensed (± SD)	Total number of generic items dispensed	Total cost of generic items dispensed	Average cost per generic item dispensed (± SD)	CPII	CPIG
Boksburg	1 559	R298k	R191 ±90.04	5 061	R625k	R123 ± 56.67	1.4	0.9
Norwood	4 425	R838k	R189 ± 93.51	8 512	R1 165k	R137 ± 61.17	1.2	0.9
Soweto	268	R48k	R180 ± 93.53	848	R108k	R127 ± 48.38	1.3	0.9
Woodmead	275	R56k	R204 ±104.75	869	R112k	R128 ±65.70	1.4	0.9
Total	6 527	R1 240k	R190 ± 93.28	15 290	R2 009k	R131 ± 59.55	1.3	0.9

Note:

k= 1000

CPI= Cost prevalence index for innovator item

CPIG= Cost prevalence index for generic item

Cost prevalence index (CPI) illustrates the relationship between the total number of medicine items prescribed and the total medicine cost

4.5 DISPENSING PATTERNS AND COST OF THE CVS ITEMS ACCORDING TO ACTIVE INGREDIENT

The dispensing patterns, cost and the average cost per item for each cvs item's active ingredient were calculated for both innovator and generic items dispensed. Please refer to table 6 and table 7 on the following pages. Appendix H shows the ranking of innovator items in terms of dispensing patterns and cost of innovator items dispensed (descending order). It also illustrates how the active ingredients were dispensed in terms of dispensing patterns and costs (Figures 6 and 7).

Please note that the dispensing patterns are influenced by points mentioned under section 2.4 on the subject of generic substitution:

According to the medicine legislation, the following applies:

- The patient has the right to refuse or prohibit the use of such generic substitution (Mestern, 2003).
- If the prescriber has written on the prescription the words "no substitution" next to the item prescribed, then the item prescribed should not be substituted.
- If the retail price of the generic medication is higher than that of the prescribed medicine then generic substitution may not take place.
- If the medication has been declared non- substitutable by the council, then the prescribed item should be dispensed (South African PSSA pharmacy law compendium: MAE30, 2003).

Table 6: The total dispensing patterns and cost of the CVS items over the 24 months at all of the participating Pick n' Pay pharmacies according to each active ingredient.

Active ingredient	Total number of Innovator items dispensed	Total Cost of Innovator items dispensed	Average cost per Innovator item	Total number of Generic items dispensed	Total Cost of Generic items dispensed	Average cost per Generic item
1. Perindopril 4mg	379	R58k	R153	1932	R258k	R134
2. Perindopril 10mg	83	R18k	R220	96	R14k	R143
3. Perindopril 4mg + Indapamide 1.25mg	346	R73k	R212	2150	R347k	R161
4. Atorvastatin 10mg	910	R186k	R204	2395	R302k	R126
5. Atorvastatin 20mg	258	R79k	R305	1699	R276k	R162
6. Atorvastatin 40mg	106	R27k	R256	443	R71k	R161
7. Atorvastatin 80mg	31	R7k	R241	28	R4k	R144
8. Pravastatin 10mg	53	R12k	R231	64	R10k	R150
9. Pravastatin 20mg	64	R18k	R288	35	R5k	R157
10. Pravastatin 40mg	28	R10k	R357	69	R16k	R225

Note: k= 1000

Table 6 continued

Active ingredient	Total number of Innovator items dispensed	Total Cost of Innovator items dispensed	Average cost per Innovator item	Total number of Generic items dispensed	Total Cost of Generic items dispensed	Average cost per Generic item
11. Bisoprolol 5mg	906	R87k	R96	1199	R63k	R53
12. Bisoprolol 10mg	242	R36k	R147	275	R26k	R95
13. Furosemide 40mg	692	R126k	R182	806	R20k	R25
14. Nifedipine XL 30mg	437	R113k	R260	283	R51k	R181
15. Nifedipine XL 60mg	200	R63k	R314	133	R30k	R226
16. Amlodipine 5mg	652	R102k	R156	1557	R154k	R99
17. Amlodipine 10mg	242	R53k	R221	1013	R141k	R139
18. Losartan 50mg	317	R37k	R116	126	R14k	R111
19. Losartan 100mg	103	R11k	R107	123	R13k	R107
20. Losartan 50mg + Hydrochlorothiazide 12.5mg	115	R14k	R125	4	R0.4k	R106

Note: k= 1000

Table 6 continued

Active ingredient	Total number of Innovator items dispensed	Total Cost of Innovator items dispensed	Average cost per Innovator item	Total number of Generic items dispensed	Total Cost of Generic items dispensed	Average cost per Generic item
21. Irbesartan 150mg	73	R17k	R236	30	R5k	R171
22. Irbesartan 300mg	70	R18k	R251	88	R15k	R172
23. Irbesartan 150mg + Hydrochlorothiazide 12.5mg	82	R20k	R247	9	R1.6k	R177
24. Irbesartan 300mg + Hydrochlorothiazide 12.5mg	61	R15k	R241	134	R23k	R174
25. Clopidogrel 75mg	77	R39k	R507	599	R148k	R247

Note: k= 1000

Table 7: The total dispensing patterns and cost of the CVS items over the 24 months at all of the participating Pick n' Pay Pharmacies (%).

Active ingredient	Innovator items dispensed (%)	Generic items dispensed (%)	Cost of Innovator items dispensed (%)	Cost of Generic items (%)	CPII	CPIG
1. Perindopril 4mg	16.4	83.6	18.3	81.7	1.12	0.98
2. Perindopril 10mg	46.4	53.6	57.2	42.8	1.23	0.80
3. Perindopril 4mg + Indapamide 1.25mg	13.9	86.1	17.5	82.5	1.26	0.96
4. Atorvastatin 10mg	27.5	72.5	38.1	61.9	1.38	0.85
5. Atorvastatin 20mg	13.2	86.8	22.2	77.8	1.68	0.90
6. Atorvastatin 40mg	19.3	80.7	27.6	72.4	1.43	0.90
7. Atorvastatin 80mg	52.5	47.5	64.9	35.1	1.24	0.74
8. Pravastatin 10mg	45.3	54.7	56.0	44.0	1.24	0.80
9. Pravastatin 20mg	64.6	35.4	77.1	22.9	1.19	0.65
10. Pravastatin 40mg	28.9	71.1	39.1	60.9	1.36	0.86

Table 7 continued

Active ingredient	Innovator items dispensed (%)	Generic items dispensed (%)	Cost of Innovator items dispensed (%)	Cost of Generic items (%)	CPII	CPIG
11. Bisoprolol 5mg	43.0	57.0	57.9	42.1	1.35	0.74
12. Bisoprolol 10mg	46.8	53.2	57.6	42.4	1.23	0.80
13.Furosemide 40mg	46.2	53.8	86.2	13.8	1.91	0.24
14. Nifedipine XL 30mg	60.7	39.3	68.9	31.1	1.14	0.79
15.Nifedipine XL 60mg	60.1	39.9	67.6	32.4	1.13	0.81
16. Amlodipine 5mg	29.5	70.5	39.8	60.2	1.35	0.85
17. Amlodipine 10mg	19.3	80.7	27.5	72.5	1.43	0.90
18. Losartan 50mg	71.6	28.4	72.5	27.5	1.01	0.97
19. Losartan 100mg	45.6	54.4	45.5	54.5	1.00	1.00
20. Losartan 50mg + Hydrochlorothiazide 12.5mg	96.6	3.4	97.1	2.9	1.01	0.85

Table 7 continued

Active ingredient	Innovator items dispensed (%)	Generic items dispensed (%)	Cost of Innovator items dispensed (%)	Cost of Generic items (%)	CPII	CPIG
21. Irbesartan 150mg	70.9	29.1	77.0	23.0	1.09	0.79
22. Irbesartan 300mg	44.3	55.7	53.7	46.3	1.21	0.83
23. Irbesartan 150mg + Hydrochlorothiazide 12.5mg	90.1	9.9	92.7	7.3	1.03	0.74
24. Irbesartan 300mg + Hydrochlorothiazide 12.5mg	31.3	68.7	38.7	61.3	1.24	0.89
25. Clopidogrel 75mg	11.4	88.6	20.9	79.1	1.83	0.89

Note, For table 7: CPII= Cost prevalence index for innovator item.

CPIG= Cost prevalence index for generic item.

Cost prevalence index (CPI) illustrates the relationship between the total number of medicine items prescribed and the total medicine cost.

4.5.1 PERINDOPRIL 4MG

From the results on tables 6 and 7, it can be viewed that for frequency, 379 items (16.4%) of the total number of 2 311 items dispensed (both innovator and generic) were Coversyl 4mg (innovator) and generics amounted to 1 932 (83.6%). The frequency of Coversyl 4mg dispensed decreased from P1 to P6 (by 8.3%) and there was a corresponding increase in generic usage (by 8.3%). Although there was a high usage of generic items for this ingredient, majority of the generic items dispensed were due to the innovator item's clone molecule which is investigated later.

Coversyl 4mg accounted for R58k (18.3%) of the total cost of items dispensed which was R316k (both innovator and generic). The generics accounted for R258k (81.7%). For the entire study period the following were revealed: The average cost per item was R137 (±R40.70), average cost per innovator item dispensed was R153 (±R31.41) and the average cost per generic item dispensed was R134 (±R42.27). A price differential of R19 compared to innovator item was noted. The average cost of an innovator tablet was R5.07, and for a generic tablet R4.44. The following increased from P1 to P6: the average cost per item (4.9%), average cost per innovator item dispensed (7.5%) and the average cost per generic item dispensed (5.9%). This could have been due to price increases.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.2 PERINDOPRIL 10MG

Note: Prexum 10mg was available as a generic for dispensing on the 17th of May 2010 at the pharmacies. Therefore no innovator medicine item (Coversyl 10mg) was taken into account before this period as there was not a generic available.

From the results on tables 6 and 7 it can be viewed that for frequency, 83 items (46.4%) of the total number of 179 items dispensed (both innovator and generic) were Coversyl 10mg (innovator) and generics accounted for 96 items (53.6%). Prexum 10mg was the first and only generic to enter the market for Coversyl 10mg. Few factors may have resulted in the innovator being frequently dispensed: Prescribers were not aware that a generic was available, doctors did not want the generic to be dispensed and patients may have preferred the innovator. This is interesting as the generic is a clone molecule of the original. Pharmaceutical organizations could focus more on educating prescribers as well as pharmacists of the benefits of the generic. The frequency of Coversyl 10mg dispensed decreased from P3 to P6 (by 78.1%) and there was a corresponding increase in generic usage (78.13%).

In tables 6 and 7, Coversyl 10mg accounted for R18k (57.2%) of the total cost of items dispensed which was R32k (both innovator and generic). The generics accounted for R14k (42.8%). For the entire study period the following were revealed: The average cost per item was R179 (±R49.35), average cost per innovator item dispensed was R220 (±R27.18) and the average cost per generic item dispensed was R143 (±R34.31). A price differential of R77 compared to innovator item was noted. The average cost of an innovator tablet was R 7.43, and for a generic tablet R5.14. The percentage for Coversyl 10mg decreased by 69.6% from P3 to P6 in terms of the total costs. The average cost per item decreased from P3 to P6 (by 38.9%). This was due to generic being dispensed more frequently. The average cost per innovator item dispensed increased (0.2%) as well as the average cost per generic item dispensed (0.3%) from P3 to P6. There was not a substantial increase in average cost for both the innovator and generic. This could been due to the short period of investigation of this molecule (P3 to P6) where no significant price changes had taken place.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.3 PERINDOPRIL 4MG + INDAPAMIDE 1.25MG (Drug item which possess both these ingredients per tablet)

In tables 6 and 7, 346 items (13.9%) of the total number of 2 496 items dispensed (both innovator and generic) were innovator items and the rest were generics, 2 150 items (86.1%). The frequency of Coversyl Plus dispensed decreased from P1 to P6 (11.7%) and there was a corresponding increase in generic usage (11.7%). Although there was a high usage of generic items for this combination medication, majority of the generic items dispensed were due to the innovator item's clone molecule which is investigated later.

Innovator items accounted for R73k (17.5%) of the total cost of items dispensed which was R420k (both innovator and generic). The generics accounted for R347k (82.5%). For the entire study period the following were revealed: The average cost per item was R168 (±R40.28), average cost per innovator item dispensed was R212 (±R44.99) and the average cost per generic item dispensed was R161 (±R34.33). A price differential of R51 compared to innovator item was noted. The average cost of an innovator tablet was R6.96, and for a generic tablet R5.59. The percentage of innovator items decreased by 12.3% from P1 to P6 in terms of the total cost. The average cost per item decreased by 2.3% from P1 to P6. This was due to generic being dispensed more frequently. The average cost per innovator item dispensed increased (12.2%) and the average cost per generic item dispensed remained relatively the same from P1 to P6**.**

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.4 ATORVASTATIN 10MG

From tables 6 and 7, 910 items (27.5%) of the total number of 3 305 items (both innovator and generic) dispensed were innovator items and the rest were generics, 2 395 items (72.5%). The frequency of innovator items dispensed

decreased by 12.74% from P1 to P6 and there was a corresponding increase in generic usage. Although there was a high usage of generic items for this ingredient, majority of the generic items dispensed was due to the innovator item's clone molecule which is investigated later.

Innovator items accounted for R186k (38.1%) of the total cost of items dispensed which was R488k (both innovator and generic). The generics for R302k (61.9%). For the entire study period the following were revealed: The average cost per item was R148 (±R52.11), average cost per innovator item dispensed was R204 (±R47.43) and the average cost per generic item dispensed was R126 (±R36.26). A price differential of R78 compared to innovator item was noted. The average cost of an innovator tablet was R6.76, and for a generic tablet R4.23. The percentage for innovator items decreased by 3.57% from P1 to P6 in terms of the total costs. The average cost per item decreased from P1 to P6 (by 29.9%). This was due to generic being dispensed more frequently. The average cost per innovator item dispensed increased (by 2.5%) and the average cost per generic item dispensed decreased from P1 to P6 (by 37.8%)**.**

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

Lipitor 10mg was noted as the innovator item that had the highest dispensing frequency and cost compared to the other innovator items.

4.5.5 ATORVASTATIN 20MG

It was revealed in tables 6 and 7that 258 items (13.2%) of the total number of 1 957 items dispensed (both innovator and generic) were innovator items and the rest were generics, 1 699 (86.8%). The frequency of innovator items dispensed decreased by 7.9% from P1 to P6 and there was a corresponding increase in generic usage. Although there was a high usage of generic items for this

ingredient, majority of the generic items dispensed was due to the innovator item's clone molecule which is investigated later.

Innovator items accounted for R79k (22.2%) of the total cost of items dispensed which was R355k (both innovator and generic). The generics accounted for R276k (77.8%). For the entire study period the following were revealed: The average cost per item was R181 (±R65.07), average cost per innovator item dispensed was R305 (±R43.73) and the average cost per generic item dispensed was R162 (±R43.53). A price differential of R143 compared to innovator item was noted. The average cost of an innovator tablet was R10.40, and for a generic tablet R5.55. The percentage for innovator items decreased by 4.7% from P1 to P6 in terms of the total cost. The average cost per item decreased from P1 to P6 (by 32.3%). This was due to generic being dispensed more frequently. The average cost per generic item dispensed also decreased from P1 to P6 (by 34.4%).

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.6 ATORVASTATIN 40MG

From tables 6 and 7, 106 items (19.3%) of the total number of 549 items dispensed (both innovator and generic) were innovator items and the rest were generics, 443 items (80.7%). The frequency of innovator items dispensed decreased by 11.7% from P1 to P6 and there was a corresponding increase in generic usage. Although there was a high usage of generic items for this ingredient, majority of the generic items dispensed was due to the innovator item's clone molecule which is investigated later.

Innovator items accounted for R27k (27.6%) of the total cost of items dispensed which was R99k (both innovator and generic). The generics accounted for R71k (72.4%). For the entire study period the following were revealed: The average

cost per item was R180 (±R63.96), average cost per innovator item dispensed was R256 (±R73.38) and the average cost per generic item dispensed was R161 (±R44.16). A price differential of R95 compared to innovator item was noted. The average cost of an innovator tablet was R10.61, and for a generic tablet R5.32. The percentage for innovator items decreased by 8.5% from P1 to P6 in terms of the total cost. The average cost per item decreased by 26.2% from P1 to P6. This was due to generic being dispensed more frequently. The average cost per innovator item dispensed and the average cost per generic item dispensed decreased from P1 to P6, by 6.2% and 28.3% respectively.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.7 ATORVASTATIN 80MG

Note: The generic for Lipitor 80mg was available for dispensing on the 19th of February 2010 at the pharmacies. Therefore no innovator medicine item was taken into account before this period as there was not a generic available.

As illustrated in tables 6 and 7, it was calculated that 31 items (52.5%) of the total number of 59 items dispensed (both innovator and generic) were innovator items and the rest were generics, 28 items (47.5%). The frequency of innovator items dispensed decreased by 76.5% from P1 to P6 and there was also an increase in generic usage by the same amount. The generic items for Lipitor 80mg were introduced into the study pharmacies during P3. This could have affected the frequency patterns resulting in the innovator item being dispensed more often. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R7k (64.9%) of the total cost of items dispensed which was R11k (both innovator and generic). The generics accounted for R4k

(35.1%). For the entire study period the following were revealed: The average cost per item was R195 (±R75.26), average cost per innovator item dispensed was R241 (±R76.05) and the average cost per generic item dispensed was R144 (±R25.30). A price differential of R97 compared to innovator item was noted. The average cost of an innovator tablet was R10.70, and for a generic tablet R4.63. The percentage for innovator items decreased by 72.5% from P1 to P6 in terms of the total costs. The average cost per item decreased by 45.8% from P1 to P6. This was due to generic being dispensed more frequently. The average cost per innovator item dispensed and the average cost per generic item dispensed also decreased, by 36.6% and 34.0% respectively**.**

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.8 PRAVASTATIN 10MG

As per tables 6 and 7, for the active ingredient pravastatin 10mg, 53 items (45.3%) of the total number of 117 items dispensed (both innovator and generic) were innovator items and the rest were generics, 64 items (54.7%). The frequency of innovator items dispensed decreased by 54.6% from P1 to P6 and there was a corresponding increase in generic usage. The innovator item had been dispensed almost as frequently as the generic item. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R12k (56.0%) of the total cost of items dispensed which was R22k (both innovator and generic). The generics accounted for R10k (44.0%). For the entire study period the following were revealed: The average cost per item was R187 (±R58.52), average cost per innovator item dispensed was R231 (±R54.57) and the average cost per generic item dispensed was R150 (±R19.19). A price differential of R81 compared to innovator item was noted. The

average cost of an innovator tablet was R8.25, and for a generic tablet R5.09. The average cost per item decreased by 9.5% from P1 to P6. This was due to generic being dispensed more frequently. The average cost per innovator item dispensed (by 25.14%) and the average cost per generic item dispensed (by 11.4%) increased.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.9 PRAVASTATIN 20MG

As per tables 6 and 7 for the active ingredient pravastatin 20mg, 64 items (64.6%) of the total number of 99 items dispensed (both innovator and generic) were innovator items and the rest were generics, 35 items (35.4%). The frequency of innovator items increased by 30.4% from P1 to P6 and generic items dispensed decreased by 30.4%. The innovator item was dispensed more often than the generic item. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R18k (77.1%) of the total cost of items dispensed which was R24k (both innovator and generic). The generics accounted for R5k (22.9%). For the entire study period the following were revealed: The average cost per item was R242 (±R93.99), average cost per innovator item dispensed was R288 (±R79.12) and the average cost per generic item dispensed was R157 (±R48.14). A price differential of R131 compared to innovator item was noted. The average cost of an innovator tablet was R10.13, and for a generic tablet R6.06. The average cost per item increased by 35.7% from P1 to P6. This was due to the innovator item being dispensed frequently. The average cost per innovator item dispensed increased by 5.9% and the average cost per generic item dispensed increased by 69.4%.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.10 PRAVASTATIN 40MG

In tables 6 and 7, 28 items (28.9%) of the total number of 97 items dispensed (both innovator and generic) were innovator items and the rest were generics, 69 items (71.1%). The frequency of innovator items dispensed decreased by 20.6% from P1 to P6 and there was a corresponding increase in generic usage.

Innovator items accounted for R10k (39.1%) of the total cost of items dispensed which was R26k (both innovator and generic). The generics accounted for R16k (60.9%). For the entire study period the following were revealed: The average cost per item was R263 (±R75.39), average cost per innovator item dispensed was R357 (±R11.85) and the average cost per generic item dispensed was R225 (±R52.75). A price differential of R132 compared to innovator item was noted. The average cost of an innovator tablet was R11.89, and for a generic tablet R7.61. The average cost per item increased by 19.4% from P1 to P6. This was due to the increase in the average cost per innovator item dispensed (by 7.0%) and the increase in the average cost per generic item dispensed (74.5%).

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.11 BISOPROLOL 5MG

Note: Concor and Cardicor 5mg are both innovator items that are made by the same manufacturer and have the same active molecule, therefore their dispensing patterns and cost were added together for each period.

From the results in tables 6 and 7, it was illustrated that 906 items (43.0%) of the total number of 2105 items dispensed (both innovator and generic) were

innovator items and the rest were generics, 1199 items (57.0%). The frequency of innovator items dispensed decreased by 6.5% from P1 to P6 and there was an increase in generic usage (by 6.5%). There was a high amount of innovator items dispensed. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R87k (57.9%) of the total cost of items dispensed which was R150k (both innovator and generic). The generics accounted for R63k (42.1%). For the entire study period the following were revealed: The average cost per item was R71 (±R35.38), average cost per innovator item dispensed was R96 (±R39.50) and the average cost per generic item dispensed was R53 (±R14.35). A price differential of R43 compared to innovator item was noted. The average cost of an innovator tablet was R3.48, and for a generic tablet, R1.98. From P1 to P6 the following was noted. The average cost per item increased by 5.8%. The average cost per innovator item dispensed increased by 5.7% and the average cost per generic item dispensed increased 16.7%**.**

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.12 BISOPROLOL 10MG

It was revealed from tables 6 and 7 that 242 items (46.8%) of the total number of 517 items dispensed (both innovator and generic) were innovator items and the rest were generics, 275 items (53.2%). No innovator Cardicor 10mg was dispensed. The frequency of innovator items dispensed decreased by 12.4% from P1 to P6 and there was a corresponding increase in generic usage. The innovator item had been substantially dispensed relatively. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R36k (57.6%) of the total cost of items dispensed which was R62k (both innovator and generic). The generics accounted for R26k (42.4%). For the entire study period the following were revealed: The average cost per item was R120 (±R45.33), average cost per innovator item dispensed was R147 (±R38.57) and the average cost per generic item dispensed was R95 (±R37.07). A price differential of R52 compared to innovator item was noted. The average cost of an innovator tablet was R5.42, and for a generic tablet R3.35. From P1 to P6 the following was noted: The average cost per item increased by 4.4% from P1 to P6. The average cost per innovator item dispensed increased by 13.2% and the average cost per generic item dispensed increased by 5.3%.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.13 FUROSEMIDE 40MG

According to tables 6 and 7, 692 items (46.2%) of the total number of 1 498 items dispensed (both innovator and generic) were innovator items and the rest were generics, 806 items (53.8%). The frequency of innovator items dispensed increased by 0.16% from P1 to P6 and generic items decreased by the same percentage. There was a relatively high amount of innovator items dispensed. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R126k (86.2%) of the total cost of items dispensed which was R146k (both innovator and generic). The generics accounted for R20k (13.8%). For the entire study period the following were revealed: The average cost per item was R97 (±R102.84), average cost per innovator item dispensed was R182 (±R86.75) and the average cost per generic item dispensed was R25 (±R25.69). A price differential of R157 compared to innovator item was noted.

The average cost of an innovator tablet was R4.52, and for a generic tablet R0.55. From P1 to P6 the following was noted. The average cost per item decreased by 12.6% from P1 to P6. The average cost per innovator item dispensed decreased by 9.3% whilst the average cost per generic item dispensed remained relatively the same.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.14 NIFEDIPINE XL 30MG

For this active ingredient, the results from tables 6 and 7 showed that 437 items (60.7%) of the total number of 720 items dispensed (both innovator and generic) were innovator items and the rest were generics, 283 items (39.3%). The frequency of innovator items dispensed decreased from by 28.7% P1 to P6 and but there was an increase in generic items by. The innovator item was dispensed more often than the generic item. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R113k (68.9%) of the total cost of items dispensed which was R165k (both innovator and generic). The generics accounted for R51k (31.1%). For the entire study period the following were revealed: The average cost per item was R229 (±R83.42), average cost per innovator item dispensed was R260 (±R78.32) and the average cost per generic item dispensed was R181 (±R66.25). A price differential of R79 compared to innovator item was noted. The average cost of an innovator tablet was R8.65, and for a generic tablet R5.63. The average cost per innovator item dispensed increased by 24.6% from P1 to P6 whilst the average cost per generic item dispensed decreased (3.2%).

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.15 NIFEDIPINE XL 60MG

From the results in tables 6 and 7, it was revealed that 200 items (60.1%) of the total number of 333 items dispensed (both innovator and generic) were innovator items and the rest were generics, 133 items (39.9%). The frequency of innovator items dispensed decreased by 36.6% from P1 to P6 and there was an increase in generic usage by the same percentage. Also the innovator item was dispensed more often than the generic item. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R63k (67.6%) of the total cost of items dispensed which was R93k (both innovator and generic). The generics accounted for 30k (32.4%). For the entire study period the following were revealed: The average cost per item was R279 (±R78.70), average cost per innovator item dispensed was R314 (±R81.62) and the average cost per generic item dispensed was R226 (±R27.16). A price differential of R88 compared to innovator item was noted. The average cost of an innovator tablet was R11.53, and for a generic tablet R7.59. The average cost per innovator item dispensed increased by 10.7% and the average cost per generic item dispensed increased by 2.9%.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.16 AMLODIPINE 5MG

As per tables 6 and 7, it was calculated that 652 items (29.5%) of the total number of 2 209 items dispensed (both innovator and generic) were innovator

items and the rest were generics, 1 557 (70.5%). The frequency of innovator items dispensed increased by 0.82% from P1 to P6 and there was a decrease in generic usage by 0.82%. Pharmacists and prescribers need to promote more generic medication utilization.

Innovator items accounted for R102k (39.8%) of the total cost of items dispensed which was R255k (both innovator and generic). The generics accounted for R154k (60.2%). For the entire study period the following were revealed: The average cost per item was R116 (±R40.11), average cost per innovator item dispensed was R156 (±R39.64) and the average cost per generic item dispensed was R99 (±R25.86). A price differential of R57 compared to innovator item was noted. The average cost of an innovator tablet was R5.53, and for a generic tablet R3.33. The average cost per innovator item dispensed increased (2.9%) whilst the average cost per generic item dispensed decreased (by 9.6%)**.**

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.17 AMLODIPINE 10MG

It was revealed as per tables 6 and 7 that 242 items (19.3%) of the total number of 1 255 items dispensed (both innovator and generic) were innovator items and the rest were generics, 1 013 (80.7%). The frequency of innovator items dispensed decreased by 8.5% from P1 to P6 and there was an increase in generic usage (8.5%).

Innovator items accounted for R53k (27.5%) of the total cost of items dispensed which was R194k (both innovator and generic). The generics accounted for R141k (72.5%). For the entire study period the following were revealed: The average cost per item was R155 (±R42.43), average cost per innovator item dispensed was R221 (±R22.12) and the average cost per generic item dispensed was R139 (±R30.38). A price differential of R82 compared to innovator item was

noted. The average cost of an innovator tablet was R7.38, and for a generic tablet R4.68. The following was noted from P1 to P6: The average cost per item decreased by 8.6%. The average cost per innovator item dispensed increased by 6.1% and the average cost per generic item dispensed decreased 8.4%**.**

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.18 LOSARTAN 50MG

Tables 6 and 7 illustrated that 317 items (71.6%) of the total number of 443 items dispensed (both innovator and generic) were innovator items and the rest were generics, 126 items (28.4%). From P1 to P6 there was an increase in generic usage by 25.8% in terms of frequency. Innovator item usage decreased by the same percentage. The innovator item was dispensed more often than the generic item. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R37k (72.5%) of the total cost of items dispensed which was R51k (both innovator and generic). The generics accounted for R14k (27.5%). For the entire study period the following were revealed: The average cost per item was R115 (±R44.99), average cost per innovator item dispensed was R116 (±R38.31) and the average cost per generic item dispensed was R111 (±R58.64). A price differential of R5 compared to innovator item was noted. The average cost of an innovator tablet was R3.58, and for a generic tablet R3.20. The average cost per item decreased from P1 to P6 by 8.5%. The average cost per innovator item dispensed decreased by 12.9%. The average cost per generic item increased by 7.6%.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.19 LOSARTAN 100MG

Tables 6 and 7 showed that 103 items (45.6%) of the total number of 226 items dispensed (both innovator and generic) were innovator items and the rest were generics, 123 items (54.4%). From P1 to P6 the frequency of innovator items dispensed increased by 3.2% from and there was a decrease in generic usage by 3.2%. There was a relatively high amount of innovator items dispensed. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R11k (45.5%) of the total cost of items dispensed which was R24k (both innovator and generic). The generics accounted for R13k (54.5%). For the entire study period the following were revealed: The average cost per item was R107 (±R33.82), average cost per innovator item dispensed was R107 (±R14.35) and the average cost per generic item dispensed was R107 (±R43.81). A price differential of R0 compared to innovator item was noted. The average cost of an innovator tablet was R3.60, and for a generic tablet R3.45. The average cost per item increased by 13.3% from P1 to P6. The average cost per generic item dispensed increased by 23.2%**.**

The cost- prevalence index (CPI) was calculated for each period. There was a balance between the cost and prevalence for innovator and generic items.

4.5.20 LOSARTAN 50MG + HYDROCHLOROTHIAZIDE 12.5MG (Drug item which contains a combination of both these ingredients per tablet)

Note: Sartoc 50mg/12.5mg (losartan 50mg + hydrochlorothiazide 12.5mg) was available for dispensing as a generic on the 18th of November 2010 at the

pharmacies. Therefore no innovator medicine item was taken into account before this period as there was not a generic available.

It was noted on tables 6 and 7, that 115 items (96.6%) of the total number of 119 items dispensed were innovator items and the rest were generics, 4 items (3.4%). From P1 to P6 the frequency of innovator items dispensed decreased by 5.5% and there was an increase in generic usage by 5.5%. The innovator item had been substantially dispensed, more often than the generic. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product.

Innovator items accounted for R14k (97.1%) of the total cost of items dispensed which was R15k (both innovator and generic). The generics accounted for R0.4k (2.9%). For the entire study period the following were revealed: The average cost per item was R125 (±R32.77), average cost per innovator item dispensed was R125 (±R33.15) and the average cost per generic item dispensed was R106 (±R1.51). A price differential of R19 compared to innovator item was noted. The average cost of an innovator tablet was R4.05, and for a generic tablet R3.54.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.21 IRBESARTAN 150MG

Note: Irbewin 150mg (generic) was available for dispensing on the 08th of June 2009 at the pharmacies. Therefore no innovator medicine item was taken into account before this period as there was not a generic available.

For this active ingredient tables 6 and 7 revealed: 73 items (70.9%) of the total number of 103 items dispensed (both innovator and generic) were innovator items and the rest were generics, 30 items (29.1%). From P1 to P6 the frequency

of innovator items dispensed decreased by 32.9% and there was an increase in generic usage by 32.9%. The innovator item had substantially been dispensed, more often than the generic. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product. Also during the entire study period, only one generic was made available for this active ingredient and this could have affected prescribing and dispensing patterns.

Innovator items accounted for R17k (77.0%) of the total cost of items dispensed which was R22k (both innovator and generic). The generics accounted for R5k (23.0%). For the entire study period the following were revealed: The average cost per item was R217 (±R43.12), average cost per innovator item dispensed was R236 (±R33.09) and the average cost per generic item dispensed was R171 (±R28.08). A price differential of R65 compared to innovator item was noted. The average cost of an innovator tablet was R8.05, and for a generic tablet R5.84. The average cost per innovator item dispensed increased by 7.2% and the average cost per generic item dispensed increased by 24.0% from P1 to P6.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.22 IRBESARTAN 300MG

Note: Irbewin 300mg (generic) was available for dispensing on the 08th of June 2009 at the pharmacies. Therefore no innovator medicine item was taken into account before this period as there was not a generic available. The amount of innovator decreased whilst the amount generic items dispensed increased from P1 to P6

For the active ingredient irbesartan 300mg tables 6 and 7 illustrated: 70 items (44.3%) of the total number of 158 items dispensed (both innovator and generic) were innovator items and the rest were generics, 88 items (55.7%). From P1 to

P6 the frequency of innovator items dispensed decreased by 36.7% and there was an increase in generic usage by 36.7%. There was a relatively high amount of innovator items dispensed. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product. Also during the entire study period, only one generic was made available for this active ingredient and this could have affected prescribing and dispensing patterns.

Innovator items accounted for R18k (53.7%) of the total cost of items dispensed which was R33k (both innovator and generic). The generics accounted for R15k (46.3%). For the entire study period the following were revealed: The average cost per item was R207 (±R49.79), average cost per innovator item dispensed was R251 (±R61.09) and the average cost per generic item dispensed was R172 (±R12.70). A price differential of R79 compared to innovator item was noted. The average cost of an innovator tablet was R8.23, and for a generic tablet R5.90. From P1 to P6: The average cost per innovator item dispensed increased by 6.5% and the average cost per generic item dispensed increased by 7.1%.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.23 IRBESARTAN 150MG + HYDROCHLOROTHIAZIDE 12.5MG (Drug item which contains a combination of both these ingredients per tablet)

Note: Co- Irbewin 150mg (generic) was available for dispensing on the 08th of June 2009 at the pharmacies. Therefore no innovator medicine item was taken into account before this period as there was not a generic available.

As per tables 6 and 7, it was calculated that 82 items (90.1%) of the total number of 91 items dispensed (both innovator and generic) were innovator items and the rest were generics, 9 items (9.9%). From P1 to P6 the frequency of innovator items dispensed decreased by 44.4% and there was an increase in generic

usage by 44.4%. The innovator item had been significantly dispensed, more often than the generic. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product. Also during the entire study period, only one generic was made available for this active ingredient and this could have affected prescribing and dispensing patterns.

Innovator items accounted for R20k (92.7%) of the total cost of items dispensed which was R22k (both innovator and generic). The generics accounted for R1.6k (7.3%). For the entire study period the following were revealed: The average cost per item was R240 (±R41.15), average cost per innovator item dispensed was R247 (±R28.36) and the average cost per generic item dispensed was R177 (±R13.66). A price differential of R70 compared to innovator item was noted. The average cost of an innovator tablet was R8.25, and for a generic tablet R5.95. From P1 to P6: The average cost per innovator item dispensed increased by 7.8%and the average cost per generic item dispensed increased.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.24 IRBESARTAN 300MG + HYDROCHLOROTHIAZIDE 12.5MG (Drug item which contains a combination of both these ingredients per tablet)

Note: Co- Irbewin 300mg (generic) was available for dispensing on the 08th of June 2009 at the pharmacies. Therefore no innovator medicine item was taken into account before this period as there was not a generic available.

As illustrated on tables 6 and 7: 61 items (31.3%) of the total number of 195 items dispensed (both innovator and generic) were innovator items and the rest were generics, 134 items (68.7%). From P1 to P6 the frequency of innovator items dispensed decreased by 47.2% and there was an increase in generic usage by 47.2%. There was a relatively high amount of innovator items that were

dispensed. Reasons for dispensing the original item may have been due to prescribers, pharmacists and patients not being aware of the generic being available or they could have preferred the original product. Also during the entire study period, only one generic was made available for this active ingredient and this could have affected prescribing and dispensing patterns.

Innovator items accounted for R15k (38.7%) of the total cost of items dispensed which was R38k (both innovator and generic). The generics accounted for R23k (61.3%). For the entire study period the following were revealed: The average cost per item was R195 (±R37.20), average cost per innovator item dispensed was R241 (±R35.46) and the average cost per generic item dispensed was R174 (±R13.59). A price differential of R67 compared to innovator item was noted. The average cost of an innovator tablet was R8.34, and for a generic tablet R5.84. From P1 to P6: The average cost per innovator item dispensed increased by 9.0% and the average cost per generic item dispensed increased by 7.2%.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.25 CLOPIDOGREL 75MG

Tables 6 and 7 showed that for this active ingredient 77 items (11.4%) of the total number of 676 items dispensed were innovator items and the rest were generics, 599 (88.6%). From P1 to P6 the frequency of innovator items dispensed decreased by 11.9% and there was an increase in generic usage by 11.9%. The innovator item is a well- known blockbuster drug that had a great impact in terms of sales when it had entered the market. Reasons for the reduction in its market share could have been due to the introduction of more and cheaper generics into the market, patients unable to afford the original drug and medical schemes not fully paying for the original product.

Innovator items accounted for R39k (20.9%) of the total cost of items dispensed which was R187k (both innovator and generic). The generics accounted for R148k (79.1%). For the entire study period the following were revealed: The average cost per item was R277 (±R97.44), average cost per innovator item dispensed was R507 (±R58.95) and the average cost per generic item dispensed was R247 (±R49.99). A price differential of R260 compared to innovator item was noted. The average cost of an innovator tablet was R17.72, and for a generic tablet R8.43. From P1 to P6: The average cost per innovator item dispensed increased by 2.3%% and the average cost per generic item dispensed increased by 1.3%.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.5.26 Discussion of the results

Anti-hypertensives were ranked the number 1 therapeutic group according to the Mediscor Top 25 therapeutic groups. This was according to total expenditure for 2011. From a list of 50 top products, ACE inhibitors as a therapeutic group represented the highest percentage expenditure at 34.8% under anti-hypertensive class. Prexum Plus appeared as the 3rd highest brand name item according to expenditure from a list of Top 50 products, with Prexum 4mg being ranked 10th (Mediscor PBM, 2012). Many factors are taken into account before an antihypertensive is chosen. These include patient related factors such as risk factors, contraindications, effectiveness of treatment and favourable conditions for use. Cost of a drug class also plays a significant role. Generally in uncomplicated essential hypertension there are three essential first- line antihypertensive agents which are: diuretics, ACE-inhibitors and calcium channel blockers. Therapy can be initiated with any of these three agents (Seedat and Rayner, 2012).

Perindopril is indicated for hypertension and can also be used for the treatment of heart failure and to reduce the risk of myocardial infarction (Rossiter, 2010). In a meta- analysis based on 20 clinical trials involving 158 998 patients the significant value of ACE inhibitors as first- line choice in hypertension were noted. In particular perindopril- based regimens were associated with a 13% all-cause mortality reduction (Van Vark *et al*, 2012). Therefore it would be understandable as to why perindopril could be prescribed frequently.

In a previous study done to investigate the prescribing patterns of ACE- inhibitors in South Africa it was illustrated that the items with the largest prevalence percentage were perindopril and the combination of perindopril and indapamide for the period of 2004 until 2006 (Rothmann, 2007). In this study perindopril (including the combination of perindopril and indapamide) was the second highest most frequently dispensed active ingredient at 23% as well as the second highest in terms of cost at 24%.

Hypolipdaemic agents were ranked the 5th highest therapeutic group according to the Mediscor Top 25 therapeutic groups. This was according to total expenditure for 2011 (Mediscor PBM, 2012). **Atorvastatin** had the second highest percentage total expenditure at 34.1% and pravastatin had the 4th highest at 3.4% in this group (Mediscor PBM, 2012). Lipitor is known for being one of the bestselling drugs of all time with record worldwide sales especially over the last couple of decades. It is primarily used for dyslipidemia and for the prevention of cardiovascular diseases (Lancet, 2011). For this study, atorvastatin accounted for the most frequently dispensed ingredient at the pharmacies for the study period at 27%. In addition it also accounted for the highest total cost at the pharmacies at 29%. Lipitor 10mg was the most frequently dispensed innovator item (n = 910) and it also had the highest cost (186K) compared to the other innovator items. Even though a generic was available, the atorvastatin innovator items were still being prescribed and dispensed. Patients and prescribers may have preferred the innovator item.

Evidence for the use of **pravastatin** is usually weaker than for the other statins. A trial was conducted to investigate antihypertensive and lipid-lowering treatment to prevent heart attack. A set of patients received pravastatin daily (which was regarded as a usual staring dose) and others received the usual care. The trial had failed to show a difference by reducing all-cause mortality, nonfatal myocardial infarction or fatal coronary heart diseases between the two groups of patients (ALLHAT Officers and Coordinators, 2002). In this study, the average cost of pravastatin 10mg, 20mg, 40mg innovator and generic items were also high compared to the other statins. These factors could explain why pravastatin was the least dispensed active ingredient of this study from all of the study drugs (1%, n= 313) and also had the least total cost (2%, n= R71K).

In Mediscor medicines review 2011, **bisoprolol** was the active ingredient with the highest percentage total expenditure at 41.5% and highest percentage total item volume at 47.3% for the group of beta-receptor blockers. Bilocor 5mg was also in the top 10 anti-hypertensive products being ranked 8th (Mediscor PBM, 2012). It is known to be added to ACE inhibitors and diuretics a as a mortality benefit in the treatment of congestive cardiac failure (Rossiter, 2010). In this study bisoprolol as an active ingredient was the 4th highest most frequently dispensed ingredient at the pharmacies for the study period at 12 % but had the 5th highest total cost at the pharmacies at 6%. Also bisoprolol innovator items were the 2nd highest most frequently dispensed items from all the other innovator items and had the fifth highest cost.

Diuretics are used in uncomplicated essential hypertension as one of the essential first- line antihypertensive agents. Diuretics are usually considered when treatment costs become important (Seedat and Rayner, 2012). **Furosemide** is primarily used for the treatment of oedema of cardiac, hepatic or renal origin (Rossiter, 2010). In this study Lasix 40mg was the 3rd highest innovator item dispensed from all the other innovator items but had the 2nd highest cost compared to the other innovator items. These costs were attributed to the relatively high dispensing patterns of the much higher priced innovator drug. The highlight was in the difference in the average cost per innovator item

dispensed which was R182 (±R86.75) and the average cost per generic item dispensed which was R25 (±R25.69). A substantial price differential of R157 compared to innovator item was noted. There could have been many factors that lead to the innovator being dispensed: because of the severe nature of a cardiovascular condition prescribers may prefer and feel more confident by prescribing the innovator and likewise patients may also prefer the innovator. The vast difference in price between the innovator and generic can also lead people to suspect that the innovator and generic may not be as equivalent to each other.

Nifedipine is used in cases of hypertension and angina pectoris (Rossiter, 2010). As an active ingredient it was ranked 6th in terms of highest frequency and 4th in terms of highest cost. Innovator items being dispensed may have attributed to these high costs. In this study Adalat XL 30mg was ranked the 5th highest most frequently dispensed innovator item from all of the innovator items but had the 3rd highest cost at 113K. Also the average cost of both innovator and generic items are substantially higher compared to other calcium channel blockers. Prescribers probably prefer the item's long- acting benefits.

As mentioned earlier in the discussion many factors are considered before an antihypertensive is chosen. Cost can be a factor when choosing between different calcium channel blockers. In Mediscor medicines review 2011, **amlodipine** was the active ingredient with the highest total expenditure for the group of calcium channel blockers and the total highest volume. It also had the least average cost per item at R111 in this group. The brand names of Amloc 5mg and 10mg were ranked 3rd and 7th respectively on the top 10 antihypertensive products as well. (Mediscor PBM, 2011). In this study amlodipine was the 3rd highest most frequently dispensed active ingredient at 16% and also had the 3rd highest total cost for an active ingredient amongst the other study ingredients. The innovator item Norvasc 5mg was ranked the 4th highest innovator item to be frequently dispensed and was also the 4th highest in terms of innovator cost at 102k.

Uncomplicated essential hypertension can be initiated with an ACE inhibitor or an ARB (angiotensin 2 receptor blocker). Also there is little difference between ACE inhibitors and ARBs in terms of their effects and uses. The main factors to consider between choosing either an ACE inhibitor or an ARB would be cost and tolerability (Seedat and Rayner, 2012).

Losartan was ranked 4th in terms of the percentage total expenditure but 3rd in terms of percentage total item volume according to the Mediscor medicines review 2011 report. The average cost per item was R107. However, the combination of losartan with hydrochlorothiazide was ranked 3rd in terms of expenditure percentage and 4th in terms of item volume percentage. The average cost of the combination was R128 (Mediscor PBM, 2012). In this study losartan was the second lowest active ingredient to be most frequently dispensed at 4% and was also the 2nd lowest in terms of cost. However ARBs could have been more cost effective to prescribe in this case by comparing it to the average costs of other ACE- inhibitors. This will depend on prescriber preference, cost and effectiveness of a treatment and patient factors as explained earlier. Also the average cost of the innovator does not seem to be significantly different from the generic. This may have been due to the dispensed generics' price being close to that of the innovator or the innovator decreasing its original price over the years to be competitive in the market. Pharmaceutical organizations also have an influence on prescribers and pharmacists on which generic to dispense sighting their own benefits.

The Mediscor 2011 review ranked irbesartan and the combination of **irbesartan** and hydrochlorothiazide quite lowly compared to other ARBs in the group. This was in terms of percentage total expenditure and percentage total item volume. The average cost was R206 for both irbesartan and the combination (Mediscor PMB, 2012). In this study irbesartan as an active ingredient was second lowest ingredient to be dispensed but 7th highest in terms of total costs of an active ingredient. One of the main factors to consider when prescribing this ingredient is cost. Due to its high costs relative to other antihypertensive most patients would

not have access to it and it may only be prescribed if patients have tolerability issues to other cost effective antihypertensives.

The innovator for **clopidogrel**, Plavix is available worldwide and received record sales over the years (IMS Health, 2011). Clopidogrel is known to effective in coronary artery stenting and in reducing the risk of myocardial infarction and stroke in individuals who have acute coronary syndromes (Rossiter, 2010). In the Mediscor 2008 medicines review report Plavix was ranked 9th from a list of top 50 products by contribution to total medicine expenditure for the year 2008 with an average cost per item of R451 (Mediscor PBM, 2009). In this study clopidogrel was one of the least active ingredients to be dispensed at 3% but had the 5th highest total cost. Plavix was also ranked 10th highest innovator item in terms of total innovator items cost. A substantial price difference of R260 between the innovator and generic item was noted earlier on. Again there may have been factors that lead to the innovator being dispensed: because of the nature of a cardiovascular condition prescribers may prefer and feel more confident by prescribing the innovator and likewise patients may also prefer the innovator. The vast difference in price between the innovator and generic can also lead people to suspect that the innovator and generic may not be as equivalent to each other.

In terms of all of the study drugs, the decreases in average cost from P1 to P6 of both innovator and generic items may be due to the fact that more and also cheaper generic medications are entering the market. Innovator companies may have also decreased their prices in order to remain competitive in the market.

As explained in section 4.4.1, there are also few other factors to consider regarding the frequency patterns and costs of innovator and generic items: medical schemes refusing to cover fully for certain innovator products because of the cost and thus vouching for the respective cheaper generic, patients being offered and advised to try the cheaper generic with it's potential cost saving, due to prices increases patients cannot afford the expensive innovator product and thus opt for the generic drug, more and more doctors are advised to prescribe a generic equivalent of a medicine item because of its equivalent effect and cost

saving. Doctors are also gaining more confidence with generic products and are therefore prescribing accordingly. The impact of these factors can be seen in the decrease in market share of innovator items for selected active ingredients or even a change in the average cost of the innovator item from P1 to P6. On rare occasions the innovator item can be prescribed and dispensed in cases where the generic item manufacturer has no stock of the generic item due reasons such as: shortage of ingredients to produce the generic, legal agendas or a health and safety notice.

Reasons for the innovator items being dispensed may also have been due to: prescribers and patients feeling that generics are inferior and are not as effective when compared to the original and therefore would be receiving substandard treatment. They are also not aware and do not understand the nature and effectiveness of generic products.

Usually in microeconomic theory the demand for prescribed medications should be inversely related to the prices of medications and directly related to marketing expenditure. When patents expire market share of products are expected to change and can lead to a reduction in the average price of a drug. Increasing the amount of manufacturers of generic products in the market (because of the patent expiring) should reduce prices and this would thereafter increase demand. However in certain conditions this may not be the case as purchasers may not be sensitive to price in terms of a demanded product. This could be due to medical schemes or third parties paying for an item. The other reason is that companies adopt different marketing strategies for their products which has a significant impact on market share and sales of their products. Promotional activities increase sales of various molecules. Some patients are also loyal to a brand, especially if they had started treatment with an innovator item. They may perceive that generics are of inferior quality and wish not to compromise their health (Duflos and Lichtenberg, 2011).

However these are factors that fall outside the scope of this study as they are uncontrollable from the viewpoint of this study.

4.6 COST SAVINGS

Generally when an innovator medicine item is substituted by an equivalent generic medicine item, it can be presumed that some kind of cost saving will occur. This section will investigate the potential cost savings for the study cardiovascular drugs. Cost savings for an innovator item will be calculated by multiplying the cost per tablet (refer to Appendix A) of either the least expensive generic (LEG) or the most expensive generic (MEG) by the number of innovator tablets (the relevant innovator item) for each study period (P1 to P6), and then this cost will be subtracted from the total cost of the total amount of innovator tablets for that relevant period. This formula was adapted from similar research done in this area (Van der Westhuizen, 2007). The equation below will be utilized for each period and for the specific innovator item.

Cost Saving of Innovator Item for Py =
Total cost (Innovator tablets) –
[Cost per tablet (Generic item) X Total number of innovator tablets]

…….Equation 4

Where:

Innovator item: Is the name of an innovator item. E.g. Lipitor 10mg, Coversyl 4mg.

Py: Specific period of analysis. P1, P2, P3, P4, P5, P6**.**

Calculations were adapted for the relevant medicine price changes that occurred during a period. Cost savings were only calculated and taken into account for those innovator items that had generic equivalents and where the generic item is less expensive than the innovator product.

A generic item had to be available throughout a study period (at the beginning and the end of a period) in order to be taken in account. Only in instances where a generic item was the first to market, exceptions were made. In these cases

calculations were made from the date of entry into the market (e.g. the generic Prexum 10mg). Prior to this date, no generic item existed for the relevant innovator item and therefore no calculations were done.

Appendix B shows the potential cost savings at each pharmacy that would have occurred if the particular innovator item's tablets for each period were substituted by least expensive generic (LEG) or most expensive generic (MEG) for each period. The results below for each innovator will only contain the sum total of cost savings for the entire study period. Calculations that were excluded included instances where a generic item cost more than innovator item or when there were no cost savings achieved. Also the percentage of savings of each ingredient relative to its actual total costs were calculated and added next to the cost savings rand figure (%).

Frequency and utilization patterns of the 25 study innovator items will also have an impact on the extent of cost savings achieved for a particular active ingredient. Also various price differentials during the periods of study will also have an impact on the extent of cost savings. As more and cheaper generics enter the market they have a significant impact on cost savings as well.

4.6.1. COVERSYL 4MG

Table 8a: Cost savings of Coversyl 4mg tablets (k=1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
Coversyl 4mg	R22k	R7k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R22k (7.1%) and if the most expensive generic was substituted the potential cost savings would have been R7k (2.1%).

Coversyl 4mg was the 6th highest innovator item in terms of total frequency to be dispensed and was ranked 9th in terms of total costs of innovator items dispensed. Also the difference in savings between the LEG and MEG is more than double. In order to be competitive in the generics market, pharmaceutical companies must focus on being price competitive. However some organizations have key marketing strategies that effectively demonstrate the benefits of their products to prescribers and pharmacists which enables them to charge a higher price.

4.6.2. COVERSYL 10MG

Table 8b: Cost savings of Coversyl 10mg tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
Coversyl 10mg	R6k	R6k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R6k (18.0%) and if the most expensive generic was substituted the potential cost savings would have been R6k (18.0%).

Coversyl 10mg was ranked in the bottom half of the most frequently dispensed innovator items list and also in terms of total costs of innovator items dispensed. Since there was only one generic available on the market cost savings of both LEG and MEG are the same. However this generic is a clone molecule of the innovator. Other generic manufactures should consider providing a much cheaper generic that could provide greater cost savings and gain market share. Factors such as the molecule not being profitable enough to produce or conditions of patents could be preventing these organizations from manufacturing them.

4.6.3. COVERSYL PLUS

Table 8c: Cost savings of Coversyl Plus tablets (k =1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
3. Coversyl Plus	R21k	R14k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R21k (5.0%) and if the most expensive generic was substituted the potential cost savings would have been R14k (3.2%).

Coversyl Plus was the 7th highest innovator item in terms of total frequency to be dispensed and was ranked also 7th in terms of total costs of innovator items dispensed. There was also a notable difference in savings between the LEG and MEG. In order to be competitive in the generics market, pharmaceutical companies must focus on being price competitive. However some organizations have key marketing strategies that effectively demonstrate the benefits of their products to prescribers and pharmacists which enables them to charge a higher price.

4.6.4. LIPITOR 10MG

Table 8d: Cost savings of Lipitor 10mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Lipitor 10mg	R72k	R64k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R72k (14.8%) and if the most expensive generic was substituted the potential cost savings would have been R64k (13.1%).

Lipitor 10mg was the highest innovator item in terms of total frequency to be dispensed and was also the highest in terms of total costs of innovator items dispensed. There is also a noteworthy difference in savings between the LEG and MEG. In order to be competitive in the generics market, pharmaceutical companies must focus on being price competitive. Recently however the average cost of a generic item had been made substantially less and it had forced even the clone molecule to drastically reduce its price. These changes in price had affected the market share and costs of all strengths of Lipitor and for Aspavor 10mg, 20mg, 40mg.

4.6.5. LIPITOR 20MG

Table 8e: Cost savings of Lipitor 20mg tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
Lipitor 20mg	R39k	R35k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R39k (10.9%) and if the most expensive generic was substituted the potential cost savings would have been R35k (9.9%).

Lipitor 20mg was the 9th highest innovator item in terms of total frequency to be dispensed and was ranked 6th in terms of total costs of innovator items dispensed.

4.6.6. LIPITOR 40MG

Table 8f: Cost savings of Lipitor 40mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Lipitor 40mg	R14k	R13k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R14k (14.3%) and if the most expensive generic was substituted the potential cost savings would have been R13k (13.2%).

Lipitor 40mg was the 14th highest innovator item in terms of total frequency to be dispensed and was ranked 14th in terms of total costs of innovator items dispensed.

4.6.7. LIPITOR 80MG

Table 8g: Cost savings of Lipitor 80mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
7. Lipitor 80mg	R4k	R4k

Note: The generic for Lipitor 80mg was available for dispensing on the 19th of February 2010 at the pharmacies. Therefore no innovator medicine item was taken into account before this period as there was not a generic available.

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been

R4k (35.1%) and if the most expensive generic was substituted the potential cost savings would have been R4k (34.5%).

Fewer savings compared to the other active ingredients can be expected for Lipitor 80mg. This was probably due to the fact that the generic for Lipitor 80mg was available for dispensing on the 19th of February 2010 at the pharmacies. Therefore no innovator medicine item was taken into account before this period as there was not a generic available. This would have decreased the amount of items of Lipitor 80mg used for the study. Also only one generic was available so both LEG and MEG appear to be the same.

4.6.8. PRAVA 10MG

Table 8h: Cost savings of Prava 10mg tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
8. Prava 10mg	R5k	R4k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R5k (23.5%) and if the most expensive generic was substituted the potential cost savings would have been R4k (19.6%).

As discussed earlier, pravastatin was the least dispensed active ingredient in terms of total frequency and cost. The innovator for pravastatin 10mg was ranked 23rd in terms dispensing patterns of all the innovator items and was ranked 22nd in terms total innovator costs for an active ingredient. Therefore there was not much cost savings achieved for Prava 10mg as compared to the other innovator items.

4.6.9. PRAVA 20MG

Table 8i: Cost savings of Prava 20mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Prava 20mg	R8k	R6k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R8k (32.7%) and if the most expensive generic was substituted the potential cost savings would have been R6k (27.1%).

The innovator for pravastatin 20mg was ranked 21st in terms dispensing patterns of all the innovator items but ranked 16th in terms total innovator costs for an active ingredient. This could have been due to the high average cost of Prava 20mg. However not much cost savings was achieved for Prava 20mg as compared to the other innovator items due to a low dispensing frequency.

4.6.10. PRAVA 40MG

Table 8j: Cost savings of Prava 40mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
10. Prava 40mg	R4k	R4k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R4k (14.8%) and if the most expensive generic was substituted the potential cost savings would have been R4k (14.3%).

Prava 40mg was the innovator item to be the least dispensed from all the other innovator items and was ranked 24th in terms total innovator costs for an active ingredient. Therefore there was not much cost savings achieved for Prava 40mg as compared to the other innovator items due to the low dispensing patterns.

4.6.11. CONCOR AND CARDICOR 5MG

Table 8k: Cost savings of Concor and Cardicor 5mg tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
Concor and Cardicor 5mg	R38k	R38k

Note: Concor and Cardicor 5mg are both innovator items that are made by the same manufacturer and have the same active molecule, therefore their quantities of tablets dispensed were added together for each period. Therefore more cost savings had been achieved due to the addition.

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R38k (25.5%) and if the most expensive generic was substituted the potential cost savings would have been R38k (25.3%).

The innovator item was the 2nd highest innovator item in terms of total frequency to be dispensed and was ranked 5th in terms of total costs of innovator items dispensed. Both LEG and MEG show the same cost savings. This was due to the fact that both the LEG and MEG differed by only a few cents. Substantial cost savings were expected and Concor and Cardicor 5mg were ranked 3rd in the top five innovator drugs where patients could have saved the most if the most expensive generics were dispensed.

4.6.12. CONCOR 10MG

Table 8l: Cost savings of Concor 10mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
12. Concor 10mg	R14k	R14k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R14k (22.7%) and if the most expensive generic was substituted the potential cost savings would have been R14k (22.2%).

The innovator item was the 10th highest innovator item in terms of total frequency to be dispensed and was ranked 13th in terms of total costs of innovator items dispensed. As in the case of Concor and Cardicor 5mg both LEG and MEG show the same cost savings. This was also due to the fact that both the LEG and MEG differed by only a few cents. It also gives us an indication that generic companies try to be competitive by charging prices that are as close as possible to the cheapest generic.

4.6.13. LASIX 40MG

Table 8m: Cost savings of Lasix 40mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Lasix 40mg	R122k	R105k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been

R122k (83.5%) and if the most expensive generic was substituted the potential cost savings would have been R105k (71.8%).

Lasix 40mg was the 3rd highest innovator item in terms of total frequency to be dispensed and was ranked 2nd in terms of total costs of innovator items dispensed. As noted earlier there was a substantial price difference between the innovator and generic item. This had lead to Lasix 40mg being the innovator item that patients could have saved the most if the most expensive generics were dispensed as well as if the least expensive generics were dispensed.

4.6.14. ADALAT XL 30MG

Table 8n: Cost savings of Adalat XL 30mg tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
Adalat XL 30mg	R43k	R34k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R43k (26.0%) and if the most expensive generic was substituted the potential cost savings would have been R34k (21.0%).

Adalat XL 30mg was the 5th highest innovator item in terms of total frequency to be dispensed and was ranked 3rd in terms of total costs of innovator items dispensed. Together with the price differential between Adalat XL 30mg and the generic items, Adalat XL 30mg was in the top five lists of innovator items where patients could have saved the most if either LEG or MEG were dispensed.

4.6.15. ADALAT XL 60MG

Table 8o: Cost savings of Adalat XL 60mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Adalat XL 60mg	R22k	R22k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R22k (23.8%) and if the most expensive generic was substituted the potential cost savings would have been R22k (23.5%).

Adalat XL 60mg was the 12th highest innovator item in terms of total frequency to be dispensed and was ranked 8th in terms of total costs of innovator items dispensed. Both the LEG and MEG show the same cost savings. This was due to the fact that both the LEG and MEG were the same generic item (Fedaloc SR 60mg). The generic Spec- Nifedipine appeared later on in P6 as a LEG available for dispensing. Since there were just a few generics available for Adalat XL 60mg, it provides a greater opportunity for more and cheaper generics to enter the market and to provide further cost savings to patients.

4.6.16. NORVASC 5MG

Table 8p: Cost savings of Norvasc 5mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Norvasc 5mg	R57k	R22k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R57k (22.3%) and if the most expensive generic was substituted the potential cost savings would have been R22k (8.7%).

Norvasc 5mg was the 4th highest innovator item in terms of total frequency to be dispensed and was also ranked 4th in terms of total costs of innovator items dispensed. Together with the price differential between Norvasc 5mg and the generic items, Norvasc 5mg was in the top five lists of innovator items where patients could have saved the most if either LEG were to be dispensed. Also of interest is that the difference between the LEG and MEG is almost double during the study periods. Further investigation as to why such differences exist should take place. However this falls outside the scope of this study.

4.6.17. NORVASC 10MG

Table 8q: Cost savings of Norvasc 10mg tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
Norvasc 10mg	R26k	R12k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R26k (13.3%) and if the most expensive generic was substituted the potential cost savings would have been R12k (6.2%).

Norvasc 10mg was the 11th highest innovator item in terms of total frequency to be dispensed and was ranked 10th in terms of total costs of innovator items dispensed. There is also a notable difference between the LEG and MEG during the study periods. Further investigation as to why such differences exists should take place. However this falls outside the scope of this study.

4.6.18. COZAAR 50MG

Table 8r: Cost savings of Cozaar 50mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Cozaar 50mg	R12k	R3k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R12k (22.8%) and if the most expensive generic was substituted the potential cost savings would have been R3k (5.0%).

Cozaar 50mg was the 8th highest innovator item in terms of total frequency to be dispensed but was ranked 12th in terms of total costs of innovator items dispensed. There wasn't a substantial amount of savings both for the LEG and MEG. This may have been due to the fact that the average cost of an innovator tablet was R3.58, and for a generic tablet R3.20, with arguably not much of a price differential. A generic item should be much cheaper in my opinion to the innovator item. This is one of the main benefits of providing a generic to a patient. Further investigation should take place however this is not within the scope of this study.

4.6.19. COZAAR 100MG

Table 8s: Cost savings of Cozaar 100mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Cozaar 100mg	R0.5k	R0.2k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R0.5k (2.1%) and if the most expensive generic was substituted the potential cost savings would have been R0.2k (0.8%).

There wasn't a substantial amount of savings both for the LEG and MEG. This may have been due to the fact that the average cost of an innovator tablet was R3.60, and for a generic tablet R3.45 with not much of a price differential. Also Cozaar 100mg was ranked 23rd in terms of total costs of innovator items dispensed. A generic item should be much cheaper in my opinion to the innovator item. This is one of the main benefits of providing a generic to a patient. Further investigation should take place however this is not within the scope of this study.

4.6.20. COZAAR COMP

Table 8t: Cost savings of Cozaar Comp tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
Cozaar Comp	R2k	R2k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R2k (14.1%) and if the most expensive generic was substituted the potential cost savings would have been R2k (14.1%).

Fewer savings compared to the other active ingredients can be expected for Cozaar Comp. This was probably due to the fact that the generic for Cozaar Comp was available for dispensing very late into the study at the pharmacies. This would have decreased the amount of items of Cozaar Comp used for the

study. Also only one generic was available so both LEG and MEG appear to be the same.

4.6.21. APROVEL 150MG

Table 8u: Cost savings of Aprovel 150mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
21. Aprovel 150mg	R5k	R5k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R5k (23.1%) and if the most expensive generic was substituted the potential cost savings would have been R5k (23.1%).

There was only one generic item available for dispensing for the entire study period. Not much cost savings had been achieved since Aprovel 150mg was not dispensed that often as compared to the other innovator items. However there exists an opportunity for more generics to enter the market and to provide a cheaper price.

4.6.22. APROVEL 300MG

Table 8v: Cost savings of Aprovel 300mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Aprovel 300mg	R5k	R5k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R5k (15.0%) and if the most expensive generic was substituted the potential cost savings would have been R5k (15.0%).

There was only one generic item available for dispensing for the entire study period. Not much cost savings had been achieved since Aprovel 300mg was not dispensed that often as compared to the other innovator items. However there exists an opportunity for more generics to enter the market and to provide a cheaper price.

4.6.23. COAPROVEL 150MG

Table 8w: Cost savings of Coaprovel 150mg tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
Coaprovel 150mg	R6k	R6k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R6k (26.0%) and if the most expensive generic was substituted the potential cost savings would have been R6k (26.0%).

There was only one generic item available for dispensing for the entire study period. Not much cost savings had been achieved since Coaprovel 150mg was not dispensed that often as compared to the other innovator items. However there exists an opportunity for more generics to enter the market and to provide a cheaper price.

4.6.24. COAPROVEL 300MG

Table 8x: Cost savings of Coaprovel 300mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Coaprovel 300mg	R4k	R4k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R4k (11.3%) and if the most expensive generic was substituted the potential cost savings would have been R4k (11.3%).

There was only one generic item available for dispensing for the entire study period. Not much cost savings had been achieved since Coaprovel 300mg was not dispensed that often as compared to the other innovator items. However there exists an opportunity for more generics to enter the market and to provide a cheaper price.

25. PLAVIX 75MG

Table 8y: Cost savings of Plavix 75mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Plavix 75mg	R25k	R20k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R25k (13.6%) and if the most expensive generic was substituted the potential cost savings would have been R20k (10.6%).

Plavix 75mg was the 18th highest innovator item in terms of total frequency to be dispensed but was ranked 11th in terms of total costs of innovator items dispensed. Cost savings were attainable due to the substantial difference in average price (generic item average cost was more than half the average cost of the innovator item). During the study period more generic items became available for this ingredient and at a lesser price which allowed more cost savings in terms of the LEG to be achieved.

TOTAL COST SAVINGS

Table 8z: Total cost savings of all innovator tablets

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
All innovator items	R576k	R448k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R576k and if the most expensive generic was substituted the potential cost savings would have been R448k.

As explained earlier, the frequency and utilization patterns of the 25 study innovator items will also have an impact on extent of cost savings achieved for a particular active ingredient. Also various price differentials during the periods of study will also have an impact on the extent of cost savings.

The top five innovator drugs where patients could have saved the most if the least expensive generics were dispensed were (in descending order): 1. Lasix 40mg: R122k, 2. Lipitor 10mg: R72k, 3. Norvasc 5mg: R57k, 4. Adalat XL 30mg: R43k, 5. Lipitor 20mg: R39k.

The top five innovator drugs where patients could have saved the most if the most expensive generics were dispensed were (in descending order): 1. Lasix

40mg: R105k, 2. Lipitor 10mg: R64k, 3. Concor and Cardicor 5mg: R38k 4. Lipitor 20mg: R35k, 5. Adalat XL 30mg: R34k.

The study done by Boyce and Bartlett in 1990 illustrated the effects of generic prescribing and generic substitution in terms of cost savings in South Africa where savings in the region of 9.9% to 59.7% can be achieved depending on which medication is prescribed. These savings were illustrated again in 2006 where a potential saving of 9.3% was calculated of the actual antidepressant cost, if there was total substitution of all original or innovator drugs at the average price (Van der Westhuizen et al., 2010). In this study a potential cost saving of 17.7% of the actual study CVS total drug costs would have been achieved if the least expensive generic was dispensed and a potential cost saving of 13.8% would have been achieved if the most expensive generic was prescribed for the entire study period.

Also an important point to note is that on many occasions the cheapest generic that is available on the market is not prescribed or dispensed to the patient who would be able to realize much more cost savings. Reasons could be: pharmacists and prescribers are not aware of the cheapest generic, marketing strategies of pharmaceutical organizations are rigorous in some companies but not in others, patient complaints about generic products, pharmacists and prescribers may not believe that the cheapest generic has same effectiveness and quality compared to more expensive generics and to the innovator item itself. Medical scheme organizations can also play a strong role in improving the use of the cheapest generic on the market. This can be done by structuring their benefit programmes to pay for the cheapest generic and charging a high co- payment for other generics.

4.7 THE DISPENSING PATTERNS AND COST OF INNOVATOR MEDICINE ITEM'S CLONE MOLECULES COMPARED TO GENERIC MEDICINE ITEMS

Some of the innovator items have clone molecules which are manufactured by the same or a 'sister' pharmaceutical company of the original. These innovator companies choose to start their very own generic division. An example is a generic company called Pharmacia which belongs to Pfizer Pharmaceutical. This is done in order for these pharmaceutical companies not to lose complete market share because of the threat of new generic entrants and they are now therefore able to compete with other generic companies. These clone molecules are produced under the same manufacturing conditions as the original so it is almost identical to the original (Igbinovia, 2007). Therefore this section aims to identify the impact these clone molecules have on the market.

Examples of clone molecules include (innovator in brackets): Prexum 4mg and Prexum Plus (Coversyl 4mg and Coversyl plus), Aspavor (Lipitor). Their dispensing patterns and cost will be analyzed. The clone molecule will be regarded as an innovator clone item. Innovator clone and generic dispensing patterns and their cost will also be compared. The average cost per innovator clone item dispensed and the average cost per generic item will also be compared. This analysis will not take into account any originator medicine (Coversyl 4mg, Coversyl plus and Lipitor 10mg, 20mg, 40mg). Generic items will include all generics for a particular active ingredient and strength and will not include any of the clone molecules.

Table 9: The total dispensing patterns and cost of CVS innovator clone items and generic items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies.

Active ingredient	Total number of Innovator Clone items dispensed	Total Cost of Innovator Clone items dispensed	Average cost per Innovator Clone item	Total number of Generic items dispensed	Total Cost of Generic items dispensed	Average cost per Generic item
1. Perindopril 4mg	1735	R234k	R135	197	R24k	R124
2. Perindopril 4mg + indapamide 1.25mg	1761	R287k	R163	389	R59k	R153
3. Atorvastatin 10mg	1492	R168k	R113	107	R9k	R85
4. Atorvastatin 20mg	1078	R157k	R145	47	R5k	R109
5. Atorvastatin 40mg	290	R43k	R147	39	R6k	R147

Note: k= 1000

Table 10: The total dispensing patterns and cost of CVS innovator clone items and generic items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies (%).

Active ingredient	Innovator Clone items dispensed	Generic items dispensed	Cost of Innovator Clone item dispensed	Cost of Generic item	CPII	CPIG
1. Perindopril 4mg	89.8%	10.2%	90.5%	9.5%	1.01	0.93
2. Perindopril 4mg + indapamide 1.25mg	81.9%	18.1%	82.9%	17.1%	1.01	0.94
3. Atorvastatin 10mg	95.5%	4.5%	97.0%	3.0%	1.02	0.67
4. Atorvastatin 20mg	97.2%	2.8%	98.2%	1.9%	1.01	0.68
5. Atorvastatin 40mg	91.2%	8.8%	92.0%	8.0%	1.01	0.91

CPI= Cost prevalence index for innovator item

CPIG= Cost prevalence index for generic item

Note for Table 10:

Cost prevalence index (CPI) illustrates the relationship between the total number of medicine items prescribed and the total medicine cost.

The cost- prevalence index (CPI) for each item was calculated for each period. The CPI for innovator clone items was fairly expensive compared to generic medicines because the value of CPI was larger than 1.

From the results in tables 9 and 10, the following were revealed:

4.7.1 Perindopril 4mg

From the results it can be viewed that for dispensing patterns, 1 735 items (89.8%) of the total number of items dispensed (both innovator and generic) were Prexum 4mg and the rest were generics, 197 items (10.2%). The innovator clone item was dispensed more often than the other generic items. Reasons for dispensing the original item may have been due to Prexum 4mg being the first to market generic and clone molecule of Coversyl 4mg (Original item), prescribers and pharmacists and patients not being aware of other generics in the market or they could have preferred the original clone product because it originates from the original drug and could be much more similar compared to other generic items. Marketing strategies of the drug companies may have also influenced the dispensing patterns.

Prexum 4mg accounted for R234k (90.5%) of the total cost of items dispensed (both innovator and generic). The generics accounted for R24k (9.5%). For the entire study period the following were revealed: The average cost per innovator item dispensed was R135 (±R42.96) and the average cost per generic item dispensed was R124 (±R24.38). A price differential of R11 compared to innovator item was noted.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.7.2 Perindopril 4mg + indapamide 1.25mg (drug item which possess both these ingredients per tablet)

For dispensing patterns, 1 761 (81.9%) of the total number of items dispensed (both innovator and generic) were Prexum Plus and the rest were generics, 389 items (18.1%). The innovator clone item was dispensed more often than the

other generic items. Reasons for dispensing the original item may have been due to Prexum Plus being the first to market generic and clone molecule of Coversyl Plus (Original item), prescribers and pharmacists and patients not being aware of other generics in the market or they could have preferred the original clone product because it originates from the original drug and could be much more similar compared to other generic items. Marketing strategies of the drug companies may have also influenced the dispensing patterns.

Prexum Plus accounted for R287k (82.9%) of the total cost of items dispensed (both innovator and generic). The generics accounted for R59k (17.1%). For the entire study period the following were revealed: The average cost per innovator item dispensed was R163 (±R35.85) and the average cost per generic item dispensed was R153 (±R25.22). A price differential of R10 compared to innovator item was noted.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.7.3 Atorvastatin 10mg

Note: Lipogen 10mg (generic) was available for dispensing on the 19th of February 2010 at the pharmacies. Therefore no innovator clone medicine item was taken into account before this period as there was not a generic available. The innovator clone item was dispensed more often than the other generic items. Reasons for dispensing the original item may have been due to Aspavor 10mg being the first to market generic and clone molecule of Lipitor 10mg (Original item), prescribers and pharmacists and patients not being aware of other generics in the market or they could have preferred the original clone product because it originates from the original drug and could be much more similar compared to other generic items. Marketing strategies of the drug companies may have also influenced the dispensing patterns.

For dispensing patterns, 1492 items (93.3%) of the total number of items dispensed (innovator and generic) were Aspavor 10mg and the rest were generics, 107 items (6.7%).

Aspavor 10mg accounted for R168k (94.9%) of the total cost of items dispensed (both innovator and generic). The generics accounted for R9k (5.1%). For the entire study period the following were revealed: The average cost per innovator item dispensed was R113 (±R31.31) and the average cost per generic item dispensed was R85 (±R10.90). A price differential of R28 compared to innovator item was noted.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.7.4 Atorvastatin 20mg

Note: Lipogen 20mg (generic) was available for dispensing on the 19th of February 2010 at the pharmacies. Therefore no innovator clone medicine item was taken into account before this period as there was not a generic available. The innovator clone item was dispensed more often than the other generic items. Reasons for dispensing the original item may have been due to Aspavor 20mg being the first to market generic and clone molecule of Lipitor 20mg (Original item), prescribers and pharmacists and patients not being aware of other generics in the market or they could have preferred the original clone product because it originates from the original drug and could be much more similar compared to other generic items. Marketing strategies of the drug companies may have also influenced the dispensing patterns.

1078 items (95.8%) of the total number of items dispensed (both innovator and generic) were Aspavor 20mg and the rest were generics, 47 items (4.2%).

Aspavor 20mg accounted for R157k (96.8%) of the total cost of items dispensed (both innovator and generic). The generics accounted for R5k (3.2%). For the entire study period the following were revealed: The average cost per innovator item dispensed was R145 (±R33.12) and the average cost per generic item dispensed was R109 (±R17.95). A price differential of R36 compared to innovator item was noted.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

4.7.5 Atorvastatin 40mg

Note: Lipogen 40mg (generic) was available for dispensing on the 19th of February 2010 at the pharmacies. Therefore no innovator clone medicine item was taken into account before this period as there was not a generic available.

For this active ingredient, 290 items (88.1%) of the total number of items dispensed were Aspavor 40mg and the rest were generics, 39 items (11.9%). The innovator clone item was dispensed more often than the other generic items. Reasons for dispensing the original item may have been due to Aspavor 40mg being the first to market generic and clone molecule of Lipitor 40mg (Original item), prescribers and pharmacists and patients not being aware of other generics in the market or they could have preferred the original clone product because it originates from the original drug and could be much more similar compared to other generic items. Marketing strategies of the drug companies may have also influenced the dispensing patterns.

Aspavor 40mg accounted for R43k (88.1%) of the total cost of items dispensed (both innovator and generic). The generics accounted for R6k (11.9%). For the entire study period the following were revealed: The average cost per innovator item dispensed was R147 (±R38.23) and the average cost per generic item

dispensed was R147 (±R42.47). A price differential of R0 compared to innovator item was noted.

The cost- prevalence index (CPI) was calculated for each period. The CPI for innovator items was fairly expensive compared to generic medicine because the value of CPI is larger than 1.

The results illustrate that even though patents expire for original molecules they still can dominate the market by manufacturing clone molecules of the original to gain substantial profits. Innovator clone molecules were dispensed more frequently than the other generic items.

4.8 COST SAVINGS (Innovator clone items)

Potential cost savings for innovator clone molecules were calculated using the same approach as discussed earlier in this chapter. The results below for each innovator will only contain the sum total of cost savings for the entire study period. Appendix C illustrates the least expensive generic (LEG) and the most expensive generic (MEG) for each study period (P1 to P6). Appendix D shows the cost savings during each study period for each innovator clone item.

4.8.1. PREXUM 4MG

Table 11a: Cost savings of Prexum 4mg tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
Prexum 4mg	R71k	R2k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R71k and if the most expensive generic was substituted the potential cost savings would have been R2k. During certain periods of the study the MEG cost more than the innovator clone molecule and no savings could be attained for the MEG during those periods. This ultimately had an impact on the total savings the patient could receive if the MEG was dispensed.

4.8.2. PREXUM PLUS

Table 11b: Cost savings of Prexum Plus tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Prexum Plus	R38k	R25k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R38k and if the most expensive generic was substituted the potential cost savings would have been R25k. These savings were attainable because of the high dispensing frequency of the innovator clone molecules.

4.8.3. ASPAVOR 10MG

Table 11c: Cost savings of Aspavor 10mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Aspavor 10mg	R37k	R13k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R37k and if the most expensive generic was substituted the potential cost savings would have been R13k.

These savings were attainable because of the high dispensing frequency of the innovator clone molecules. During certain periods of the study the MEG cost more than the innovator clone molecular. The other generics for the clone molecule only entered the market in P3. Therefore more cost savings would have

been achieved if a generic was available from the beginning of the study period. Towards the end of the study the cost per tablet of the LEG and MEG had decreased and provided further savings.

4.8.4. ASPAVOR 20MG

Table 11d: Cost savings of Aspavor 20mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Aspavor 20mg	R35k	R7k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R35k and if the most expensive generic was substituted the potential cost savings would have been R7k.

These savings were attainable because of the high dispensing frequency of the innovator clone molecules. During certain periods of the study the MEG cost more than the innovator clone molecular. The other generics for the clone molecule only entered the market in P3. Therefore more cost savings would have been achieved if a generic was available from the beginning of the study period. Towards the end of the study the cost per tablet of the LEG and MEG had decreased and provided further savings.

4.8.5. ASPAVOR 40MG

Table 11e: Cost savings of Aspavor 40mg tablets (k= 1000)

Branded Drug	Cost saving for entire study period	
	Least Expensive Generic	Most Expensive Generic
Aspavor 40mg	R8k	R2k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R8k and if the most expensive generic was substituted the potential cost savings would have been R2k.

Aspavor 40mg was not as frequently dispensed compared to the Aspavor 10mg and 20mg strengths. Therefore lower cost savings had been achieved. However the savings were attainable because of the higher dispensing frequency of the innovator clone molecules compared to the other generics. During certain periods of the study the MEG cost more than the innovator clone molecular. The other generics for the clone molecule only entered the market in P3. Therefore more cost savings would have been achieved if a generic was available from the beginning of the study period. Towards the end of the study the cost per tablet of the LEG and MEG had decreased and provided further savings.

Of note was the fact that for both strengths of Aspavor 20mg and 40mg and their LEG and MEG, their cost per tablet where almost similar during the study period. Prescribers can look at prescribing the 40mg strength where patients can break a tablet in half if a 20mg dose is required. Further savings could be achieved by this process.

4.8.6 TOTAL COST SAVINGS FOR CLONE MOLECULES

Table 11f: Total cost savings of all innovator clone tablets (k= 1000)

Branded Drug	**Cost saving for entire study period**	
	Least Expensive Generic	**Most Expensive Generic**
All innovator clone items	R189k	R49k

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R189k and if the most expensive generic was substituted the potential cost savings would have been R49k.

As explained earlier on many occasions the cheapest generic that is available on the market is not prescribed or dispensed to the patient who would be able to realize much more cost savings. Reasons could be: pharmacists and prescribers are not aware of the cheapest generic, marketing strategies of pharmaceutical organizations are rigorous in some companies but not in others, patient complaints about generic products, pharmacists and prescribers may not believe that the cheapest generic has same effectiveness and quality compared to more expensive generics and to the innovator item itself. Medical scheme organizations can also play a strong role in improving the use of the cheapest generic on the market. This can be done by structuring their benefit programmes to pay for the cheapest generic and charging a high co- payment for other generics.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

In this chapter, the limitations and the conclusions based on the results of the investigations are discussed. Recommendations for future studies will also be made.

5.1 LIMITATIONS

This study was conducted in certain regions of the Johannesburg area and therefore its results cannot reflect or be related to all South African healthcare users. This study was limited to patients based in the private corporate community pharmacy sector therefore data may not be directly related to the public sector environment. The analysis of data was also limited to drugs that are kept on the shelves by the Pick n' Pay pharmacies. Also the different medical schemes may pay for certain generics only according to their formulary and this may also influence the drugs that are kept on the pharmacies' shelves. The potential cost savings calculated were only applicable to the study Pick n' Pay pharmacies. Some percentages did not add up to a hundred percent. This was due to certain numerical values being rounded off.

5.2 CONCLUSIONS

The following conclusions were made for the research objectives that were stated:

The **first research objective** was to determine the extent of usage of generic cardiovascular medications in the private community pharmacy health care environment in the Johannesburg area of South Africa during the period of June 2009 to May 2011. This will be done at selected pharmacies.

In terms of the general dispensing patterns of the study cardiovascular drugs, the study cardiovascular (CVS) drugs accounted for 7.7% of the total number of all items dispensed (n= 282 109) at all pharmacies for the study period. From the total of 21 817, the innovator CVS drugs accounted for 29.9% (n = 6 527) and the generics 70.1% (n= 15 290) of all the CVS items dispensed for the entire study period. From P1 to P6 it was seen that there was a decline in terms of percentage of the use of innovator products (9.7%) and a corresponding increase in the use of generic products by the same percentage. As discussed earlier, the Mediscor Medicines Review for 2006 mentioned that the usage of generic medications in South Africa increased with 18.4 per cent from 2004 to 2006 (Bester M and Hammann E, 2007). In the 2011 report generic utilization continued to rise. The recorded rate in 2011 was 52.4% in comparison to 50.0% in 2010 and 48.8% for 2009 (Mediscor PBM, 2012).

The total cost of all items dispensed at all the study pharmacies was R43 672k. The total cost of the study CVS innovator and generic drugs were R3 249k. This accounted for 7.4% of the total cost of all items dispensed for all the study pharmacies. From the total of R3 249k for the study drugs, 38.2% (n= R1 240k) accounted for the innovator items and 61.8% (n= R2 009k) accounted for the generic items. Although the study innovator CVS drugs accounted for 29.9% of all the study CVS items dispensed, its cost is 38.2% of the total cost of those CVS items. In comparison, generics accounted for 70.1% of the total number of study CVS items dispensed and 61.8% of that cost.

The average cost per item for the entire study period was R149. The innovator average cost per item dispensed was R190 (±R93.28) and for generics R131 (±R59.55). It can be viewed up until P6 that the average cost per item had steadily decreased. This could be due to the increase in usage of generic items instead of the innovator. There is also a 9.8% decrease in percentage of innovator total cost and a corresponding 9.8% increase in percentage of generic cost from P1 to P6. From P1 to P6 the following had been revealed: The average cost per item decreased by R18 (from R156 during P1 to R138 for P6). The average cost per innovator item dispensed decreased by R10 (from R191 during

P1 to R181 for P6) and the average cost per generic item decreased by R14 (from R138 during P1 to R124 for P6).

The dispensing patterns and cost of innovator medicine item's clone molecules compared to generic medicine items were also investigated. The clone molecules were more frequently dispensed compared to other generics. Innovator clone items were fairly expensive compared to other generic medicines because their value of CPI was greater than 1.

The **second research objective** was to determine the possible cost savings that could be achieved by dispensing generic medications and /or practicing generic substitution in the private community pharmacy health care environment in the Johannesburg area of South Africa during the period of June 2009 to May 2011. This will be done at selected pharmacies.

In total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R576k and, vice versa, if the most expensive generic was substituted the potential cost savings would have been R448k. In this study a potential cost saving of 17.7% of the actual study CVS total drug costs would have been achieved if the least expensive generic was dispensed and a potential cost saving of 13.8% would have been achieved if the most expensive generic was prescribed for the entire study period.

The top five innovator drugs where patients could have saved the most if the least expensive generics were dispensed were (in descending order): 1. Lasix 40mg: R122k, 2. Lipitor 10mg: R72k, 3. Norvasc 5mg: R57k, 4. Adalat XL 30mg: R43k, 5. Lipitor 20mg: R39k.

The top five innovator drugs where patients could have saved the most if the most expensive generics were dispensed were (in descending order): 1. Lasix 40mg: R105k, 2. Lipitor 10mg: R64k, 3. Concor and Cardicor 5mg: R38k 4. Lipitor 20mg: R35k, 5. Adalat XL 30mg: R34k.

Cost savings for innovator clone items revealed that in total, if the least expensive generic was substituted during each period for the entire study period the potential cost savings calculated would have been R189k and if the most expensive generic was substituted the potential cost savings would have been R49k.

Innovator CVS drugs accounted for 29.9% of the study CVS items and this amounted to 38.2% (n= R1 240k) of the total cost of these CVS items. Innovator clone molecules, if available for an active ingredient, are significantly dispensed more frequently compared to other generics that may be cheaper. In my opinion there would have been an even higher utilization of generic items if patients had to pay for their medications only by cash. Therefore medical schemes have a strong influence on generic medication utilization. Generic substitution is yet to achieve its full potential at these pharmacies. There is potential for more cost savings on these CVS items and their accessibility and availability to the public also has the potential to increase.

By increasing the use of generic items it can lead to significant cost savings for patients and healthcare funders. Healthcare funders, and healthcare providers need to look at their formularies, benefits structures and their pricing strategies related to reference pricing. Adherence to therapy can improve as well since medication becomes more affordable. A particular method of encouraging generic usage is by assigning higher co-payments for innovator medicines. Prescribers, pharmacists and medical aid organizations must focus on educating patients about the benefits of generics. Also accurate and efficient detailing of prescribers and pharmacists should be undertaken either academically or by pharmaceutical organizations (Mediscor PBM, 2012).

5.3 RECOMMENDATIONS

The following recommendations can be made:

- Information related to demographics such as age, gender and sex were not investigated in this study.
- Only a selected amount of drugs from the cardiovascular group of drugs were chosen for the study. Dispensing patterns and cost should be determined for other categories and classes of medicines.
- Drug-drug interactions should be investigated with cardiovascular medications.
- Cost savings of all medicines from the Pick n' Pay database should be determined in order to estimate the full impact of generic substitution.
- Usage patterns should be determined in other private sectors.

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APPENDIX A

Table 12a: The cheapest and most expensive generic for perindopril 4mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Ran-perindopril 4mg	Prexum 4mg	3.11	4.38
P2	Ran-perindopril 4mg	Prexum 4mg	3.11	4.38
P3	Ran-perindopril 4mg	Prexum 4mg	3.11	4.38
P4	Ran-perindopril 4mg	Cipla-perindopril 4mg	3.11	4.33
			*07.09.10: 3.34	*16.06.10: 4.62
P5	Pearinda 4mg	Cipla-perindopril 4mg	3.04	4.62
P6	Pearinda 4mg	Cipla-perindopril 4mg	3.04	4.62

*date of price increase with new cost per tablet.

Table 12b: The cheapest and most expensive generic for perindopril 10mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	-	-	-	-
P2	-	-	-	-
P3	Prexum 10mg	Prexum 10mg	5.09	5.09
P4	Prexum 10mg	Prexum 10mg	5.09	5.09
P5	Prexum 10mg	Prexum 10mg	5.09	5.09
P6	Prexum 10mg	Prexum 10mg	5.09	5.09

Table 12c: The cheapest and most expensive generic for perindopril 4mg + indapamide 1.25mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Vectoryl plus	Prexum plus	5.04	5.68
P2	Vectoryl plus	Prexum plus	5.04	5.68
P3	Vectoryl plus	Prexum plus	5.04	5.68
P4	Spec- perindopril plus	Prexum plus	5.02	5.68
P5	Spec- perindopril plus	Prexum plus	5.02	5.68
P6	Pearinda Plus 4	Prexum plus	4.49	5.68

Table 12d: The cheapest and most expensive generic for atorvastatin 10mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Aspavor 10mg	Aspavor 10mg	5.23	5.23
P2	Aspavor 10mg	Aspavor 10mg	5.23	5.23
P3	Aspavor 10mg	Aspavor 10mg	5.23	5.23
			*20.03.10: 4.29	*20.03.10: 4.29
P4	Lipogen 10mg	Aspavor 10mg	3.30	4.29
				*16.09.10: 3.26
P5	Lipogen 10mg	Atolip 10	3.30	3.27
			*18.10.10: 2.64	
P6	Lipogen 10mg	Atolip 10	2.64	3.27

*date of price increase with new cost per tablet.

Table 12e: The cheapest and most expensive generic for atorvastatin 20mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Aspavor 20mg	Aspavor 20mg	6.62	6.62
P2	Aspavor 20mg	Aspavor 20mg	6.62	6.62
P3	Aspavor 20mg	Aspavor 20mg	6.62	6.62
			*20.03.10: 5.42	*20.03.10: 5.42
P4	Lipogen 20	Aspavor 20mg	4.58	5.42
				*16.09.10: 4.55
P5	Lipogen 20	Atolip 20	4.58	4.60
			*18.10.10: 3.21	
P6	Lipogen 20	Atolip 20	3.21	4.60

*date of price increase with new cost per tablet.

Table 12f: The cheapest and most expensive generic for atorvastatin 40mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	**Aspavor 40mg**	Aspavor 40mg	6.62	6.62
P2	**Aspavor 40mg**	Aspavor 40mg	6.62	6.62
P3	**Aspavor 40mg**	Aspavor 40mg	6.62	6.62
			*20.03.10: 5.42	*20.03.10: 5.42
P4	**Lipogen 40**	Aspavor 40mg	4.58	5.42
				*16.09.10: 4.55
P5	**Lipogen 40**	Atolip 40	4.58	4.60
			*18.10.10: 3.67	
P6	**Lipogen 40**	Atolip 40	3.67	4.60

*date of price increase with new cost per tablet.

Table 12g: The cheapest and most expensive generic for atorvastatin 80mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	-	-	-	-
P2	-	-	-	-
P3	**19/02/10: Lipogen 80mg 16/04/10: Atolip 80mg	**19/02/10: Lipogen 80mg 16/04/10: Atolip 80mg	5.02	5.02
P4	Atolip 80	Lipogen 80	5.02 *10.06.10: 5.02	5.02
P5	Lipogen 80	Atolip 80	5.02 *18.10.10: 4.58	5.02
P6	Lipogen 80	Atolip 80	4.58	5.02

*date of price increase with new cost per tablet.

**Entry date of first generic into the market.

Table 12h: The cheapest and most expensive generic for pravastatin 10mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Pranalip 10mg	Aspen Pravastatin 10mg	4.76	5.25
P2	Pranalip 10mg	Aspen Pravastatin 10mg	4.76	5.25
P3	Pranalip 10mg	Aspen Pravastatin 10mg	4.76	5.25 *24.05.10: 5.57
P4	Pranalip 10mg	Aspen Pravastatin 10mg	4.76 *18.08.10: 5.03	5.57
P5	Pranalip 10mg	Aspen Pravastatin 10mg	5.03	5.57
P6	Pranalip 10mg	Aspen Pravastatin 10mg	5.03	5.57

*date of price increase with new cost per tablet.

Table 12i: The cheapest and most expensive generic for pravastatin 20mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Aspen Pravastatin 20mg	Sandoz Pravastatin 20mg	5.47	6.43
P2	Aspen Pravastatin 20mg	Sandoz Pravastatin 20mg	5.47	6.43
P3	Aspen Pravastatin 20mg	Sandoz Pravastatin 20mg	5.47 *24.05.10: 6.43	6.43
P4	Pranalip 20mg	Aspen Pravastatin 20mg	5.80 *07.06.10: 6.15	6.43 *05.08.10: 6.84
P5	Colite 20mg	Aspen Pravastatin 20mg	6.42 *12.01.11: 6.32	6.84
P6	Colite 20mg	Aspen Pravastatin 20mg	6.32	6.84

*date of price increase with new cost per tablet.

Table 12j: The cheapest and most expensive generic for pravastatin 40mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Colite 40mg	Aspen Pravastatin 40mg	7.33	7.35
P2	Colite 40mg	Aspen Pravastatin 40mg	7.33	7.35
P3	Colite 40mg	Aspen Pravastatin 40mg	7.33	7.35 *24.05.10: 7.82
P4	Colite 40mg	Aspen Pravastatin 40mg	7.33 *16.08.10: 7.80	7.82
P5	Sandoz Pravastatin 40mg	Aspen Pravastatin 40mg	7.54	7.82
P6	Colite 40mg	Aspen Pravastatin 40mg	7.49	7.82

*date of price increase with new cost per tablet.

Table 12k: The cheapest and most expensive generic for bisoprolol 5mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Bilocor 5mg	Adco- Bisocor 5mg and Bisohexal 5mg	1.88	1.89
P2	Bilocor 5mg	Adco- Bisocor 5mg and Bisohexal 5mg	1.88	1.89
P3	Bilocor 5mg	Adco- Bisocor 5mg	1.88 *28.05.10 2.02	1.89 *19.05.10: 2.04
P4	Bilocor 5mg	Adco- Bisocor 5mg	2.02	2.04
P5	Bilocor 5mg	Adco- Bisocor 5mg and Bisohexal 5mg	2.02	2.04
P6	Bilocor 5mg	Adco- Bisocor 5mg and Bisohexal 5mg	2.02	2.04

*date of price increase with new cost per tablet.

Table 12l: The cheapest and most expensive generic for bisoprolol 5mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Bilocor 10mg	Adco- Bisocor 10mg	3.16	3.20
P2	Bilocor 10mg	Adco- Bisocor 10mg	3.16	3.20
P3	Bilocor 10mg	Adco- Bisocor 10mg	3.16	3.20
			*28.05.10: 3.39	*19.05.10: 3.43
P4	Bilocor 10mg	Adco- Bisocor 10mg	3.39	3.43
P5	Bilocor 10mg	Adco- Bisocor 10mg	3.39	3.43
P6	Bilocor 10mg	Adco- Bisocor 10mg	3.39	3.43

*date of price increase with new cost per tablet.

Table 12m: The cheapest and most expensive generic for furosemide 40mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Merck and Mylan furosemide 40mg	Austell Furosemide 40mg	0.14	0.73
P2	Merck and Mylan furosemide 40mg	Austell Furosemide 40mg	0.14	0.73
P3	Beuresis 40mg	Austell Furosemide 40mg	0.16 *10.04.10: 0.11	0.73 *28.05.10: 0.78
P4	Beuresis 40mg	Austell Furosemide 40mg	0.11 *01.09.10: 0.18	0.78
P5	Merck and Mylan furosemide 40mg	Austell Furosemide 40mg	0.15	0.78
P6	Merck and Mylan furosemide 40mg	Austell Furosemide 40mg	0.15	0.78

*date of price increase with new cost per tablet.

Table 12n: The cheapest and most expensive generic for nifedipine xl 30mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Fedaloc SR 30mg	Adco- Vascard 30mg	5.29	5.86
P2	Fedaloc SR 30mg	Adco- Vascard 30mg	5.29	5.86
P3	Fedaloc SR 30mg	Adco- Vascard 30mg	5.29	5.86
			*28.05.10: 5.61	*19.05.10: 6.22
P4	Fedaloc SR 30mg	Adco- Vascard 30mg	5.61	6.22
P5	Fedaloc SR 30mg	Adco- Vascard 30mg	5.61	6.22
P6	Spec- Nifedipine 30mg SR	Adco- Vascard 30mg	5.24	6.22

*date of price increase with new cost per tablet.

Table 12o: The cheapest and most expensive generic for nifedipine xl 60mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Fedaloc SR 60mg	Fedaloc SR 60mg	7.32	7.32
P2	Fedaloc SR 60mg	Fedaloc SR 60mg	7.32	7.32
P3	Fedaloc SR 60mg	Fedaloc SR 60mg	7.32	7.32
			*28.05.10: 7.79	*28.05.10: 7.79
P4	Fedaloc SR 60mg	Fedaloc SR 60mg	7.79	7.79
P5	Fedaloc SR 60mg	Fedaloc SR 60mg	7.79	7.79
P6	Spec- Nifedipine 60mg SR	Fedaloc SR 60mg	7.27	7.79

*date of price increase with new cost per tablet.

Table 12p: The cheapest and most expensive generic for amlodipine 5mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Almadin 5mg	Amlosyn 5mg	2.44	4.12
P2	Almadin 5mg	Amlosyn 5mg	2.44	4.12
P3	Almadin 5mg	Amlosyn 5mg	2.44	4.12
				*24.05.10: 4.50
P4	Almadin 5mg	Amlosyn 5mg	2.44	4.50
P5	Almadin 5mg	Amlosyn 5mg	2.44	4.50
P6	Almadin 5mg	Amlosyn 5mg	2.44	4.50

*date of price increase with new cost per tablet.

Table 12q: The cheapest and most expensive generic for amlodipine 10mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Almadin 10mg	Amlosyn 10mg	3.80	5.57
P2	Almadin 10mg	Amlosyn 10mg	3.80	5.57
P3	Almadin 10mg	Amlosyn 10mg	3.80	5.57
				*24.05.10: 5.91
P4	Almadin 10mg	Amlosyn 10mg	3.80	5.91
P5	Almadin 10mg	Amlosyn 10mg	3.80	5.91
P6	Almadin 10mg	Amlosyn 10mg	3.80	5.91

*date of price increase with new cost per tablet.

Table 12r: The cheapest and most expensive generic for losartan 50mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Losartan-Winthrop 50mg	Cipla- losartan 50mg	2.67	3.23
P2	Lepitrin 50mg	Cipla- losartan 50mg	3.09 *05.10.09: 1.47	3.23
P3	Lepitrin 50mg	Cipla- losartan 50mg	1.47 *19.05.10: 1.58	3.23 *31.05.10: 3.45
P4	Losartan-Winthrop 50mg	Cipla- losartan 50mg	2.87	3.45
P5	Losartan-Winthrop 50mg	Cipla- losartan 50mg	2.87	3.45
P6	Losartan-Winthrop 50mg	Cipla- losartan 50mg	2.87	3.45

*date of price increase with new cost per tablet.

Table 12s: The cheapest and most expensive generic for losartan 100mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Zartan 100mg	Cipla- losartan 100mg	3.33	3.49
P2	Zartan 100mg	Cipla- losartan 100mg	3.33	3.49
P3	Zartan 100mg	Cipla- losartan 100mg	3.33	3.49
			*28.05.10: 3.57	*31.05.10: 3.72
P4	Zartan 100mg	Cipla- losartan 100mg	3.57	3.72
				*27.09.10: 3.58
P5	Spec- losartan 100mg	Cipla- losartan 100mg	3.49	3.58
P6	Spec- losartan 100mg	Cipla- losartan 100mg	3.49	3.58

*date of price increase with new cost per tablet.

Table 12t: The cheapest and most expensive generic for losartan 50mg + hydrochlorothiazide 12.5mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	-	-	-	-
P2		-	-	-
P3	-	-	-	-
P4	-	-	-	-
P5	**18.11.2010: Sartoc 50/12.5mg	**18.11.2010: Sartoc 50/12.5mg	3.46	3.46
P6	**18.11.2010: Sartoc 50/12.5mg	**18.11.2010: Sartoc 50/12.5mg	3.46	3.46

**Entry date of first generic into the market.

Table 12u: The cheapest and most expensive generic for irbesartan 150mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	**08.06.09 Irbewin 150mg	**08.06.09 Irbewin 150mg	5.64	5.64
P2	Irbewin 150mg	Irbewin 150mg	5.64	5.64
P3	Irbewin 150mg 28	Irbewin 150mg	5.64	5.64
			*26.05.10: 5.98	*26.05.10: 5.98
P4	Irbewin 150mg	Irbewin 150mg	5.98	5.98
P5	Irbewin 150mg	Irbewin 150mg	5.98	5.98
P6	Irbewin 150mg	Irbewin 150mg	5.98	5.98

*date of price increase with new cost per tablet.

**Entry date of first generic into the market.

Table 12v: The cheapest and most expensive generic for irbesartan 300mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	**08.06.09 Irbewin 300mg	**08.06.09 Irbewin 300mg	5.78	5.78
P2	Irbewin 300mg	Irbewin 300mg	5.78	5.78
P3	Irbewin 300mg	Irbewin 300mg	5.78	5.78
			*26.05.10: 6.13	*26.05.10: 6.13
P4	Irbewin 300mg	Irbewin 300mg	6.13	6.13
P5	Irbewin 300mg	Irbewin 300mg	6.13	6.13
P6	Irbewin 300mg	Irbewin 300mg	6.13	6.13

*date of price increase with new cost per tablet.

**Entry date of first generic into the market.

Table 12w: The cheapest and most expensive generic for irbesartan 150mg + hydrochlorothiazide 12.5mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	**08.06.09 Co-Irbewin 150mg	**08.06.09 Co-Irbewin 150mg	5.78	5.78
P2	Co-Irbewin 150mg	Co-Irbewin 150mg	5.78	5.78
P3	Co-Irbewin 150mg	Co-Irbewin 150mg	5.78	5.78
			*26.05.10: 6.13	*26.05.10: 6.13
P4	Co-Irbewin 150mg	Co-Irbewin 150mg	6.13	6.13
P5	Co-Irbewin 150mg	Co-Irbewin 150mg	6.13	6.13
P6	Co-Irbewin 150mg	Co-Irbewin 150mg	6.13	6.13

*date of price increase with new cost per tablet.

**Entry date of first generic into the market.

Table 12x: The cheapest and most expensive generic for irbesartan 300mg + hydrochlorothiazide 12.5mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	**08.06.09 Co- Irbewin 300mg	**08.06.09 Co- Irbewin 300mg	5.78	5.78
P2	Co- Irbewin 300mg	Co- Irbewin 300mg	5.78	5.78
P3	Co- Irbewin 300mg	Co- Irbewin 300mg	5.78	5.78
			*26.05.10: 6.13	*26.05.10: 6.13
P4	Co- Irbewin 300mg	Co- Irbewin 300mg	6.13	6.13
P5	Co- Irbewin 300mg	Co- Irbewin 300mg	6.13	6.13
P6	Co- Irbewin 300mg	Co- Irbewin 300mg	6.13	6.13

*date of price increase with new cost per tablet.

**Entry date of first generic into the market.

Table 12y: The cheapest and most expensive generic for clopidogrel 75mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet for CGI (R)	Cost per tablet for MEGI (R)
P1	Mistro 75mg and Plagrol 75mg	Clopidogrel-Winthrop 75mg	6.69	8.47
P2	Mistro 75mg and Plagrol 75mg	Clopidogrel-Winthrop 75mg	6.69	8.47
P3	Mistro 75mg	Clopidogrel-Winthrop 75mg	6.69	8.47 *26.05.10: 9.02
P4	Pharma Dynamics 75mg	Clopidogrel-Winthrop 75mg	5.54	9.02
P5	Pharma Dynamics 75mg	Clopidogrel-Winthrop 75mg	5.54	9.02
P6	Pharma Dynamics 75mg and Plagrol 75mg	Clopidogrel-Winthrop 75mg	5.54	9.02

*date of price increase with new cost per tablet.

**Entry date of first generic into the market.

APPENDIX B

Table 13a: The cost savings on CVS innovator items dispensed over the 24 months at Boksburg Pick n' Pay Pharmacy.

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
1. Coversyl 4mg	626.01	194.21	343.83	108.88	430.50	125.70	419.61	114.25	555.18	128.58	555.18	128.58
2. Coversyl 10mg	-	-	-	-	136.92	136.92	1490.19	1490.19	277.26	277.26	68.46	68.46
3. Coversyl Plus	704.91	471.31	678.77	438.77	783.31	494.67	941.75	615.05	784.35	526.95	965.60	519.35
4. Lipitor 10mg	991.61	991.61	1007.16	1007.16	1151.82	1151.82	1555.20	1140.60	1916.28	1673.28	2346.12	1987.02
5. Lipitor 20mg	451.68	451.68	564.60	564.60	1792.28	1792.28	1392.96	1217.46	1250.22	1041.12	645.66	520.56
6 .Lipitor 40mg	0	0	0	0	0	0	36.29	36.44	0	0	0	0
7. Lipitor 80mg	-	-	-	-	482.76	482.76	321.84	321.84	0	0	0	0
8. Prava 10mg	401.12	342.32	401.12	342.32	1002.80	836.60	920.75	718.25	0	0	0	0
9. Prava 20mg	524.68	409.48	524.68	409.48	0	0	0	0	0	0	0	0
10. Prava 40mg	127.38	126.78	0	0	0	0	0	0	0	0	0	0
11. Concor and Cardicor 5mg	1182.58	1174.48	1284.04	1275.17	937.47	925.77	675.18	665.88	905.72	894.58	1094.20	1080.70
12. Concor 10mg	598.46	586.46	552.19	541.19	653.29	640.09	706.14	691.70	562.62	551.82	577.44	566.64
13. Lasix 40mg	6832.08	5885.13	7255.65	6249.70	7414.51	6370.81	6440.69	5519.09	8058.75	6935.46	8189.26	7033.84
14. Adalat XL 30mg	2302.48	1886.95	3248.40	2652.18	2871.79	2313.43	2649.30	2161.30	2831.87	2331.67	1487.54	1075.94
15. Adalat XL 60mg	2261.81	2261.81	2205.67	2205.67	2354.73	2354.73	2102.90	2102.90	1329.94	1329.94	562.04	499.64
16. Norvasc 5mg	2391.80	1000.76	2295.84	960.24	1778.53	733.93	1881.91	674.75	2172.11	781.61	2142.23	782.63
17. Norvasc 10mg	441.64	229.24	639.66	321.06	837.68	412.88	837.38	394.28	490.73	237.53	450.32	197.12
18. Cozaar 50mg	299.47	114.67	173.67	123.27	693.24	112.44	398.52	59.22	328.11	67.11	209.67	47.27
19. Cozaar 100mg	23.49	9.09	109.62	42.42	71.10	30.30	6.51	-------	39.37	9.67	9.09	0.99
20. Cozaar Comp	-	-	-	-	-	-	-	-	274.27	274.27	355.62	355.62
21. Aprovel 150mg	131.08	131.08	0	0	0	0	0	0	0	0	0	0
22. Aprovel 300mg	402.66	402.66	268.44	268.44	201.33	201.33	216.63	216.63	292.26	292.26	216.63	216.63
23. Coaprovel 150mg	800.32	800.32	534.38	534.38	268.44	268.44	496.95	496.95	578.26	578.26	288.84	288.84
24. Coaprovel 300mg	778.62	778.62	67.11	67.11	201.33	201.33	288.84	288.84	72.21	72.21	75.63	75.63
25. Plavix 75mg	1572.20	1305.20	1257.76	1044.16	1553.21	1289.77	1397.24	1021.40	0	0	382.13	277.73

Table 13b: The cost savings on CVS innovator items dispensed over the 24 months at Norwood Pick n' Pay Pharmacy.

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
1. Coversyl 4mg	2858.04	914.94	2456.77	767.67	2363.87	738.27	2781.13	906.94	2676.57	701.57	1755.01	475.21
2. Coversyl 10mg	-	-	-	-	136.92	136.92	1369.20	1369.20	1107.57	1107.57	973.17	973.17
3. Coversyl Plus	3058.21	1979.81	2718.45	1761.01	2313.25	1500.45	2250.65	1557.65	1557.96	1082.76	1530.07	851.77
4. Lipitor 10mg	7048.65	7048.65	6383.48	6383.48	8951.65	8951.65	11956.97	8902.97	11772.12	10183.35	11182.67	9462.77
5. Lipitor 20mg	5358.34	5358.34	4337.16	4337.16	4075.06	4075.06	4178.88	3652.38	5004.30	4167.90	5490.24	4435.23
6 .Lipitor 40mg	1297.31	1297.31	1408.80	1408.80	1496.06	1496.06	2142.88	1931.68	3607.05	3173.40	3545.34	3075.69
7. Lipitor 80mg	-	-	-	-	929.52	929.52	1138.17	1138.17	752.58	706.38	407.52	381.12
8. Prava 10mg	653.40	565.20	690.61	595.06	300.84	256.74	548.40	443.10	215.96	183.56	0	0
9. Prava 20mg	1059.50	826.22	1204.37	952.85	1114.34	875.30	1497.13	1328.41	1031.00	917.90	877.31	768.11
10. Prava 40mg	764.28	760.68	509.52	507.12	636.90	633.90	415.02	385.02	578.28	544.68	733.77	684.27
11. Concor and Cardicor 5mg	5352.29	5315.47	4917.12	4883.84	5414.47	5321.85	5672.15	5601.05	5066.87	5004.11	4876.07	4818.97
12. Concor 10mg	1519.91	1493.51	1300.78	1275.66	1489.79	1456.93	2044.81	2006.85	1962.15	1925.55	1454.62	1427.62
13. Lasix 40mg	10624.94	9100.38	11740.79	10097.05	11078.96	9517.84	11850.93	10147.62	9406.66	8110.75	11501.82	9955.80
14. Adalat XL 30mg	4198.56	3442.74	4079.01	3310.65	3799.55	3159.95	4224.22	3437.32	2764.53	2250.91	2088.24	1500.24
15. Adalat XL 60mg	1396.08	1396.08	1529.05	1529.05	1063.95	1063.95	1448.11	1448.11	1498.92	1498.92	1826.63	1623.83
16. Norvasc 5mg	5606.50	2348.98	6554.48	2908.88	6167.91	2532.87	7987.57	2891.13	8479.43	3152.27	7498.91	2707.35
17. Norvasc 10mg	4549.35	2106.75	4257.43	1974.13	3732.64	1843.54	2843.57	1366.57	3159.08	1386.68	3275.08	1439.38
18. Cozaar 50mg	1463.30	589.70	2786.37	440.07	2462.80	358.81	708.27	114.93	728.06	136.46	777.28	237.88
19. Cozaar 100mg	31.32	12.12	31.32	12.12	55.44	24.24	5.67	0.33	43.92	10.17	56.81	27.11
20. Cozaar Comp	-	-	-	-	-	-	-	-	431.53	431.53	745.16	745.16
21. Aprovel 150mg	1118.72	1118.72	923.22	923.22	775.91	775.91	1006.25	1006.25	534.39	534.39	604.26	604.26
22. Aprovel 300mg	536.88	536.88	619.37	619.37	536.88	536.88	649.89	649.89	662.81	662.81	288.84	288.84
23. Coaprovel 150mg	397.66	397.66	268.44	268.44	268.44	268.44	692.46	692.46	361.05	361.05	72.21	72.21
24. Coaprovel 300mg	524.38	524.38	578.60	578.60	633.18	633.18	505.47	505.47	216.63	216.63	288.84	288.84
25. Plavix 75mg	2496.53	2072.89	2545.16	2117.96	3104.33	2568.07	3848.30	2804.30	1307.61	956.13	0	0

Table 13c: The cost savings on CVS innovator items dispensed over the 24 months at Soweto Pick n' Pay Pharmacy.

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
1. Coversyl 4mg	56.04	17.94	112.08	35.88	285.30	82.10	393.27	102.12	129.96	35.16	129.96	35.16
2. Coversyl 10mg	-	-	-	-	0	0	68.46	68.46	136.92	136.92	0	0
3. Coversyl Plus	0	0	168.03	110.43	100.62	62.22	247.12	167.92	455.83	317.23	402.65	224.15
4. Lipitor 10mg	45.78	45.78	137.34	137.34	308.12	308.12	103.68	73.98	123.48	104.58	0	0
5. Lipitor 20mg	0	0	0	0	0	0	0	0	218.64	176.94	215.22	173.52
6 .Lipitor 40mg	225.84	225.84	225.84	225.84	0	0	0	0	0	0	0	0
7. Lipitor 80mg	-	-	0	0	0	0	0	0	0	0	0	0
8. Prava 10mg	0	0	0	0	0	0	0	0	0	0	0	0
9. Prava 20mg	0	0	0	0	0	0	0	0	0	0	0	0
10. Prava 40mg	0	0	0	0	0	0	0	0	0	0	0	0
11. Concor and Cardicor 5mg	0	0	104.43	103.73	0	0	0	0	0	0	0	0
12. Concor 10mg	185.01	181.41	0	0	0	0	0	0	0	0	64.16	62.96
13. Lasix 40mg	181.81	158.21	1543.40	1325.69	1189.59	1016.59	1313.51	1117.38	1729.05	1473.27	326.67	280.05
14. Adalat XL 30mg	1181.53	958.66	567.44	463.70	931.06	748.06	1159.55	950.32	477.14	394.18	788.94	581.18
15. Adalat XL 60mg	210.24	210.24	250.70	250.70	404.00	404.00	315.79	315.79	625.13	625.13	352.20	315.80
16. Norvasc 5mg	348.28	146.68	351.32	148.04	470.13	201.33	386.96	139.76	17.26	6.96	6.92	2.80
17. Norvasc 10mg	99.01	45.91	0	0	73.53	31.33	0	0	112.58	49.28	0	0
18. Cozaar 50mg	0	0	0	0	63.63	10.83	108.15	21.15	151.41	29.61	159.34	37.54
19. Cozaar 100mg	0	0	0	0	0	0	0	0	0	0	12.28	6.88
20. Cozaar Comp	-	-	-	-	-	-	-	-	90.80	90.80	98.18	98.18
21. Aprovel 150mg	0	0	0	0	0	0	0	0	0	0	0	0
22. Aprovel 300mg	0	0	0	0	0	0	0	0	0	0	0	0
23. Coaprovel 150mg	67.11	67.11	193.83	193.83	193.83	193.83	138.74	138.74	0	0	0	0
24. Coaprovel 300mg	0	0	0	0	67.11	67.11	0	0	0	0	0	0
25. Plavix 75mg	0	0	0	0	0	0	0	0	0	0	0	0

Table 13d: The cost savings on CVS innovator items dispensed over the 24 months at Woodmead Pick n' Pay Pharmacy.

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
1. Coversyl 4mg	392.28	125.58	471.50	128.60	530.76	149.76	670.98	289.08	880.08	216.48	584.82	158.22
2. Coversyl 10mg	-	-	-	-	0	0	0	0	0	0	0	0
3. Coversyl Plus	315.25	200.05	103.12	64.72	313.79	198.59	297.06	198.06	240.09	160.89	0	0
4. Lipitor 10mg	408.26	408.26	336.60	336.60	845.82	845.82	1140.48	875.58	1289.04	1120.74	987.84	836.64
5. Lipitor 20mg	451.68	451.68	564.60	564.60	410.76	410.76	696.48	621.78	819.78	694.08	645.66	520.56
6 .Lipitor 40mg	142.56	142.56	0	0	0	0	0	0	0	0	0	0
7. Lipitor 80mg	-	-	-	-	0	0	0	0	0	0	0	0
8. Prava 10mg	0	0	0	0	0	0	0	0	0	0	0	0
9. Prava 20mg	0	0	0	0	0	0	0	0	0	0	0	0
10. Prava 40mg	0	0	0	0	0	0	0	0	0	0	0	0
11. Concor and Cardicor 5mg	267.90	266.10	0	0	89.30	88.70	191.50	189.10	47.94	47.34	167.79	165.69
12. Concor 10mg	0	0	0	0	0	0	0	0	285.18	279.58	64.16	62.96
13. Lasix 40mg	441.77	382.77	935.20	811.30	1068.80	929.00	1417.68	1220.88	850.92	737.52	449.48	389.63
14. Adalat XL 30mg	184.26	150.06	175.92	144.00	180.09	147.03	232.74	191.26	94.28	77.20	209.28	154.40
15. Adalat XL 60mg	0	0	221.12	221.12	0	0	0	0	118.56	118.56	0	0
16. Norvasc 5mg	0	0	0	0	87.07	36.67	245.27	90.77	0	0	0	0
17. Norvasc 10mg	0	0	99.01	45.91	0	0	0	0	0	0	0	0
18. Cozaar 50mg	34.64	12.24	0	0	0	0	60.30	8.10	7.21	1.41	0	0
19. Cozaar 100mg	0	0	0	0	0	0	0	0	0	0	0	0
20. Cozaar Comp	-	-	-	-	-	-	-	-	36.32	36.32	63.95	63.95
21. Aprovel 150mg	0	0	0	0	0	0	73.57	73.57	0	0	0	0
22. Aprovel 300mg	0	0	0	0	0	0	0	0	0	0	0	0
23. Coaprovel 150mg	0	0	0	0	64.61	64.61	0	0	0	0	0	0
24. Coaprovel 300mg	0	0	0	0	0	0	0	0	0	0	0	0
25. Plavix 75mg	0	0	0	0	886.35	736.83	2157.08	1565.48	1805.75	1318.55	1083.45	791.13

Table 13e The cost savings on CVS innovator items dispensed over the 24 months at all the Pick n' Pay Pharmacies.

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
1. Coversyl 4mg	3932.37	1252.67	3384.18	1041.03	3610.43	1095.83	4264.99	1412.39	4241.79	1081.79	3024.97	797.17
2. Coversyl 10mg	0	0	0	0	273.84	273.84	2927.85	2927.85	1521.75	1521.75	1041.63	1041.63
3. Coversyl Plus	4078.37	2651.17	3668.37	2374.93	3510.97	2255.93	3736.58	2538.68	3038.23	2087.83	2898.32	1595.27
4. Lipitor 10mg	8494.3	8494.3	7864.58	7864.58	11257.41	11257.41	14756.33	10993.13	15100.92	13081.95	14516.63	12286.43
5. Lipitor 20mg	6261.7	6261.7	5466.36	5466.36	6278.1	6278.1	6268.32	5491.62	7292.94	6080.04	6996.78	5649.87
6 .Lipitor 40mg	1665.71	1665.71	1634.64	1634.64	1496.06	1496.06	2179.17	1968.12	3607.05	3173.4	3545.34	3075.69
7. Lipitor 80mg	0	0	0	0	1412.28	1412.28	1460.01	1460.01	752.58	706.38	407.52	381.12
8. Prava 10mg	1054.52	907.52	1091.73	937.38	1303.64	1093.34	1469.15	1161.35	215.96	183.56	0	0
9. Prava 20mg	1584.18	1235.7	1729.05	1362.33	1114.34	875.3	1497.13	1328.41	1031	917.9	877.31	768.11
10. Prava 40mg	891.66	887.46	509.52	507.12	636.9	633.9	415.02	385.02	578.28	544.68	733.77	684.27
11. Concor and Cardicor 5mg	6802.77	6756.05	6305.59	6262.74	6441.24	6336.32	6538.83	6456.03	6020.53	5946.03	6138.06	6065.36
12. Concor 10mg	2303.38	2261.38	1852.97	1816.85	2143.08	2097.02	2750.95	2698.55	2809.95	2756.95	2160.38	2120.18
13. Lasix 40mg	18080.6	15526.49	21475.04	18483.74	20751.86	17834.24	21022.81	18004.97	20045.38	17257	20467.23	17659.32
14. Adalat XL 30mg	7866.83	6438.41	8070.77	6570.53	7782.49	6368.47	8265.81	6740.2	6167.82	5053.96	4574	3311.76
15. Adalat XL 60mg	3868.13	3868.13	4206.54	4206.54	3822.68	3822.68	3866.8	3866.8	3572.55	3572.55	2740.87	2439.27
16. Norvasc 5mg	8346.58	3496.42	9201.64	4017.16	8503.64	3504.8	10501.71	3796.41	10668.8	3940.84	9648.06	3492.78
17. Norvasc 10mg	5090	2381.9	4996.1	2341.1	4643.85	2287.75	3680.95	1760.85	3762.39	1673.49	3725.4	1636.5

Table 13e continued

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
18. Cozaar 50mg	1797.41	716.61	2960.04	563.34	3219.67	482.08	1275.24	203.4	1214.79	234.59	1146.29	322.69
19. Cozaar 100mg	54.81	21.21	140.94	54.54	126.54	54.54	12.18	0.33	83.29	19.84	78.18	34.98
20. Cozaar Comp	0	0	0	0	0	0	0	0	832.92	832.92	1262.91	1262.91
21. Aprovel 150mg	1249.8	1249.8	923.22	923.22	775.91	775.91	1079.82	1079.82	534.39	534.39	604.26	604.26
22. Aprovel 300mg	939.54	939.54	887.81	887.81	738.21	738.21	866.52	866.52	955.07	955.07	505.47	505.47
23. Coaprovel 150mg	1265.09	1265.09	996.65	996.65	795.32	795.32	1328.15	1328.15	939.31	939.31	361.05	361.05
24. Coaprovel 300mg	1303	1303	645.71	645.71	901.62	901.62	794.31	794.31	288.84	288.84	364.47	364.47
25. Plavix 75mg	4068.73	3378.09	3802.92	3162.12	5543.89	4594.67	7402.62	5391.18	3113.36	2274.68	1465.58	1068.86
TOTAL	90999.48	72958.35	91814.37	72120.42	97083.97	77265.62	108361.3	82654.1	98389.89	75659.74	89284.48	67529.42

APPENDIX C

Please note that in this appendix does not take into account any originator medicine (Coversyl 4mg, Coversyl plus and Lipitor 10mg, 20mg, 40mg). Generic items will include all generics for a particular active ingredient and strength and will not include any of the clone molecules.

Table 14a: The cheapest and most expensive generic for perindopril 4mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet (CGI) (R)	Cost per tablet (MEGI) (R)
P1	Ran-perindopril 4mg	Cipla- Perindopril 4mg	3.11	4.33
P2	Ran-perindopril 4mg	Cipla- Perindopril 4mg	3.11	4.33
P3	Ran-perindopril 4mg	Cipla- Perindopril 4mg	3.11	4.33
P4	Ran-perindopril 4mg	Cipla-perindopril 4mg	3.11	4.33
			*07.09.10: 3.34	*16.06.10: 4.62
P5	Pearinda 4mg	Cipla-perindopril 4mg	3.04	4.62
P6	Pearinda 4mg	Cipla-perindopril 4mg	3.04	4.62

*date of price increase with new cost per tablet.

Table 14b: The cheapest and most expensive generic for perindopril 4mg + indapamide 1.25mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet (CGI) (R)	Cost per tablet (MEGI) (R)
P1	Vectoryl plus	Vectoryl plus	5.04	5.04
P2	Vectoryl plus	Vectoryl plus	5.04	5.04
P3	Vectoryl plus	Vectoryl plus	5.04	5.04
P4	Spec- perindopril plus	Vectoryl plus	5.02	5.33
P5	Spec- perindopril plus	Vectoryl plus	5.02	5.33
P6	Pearinda Plus 4	Vectoryl plus	4.49	5.33

Table 14c: The cheapest and most expensive generic for atorvastatin 10mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet (CGI) (R)	Cost per tablet (MEGI) (R)
P1	-	-	-	-
P2	-	-	-	-
P3	**19.02.10 Lipogen 10mg	**16.04.10 Atolip 10	3.30	3.90
P4	Lipogen 10mg	Atolip 10	3.30	3.90 *10.06.10 3.27
P5	Lipogen 10mg	Atolip 10	3.30 *18.10.10: 2.64	3.27
P6	Lipogen 10mg	Atolip 10	2.64	3.27

*date of price increase with new cost per tablet.

**Entry date of first generic into the market.

Table 14d: The cheapest and most expensive generic for atorvastatin 20mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet (CGI) (R)	Cost per tablet (MEGI) (R)
P1	-	-	-	-
P2	-	-	-	-
P3	**19.02.10 Lipogen 20	**16.04.10 Atolip 20	4.58	5.02
P4	Lipogen 20	Atolip 20	4.58	5.02 *10.06.10 4.60
P5	Lipogen 20	Atolip 20	4.58 *18.10.10: 3.21	4.60
P6	Lipogen 20	Atolip 20	3.21	4.60

*date of price increase with new cost per tablet.

**Entry date of first generic into the market.

Table 14e: The cheapest and most expensive generic for atorvastatin 40mg including the cost per tablet during each study period.

Period	Cheapest Generic item (CGI)	Most Expensive Generic item (MEGI)	Cost per tablet (CGI) (R)	Cost per tablet (MEGI) (R)
P1	-	-	-	-
P2	-	-	-	-
P3	**19.02.10 Lipogen 40	**16.04.10 Atolip 40	4.58	5.02
P4	Lipogen 40	Atolip 40	4.58	5.02 *10.06.10 4.60
P5	Lipogen 40	Atolip 40	4.58 *18.10.10: 3.67	4.60
P6	Lipogen 40	Atolip 40	3.67	4.60

*date of price increase with new cost per tablet.

**Entry date of first generic into the market.

APPENDIX D

Table 15a: The cost savings on CVS innovator clone items dispensed over the 24 months at Boksburg Pick n' Pay Pharmacy.

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
1. Prexum 4mg	2764.30	92.50	2453.56	83.10	2809.88	64.88	3000.65	12.22	3497.41	-	3208.63	-
2. Prexum Plus	1619.66	1619.66	1191.40	1191.40	1094.94	1094.94	1054.77	532.42	1396.53	734.99	2802.94	807.94
3. Aspavor 10mg	-	-	-	-	2711.41	316.20	2038.80	1960.62	1309.01	1130.81	1133.28	18.18
4. Aspavor 20mg	-	-	-	-	2464.46	353.11	1627.49	1506.29	2756.70	-	2920.25	-
5. Aspavor 40mg	-	-	-	-	460.01	43.2	194.22	175.62	199.21	172.85	207.08	

Table 15b: The cost savings on CVS innovator clone items dispensed over the 24 months at Norwood Pick n' Pay Pharmacy.

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
1. Prexum 4mg	5435.93	-	5929.33	-	6567.62	-	7361.66	142.78	8425.96	-	9576.35	-
2. Prexum Plus	3014.17	3014.17	3306.88	3306.88	3092.65	3092.65	3524.66	1871.43	3479.95	1862.68	6321.08	1850.60
3. Aspavor 10mg					8692.53	1275.71	7654.48	7496.83	4803.71	59.37	5952.68	165.50
4. Aspavor 20mg					5367.72	1138.24	3538.13	3271.73	6080.20	-	7794.05	128.20
5. Aspavor 40mg					1600.37	359.93	1105.03	1012.93	1251.10	-	2099.19	-

Table 15c: The cost savings on CVS innovator clone items dispensed over the 24 months at Soweto Pick n' Pay Pharmacy.

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
1. Prexum 4mg	873.14	74.04	594.08	594.08	25.56	9.90	911.83	13.03	850.67	-	638.95	-
2. Prexum Plus	469.85	469.85	746.56	746.56	677.73	677.73	617.88	321.83	503.90	271.40	1004.58	298.98
3. Aspavor 10mg	-	-	-	-	146.79	23.32	117.32	121.82	97.87	2.95	95.22	0.72
4. Aspavor 20mg	-	-	-	-	137.36	24.28	50.68	49.48	0	0	0	0
5. Aspavor 40mg	-	-	-	-	0	0	50.68	36.88	0	0	0	0

Table 15d: The cost savings on CVS innovator clone items dispensed over the 24 months at Woodmead Pick n' Pay Pharmacy.

Branded Drug	Cost Savings (R)											
	P1		P2		P3		P4		P5		P6	
	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG	LEG	MEG
1. Prexum 4mg	552.89	22.19	762.60	30.60	1245.09	586.29	1049.04	134.49	1398.99	-	1035.14	-
2. Prexum Plus	76.40	76.40	248.30	248.30	422.75	422.75	412.42	216.19	334.29	176.19	629.67	201.27
3. Aspavor 10mg	-	-	-	-	652.30	139.86	430.23	446.43	287.34	-	402.00	42.90
4. Aspavor 20mg	-	-	-	-	927.80	109.62	370.41	119.80	703.87	-	617.13	-
5. Aspavor 40mg	-	-	-	-	259.12	53.52	129.72	126.10	131.80	-	92.26	-

APPENDIX E

Table 16a: The total dispensing patterns and cost of all prescriptions and items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies.

Pharmacy	Total cost of items dispensed	Total number of prescriptions	Average cost per prescription	Total number of items dispensed	Average number of items per prescription	Average cost per item
Boksburg	R9616754.95	34301	R280.36	71388	2.08	R134.71
Norwood	R28780664.19	92597	R310.82	166709	1.80	R172.64
Soweto	R2013981.66	11945	R168.60	21280	1.78	R94.64
Woodmead	R3260392.34	12678	R257.17	22732	1.79	R143.43
Total	R43671793.14	151521	R288.22	282109	1.86	R154.80

Table 16b: The total dispensing patterns and cost of CVS innovator and generic items dispensed over the 24 months at all the participating Pick n' Pay Pharmacies.

Period	Total number of innovator items dispensed	Total cost of innovator items dispensed	Average cost per innovator item dispensed	Total number of generic items dispensed	Total cost of generic items dispensed	Average cost per generic item dispensed	CPII	CPIG
P1	1 165	R223032.02	R192.67	2 214	R304698.80	R137.62	1.2	0.9
P2	1 134	R214487.71	R189.14	2 397	R336106.90	R140.22	1.2	0.9
P3	1 095	R212786.16	R194.81	2 485	R331586.21	R133.44	1.3	0.9
P4	1 150	R224365.76	R195.10	2 606	R342121.83	R131.28	1.3	0.9
P5	1 047	R196081.72	R190.98	2 749	R341499.02	R124.23	1.3	0.9
P6	936	R169287.66	R180.86	2 839	R352539.82	R124.18	1.3	0.9
Total	6 527	R1240041.03	R189.99	15 290	R2008552.58	R131.36	1.3	0.9

Table 16c: The total dispensing patterns and cost of the CVS items over the 24 months at each of the participating Pick n' Pay Pharmacies.

Pharmacy	Total number of innovator items dispensed	Total cost of innovator items dispensed	Average cost per innovator item dispensed	Total number of generic items dispensed	Total cost of generic items dispensed	Average cost per generic item dispensed	CPII	CPIG
Boksburg	1 559	R298234.25	R191.30	5 061	R624566.28	R123.41	1.4	0.9
Norwood	4 425	R837500.45	R189.27	8 512	R1164793.57	R136.84	1.2	0.9
Soweto	268	R48242.80	R180.01	848	R107606.98	R126.90	1.3	0.9
Woodmead	275	R56063.53	R203.87	869	R111585.75	R128.41	1.4	0.9
Total	6 527	R1240041.03	R189.99	15 290	R2008552.58	R131.36	1.3	0.9

Table 16d: The total dispensing patterns and cost of the CVS items over the 24 months at all of the participating Pick n' Pay pharmacies according to each active ingredient.

Active ingredient	Total number of Innovator items dispensed	Total Cost of Innovator items dispensed	Average cost per Innovator item	Total number of Generic items dispensed	Total Cost of Generic items dispensed	Average cost per Generic item
1. Perindopril 4mg	379	R57846.15	R152.63	1932	R258124.91	R133.61
2. Perindopril 10mg	83	R18281.38	R220.26	96	R13681.71	R142.52
3. Perindopril 4mg + Indapamide 1.25mg	346	R73495.97	R212.42	2150	R346575.48	R161.20
4. Atorvastatin 10mg	910	R185813.64	R204.19	2395	R302157.86	R126.16
5. Atorvastatin 20mg	258	R78764.07	R305.29	1699	R276064.26	R162.49
6. Atorvastatin 40mg	106	R27158.87	R256.22	443	R71388.08	R161.15
7. Atorvastatin 80mg	31	R7458.73	R240.60	28	R4027.80	R143.85
8. Pravastatin 10mg	53	R12252.20	R231.17	64	R9617.89	R150.28
9. Pravastatin 20mg	64	R18450.44	R288.29	35	R5480.48	R156.59
10. Pravastatin 40mg	28	R9985.65	R356.74	69	R15525.48	R225.01

Table 16d continued

Active ingredient	Total number of Innovator items dispensed	Total Cost of Innovator items dispensed	Average cost per Innovator item	Total number of Generic items dispensed	Total Cost of Generic items dispensed	Average cost per Generic item
11. Bisoprolol 5mg	906	R86703.84	R95.70	1199	R63049.72	R52.59
12. Bisoprolol 10mg	242	R35625.43	R147.21	275	R26200.41	R95.27
13.Furosemide 40mg	692	R125758.35	R181.73	806	R20199.74	R25.06
14. Nifedipine XL 30mg	437	R113446.47	R259.60	283	R51088.57	R180.52
15.Nifedipine XL 60mg	200	R62719.87	R313.60	133	R30029.10	R225.78
16. Amlodipine 5mg	652	R101790.83	R156.12	1557	R153662.26	R98.69.
17. Amlodipine 10mg	242	R53372.69	R220.55	1013	R140886.09	R139.08
18. Losartan 50mg	317	R36889.31	R116.37	126	R13991.96	R111.05
19. Losartan 100mg	103	R11012.29	R106.92	123	R13178.48	R107.14
20. Losartan 50mg + Hydrochlorothiazide 12.5mg	115	R14420.35	R125.39	4	R424.71	R106.18

Table 16d continued

Active ingredient	Total number of Innovator items dispensed	Total Cost of Innovator items dispensed	Average cost per Innovator item	Total number of Generic items dispensed	Total Cost of Generic items dispensed	Average cost per Generic item
21. Irbesartan 150mg	73	R17193.18	R235.52	30	R5136.32	R171.21.
22. Irbesartan 300mg	70	R17579.42	R251.13	88	R15137.67	R172.02
23. Irbesartan 150mg + Hydrochlorothiazide 12.5mg	82	R20253.99	R247.00	9	R1594.65	R177.18
24. Irbesartan 300mg + Hydrochlorothiazide 12.5mg	61	R14692.31	R240.86	134	R23302.78	R173.90
25. Clopidogrel 75mg	77	R39075.60	R507.48	599	R148026.17	R247.12

Table 16e: The total dispensing patterns and cost of the CVS clone molecule items over the 24 months at all of the participating Pick n' Pay pharmacies according to each active ingredient.

Active ingredient	Total number of Innovator items dispensed	Total Cost of Innovator items dispensed	Average cost per Innovator item	Total number of Generic items dispensed	Total Cost of Generic items dispensed	Average cost per Generic item
1. Perindopril 4mg	1735	R233635.38	134.66	197	R24489.53	124.31
2. Perindopril Plus	1761	R287223.61	163.10	389	R59351.87	152.58
3. Atorvastatin 10mg	2288	R293083.72	128.10	107	R9074.14	84.81
4. Atorvastatin 20mg	1652	R270948.41	164.01	47	R5115.85	108.85
5. Atorvastatin 40mg	404	R65640.74	162.48	39	R5747.34	147.37

APPENDIX F

Master of Science in Medicine (Pharmaceutical Affairs): Approval of Title

APPENDIX G

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Mr Sagel Govender

CLEARANCE CERTIFICATE	**M111102**
PROJECT	Utilization Patterns and Potential Cost Savings of Generic Cardiovascular Medications at Private Community Pharmacies in the Johannesburg Area: An Analysis of Medical Claims Retrospectively
INVESTIGATORS	Mr Sagel Govender.
DEPARTMENT	Department of Pharmacy & Pharmacology
DATE CONSIDERED	25/11/2011
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 25/11/2011 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Dr Neil Butkow

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

APPENDIX H

Table 17a :Most frequently dispensed innovator items at all the pharmacies (in descending order)

Innovator drug	Total amount of items dispensed
1. Lipitor 10mg	910
2. Concor and Cardicor 5mg	906
3. Lasix 40mg	692
4. Norvasc 5mg	652
5. Adalat XL 30mg	437
6. Coversyl 4mg	379
7. Coversyl Plus	346
8. Cozaar 50mg	317
9. Lipitor 20mg	258
10. Concor 10mg	242
11. Norvasc 10mg	242
12. Adalat XL 60mg	200
13. Cozaar Comp	115
14. Lipitor 40mg	106
15. Cozaar 100mg	103
16. Coversyl 10mg	83
17. Coaprovel 150mg	82
18. Plavix 75mg	77
19. Aprovel 150mg	73
20. Aprovel 300mg	70
21. Prava 20mg	64
22. Coaprovel 300mg	61
23 Prava 10mg	53
24. Lipitor 80mg	31
25. Prava 40mg	28

Table 17b: Innovator items dispensed total costs at all the study pharmacies (in descending order)

Innovator drug	Total cost of items dispensed
1. Lipitor 10mg	185813.64
2. Lasix 40mg	125758.35
3. Adalat XL 30mg	113446.47
4. Norvasc 5mg	101790.83
5. Concor and Cardicor 5mg	86703.84
6. Lipitor 20mg	78764.07
7. Coversyl Plus	73495.97
8. Adalat XL 60mg	62719.87
9. Coversyl 4mg	57846.15
10. Norvasc 10mg	53372.69
11. Plavix 75mg	39075.6
12. Cozaar 50mg	36889.31
13. Concor 10mg	35625.43
14. Lipitor 40mg	27158.87
15. Coaprovel 150mg	20253.99
16. Prava 20mg	18450.44
17. Coversyl 10mg	18281.38
18. Aprovel 300mg	17579.42
19. Aprovel 150mg	17193.18
20. Coaprovel 300mg	14692.31
21. Cozaar Comp	14420.35
22. Prava 10mg	12252.2
23. Cozaar 100mg	11012.29
24. Prava 40mg	9985.65
25. Lipitor 80mg	7458.73

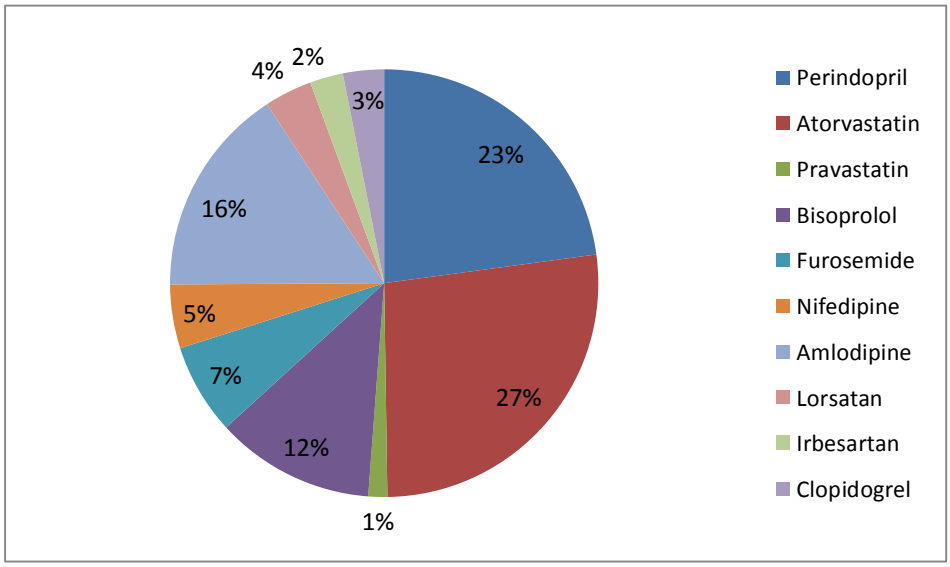

Figure 6: Most dispensed active ingredient according to frequency (%), n= 21817

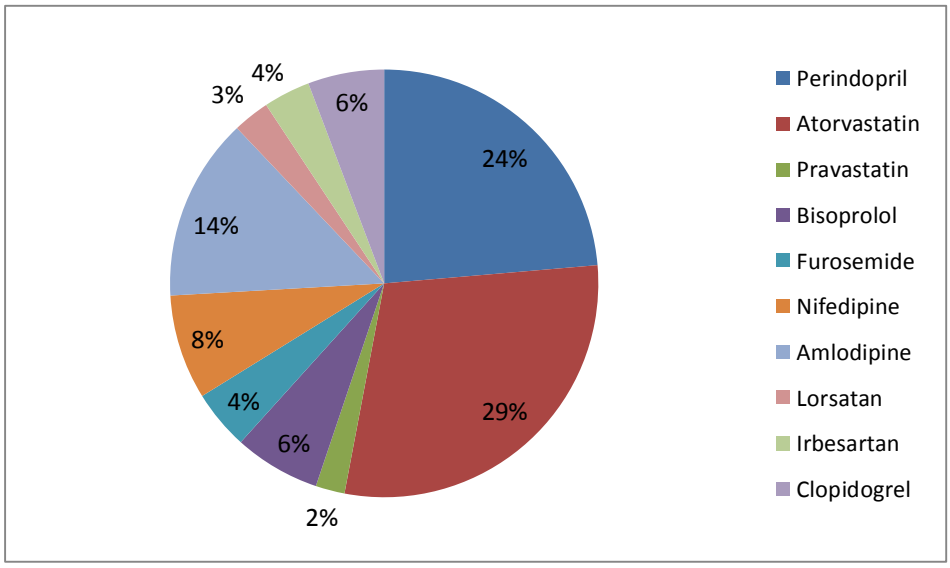

Figure 7: Most dispensed active ingredient according to cost (%), n= R3248593.61